Government of Pakistan's Agriculture and Water Policies with respect to Climate Change

Policy Gap Analysis

Technical Advisory Panel on Climate Change, Pakistan

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Executive Summary

Pakistan is a front-line state coming to grips with the serious concerns of Climate Change. South Asia has been tagged by the IPCC, 2007 as a region that will face serious water shortages despite intensive bouts of precipitation at short intervals during the monsoon seasons.

This is likely to result in an enhanced frequency of floods and drought. With glaciers receding, the long-term prospects of survival under a 'business as usual' scenario look bleak. Two important task forces, one under the Technical Advisory Panel of the Ministry of Environment and the other the Task Force on Climate Change by the Pakistan Planning Commission, are providing guidance on how to address the challenges of global warming and climate change. Unequivocally, the attention is on adaptation to climate change. On the other hand, mitigation, though recognized, is not considered a major priority for Pakistan.

Water, energy and agriculture are major sectors that will be impacted by climate change in Pakistan. Pakistan has formulated certain policies (mostly in draft form) that are aimed at spelling out its national priorities. While it does not have a climate change policy as such, the need to incorporate climate change concerns in the existing policy documents on agriculture and water was recognized by IUCN Pakistan. Consequently, a one-month study was conducted with the following TOR's:

- Undertake a detailed literature **search** on the subject and properly document it in the study annexes;
- Conduct **interviews** with relevant professionals;
- **Review** all the agriculture and water policies that are currently in effect, either as proper policy documents or in the form of notifications, speeches, or in any other form;
- **Identify gaps** in the existing policies, with respect to their relevance to and contradictions of GoP's national and international commitments under climate change;
- Make **recommendations** on how to address the gaps/anomalies in the existing policy framework of agriculture and water, with respect to climate change.

The study entailed a review of the existing literature relevant to agriculture policy, water policy and the status of various conventions/protocols to which Pakistan is a signatory. It involved interviewing some of the key professionals dealing with agriculture, water and climate change issues. It identifies the gaps and makes recommendations on ways and means to address the gaps in the existing documents. Gap analysis techniques include commenting on what the present state is and how one could get to a desired state. The analysis also looks at the factors that contribute to the gaps and the underlying root causes.

The specific information relevant to agriculture policy is rather scant. An earlier policy framed in 1991 was the only guiding document, along with the Report by the National Commission on Agriculture (1988), whereas later documents, in the form of the Medium-Term Development Framework, Vision Statement till 2030, Agriculture Perspective and Policies, etc., are more recent but are not strictly policy documents. The other less relevant documents are individual policies, like the fertilizer policy, pesticide policy, credit policy and price support policies. In the agriculture sector there are several speeches and notifications, besides coalition party manifestos, that were also reviewed and documented.

Pakistan has a draft National Water Policy - 2005 that served as the focal document. In addition, there is the Apportionment Accord and the Indus Water Treaty. These, along with some of the major studies undertaken over the past several years, were reviewed from a climate change perspective.

The National Communication on Climate Change indicated the following expected impacts on agriculture in Pakistan:

Shift in Spatial Boundaries of Crop Potential Areas: Global climate change will affect the growing season's length, due to higher temperatures and reduced soil moisture, alter the stages of plant growth, with accelerated growth early in the season, affect the partitioning and quality of bio-mass, affect crop pests and diseases, and entail spatial shifts in potential areas of agricultural crops.

Changes in Productivity Potential: The quality and quantity of crop yield will be affected by climate change in two ways: a) direct effects from changes in temperature, water balance, CO_2 concentrations and extreme events; b) indirect effects through changes in distribution, frequency and severity of pest and disease outbreaks, incidence of fire, weed infestation, or through changes in soil properties.

Changes in Water Availability and Use: The increase in temperature has a direct effect on crop evapo-transpiration and loss of soil moisture. The increase in crop evapo-transpiration, when combined with a decrease in precipitation in the rain-fed environments, results in decreased crop evapo-transpiration due to limited availability and the use of soil moisture by crops.

Changes in Cropping Patterns: A rise in temperature and reduction in rainfall could increase the net irrigation water requirement of crops, thereby forcing farmers to make changes in cropping patterns to adjust to climate change.

Changes in Land Use Systems: The global warming, climatic extremes and CO_2 concentrations would lead to

changes in land use systems due to changes in the growing season of crops. The climatic changes in arid climates would result in increased salinity and/or water-logging, which would in turn create a demand for integration of forestry and aquaculture with the crop-based farming systems.

It was noted that in the agriculture policy context a general statement must be added that reflects the climate change scenario faced by Pakistan. The present study proposes the following statement:

A. Agriculture policy will implement measures that will help preserve our agriculture, protect the productivity and sustainability of farm communities and ensure economic welfare by adapting to the challenges posed by climate change through the adoption of new technologies and application of science-based knowledge.
B. Agriculture policy will address the issues of climate change amongst farms, agribusiness entities, producers and consumers by providing information and know-how on finding ways and means to adjust by shifting/substitution to new crops, crop rotations, livestock species, fisheries and forestry that ensure the sustained growth of our farm systems by showing sensitivity to greenhouse gas emissions.
C. Climate change will alter the comparative advantages of certain productive enterprises. Research organizations and economic analysis institutions will be supported to evaluate the postulated impacts on each of the dominant enterprises within the 8 climatic zones and propose modifications in enterprise mix, technology, input use and incentives. Modeling policy proposals will help analyze present, future and predicted impacts under various scenarios.
D Agriculture policy will incorporate a monitoring and evaluation mechanism to ensure widespread compliance with international conventions and agreements relevant to agriculture (UNFCCC, Kyoto Protocol, WTO, Basal Agreement, etc.) entered into by the Government of Pakistan.
E. All national policies on agriculture will be developed through stakeholder participation, with special attention given to provincial governments' viewpoints to reflect the close harmony between the federal government and provinces, as agriculture is essentially a provincial subject.

The Vision Statement 2030 amplifies: "Our vision is an efficient and competitive sustainable agriculture ensuring food security and with ability to contribute to the economic development and poverty alleviation in Pakistan". The Vision Statement should make a strong case for agriculture in the context of climate change. Pakistan is a signatory to the Kyoto Protocol and UNFCCC, along with several other conventions related to environmental sustainability. The Vision Statement should reflect our commitment to these conventions with clearly identified programs and projects relevant to Pakistani conditions. As Pakistan plays its role in reducing emissions as a responsible member of the international community, it will require huge financial resources to tackle the problems of the negative impacts caused by climate change. The Vision Statement must reflect the harsh realities of financial crisis, the global impacts of uncertain prices and markets, and its strategic location between China and India, which are rapidly emerging economies with the likelihood of high carbon emissions.

This review of government circulars, notifications and newspaper statements clearly shows that the present government policies:

1. Aim at protection of small-holder agriculture (almost 70%) and ensuring that farm productivity is increased at a rate that is commensurate with the population growth rate of the country.
2. Accord simplistic recognition to the fact that there are threats to agriculture from climate change that can have negative impacts, but do not give them adequate importance in the formulation of water and agriculture policies. They pay little attention to the opportunities that climate change may offer in some areas, e.g. in water-logged areas.
3. Clearly define Food Security as a priority area, and yet only propose the implementation of short-term measures without a clearly chalked out long-term course of action based on sound modeling and analytical analysis.
4. Do not adequately reflect the changing realties in international trade and the international commitments under WTO to which Pakistan is a signatory.
5. Fail to acknowledge or highlight the fact that Pakistan is not a major player in carbon emissions but is being penalized for the actions of others in the past (Western industrialized countries) and more recently those emerging as expanding economies (India and China).
6. Only look at policy from a domestic perspective, ignoring the new opportunities of leasing out large chunks of land to other (i.e. Middle Eastern) countries to be submitted to high-tech agriculture on a long-lease basis. Maldives is considering the outright purchase of land, fearing its land mass will be submerged by a rise in sea levels. Pakistan's delta regions and coastline would face similar consequences.

This review clearly shows that climate change will impact agriculture in the following ways:

- Reduce yields of all major cereals in the southern plains with minor improvements in yield in the northern area.
- Lead to significant shifts in cropping patterns and crop rotations and significantly modify the crop calendar in response to climate change.
- Reduce the overall agricultural growth rate, resulting in widespread poverty amongst already marginalized and disadvantaged groups.
- Lead to land degradation and the creation of 'hot spots' that have large populations.
- Increase the demand for agricultural produce in urban areas due to a shift in rural-urban populations and the creation of mega-cities. This trend will intensify the need for 'urban agriculture', which has been neglected in the past. Such shifts will impact the income of areas that have traditionally maintained a comparative advantage in the production of fruits, livestock (meat & milk), vegetables and fish.
- Change the type of investment needed to maintain agricultural production at present levels. Huge amounts of investment will become a prerequisite to procure technology, build a market infrastructure and create asset formation, as never seen in the past.
- Climate change-related energy crises will have direct linkages to agriculture mechanization. Renewable energy resource shifts will force farming communities to invest in energy-saving techniques, thus changing the profitability of agriculture. Bio-fuels present an emerging opportunity that needs to be explored carefully.
- Sustainability concepts may no longer be sustainable, as lifestyles and patterns of living will have to change in meaningful ways in order to adapt to climate change. Expecting agriculture to maintain production at sustainable levels would seem unreasonable under such a regime.
- Create many new situations not yet planned or perceived. These include the rapidly expanding weed complex in both the irrigated and dry lands of Pakistan. The shifts in monsoon rainfall patterns now pose challenges for most farming systems. A good example is the uneven ripening of the crops, e.g. gram, where in certain fields 30% of the crop is completely ripe, 30% half-ripe, and 40% completely green. Imagine the difficulties in harvesting such a crop using migrant labor.

Perspective Plan and Policies

Only a casual mention of climate change is found in this important document. Agriculture Perspective and Policy (2004) states on page 78:

vii. Global Climate Changes

- ***Development of agricultural meteorology laboratories network for Database forecasting, modeling and simulation of the effects of changing climate on crop yields/cropping patterns for development of early warning systems.***
- ***Effect of global climate change on crop yields.***
- ***Effect of global climate change on forests and rangelands.***
- ***Greenhouse gas emissions from agricultural lands and animal farms.***
- ***quantification and control technologies.***

This list of research areas is rather limited and seems to overlook the widespread impact climate change will have on Pakistan's agriculture within the dominant agro-ecological zones. According to IPCC (2007), the yield of cereal crops could go down by more than 20-40%, creating immense food shortages. Similar impacts are envisaged for other, non-cereal crops, livestock, fisheries, fruits and vegetables in irrigated areas, dry lands and the delta regions of Sindh. Besides yield decreases, the quality of produce is likely to be impacted negatively.

A dramatic shift in the present research goals is needed to ensure that future breeding programs worry more about how to maintain yield or even sacrifice yield in favor of more drought-tolerant varieties.

Research and adaptation-related applied trials are needed to address forest, inland fisheries and high-value horticultural crops to determine their production thresholds under a variety of climate change scenarios.

Develop an adaptation plan for the agriculture sector and ensure that all stakeholders accept ownership. Since agriculture is essentially a provincial subject, it is important that all the provinces are kept abreast of state-of-the-art knowledge on climate change and coordinate efforts to mitigate its effects and adapt to its vagaries. Most of the implementation and prescriptive policies must be developed and owned by the provincial governments, which are responsible for their design, implementation, gains/losses, outcomes, etc. At times provincial governments are not sufficiently consulted and are hesitant to implement decisions that are 'top-down' in nature.

This review, undertaken to determine gaps and anomalies, revealed a lack of recognition of a climate change

perspective in planning documents that relate to agriculture policy. Firstly, as noted, none of the documents after 2000 recognizes the negative or positive aspects of climate change as the driver of policy instruments and prescriptions. Secondly, the National Commission on Agriculture culminated in 1988 and was to serve as a broader review of the agriculture sector, with detailed recommendations on tackling the challenges to agriculture. It is almost 20 years old and in need of immediate attention and reformulation. Thirdly, 5-year plans, strategy documents, and the Medium-Term Development Framework generally overlooked the debate on climate change and are seriously deficient in this aspect.

Where they do mention climate change, it is often unclear how climate change is included as a cross-sectoral issue that impacts all aspects of agricultural enterprise production, marketing, processing and transportation. Likewise, the policies in agriculture are duplicative and at times contradictory to climate change mitigation and adaptation, for example, granting loans for additional sugarcane mills and enhancing sugarcane acreage in a situation where water shortages are anticipated. Another example is the electricity subsidization issue in Balochistan that has depleted the aquifers beyond recovery. These policies are counter-intuitive in the context of climate change, and need to be rationalized and reformulated without delay.

Pakistan has signed several international conventions, and it is important that the policy documents reflect the commitments and actions it has taken to address the covenants of the conventions. Likewise, there is a clear gap in documenting examples of climate change in Pakistan's agriculture that are location and time-specific, such as sea intrusion, extended droughts, shifting of the Rabi crop harvesting, with its implications on the crop calendar. A few studies on wheat and rice, based on secondary time series data and regional climate change models, are helpful but require far more down-scaling to be useful in policy planning.

Civil society organizations and NGO's are interacting with a variety of stakeholders in the agriculture sector. Their experiences also need to be better documented and made available to the policy makers[1]. Another important gap is the inclusion of a climate change perspective as highlighted by donor agencies (i.e. World Bank, Asian Development Bank, UNDP, USAID) in projects being negotiated or implemented in Pakistan. This needs to be rectified to ensure that upcoming projects being appraised by the Planning Commission and other agencies meet international standards and comply with the commitments Pakistan is making under international conventions.

The National Water Policy aims to achieve the following **objectives:**

- Efficient management and conservation of existing water resources
- Optimal development of potential water resources
- Steps to minimize time and cost over-runs in completion of water sector projects
- Equitable water distribution in various areas and canal commands
- Measures to reverse rapidly declining groundwater levels in low-recharge areas
- Increased groundwater exploitation in potential areas
- Effective drainage interventions to maximize crop production in water-logged areas
- Improved flood control and protective measures
- Steps to ensure acceptable and safe quality of water
- Minimization of salt build-up and other environmental hazards in irrigated areas
- Institutional reforms to make the managing organizations more dynamic and responsive

As can be noted from the above policy objectives, the climate change perspective is totally missing in recognition and/or scope, thereby leading to setting goals, objectives and targets that become difficult to achieve in the medium to long term. This is a serious flaw and in recent conferences and discussions, both nationally and internationally, climate change is noted as a threat to Pakistan's water resources.

The study provides suggestions for incorporating text within the 18 policy areas covered by the draft NWP. Therefore, in making any revisions in the water policy these statements can be incorporated after suitable modifications and vetting by stakeholders.

The study also looked at the Water Apportionment Accord of 1991 and found the document silent on the SOP's for the document, nor does it deal with the question of unexpected changes in the overall water resources resulting from extreme glacier melt, significant changes in timing, the intensity and pattern of precipitation from worldwide phenomena such as global warming and climate change. It also does not speak about what the terms of the Accord are under *force majeure* conditions.

The document should be revised by taking all the key stakeholders into confidence. An amendment needs to be made on water allocations under

1 A Powerpoint presentation documenting the field situation is provided by Sindhu, S. 'Increasing the resilience of poor communities in Pakistan to cope with impacts of Climate Change in Pakistan', Rural Development Policy Research Institute (no date). Locate on net with title.

climate change after (a) careful and detailed analysis of the protection of water rights and the agriculture food security of the country, (b) establishing a conflict resolution authority to address the issues of a high level of water variability resulting from uncertain conditions that may have permanence. Current institutions like IRSA may not be adequately equipped to handle such complex issues with solid analytical modeling and research support.

IUCN should bring up this issue and facilitate discussion. The actual revision of the document should only be attempted after it gains acceptance by all the stakeholders and is reviewed at the level of various provincial water forums and a National Water Council (or similar body) and the parliament.

The study also underlined the need to re-look at the Indus Water Treaty and take a long-term view of its validity under a climate change scenario. It emphasizes that as climate change brings more and more waters during floods to India it will store whatever it can and release the rest to the detriment of the lower riparian (Pakistan). A recent example is the 2008 floods in Sutlej that played havoc with Pakistan's agriculture. In another instance, Pakistan is claiming that due to upper storage construction on the Western rivers (which belong to Pakistan) it is being deprived of almost 0.2 MAF water so critical to Punjab's agriculture. Pakistan has hinted it will seek compensation from India over the stoppage of this water.

The Indian energy and water demand scenario, climate change and Pakistan's position on India's water storage and development works on Western rivers suggest a careful re-assessment of the Treaty (possible re-negotiation under a *force majeure* clause) to address the serious emerging trends that will have widespread consequences for the two countries. In Pakistan there is a strong lobby that considers the Treaty as sacrosanct and argues that since Pakistan is the lower riparian and it took almost 10 years to arrive at this Treaty, opening up the issue again is not in Pakistan's interest. This uncompromising view may be appropriate under a 'business as usual' scenario, but Pakistan must take a very serious look at its options in the wake of postulated climate changes and the changing regional political situation (i.e. the November 2008 terrorist attack in Mumbai and its effects on India-Pakistan relations).

While discussions on the scope of the Baglihar Dam project (Chenab river) and the Kishanganga project design (Jhelum river) were beyond the scope of this study, the lesson to be drawn is simple: under extreme situations, like that of unexpected changes in water resource availability, countries will be forced to revisit (sometimes even revamp) treaties - and climate change is unfortunately such an unexpected extreme case!

Water

1. Further debate the proposed incorporation of text suggested in chapter 3 in the relevant clauses of the draft National Water Policy
2. Open up in-house discussion on the Indus Water Treaty and re-evaluate the effectiveness of this Treaty under the various climate change scenarios identified in IPCC, 2007 and newly emerging evidence that the incidence and intensity of certain events like the melting of snow-caps, glacier melt and shortened but intensive bouts of precipitation are happening earlier than predicted.
3. Address the shortcomings in the Water Apportionment Accord in the light of anticipated climate change and take all the provinces into confidence on appropriate fallback proposals. Such in-house debate should be held in a transparent manner and all parties taken into confidence about the likely future scenarios.
4. Pakistan met the challenges of water-logging and salinity with international help in the sixties. The present water resource challenge posed by climate change requires a similar response that brings together some of the best minds in the world to address a problem of such serious magnitude. The possibility of acquiring such high-level technical assistance and specialized expertise (e.g. the Roger Revelle Report under President J. F. Kennedy) to review and recommend action and seek international help should be seriously explored with the new US administration.
5. Conserving water must become a national duty and not be left to any single department or institution. A strong advocacy program backed by field experience must be launched immediately.
6. On trans-boundary matters, there is a need to analyze how India has managed to develop more than 10 large dams on its river system and what factors and mechanisms it has in place to harness most of its excess water resources. Likewise, neighboring China is putting more than 100 dams in place under an extremely diverse set of circumstances.
7. A sufficiently articulated draft water policy is in place. It should be made succinct and flexible enough to serve as a guiding document for pragmatic decision-making by incorporating current thinking on the subject.
8. Investments in water should be linked directly to the benefits derived from zero carbon emissions in hydro-power

generation. International financial assistance should be sought for this as the thrust argument in the wake of climate change.

General Recommendations:

1. Upon the incorporation of relevant statements, clauses and articles into agriculture and water policy documents, solicit suggestions from a wide array of stakeholders at federal and provincial level before the finalization of the documents. This is an ideal opportunity to undertake this exercise as the Water Policy exists only in draft form while there is no current agreed-upon agriculture policy.
2. Hold policy seminars (agriculture and water) at the Planning Commission and provincial government P&D departments, engaging planners, policy makers, progressive farmers, agribusiness concerns and decision makers from both government and political arenas.
3. Develop a mechanism for continued feedback from important stakeholders. This could be in the form of a website on 'Agriculture and Water Policy under Climate Change'.
4. Initiate action to develop the necessary legal framework/legislation in response to climate change-related litigation (national/international) and apprise the legal community of emerging trends in international law that will apply to Pakistan under the various covenants of treaties and conventions (UNFCCC, Kyoto, Bali) and the need to keep abreast with such changes.
5. Pakistan is under obligation to produce various convention communications, e.g. the second UNFCCC communication, WTO implementation agreements, etc. Who should be made responsible for the water and agriculture sectors based on the comparative advantage of institutions and knowledgeable manpower? There is a need to take a holistic view of such obligations with input from multiple stakeholders. The present state of affairs results in poor representation for Pakistan at international forums.
6. Engage the print and TV/radio media to educate the public about the challenges of climate change and facilitate a policy dialogue amongst concerned stakeholders.
7. Put in place an economic, financial and social prediction, projection and forecasting capability to address adaptation measures for climate change impacts on agriculture and water. Social research organizations should engage academia to develop a long-term capacity to analyze such issues and propose prescriptions in the light of sound data which is relevant to Pakistani conditions.
8. Allied policies related to drinking water and sanitation, inland fisheries, livestock, forestry and the environment should also be reviewed to ensure that climate change is adequately incorporated and agreed upon by stakeholders.
9. Revisit the existing draft Water and Agriculture policy (1991) documents and propose much shorter versions (perhaps less than 10 pages), and distinguish between a national policy document and government planning documents.
10. It is recommended that Pakistan take the initiative to draft a National Climate Change Policy after widespread consultation with stakeholders from all walks of life.
11. There are major difficulties in obtaining policy-related information from government organizations. The Planning Commission may look into ways to simplify document procurement procedures and also to develop a mechanism to ensure monitoring and evaluation of the policies being implemented. Promotional bulletins, synthesis leaflets and case studies should be made available in all local languages for more widespread distribution.
12. Perhaps the single most important policy Pakistan needs is an **'Implementation Policy'.**

Way Forward:

The above recommendations suggest that the way forward lies in moving from careful analysis (based on the international community concerns raised in IPCC, 2007 and its earlier assessments) and Pakistan's own findings to the establishment of an Adaptations Center that addresses the impacts of climate change on agriculture and water.

Equally important is the need to understand the ecological imbalances resulting from human activity, which are often ignored when postulating the impacts of climate change. There are no 'single silver bullet' solutions to the overall problem of climate change. The core problem has to be analyzed piecemeal with most major hotspots and agro-ecological zones modeled and prioritized for close monitoring and adaptation. Worldwide signals reveal that the rate of climate change increase is much higher than earlier anticipated (e.g global warming, rising sea levels, precipitation rate, etc.). This needs to be seriously highlighted in all discussions and documentation. The views of those who dispel climate change as 'climate variability' must be listened to carefully and responded to with scientific data and evidence.

It is equally important for the government to be warned against implementing extreme responsive measures, such as using high-quality

land to produce bio-fuels, setting up costly irrigation expansion projects that spread water too thin, and poorly chosen policy instruments that have uncertain results. With dwindling water resources growth must be vertical and measures to achieve this will require a diametrical shift in thinking (knowledge, technology and investment) that traditionally focuses on 'more and more' unplanned infrastructure.

Serious consideration must be given to bringing agricultural produce (i.e. vegetables, milk and other high-volume consumption products) nearer to urban centers and perhaps through skyscraper (vertical) expansion of the agriculture resource base. This is important, as almost 60% of Pakistan's population will be living in urban areas by 2030 and will cause serious problems of pollution through overcrowding. This close proximity of production to city centers (urban agriculture) is an emerging area for research and development and can help reduce high transportation costs, promote retail efficiencies, and result in improvement in quality, thus bringing about major savings in carbon imprints.

Besides expanding our public forest cover, which remains almost 50% under par, Pakistan can contribute significantly to reducing CO_2 emission problems by expanding on-farm forestry near water channels and on homesteads. This could be an important strategy that would mainly require knowledge and motivating farmers and could result in huge pay-offs.

Finally, widespread awareness campaigns can help spread the message that past assumptions about agricultural productivity and water availability may be seriously undermined by climate change. Fresh thinking, based on sound science, is needed, **where high-cost, first class water is directly related to high-tech, first class agriculture.** This will hold true for both irrigated and dry-land agriculture. This should be the over-riding challenge for policy and decision-makers and should be reflected in the development resources shared between agriculture and water.

I. Introduction

Purpose: This document fulfills the contractual requirements of a gap analysis related to climate change aspects relevant to agriculture and water policies commissioned by the International Union for Conservation of Nature, Pakistan and carried out by the consultant. The study has been carried out in the wake of widespread demand from national and international agencies to document how national programs (like Pakistan's) are proceeding with Climate Change policy incorporation in high-impact sectors.

Climate Change has gained widespread recognition only in the last few years despite the fact that the phenomenon has been set in motion by anthropogenic impacts over the past few decades. It is only in the last few years that the threat from climate change has received attention and the understanding is still evolving. So are the policies and paradigms. The study takes this lag effect into account and reviews Pakistan's experiences in addressing climate change in its water and agriculture policies as an opportunity and an on-going process.

TOR'S

To undertake a detailed gap analysis of the Government of Pakistan's policies on agriculture and water, with respect to climate change.

The study fulfills the following Terms of Reference:

- Undertake a detailed **search** of literature on the subject and properly document it in the study annexures;
- Conduct **interviews** with relevant professionals;
- **Review** all the agriculture and water policies that are currently in effect, either as official policy documents or in the form of notifications, speeches, or in any other form;
- **Identify gaps** in the existing policies, with respect to their relevance to and contradictions of GoP's national and international commitments under climate change;
- Make **recommendations** on how to address the gaps/anomalies in the existing policy framework of agriculture and water, with respect to climate change.

Approach: The study entailed a review of the existing literature relevant to agriculture policy, water policy and the status of various conventions/ protocols into which Pakistan has entered. It identifies the gaps in the existing documents and makes recommendations to address them. Specific information relevant to an agriculture policy is rather scant. An earlier policy framed in 1991 was the only guiding document along with the National Commission on Agriculture (1988) report.

While other documents, in the form of the Medium-Term Development Framework, Vision Statement till 2030, Agriculture Perspective and Policies, Powerpoint presentation of Secretary Agriculture, etc., are more recent, they are not strictly policy documents. Other, less relevant documents relate to individual policies, such as the fertilizer policy, pesticide policy, credit policy and price support policies.

The wheat procurement policy is revised every year or after every few years and is anxiously awaited by many in the agri-business sector. In the agriculture sector there are several speeches and notifications, besides coalition party manifestos, that were also reviewed and documented. The international literature base on agriculture policy and climate change is very rich. While it was reviewed where it relates to policy aspects its documentation in the report is kept to a minimum to restrict the scope to the Pakistan context.

Pakistan has a draft National Water Policy - 2005 that served as the focal document. In addition, there is the Apportionment Accord and the Indus Water Treaty. These, along with some of the major studies undertaken over the past several years, were reviewed from a climate change perspective.

While reviewing both the agriculture and water policies, important clauses and covenants relevant to climate change are noted, gaps in the policies are identified, **appropriate text suggested to be included is highlighted, and where a major paragraph is needed it is blocked as a box.**

Pakistan is also a signatory to several international conventions, like the UNFCCC, Kyoto Protocol, Basal Agreements, WTO, agreement on Trade Related Intellectual Property Rights (TRIP's) and many others. An updated listing of these agreements is provided in Chapter 4.

The report is organized into 5 chapters: I. Introduction, II. Agriculture Policy, III. Water Policy, IV. Conventions and Protocols, and finally V. Recommendations and Way Forward.

All the major documents that at times are difficult to trace have been included as annexed material and the overall documentation has been organized into a two-volume report: Volume I is the main report while Vol. II contains the appendix material (somewhat voluminous). A separate CD is provided that includes the Internet searches carried out which are relevant to the topic and the web resources (main reports) that can be used for future reference.

The consultant also met relevant professionals in the fields of agriculture and water policy. Ideas were shared and views solicited for possible incorporation from a climate change perspective. Serving as a member of the Technical Advisory Panel on Climate Change (Ministry of Environment) and as an expert on the Special Task Force on Climate Change formed by the Planning Commission of Pakistan has also helped the consultant incorporate the views of a highly select group of professionals where appropriate.

II. Agriculture Policy

Pakistan has a vibrant agriculture sector that contributes roughly 25% to the GDP, employs 44% of the labor force and its value to total exports is around 60 per cent. Its dominant sectors are crops (both major and minor), livestock, dairy and fisheries. The average annual growth rates are highly variable, averaging about 4%. The performance of Pakistan's agriculture, due to close linkages with the textile, sugarcane and allied industries, determines the overall national economic growth rate.

With the looming industrial crisis (almost 60% of industrial units are closed due to energy shortages and the negative impacts of global financial recession/depression), agriculture remains the most significant and important component of Pakistan's economy and can rightfully be termed its 'engine of growth'. This is especially so in the absence of non-agriculture related industries. However, despite its importance, the investment in this sector (both public and private) is dismally low. In the 2003 budget agriculture was only allocated 1% of the national budget (Ahmed, 2003).

The year 2008 has been marked by rampant inflation, where the prices of all major agriculture inputs, particularly fertilizers, pesticides, water and diesel, have increased by more than 60% . Food-related inflation has averaged 32% with wide variations. There have also been increases in output prices due to the international demand and supply situation. All signs indicate a major reduction in the production of crops, due to rising production costs, a reduction in canal water that is forecast to be about 35-40% (IRSA, 2008) and an overall slowdown of the economy in line with the overall depression in the global economy.

The ongoing wheat crisis has its own socio-political dimensions. Pakistan produces about 23-24 million tons of wheat and the government set itself a target in 2008 of 25 million tons. However, it quickly revised its estimates downwards by almost a million tons and achieving even this target seems highly unlikely (see Rafique Goraya, October 23, 2008 at www.Pakissan), given the acute water shortage, high input prices and the general inflationary trends in the country. Last year Pakistan imported almost 4 million tons of wheat and received a wheat grant from the US in the form of a grain shipment. Given the fact that Pakistan considers itself an agriculture-based economy, there seem to be significant flaws in its performance and there is wide scope for improvement.

Agriculture policy is a major subject but seldom taken seriously in Pakistan. The country lacks an acceptable and agreed upon document termed as an Agriculture Policy. In the review of SAARC[2] country agriculture policy, the only reference is to a Pakistan agriculture policy matrix (essentially an SAR proposal for TA to the Asian Development Bank), while there exist clear agriculture policy documents for other countries like India, Bangladesh, Nepal and Sri Lanka (these are placed in annexure and included on the disk to serve as illustrations). This lack of updated documentation on an agriculture policy is a matter of surprise and a significant gap.

Pakistan has recently set up an Agriculture Policy Institute in Islamabad by merging it with the earlier institution of Agriculture Prices Commission. While the mandate of this institution is still evolving, the government does initiate policy actions through various documents like the 5-year national plans, annual development plans, Medium-Term Development Framework, establishment of a millennium development framework and so forth. It also relies on the agriculture sector strategies developed by various donors, like the Asian Development Bank, UNDP and the World Bank. For example, in 2005 Pakistan received technical assistance for development of a strategy for agriculture (Asian Development Bank, 2005).

While a comprehensive agriculture policy document is lacking, there are some documents that refer to agriculture price support policies, a fertilizer procurement and pricing policy, an agriculture credit policy of the Zarai Taraqiati Bank (Agriculture Development Bank) and so forth.

Broad Goals of Agriculture Department:

According to the 1990's Agriculture Policy[3] document the goals of Pakistan's agriculture development are:

1. Social equity
2. Self reliance
3. Export orientation
4. Sustainable agriculture
5. Enhanced productivity

The document further elaborates that an action plan is adapted to:

a. Obtain a growth rate higher than population growth to ensure food security, self-sufficiency and export surpluses
b. Increase productivity of the crop sector, livestock, fisheries and forestry sectors
c. Evolve an export-oriented strategy to exploit the export potential
d. Conserve and develop natural resources
e. Institutionalize reforms, promote institutional development and bring social and economic equity to the agrarian structure
f. Focus on small farmers and barani areas development
g. Achieve full employment in rural areas through rural agro-based industrialization

More recent documents, like the Medium Term Development Framework 2005-10, highlight strategies to achieve similar objectives and targets that could lead to higher growth rates in agriculture and its associated sectors.

2 See SAARC Agrinet for agriculture policy documents of all SAARC countries.
3 See National Agricultural Policy, 1991, Ministry of Food, Agriculture and Cooperatives, Government of Pakistan, Islamabad. A copy is placed in annexure.

CORE ISSUES FACING AGRICULTURE

The planning documents refer to core issues in the areas of land and water along with allied input constraints at the production level. The difference between potential yields on progressive farms and the average farms still remains high and narrowing this yield gap has been a constant challenge for governments since the 1970's and a core issue for the present government. Farmers are facing acute difficulties with the processing, transportation, grading, and marketing of their agricultural produce (crops, fruits, vegetables and livestock). Agriculture faces major issues from heightened competition from neighboring countries like China and India. WTO regimes now require opening up Pakistani markets to foreign producers. With declining trends in trade and highly variable and less profitable agriculture, keeping youth in agriculture is becoming a formidable issue. Water-logging and salinity continue to remain sore points of Pakistan's agriculture, and climate change is likely to further impact productivity.

Institutional issues related to the absence of a consistent policy on agriculture and a lack of pragmatic land reforms continue to be deterrents to progress in the agriculture sector in Pakistan, with its much skewed distribution of land ownership. The broader issues of agriculture are now common to South Asia and in many cases a regional approach, especially in marketing and technology transfer, can help address cross-sectoral problems like agriculture-water-energy-market-technology. For more details on a SAARC exposition see[4].

CHALLENGES OF AGRICULTURE

According to a presentation by Secretary Agriculture, 2007, the key policy goals of Pakistan for its agriculture are:

- Diversification into horticulture, livestock and fisheries
- Narrowing the yield gap
- Focusing on small-holders, who are increasing in number and importance
- Demand-driven research and new technology
- Extending the irrigation network and ensuring higher efficiency in irrigation
- Ensuring fair prices to farmers
- Creation of a market infrastructure and continuing development
- Compliance with WTO regulations, especially those relating to international quality standards, and getting a larger share in the international market

These statements, coupled with a recent vision statement by the Ministry of Agriculture, set the stage for agriculture policies that contribute to the overall economy, are participatory in nature, and put special focus on enhancing agricultural productivity. Also see Ahmed (2008) on Agriculture: the issues and challenges[5].

The Vision Statement[6] 2030 declares, "Our vision is an efficient and competitive sustainable agriculture ensuring food security and with ability to contribute to the economic development and poverty alleviation in Pakistan."

This Vision Statement makes special mention of **climate change** and its relationship to agriculture, while cautioning against the impact of global warming on certain crops, such as wheat, whose productivity is likely to decline, by some estimates, by more than 10% (GCISE, 2008). A positive offshoot noted in the document is the increased water availability due to glacier melt till 2030.

This document sets the stage for incorporating the crucial climate change

> "Global change, especially in biophysical environment, is impacting the lives of all inhabitants. Ramifications of global warming are having disastrous consequences in the form of drought, floods, low and high temperatures extremes and hurricanes. Recent data reveals that 1990s was the warmest decade, and 1998 was the warmest year. Unprecedented heat wave in 2004 resulted in large number of deaths.
>
> Similarly, high intensity typhoons in the USA and the Tsunami in Indonesia, the prolonged and severe drought in Southern Pakistan confirm a trend in global climatic change. In our region, the monsoon season has been shifting both in intensity and time resulting in heavy losses to national economies. Therefore, comprehensive and careful research studies are needed to understand the nature and the extent of this climatic change and develop plants and animals types and farming systems, which are less vulnerable to such climatic changes.
>
> Models show that Pakistan will grow warmer by 1.0 degree C by 2030; this may require extra water for wheat. We will also need wheat varieties which are more drought as well as more flood resistant. On the whole, wheat yield is likely to go up, even though its geographical distribution will change, while rice will not be affected."

4 Science-based agricultural transformation towards alleviation of hunger and poverty in SAARC countries New Delhi, India, March 5-7, 2008.
5 A good set of popular articles on agriculture written at Tando Jam Agriculture University can be found at www.SAU.org.
6 A copy of the detailed statement relevant to agriculture is placed in annexure.

concerns into policy debate and planning documents. The relevant section of the Vision Statement 2030 on climate change is reproduced above:

This Vision Statement recognizes the importance of climate change and how it will contribute to productivity gains and losses. The rather narrow perspective that glacier melt will increase water resources and thus enhance output is far-fetched. So far, glacier melt has merely resulted in the formation of glacier lakes. However, a part of the water from glacier lakes does find its way into rivers, contributing to groundwater recharge, and to storage in a series of dams and barrages on the River Indus. A recent survey by ARC (See R Roohi, 2007) revealed that there are over 5000 glaciers in their inventory and over 52 large lakes. The number of lakes is likely to increase over time. Not all water stored in these lakes will show up as increases in river flows. Moreover, even if there is an appreciable gain expected in river flows, unless storage is put in place to conserve this water, it is unlikely that there will be any appreciable gains. Furthermore, water is not the only constraint - its economical application to agriculture requires the associated inputs of fertilizer, seed, expertise, processing, marketing, etc. Unless these inputs are in place and the farming community finds enterprise profitability sufficiently motivating, the desired results may not be achieved.

PARTY MANIFESTOS RELATED TO AGRICULTURE

The present government is a coalition of the Pakistan Peoples Party, Pakistan Muslim League (Nawaz Group) and the Awami National Party (ANP) and some smaller parties. Their Party manifestos relevant to agriculture and water are reproduced below and provide the overall political economy framework for understanding what the government plans to do for agriculture and water during its tenure.

The Pakistan Peoples Party, the dominant party in the present coalition government, has the following stated policy goals as per its election manifesto of 2008:

Pakistan Peoples Party

Accelerating Agriculture and Rural Growth: Agriculture is the mainstay of the National Economy of Pakistan. As a farmer-friendly party, the PPP will help farmers boost production and obtain fair prices. Farmers got the best prices when the PPP was in government. The key to agricultural exportable surpluses is to augment the output per acre and productivity per farmer.

Aggressive Agriculture and Rural Development will be another central pillar of our growth and Poverty Reduction strategy. Our efforts will be focused on improving productivity and crop diversification, agricultural markets and exports, and special programs for small farmers to reduce risks faced by them. Moreover, with advances in technology the desert can be made green.

The Pakistani peasant, mired in poverty and debt, has to be rescued from the morass of despair by a bold policy which ensures that the private sector provides key inputs and services - such as credit, fertilizer, pesticides, extension, marketing, seeds, tractors - in a timely manner and at competitive prices.

Special attention would be given to encouraging Banks to expand rural lending, while maintaining sound credit policies.

Special capacity-building programs for agricultural support services will be put in place to revitalize key institutions of research and extension.

A sustainable program of farm to market roads will be put in place to ensure that perishable and valuable agricultural products like fruits, vegetables and milk can reach markets to enable better incomes for farmers and for the benefit of urban consumers.

Peoples Party commits itself to providing all surplus electric power during off peak hours for tube-wells free of cost.

Ensuring Water Security: The PPP government is committed to ensuring water security for irrigation and availability of clean drinking water.

Pakistan is now a water scarce country. Scarcity will increase with time, with a burgeoning population and climate change. The PPP will put in place a bold and comprehensive program to ensure water security for future generations. Key elements of the strategy would consist of: water conservation, additional storages, farmer-managed irrigation systems, rehabilitation of the ageing canal and

Comment: The Climate Change aspect does not seem to get visible projection in the PPP Manifesto. The focus is on addressing the farmers' productivity issues and on spurring rural development. Its rather traditional approach recommends investing in agriculture inputs (fertilizer, seed, tractors, credit) and rural infrastructure development. The party's commitment to address the energy crisis is important as this constraint is constricting agricultural productivity and leading to despair amongst the farming community. The policy seems to be based on an expansionist view, with the idea of bringing more area under production and spreading the already thin water base to larger areas by expanding the irrigation network.

barrage system, an effective drainage system, enhancing water productivity, strengthening water rights and protecting the lower delta eco-systems.

In respect of the Arid Zones, a program will be developed to harness water from rain and flash floods, promote drip irrigation and crops that need less water. Clean drinking water is a basic need. The PPP shall create a legal framework to ensure availability of clean drinking water for all.

PML (Nawaz)

The PML Manifesto drafted in 2007 spells out its goals and objectives for agricultural development in Pakistan:

Agricultural and Rural Development

Pakistan Muslim League (N) believes that prosperous agriculture is the real basis of national prosperity and diversification of the rural economy by expanding non-farm rural employment is critical for the alleviation of poverty. To accelerate the pace of agricultural and rural development, the Pakistan Muslim League (N) shall:

- Turn agriculture into a fully viable economic industry by changing the policy framework and terms of trade in favor of agriculture.
- Focus on the small farmer as the real backbone of the rural economy and assure his access to knowledge, inputs and markets. Development of the livestock sector will be given high priority.
- Revitalize the cooperative movement to meet the real needs of the rural population by setting up agri-service corporations with majority equity of the poor and managed by professional managers.
- Reform the agricultural credit system to ensure that at least 50% of the total is provided to the small farmers and land owners are able to obtain credit on the basis of the market value of the land rather than outdated produce index units.

Comment: The salient aspects of the PML (N) policy are its attention to the concerns of small-holders and its focus on high-value products. Trade features high on the Manifesto's priorities and so does a strong business orientation. A research-based policy agenda is recognized as the way to progress in the agriculture sector. Land reforms are aimed at granting rights and entitlements to the landless and the tenants who till the land. Again, the concerns of global warming and climate change are overlooked as a significant challenge to the sector.

- Move rapidly towards national self-sufficiency in oil seeds.
- Convert Pakistan into a large net exporter of food and high-value crops and remove restrictions on agricultural exports.
- Building consensus on the basis of the 1991 Water Accord on the distribution of Indus System to allow new water projects to be undertaken and extension of irrigation facilities to additional areas.
- Ensure full utilization of available water resources by expanding the on-farm water management programme.
- Initiate schemes for crop insurance through private insurance companies to protect the farmer against the vagaries of weather.
- Encourage ecologically sound development policies to preserve and develop the country's natural and forest resources to counteract the impact of global warming.
- Provide incentives for farmers to adopt social forestry on a commercial scale rather than depend on restrictive laws for this purpose particularly in border areas.
- Expand the programme to fight the cancer of water-logging and salinity.
- A major programme of aquifer recharge in arid and semi arid areas of Cholistan, Thar and Balochistan to ensure that water flow from tubewells installed in these areas can be sustained.
- Immediate updating of the revenue and property records using Information Technology will be undertaken. Based on the information so generated 'benamis' can be done away with, property rights of female members protected and access to credit by the poor assured.
- Policy shift in agriculture from commodity based agriculture to product based agriculture. As an example 22 products can be produced from corn.
- All agricultural research organizations will be completely revamped to ensure that the benefits of research actually reach the farmers.
- Agricultural education in general and curriculum of agriculture universities in particular will be modernized.
- Mafias and monopolies in case of major agriculture products will be done away with by putting in place appropriate agricultural marketing strategies.

Under its land reform programme, PML (N) will reclaim and irrigate additional land for allotment to landless haris and tenants. It will also undertake a land consolidation programme to create viable units for modern agriculture.

Awami National Party

The Awami National Party, essentially representing the NWFP, elaborates its goals for agriculture and irrigation in its Manifesto of 2007:

Agriculture

- Agriculture accounts for 25% of the Pukhtunkhwa's GDP. 47% of the Province's labor force is employed in this sector and 70% of population subsists on agriculture. Hence, agricultural development will be a top priority. Similar initiatives will be made in other provinces, as well.
- Livestock is a major contributor in this sector with 12% share of the provincial GDP. ANP will give special attention to this sector because of its large scale impact on poverty reduction and growth.
- Poultry farming has made positive gains in Hazara. Similarly, the sale of dairy products and live animals for urban consumption are an additional source of income for the farmer. ANP will take measures to build on this strength.
- About 2.1 million hectares of pastureland is available throughout Pukhtunkhwa to support livestock and farming; this potential shall be exploited to the benefit of the farmers. The same will be done in other provinces, as well.
- Vast potential exists for diversification of agriculture into high value cash crops like fruits, vegetables and flowers as well as edible oil crops like olives. Incentives will be given to grow these commercially.
- Major reforms will be brought to develop forests because Pukhtunkhwa has 40% of Pakistan's forestry cover.
- Pukhtunkhwa produces 49.8% of Pakistan's maize and 71.9% of its tobacco. Downstream industries based on these products will be developed.
- ANP shall take measures to Provincialize the excise duty on tobacco.

Hydel Generation & Irrigation

- ANP will pursue the development of irrigation projects at the federal and provincial level to utilize about 2 MAF of water that is still available to it for development.
- ANP will continue to oppose projects which do not bring any economic benefit to the people of the province and which endanger their livelihoods, their lands and their environment.
- ANP will strive to make Power a provincial subject as it had been in the pre One Unit period.
- Power is sold by WAPDA at a price, which is substantially higher than the cost of production. This vitiates the comparative advantage of the province, which is a major producer of hydel power. The distribution of electricity should remain with the Province.
- ANP will encourage investment in small run of the river hydel projects.

Comment: The Manifesto of the Awami National Party concerns itself with the welfare of the NWFP province and aims to address the productivity issues of livestock and high-value horticulture and vegetable crops. The stress is on what will be addressed, without any mention of how it will be accomplished. The climate change perspective is missing and widespread expansion of livestock in already degraded lands is proposed as a counter-drought strategy. As the climate change perspective is overlooked, some of the more ambitious statements may have to be toned down in the light of the adaptation strategies that will be needed.

AGRICULTURE POLICIES AND CLIMATE CHANGE

Few of the documents produced by the government of Pakistan and reviewed herein contained any specific mention of the important and emerging relationship of agriculture and climate change. The World Bank's report on Agriculture 2007 specifically mentions the challenge agriculture faces from climate change. It states, "The GCISE recognizes the importance of agriculture being the single most impacted sector from climate change challenges." In its report (of 2007) it points to the impact of global warming on wheat and rice crop yields. As temperatures rise beyond 2 degrees, climate change will reduce yields by a significant 10-15%, and the southern part of the country will be more seriously affected. Warmer and longer days in the northern mountains will result in a 10-15% increase in yields. But since the northern areas contribute less than 2% to total wheat production no significant impact is expected.

Another review study by Dr. Rakhsan Roohi, 2007[7] looks at various research studies conducted on climate change and its impact on water resources, biological indicators and agriculture, and highlights the glacier phenomenon in considerable detail.

In reviewing the challenges to agriculture the Asian Development Bank's report, titled 'Climate Change ADB Programs – Strengthening mitigation and adaptation in Asia and Pacific, 2007', states that the ADB approach is to incorporate the climate change perspective in all its core projects, especially those in energy, water, agriculture and environment. This brochure provides a good overview on how the ADB views climate change and its long-term development implications.

7 See R. Roohi, 2007. Research on global changes in Pakistan, Mountains witnesses of Global Change. By R. Bundo, G. Tartari and E. Vuillermoz (Eds) Elsevier. USA.

Another widely cited report by the World Bank, 'Pakistan's Water Economy Running Dry (2006)', in an allusion to climate change impacts, states that:

> "Climate change will lead to rapidly decreasing glacier resources that may fall as much as 40%. In the first 30-40 years there will be large volumes of water released from these glaciers (see sobering fact #7 climate change). Obviously these significant changes in the natural water resource will have widespread impacts on Pakistan's agriculture primarily dependent on the Indus Basin."

The IPCC synthesis report of 2007, while documenting the challenges to agriculture, highlights food security as an invariable outcome of climate change. In the case of cereals the impacts are largely negative, having widespread consequences for the poor in the developing world. For Asia the report states:

"By the 2050's freshwater availability in Central, South, East and South East Asia, particularly in large rivers basins is projected to decrease.

- Coastal areas, especially heavily populated mega delta regions in South Asia, East and South East Asia will be at the greatest risk due to increased flooding in the sea and in some mega deltas, flooding from the rivers.
- Climate Change is projected to compound the pressure on natural resources and the environment associated with rapid Urbanization, Industrialization and Economic Development.
- Endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts are expected to rise in East, South and South East Asia due to projected changes in the hydrological cycle.

The IPCC synthesis report, while exhibiting caution and talking in terms of probabilities, is quite clear on the negative impacts of a temperature rise on overall cereal production. Its findings are consistent with other studies conducted in Pakistan and the general trends being witnessed in the plains. The year 2008 is a good example, where temperatures during November and December are higher than average and there is little feeling that winter has set in. The higher temperatures are negatively impacting the wheat crop and certain fodder crops like lucerne and berseem. Rabi (winter) crops will require urgent changes in the dates of planting and the associated application of inputs (fertilizer, weedicides, and insecticides). This will inevitably change the labor demand schedules in rural areas. All these changes will necessitate adjustments at the grass-roots level. The systemic implications of such changes will have significant repercussions on the overall crop-livestock linkages in its spill-over effects on Kharif (summer) crops.

The National Communication on Climate Change indicated in a recent review[8] that the following impacts on agriculture will occur in Pakistan:

- **Shift in Spatial Boundaries of Crop Potential Areas:** The global climate change will affect the growing season length of crops due to higher temperature, reduced soil moisture, alter the stages of plant growth with accelerated growth early in the season, affect the partitioning and quality of biomass, affect crop pests and diseases and entail spatial shifts in potential areas of agricultural crops;
- **Changes in Productivity Potential:** The quality and quantity of crop yield will be affected by climate change in two ways: a) direct effects from changes in temperature, water balance, CO_2 concentrations and extreme events; and b) indirect effects through changes in distribution, frequency and severity of pest and disease outbreaks, incidence of fire, weed infestation, or through changes in soil properties;
- **Changes in Water Availability and Use:** The increase in temperature has direct effect on crop evapo-transpiration and loss of soil moisture. The increase in crop evapo-transpiration when combined with decrease in precipitation in the rainfed environments resulted into decrease in crop evapo-transpiration due to limited availability and use of soil moisture by crops;
- **Changes in Cropping Pattern:** A rise in temperature and reduction in rainfall could increase the net irrigation water requirement of crops, thereby forcing farmers to make changes in cropping patterns to adjust to climate change
- **Changes in Land Use Systems:** The global warming, climatic extremes and CO_2 concentrations would lead towards changes in land use systems due to changes in the growing season of crops. The climatic changes in arid climates would result in increased salinity and/or water logging; which would certainly demand for integration of forestry and aquaculture with the crop based farming systems.

8 Also see Task Force on Food Security Sub-Committee on Water and Climate Change, Government of Pakistan, 2008.

The World Bank's report on the State of Agriculture (2007)[9] notes: "Climate change will have far reaching consequences for agriculture that will disproportionately affect the poor. Greater risks of crop failures and livestock deaths are already imposing economic losses and undermining food security and they are likely to get far more severe as global warming continues. Adaptation measures are needed urgently to reduce the adverse impacts of climate change, facilitated by concerted international action and strategic country planning. As a major source of greenhouse gas (GHG) emissions, agriculture also has much untapped potential to reduce emissions through reduced deforestation and changes in land use and agriculture practices. But for this to be achieved, the current global carbon financing mechanism needs to be changed."

Newspapers in Pakistan have reported statements by officials of the present government that are related to climate change and agriculture. Some of the policy guidelines evolved in response to climate change are also highlighted.

In a message to the Food and Agriculture Organization on the occasion of the World Food Day, on Oct. 16, 2008, President Zardari said that this year's theme, 'World food security: the challenges of climate change and bio-energy', covers all the main issues faced by agro-based economies.

He said climate change had emerged as a grave challenge to the sustainability of agricultural production and achieving food security. Drought cycles and erratic changes in temperatures have badly affected the performance of crops and livestock sub-sectors.

Food insecurity and social disharmony! All South Asian countries are genuinely worried by the medium to long term impacts of climate change that is likely to reduce agriculture productivity, especially on small farms that constitute almost 80% of all farms. This loss in productivity will further accelerate rural poverty, bring about migration to already overcrowded urban centers, re-settlement and widespread social disharmony and conflict. Signs of such happenings are already showing up in several parts of Pakistan. The recent wheat crisis is just one example that has impacted the very fabric of Pakistani society.

He said last year's wheat crop was affected by the incidence of frost at the earlier stages of crop growth and high temperature stress at the crop maturity and grain formation stages, causing production losses.

Likewise, addressing a seminar held in the National Agriculture Research Centre on the eve of the annual World Food Day, the Federal Minister for Agriculture, Nazar Mohammed Gondal, said, "Our vast and vibrant agriculture sector offers enormous opportunities to hundreds of millions of rural poor to move out of poverty. We, therefore, believe that agriculture led growth in economy would help in raising farm incomes, lowering food prices and generating surpluses for exports.

"Ensuring Food Security is the most immediate challenge before the nation," he averred. "Greater focus has been placed to enhance agricultural productivity through farm mechanization and adoption of good agricultural practices.

"Government is implementing a two-pronged agricultural strategy including generating growth by bringing additional area under the plough and narrowing down productivity gap between progressive and subsistence farmers," he told the participants of the seminar.

He said that the price of fertilizer, which is a major input, had been rationalized with an upfront subsidy of Rs. 32 billion and agriculture credit, which is the lifeline of the rural sector, had been jacked up from Rs 200 billion to Rs 250 billion. He also mentioned that the government had introduced a Crop Insurance Scheme with a built-in bias in favor of small land-owners.

He went on to say that in order to ensure food security and to improve the productivity of small farms, the government had initiated a phased 'Special Program for Food Security and Productivity Enhancement of Small Farmers' which will start by covering 1,012 villages in all four provinces and other areas and extend to 13,000 villages by the year 2015.

This program aims to enhance the crop productivity of small farmers at the village level and support them in starting income generation activities in the areas of livestock, fisheries and high value crops on a sustainable basis.

On another occasion the Minister for Agriculture declared, "We are cognizant of the seriousness of climate change and its devastating impact on our agriculture. Seventy-three percent of Pakistan's arable land is irrigated. Water for irrigation is entirely dependent on glacier melting. This source is likely to be disrupted by climate change, and other negative consequences. We have, therefore, actively participated in the global discussions on Climate Change."

9 Also see this report for an international perspective on how agriculture is changing in response to the changes in markets, climate, poverty and other challenges.

Gondal said that the government intends to launch a comprehensive process for achieving a better understanding of the impacts of climate change as well as how these can be overcome through mitigation, adaptation, the use of science and technology and the integration of climate imperatives in our economic development efforts.

Deforestation: Pakistan is one of the most forest-poor countries in the world. By some estimates, out of the 4.8% claimed forest cover only 50% of this land area is actually stocked with forest. While widespread potential exists for rapid transformation of on-farm forestry around water channels and homesteads, thereby rapidly enhancing the forest cover, practical policies and programs have been sadly lacking in this area. UNFCCC COP-14, held in Poznan, Poland in 2008, gives special attention to dramatic increases in forest cover as a vital strategy to combat climate change from reduced carbon emission.

The Prime Minister of Pakistan, Yousaf Raza Gilani, has underlined in several speeches the need to pay greater attention to agriculture to help meet the challenges of climate change, energy, and the world financial crisis. He has emphasized the fact that lack of food security is considered to be a major threat to the very survival of this country.

In a speech on the occasion of World Food Day, on October 16, 2008, the Prime Minister said the government had initiated efforts to revitalize the agricultural sector in the short and medium terms.

"It is heartening to know that Pakistan joins the international community to observe the World Food Day (WFD) every year. Today this event is being observed worldwide to highlight the role of international agencies, United Nations Organization, NGOs, agri-scientists and farming community to address the issues related to the theme of WFD this year 'World Food Security: The Challenges of Climate Change and Bio-energy'," he said.

The Prime Minister further observed, "Climate change affects agricultural performance by altering the availability of water, land, biodiversity and territorial ecosystem, and also enhances the uncertainties throughout the food chain, from yield to trade dynamics, among countries and ultimately the global economy. Bio-energy places further demand on agricultural products as well as on the natural resources."

In his address at the inaugural session of the 15th SAARC Summit in Colombo on August 2, 2008, the Prime Minister chose the theme 'Let us make South Asia the granary of the World'**.** "The SAARC region is blessed with rich natural resources," he declared. "A fifth of humankind lives here. We have a vast pool of talent. We have fertile lands and developed irrigation systems. Our societies are agrarian. We export agro-based products to the world. Yet, the region faces food shortages. We must address this issue on priority. We should share and learn from best practices in the region and beyond, modernize our irrigation systems, use appropriate technology and expand our agricultural research and resource base."

In an address to the nation on July 19, 2008, the Prime Minister, lamenting the food situation and the overall economic crisis in agriculture in Pakistan, said, "Being an agriculturist, I am fully aware of the problems of the farming community. I regret that an agrarian country like Pakistan is facing the problem of food shortages." He also highlighted the overall wheat crisis and spelled out in detail the measures being taken by the present government to address these challenges. Similarly, in his address at the launch of 'The Indus Entrepreneurs Islamabad Chapter' in June, 2008, he stated, "We need to devise, adopt and implement a comprehensive development strategy that ensures increased productivity in agriculture sector, on modern and innovative lines. Our young entrepreneurs can be instrumental in 'green and white revolution'."

The Planning Commission has recognized the likely impacts of climate change on agriculture with special reference to glacier melt. In 2008 it organized a workshop titled 'Glaciers behavior under Climate Change and its impacts on Agriculture in Pakistan' which reviewed the water situation and its impacts on agriculture. This was perhaps the first gathering of scientists and policy makers to debate the glacier retreat issues and identify institutions that can play a role in monitoring glacier recession and help devise strategies for combating predicted water shortages. Other South Asian countries, such as Nepal, Bhutan and India, and neighboring China, have already sounded alarm bells on the rapid recession of their glaciers[10].

In a recent statement to the Press, its Scientific Advisor, Dr. Ishfaque Ahmed, said the Planning Commission plans to launch a task force. This task force will assess the scope of the impact on Pakistan's economy due to climate

10 Good introductory material on what is happening in the region on glaciers can be found in Bajracharya, S. R.; Mool, P. R. and Shrestha, B. R. 2007. 'Impact of Climate Change on Himalayan glaciers and glacier lakes - Case Studies on GLOF and associated Hazards in Nepal and Bhutan' Published by ICIMOD and UNEP. Nepal 2007. and Jianchu, et al. 'The melting Himalayas' ICIMOD technical paper.

change; devise guidelines/measures for mitigation and adaptation to cope with the challenges; evaluate institutional weaknesses and suggest measures for strengthening the capacity of relevant institutions; promote programs for advocacy and awareness; mainstream climate change into national and sector-wise policies; provide guidelines for the reduction of greenhouse gas emissions and environmental pollution, as well as guidelines for the development of Clean Development Mechanism-based projects to avail international opportunities for financing.

Climate change is irreparably harming Pakistan with its tremendous social, environmental and economic impacts. The main challenges are reduced agricultural productivity, human morbidity, and stressed use of natural resources. Changing weather patterns and energy shortages are heavily taxing the country's meager forestry resources. Tree cutting is on the rise and carries on unchecked without any proper realization of the long-term ramifications of this rapidly depleting resource. Agricultural productivity in Pakistan is being affected due to changes in land and water regimes. This is negatively affecting agricultural productivity by altering established bio-physical relationships, such as causing changes in the growing periods of crops, alterations in the scheduling of cropping seasons, increased crop stresses (thermal and moisture stresses), changes in irrigation water requirements, alterations in soil characteristics, and increase in the risk of crop pests and diseases.

South Asia is particularly susceptible to the effects of climate change. Much of the population of these countries will eventually be displaced by rising sea levels. Moreover, the drinking water for much of India and Pakistan comes from the Himalayan, Karakoram, and Hindukush glaciers, which are already beginning to melt from warmer temperatures. Heavily dependent on agriculture, South Asian economies are most vulnerable to climate change[11].

There is a close link between the climate of an area and the occurrence or severity of some diseases and other threats to human health in that area. Moreover, several serious diseases appear only in warm areas. Warmer temperatures can increase air and water pollution, which in turn has a harmful effect on human health. The most direct effect of climate change would be the impact of hotter temperatures themselves. Extremely hot temperatures increase the incidence of human deaths. Other impacts follow more intricate pathways, such as those that give rise to water, food, vector and rodent-borne diseases.

During the past century the average global temperature has risen by about 1.0C, with much of that increase attributable to the burning of fossil fuels and deforestation. Global temperatures are projected to increase further by between 1.4C and 5.8C by 2100 and to continue to rise long after that. The predicted consequences include faster glacier melting, a rise in sea levels, a shortage of fresh water, increased droughts and floods, more frequent and intense forest fires, more intense storms, more extreme heat episodes, agricultural disruption, the spread of infectious diseases, and biodiversity losses (IPCC, 2007).

During recent months the government has announced several policy measures to address the issue of food production.

Attention to Major Staple Production

The present wheat crisis has taken a serious turn, with highly inflationary trends seen in wheat flour prices. For the next crop season the Pakistan government has announced a wheat support price of Rs 625 per 40 kg. It has also imported 2.5 million tons of wheat to meet the shortage and is likely to receive an additional tranche of US$ 200 million worth of wheat from the US to meet this emergency situation. Mismanagement of the support price has often resulted in wide supply responses.

Repealing Fertilizer Price Hike

The prices of fertilizers, especially DAP (selling at Rs 3200-4000 in the open market), puts them out of the

Ugly rice gluts and unpaid farmers!

Pakistan had an excellent rice crop in 2008, while the world witnessed poor rice crops. This presents a rare opportunity to take advantage of the international market situation. The opening price for quality rice was Rs 1600 and at season's end the price fell to below Rs 1000. The majority of farmers have not been paid to date for the rice they sold through beoparis. Rice millers are exploiting the situation to their fullest advantage. The end result is a large disgruntled farming community. A similar case is that of the sugarcane crop, where farmers have long complained of late payments. The government's role as a fair regulator seems to be undermined when most producers of high delta (water-consuming) crops suffer as a result of mismanagement and exploitation by a few.

11 Also see Managing Climate Change by Sadiq Ahmed and Praful Patel, South Asia Region, The World Bank - originally published in the Daily Star, November 28, 2007.

reach of the common farmer. This is partly due to inflation (higher material and gas prices) and partly to the depreciating value of the Pakistan rupee, which went from a stable Rs 65 to a dollar to hit peaks of Rs 86 to a dollar in November. Fertilizer, from being a key input in the production of all major cereals, cotton and sugarcane, is beginning to lose its parity value and a rapid decline in its usage is predicted, due to lack of availability and high prices. This will impact the target of 25 million tons set for the current wheat crop. The government has already scaled down this target by 800,000 tons. With the added complication of a tight water situation, it is highly unlikely that even the revised target will be met.

Highly Subsidized Tractor Scheme

The government announced a green tractor scheme in 2008, to help farmers overcome farm machinery constraints, offering tractors through a lottery at 50% off the regular price. It has also embarked on disbursing a sum of Rs 70 billion during 2008 as agriculture credit through the Agriculture Development Bank and other banks.

Benazir Income Support
Transfer payments have long been viewed as poor options for poverty alleviation and generally considered bad policy. How then has the government embarked on a Rs 40 billion program, which the Prime Minister announced in December would be beefed up to Rs 100 billion? The program aims to give Rs 2000 to every family earning less than Rs 5000 per month every two months. This is intended to benefit about 3-4 million families. How much does Rs 1000 per month buy for a family? The current price of a 100-kg bag of wheat is Rs 2500. How long can these transfer payments be sustained and who really benefits? Despite the best of intentions, there is considerable room for mass corruption and embezzlement. A far better option for poverty eradication is to create job opportunities. As the Chinese say, 'Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime!

Distribution of Land to Peasants and Tenants

There is a program to distribute government land to peasants and landless groups of cultivators. This will expand the land base presently not under agriculture. It will also spread even thinner the dwindling water resources, which are already at critically low levels. Transfer payments, be they in the form of free land or cash income transfers, are only temporary measures of financial relief. They are seldom sustainable or productive.

Electricity and Fuel Price Crisis Management

Electricity and fuel price management are sore points that have become major national issues. The electricity crisis has resulted in alarmingly high levels of load-shedding (12-15 hours a day). This is playing havoc with the agriculture sector and has brought industry almost to a standstill. While the international price of oil, after hitting a record US$ 146/barrel, has bounced back to US$ 43/barrel, the government has been unable to reflect this sharp decline in international prices in the diesel component. Small formal adjustments fail to jump-start the economy and obviate the sluggishness in the agriculture sector. As diesel is a key determinant of agricultural productivity (tillage, harvesting and tubewell irrigation), its present high cost is placing constraints on agriculture by way of reduced application of tube-well water on most cash crops.

Green Tractor Scheme Providing tractors at subsidized rates or through lottery draws helps only those who receive such prizes. In reality, adding more tractors to the system does not increase agricultural productivity as most villages already have excess tractor power, often lying idle. The lack of modern implements or implements for hire at village level remains a fundamental constraint. Farmers often think bigger is better and tractors with 75 plus horsepower are brought on to farms. Their operational costs are so high (diesel @ Rs 60/l) that these machines become uneconomical. A majority of tractors are sold just outside the factory gates and the cash is pocketed. These tractors often end up in haulage work and not in agriculture. The entire policy needs to be reviewed. By cutting down on unnecessary heavy tractors the government can make significant improvements in the environment and contribute to carbon emissions mitigation.

Marketing and Trade Reforms

Attention to High-Growth Sectors like Livestock and Horticulture

The Medium-Term Development Framework lays special stress on improving the performance of horticulture and livestock, which are identified as high-growth sectors. Their contribution to total GDP from agriculture is almost 50%. Several

Credit and Insurance: Discussing the topic of credit, Zaka Ashraf, Chairman Zarai Taraqiati Bank (Agriculture Development Bank), said that the government was planning to provide more than 70 billion rupees in credit this year. The bank was also studying ways to help with crop insurance and was evaluating projects that could be directed to growers in both irrigated and non-irrigated areas. While in the past dairy was a minor activity of the bank, he said it was now considering expanding its loan facilities for livestock and dairy, which are emerging as significant contributors to agricultural growth.

new projects on livestock are being implemented to alleviate the meat and milk shortages in the country.
The government in a recent notification (2008) has created a separate Ministry of Livestock to cater to the affairs of livestock development in the country.

In an international meeting held at Geneva in June 2008, the Minister for Agriculture, Nazar Gondal, pointed out that climate change is a grave challenge that will negatively impact Pakistan's agriculture and trade prospects. Elaborating on the situation, he said (box below):

This review of government circulars, notifications and newspaper statements clearly shows that the government's policies:

1. Aim at protection of small-holder agriculture (almost 70%) and ensuring that farm productivity is increased at a rate that is commensurate with the population growth rate of the country.
2. Recognize that there are threats to agriculture from climate change that can have negative impacts, but pay little attention to the opportunities that climate change may offer in some areas.
3. Focus on Food Security as a priority area and propose short-term measures with little concern for a long-term course of action based on sound modeling and analytical analysis.
4. Fail to adequately reflect the changing realities in international trade and the international commitments under WTO to which Pakistan is a signatory.
5. Fail to acknowledge or argue the position that Pakistan is not a major player in carbon emissions but is being penalized for the actions of others in the past (Western Industrialized Countries) and more recently of those emerging as expanding economies (India and China).
6. Only view policy from a domestic perspective, ignoring the new opportunities of leasing out large chunks of land that can be submitted to high-tech agriculture (i.e. by Middle Eastern countries) on a long-lease basis. Maldives is considering outright purchase of land, fearing its land mass will be submerged by rising sea levels caused by climate change.
7. Favor maintaining the *status quo* and do not promote a long-term growth strategy that will transform traditional agriculture into a high-tech business enterprise which will significantly help reduce rural and urban poverty.

"Pakistan is cognizant of the seriousness of climate change and its devastating impact on our agriculture, which is largely irrigated by river water supplied by glacier melting. This is likely to be disrupted by climate change, among other negative consequences. We have, therefore, actively participated in the global discussions on Climate Change. The Government intends to launch a comprehensive process for achieving a better understanding and overcoming the impact of climate change through mitigation, adaptation, the use of science and technology and integration of climate imperatives in our economic development efforts. The success of efforts being made by Pakistan and other developing countries and those expected of them for dealing with the important and inter-connected issues of food and energy security and climate change clearly depend on external support. Developed countries, the UN system, the World Bank and regional development banks and other institutions must provide assistance. In this regard, we wish to commend the World Bank, the Asian Development Bank, the FAO, World Food program, UNICEF, other UN agencies including the Global Environment Facility and UN Environment Programme for their initiatives and efforts to assist developing countries' endeavors to cope with the food, fuel and climate nexus."

This review clearly shows that climate change will impact agriculture in the following ways:

- Reduce yields of all major cereals in the southern plains with minor improvements in yield in the northern areas.
- Lead to significant shifts in cropping patterns and crop rotations and significantly modify the crop calendar in response to climate change.
- Reduce the overall agricultural growth rate, causing widespread poverty amongst already marginalized and disadvantaged groups.
- Lead to land degradation and creation of 'hot spots' that have large populations.
- Increase the demand for agricultural produce in urban areas

due to a shift in rural-urban populations and the creation of mega-cities. This trend will intensify the need for 'urban agriculture', which has been neglected in the past. Such shifts will impact the income of areas that have traditionally maintained a comparative advantage in the production of fruits, livestock (meat & milk), vegetables and fish.

- Change the type of investment needed even to maintain agricultural production at present levels. Huge amounts of investment will become a pre-requisite to procure technology, build a market infrastructure and ensure asset formation, like never witnessed in the past.
- Climate change-related energy crises will have direct linkages to agriculture mechanization. Renewable energy resource shifts will force farming communities to invest in energy-saving techniques and radically change the profitability of agriculture.
- Lead to many new and unforeseen situations for which no plans are in hand.

Thus, it is imperative that these aspects of climate change are built into the policy documents and it is proposed that the following statements (or similar ones) be included in the core documents:

General Statement of Climate Change Needed in Policy Documents

In the agriculture policy context, a general statement must be added that reflects the climate change scenario faced by Pakistan. It should also include the following statements:

A. Agriculture policy will implement measures that help preserve our agriculture, protect the productivity and sustainability of farm communities and ensure economic welfare by adapting to the challenges posed by climate change.

B. Agriculture policy will address climate change issues amongst farms, agribusiness entities, producers and consumers by providing information and know-how on finding ways and means to adapt to changes by shifting/substitution to new crops, crop rotations, livestock species, fisheries and forestry that ensure sustained growth on our farm systems, and by showing sensitivity to greenhouse gas emissions based on adaptation approaches that build on local know-how.

C. Climate change will cause a shift in the comparative advantages of certain productive enterprises. Research organizations and economic analysis institutions will be provided support to evaluate the postulated impacts on each of the dominant enterprises within the 8 climatic zones and propose modifications in enterprise mix, technology, input use and incentives. Modeling policy proposals will help analyze present, future and predicted impacts under various scenarios.

D. A monitoring and evaluation mechanism will be put in place to ensure widespread compliance with conventions and agreements relevant to agriculture (UNFCCC, Kyoto Protocol, WTO, Basal Agreement, etc.) entered into by the Government of Pakistan.

E. All national policies on agriculture will be developed through stakeholder participation and special attention will be given to provincial government viewpoints to promote close harmony between the federal government and the provinces, as agriculture is essentially a provincial subject.

Urban Agriculture - Mitigating Carbon Emissions

A horizontal expansion of agriculture requires large expenditures on trucking the produce to major consumption centers (mega centers). The whole chain of marketing requires a major consumption of fossil fuels, which leads to global warming and changes in climate. A strategy assuming prominence in the West is to produce vegetables, livestock and fruits near urban centers. There is even the concept of 'skyscraper agriculture', whereby high-tech farms are raised in the shape of skyscrapers, and urban consumers shop near their homes and offices, thus cutting down on unnecessary travel. Since almost 60% of Pakistan's population will be living in mega cities this idea should be incorporated into agriculture policy

Incorporation of Specific Provisions in Documents

It is recommended that the following or similar insertions be incorporated into currently operational documents to reflect the climate change aspects:

Medium-Term Development Framework (2005-10)

1. Page 252: Although the availability of water has been a serious constraint, further complicated by climate changes in the form of rising temperatures, reduced precipitation and extreme events such as droughts and floods
2. Page 252: Objectives and Targets: Put in place adaptation measures that better prepare the agriculture sector to meet the challenges of climate change and enhance food security

3. Page 254: Strategies …the government will chalk out a medium to long-term plan to address climate challenges by delineating actions required in each of the 8 agro-ecological zones
4. Page 254 Item xiv: The requirements of WTO will be *fulfilled keeping in mind the limitations and challenges being posed by climate change, global warming and changing comparative advantages* so as to maintain the competitiveness of agricultural products
5. Page 255 Para 2: Biotechnology introductions under climate change adaptation plans will require further negotiations under the Trade Related Intellectual Property Rights (TRIPS).

Perspective Plan and Policies

The only place climate change is mentioned in this important document is on page 78 (see annexure) and reproduced hereunder:

vii. Global Climate Changes

- Development of agricultural meteorology laboratories network for database for forecasting, modeling and simulation of the effects of changing climate on crop yields/cropping patterns for development of early warning systems.
- Effect of global climate change on crop yields.
- Effect of global climate change on forests and rangelands.
- Greenhouse gases emission from agricultural lands and animal farms: quantification and control technologies.

This list of research areas is rather limited and fails to recognize the widespread impact climate change will have on Pakistan's agriculture. According to IPCC (2007), the yield of cereal crops could go down by more than 20-40%, creating immense food shortages. Similar impacts are envisaged for other, non-cereal crops, livestock, fisheries, fruits and vegetables in the irrigated areas, dry lands and delta regions of Sindh. Besides yield decreases, the quality of produce is also likely to be impacted negatively.

A dramatic shift is needed in the present research goals to ensure that future breeding programs are more concerned with how to maintain yield or even with sacrificing yield in favor of more drought-tolerant varieties. The common trend is to breed for higher yield.

Research and adaptation-related applied trials are needed to address forest, inland fisheries and high-value horticulture crops in order to determine their production thresholds under a variety of climate change scenarios. Likewise, the potential water requirements of each farm enterprise must be calculated, explained to farmers and brought into policy debate.

An adaptation plan for agriculture needs to be developed and it must be ensured that all stakeholders accept ownership. Since agriculture is essentially a provincial subject, it is important that all the provinces are kept abreast of state-of-the-art knowledge on climate changes, updated on commitments being made under international climate change forums (i.e. UNFCCC) and coordinated efforts made to mitigate and adapt to its vagaries. Most of the implementation and prescriptive policies must be developed and owned by the provincial governments, which are responsible for their design, implementation, gains/losses, and outcomes and must accept the eventual responsibility for all decisions (right or wrong), etc.

Vision Statement 2030

There is a brief mention under 'Challenges—mitigating climate change' and a rather half-hearted statement on climate change without any clear direction on what the vision is or where it is supposed to take the country (see Page 69).

The Vision Statement should make a strong case for agriculture under a climate change scenario. Pakistan is a signatory to the Kyoto Protocol and UNFCCC, along with several other conventions related to environmental sustainability. The Vision Statement should reflect our commitment to these conventions, highlighting the measures Pakistan is taking to address the issues of greenhouse gas emissions and CDM, and explicitly state that while Pakistan is low on the emissions ladder (145th), it is 12th on the list of countries that will be most impacted by climate change[12]. While Pakistan plays its role in reducing emissions as a responsible member of the international community, it will at the same time require huge financial resources to tackle the problem of negative impacts caused by climate change. The Vision Statement must reflect the harsh realities of financial crisis, the global impacts of uncertain prices and markets and the country's strategic location between China and India, which are rapidly emerging economies with high carbon emissions. Likewise, Pakistan must state its anticipated risks and uncertainties given its strategic geo-political situation.

Annual Development Plan (2008-09)

There is not a single mention of the influence of climate change in the annual development plan. Nor is there any allocation of funds needed to address climate challenges through research, institutions, development of

12 See Environment Minister's Speech at UN September 24, 2007 http://www.g77.org/statement/getstatement.php?id=070924.

adaptation plans, or even debate amongst stakeholders[13]. The proposed projects lack a cross-sectoral theme on the likely impacts of climate change on agriculture, perhaps the sector of Pakistan's economy most significantly impacted. No link is established with conventions or protocol commitments Pakistan has made in the international arena. The only discussion that is included is on WTO and why the talks are deadlocked (Western countries are reluctant to eliminate subsidies at their end).

It is important to include in this document a recognition statement of the emerging problems associated with climate change and draw attention (as noted earlier) to the challenges and what Pakistan has done to date in terms of the establishment of various task forces, committees and research centers (See Pakistan's initial communication to UNFCCC, draft reports of the task force on water and agriculture, 2008; Report on Food Security, 2008). In reviewing each of the crops it should also allude to the climatic factors that are impacting productivity (e.g. the frost that hit the wheat crop in 2007 and the high temperatures during the ripening stages of the crop that led to a reduction in grain formation and consequently yield). Similarly, it should link climate factors that have impacted cotton yield by changing the weed and pest complex. The emerging threat of yellow rust on wheat from Yemen also needs to be factored in by linking it to the changing patterns in wind, cyclones, etc.

In future, plans or revisions must be introduced in new projects which address the 'mitigation and adaptation' options for the important agro-ecological zones.

AGRICULTURE POLICY: GAPS AND WEAKNESSES

The above review clearly shows that there exist significant gaps in the recognition of a climate change perspective in the planning documents that relate to Pakistan's agriculture policy. Firstly, as noted, none of the documents after 2000 recognizes either the negative or positive aspects of climate change as drivers of the policy instruments and prescriptions. Secondly, the National Commission on Agriculture concluded its deliberations in 1988 and its findings were meant to serve as a broad review of the agriculture sector with detailed recommendations on tackling the challenges of agriculture. These are almost 20 years old and in want of immediate attention and revision. Thirdly, 5-year plans, strategy documents, and the Medium-Term Development Framework generally overlooked the debate on climate change and are thus seriously deficient in this respect. Where they do mention climate change, it is often unclear how climate change is included as a cross-sectoral issue that impacts all aspects of agriculture enterprise production, marketing, processing and transportation.

It has also been shown that most documents highlight only the current scenario for climate change in Pakistan and perhaps make some statements on its impacts in rather general terms. The policy documents tend to regurgitate this information without properly digesting the underlying significance, which should be matched by knowledge and experience at the grass-roots level. Only then can policy prescriptions carry enough weight to receive broader and pragmatic attention.

In several instances the policies tend to be counter-intuitive to climate challenges. Without questioning where the extra water from glacier melt is going, naïve statements are made that considerable water resources would be available as a result of enhanced river flows. The need to delve deeper into the actual realities must be recognized and the rhetoric sifted to get to the real facts. Science is always good and, in some instances, more of it is better. However, policy is seldom based on science alone. In Pakistan planning is often based on 'second-best information'. Combining the best available information with the likely outcomes, based on scientific knowledge and experience on the ground, is the best option to narrow the information gaps. In many instances, filling those gaps would be too costly and result in limited pay-offs.

As Pakistan has signed several international conventions, it is important that the policy documents reflect these commitments and the actions it has taken to address the covenants of the conventions, i.e. reduction in greenhouse gases, CO_2 emissions, etc. Likewise, there is a distinct gap in documenting examples of climate change in Pakistan's agriculture that are location and time-specific. A few studies on wheat and rice, based on secondary time series data and regional climate change models, are helpful but require far more down-scaling to be useful in policy planning. Civil society organizations and NGO's interact with various stakeholders in the agriculture sector. Their experiences also need to be better documented and made available to the policy makers. Another significant gap is the exclusion of a climate change perspective as highlighted by donor agencies (i.e. the

13 One of our reviewers noted that there are two Carbon Sequestration projects listed in the National Budget Allocation for 2008-9 (PC1 approved earlier).

World Bank, Asian Development Bank, UNDP, USAID) in projects being negotiated or implemented in Pakistan. This needs to be rectified to ensure that upcoming projects meet international standards and comply with the commitments Pakistan is making under international conventions.

Analysis and experience about climate change is often restricted to crops in Pakistan. It is high time that policies related to livestock, inland fisheries, floriculture and horticulture are also brought into the mainstream of the debate and made synchronous with the overall thrust of agriculture policy. Provincial development plans need to be made consistent with the climate change concerns of the respective province and attention must be given to the need to inject knowledge that is relevant to the provincial situation. More specifically, the concerns of the agro-ecological zones must be addressed, while taking into account the inventory of skills, assets and resource endowments that can be brought to bear in adapting to climate change vagaries (threats of drought in Balochistan and upper Sindh). It would be appropriate to ask questions about food security policy in emerging urban centers and the impacts of climate change in re-settlement, and use the answers to formulate policy directives.

III. Water Policy

Gap analysis

Water is an essential input into agriculture, which utilizes almost 90% of the total water resources. The remainder is utilized for drinking, cooking and sanitation, industry, environmental flows (though not officially acknowledged), etc.

Pakistan's water resources are primarily dependent on precipitation, snow melt and glacier melt. Our rivers are closely linked to various sources of precipitation in the major rivers.

Table 1: Distribution of Water in Main Rivers of Pakistan

	% of IRS inflows	% Seasonal Distribution		Dominant Source in Summer	Dominant Source in Winter
		Summer (Apr-Sep)	Winter (Oct-Mar)		
Indus	44	86	14	Snow/Glacial melt	Winter Rainfall + Baseflow
Chenab	19	83	17	Snow/Glacial melt + Monsoon	Winter Rainfall + Baseflow
Jhelum	16	78	22	Mainly Snow melt + Monsoon	Winter Rainfall + Baseflow
Kabul	16	82	18	Snow/Glacial melt	Winter Rainfall + Baseflow
Others	15				

Pakistan has a large volume of documentation on water, developed over the 60 years of its history, and a proud record of management of the world's largest contiguous irrigation system. Numerous studies provide the necessary information about Pakistan's water sector, including Nazir Ahmed (1993) Water Resources of Pakistan; Revised Action Plan for Irrigated Agriculture by WAPDA, 1979; and several others. Likewise, the SCARP documentation illustrates how Pakistan met its water-logging and salinity challenge, which few thought capable of resolution (see running commentary in Prof. Abdus Salam's biography[14]). While old, these studies do bridge the data gap till the 1980s. Following this period, several good analytical studies have been conducted, so the water sector is well documented and sufficient information was available to draft a water policy.

Water in Pakistan is a rather contentious issue, primarily because of its dependence solely on river flows (and underground aquifers) as sources. Historical water rights are guarded religiously and there is an abundance of distrust and mistrust. Debate and discussions on water often lead to polarization and politicized bickering. The end result is that plenty of policies, action plans and targets are evolved, but seldom leave the filing cabinets of policy makers. The gaps in information are as much to blame for this as the distrust of data and the source of information. When these two factors are combined, they result in resistance to viable plans and projects that normally seem to be in the broader interest of the nation. This environment of half-hearted decision making is taxing Pakistan so badly that its future, or even its very existence, may be compromised when the effects of Climate Change set in fully.

Policy dialogues are quite common when it comes to water, and often they are between those who are already 'converted'. The issues are discussed in the parliament; the president and prime minister often make highly vocal statements; expensive, top-of-the-line studies are conducted; stakeholders get a reasonable opportunity to critique these studies; and the media makes its due contribution in bringing the issues and solutions to the attention of the general public. Still, this sector constitutes perhaps the most critical area, in which reforms are repeatedly proposed but seldom implemented. Paradoxically, there are often serious anomalies in the data that is cited to support or refute a given viewpoint. The source of data is often restricted to one particular organization (WAPDA). Therefore, developing trust in this institution and its allied organizations has become a major area of concern, which unless

14 A good description of how Pakistan requested the US government for assistance to solve this problem is provided in 'Science for Peace and Progress - Life and Work of Abdus Salam', edited by Anwar Dil, published by Intercultural Forum Takshila Research University, San Diego, 2008. pp301-302.

resolved will continue to impede Pakistan's progress in this crucial sector. With advanced techniques of data gathering, including satellite imagery, GPS, remote sensing and satellite-monitored telemetry, etc., this task is achievable. Much of the debate on the reliability of data and the lack of transparency has led to unresolved issues and a lack of consensus amongst the upper and lower riparians on the Indus River infrastructure projects.

Since 2000, there have been several studies conducted on the water sector. The Pakistan Water Partnership proposed the Water Vision 2025 and followed it up with 'The Framework for Action (FAA) for Achieving the Pakistan Water Vision 2025' in 2001. This document became the frame of reference for much of the debate on the water sector and showed how different stakeholders viewed its development. While concerns about climate change were noted briefly as an economic driver, much of the detail was left out from the documentation for want of a clear direction. However, despite this shortcoming, the document gave civil society a clearer understanding of the link between climate change and water resources.

The 'Water Sector Strategy of the Asian Development Bank, 2002' is a comprehensive study that builds on the Water Vision 2025 and some earlier studies by WAPDA and the Flood Commission. It is comprised of 5 volumes and takes an in-depth look at the water issues, needs, strategies and action plans. The Strategy is a forerunner to the 2005 National Draft Water Policy, reviewed in detail later in this report.

Technical Assistance Highlighting Policy Issues, relevant to Balochistan's water situation, is available on the Internet (Shahid Ahmad, 2008). This ADB-financed project has produced more than 33 policy briefs pertaining to the core policy issues facing Balochistan and some of general relevance to the whole of Pakistan. A synopsis of titles of some of the briefs produced by the study team is given below[15]:

Policy Briefings

- Policy Briefing #1 – Irrigation and Energy Nexus – Managing energy and water use for reducing subsidy for electric tubewells in Balochistan
- Policy Briefing #2 – Micro-irrigation and role of private sector for innovative development – Need for policy shift in Balochistan
- Policy Briefing #3 – Issues restricting capping of subsidy and strategy for introducing the smart subsidy in Balochistan
- Policy Briefing #4 – Payment of electric bills and recovery of arrears in Balochistan – Farmers' response and future options
- Policy Briefing #5 – Effect of farm size and landholding on equitable distribution of subsidy for tubewells in Balochistan
- Policy Briefing #6 – Building technical argument for capping tubewell subsidy in Balochistan: Part-I. Analysis of tubewell database and state of service delivery by QESCO
- Policy Briefing #7 – Freezing number of agricultural tubewells eligible for subsidy in Balochistan: Issues and way forward
- Policy Briefing #8 – Assessment and recovery of Abiana in the Indus basin canal system of Balochistan – A Way Forward
- Policy Briefing #9 – Training needs assessment and formulation of training plan for IWRM policy support in Balochistan.
- Policy Briefing #10 – Sustaining rural water supply schemes in Balochistan: Issues, Policy and Reforms
- Policy Briefing #11 – Performance of Diesel- and Electric-operated Tubewell Farms and Issue of Strategy – Lessons from Farmers' Survey
- Policy Briefing #12 – New Vision and Strategy for Managing Water and Energy Use in Tubewell Irrigated Agriculture of Balochistan, Pakistan
- Policy Briefing #13 – Framework for Targeting Subsidy and Costing High Efficiency Irrigation Systems under the National Programme
- Policy Briefing #14 – Building High Performance Knowledge Institution for Planning of Water Resources in Balochistan
- Policy Briefing #15 – Cost Effectivity of High Efficiency Irrigation Systems: Guidelines and Policy Issues for the Forthcoming Projects in Pakistan
- Policy Briefing #16 – Persistent Drought of Balochistan and Impacts on Water Availability and Agriculture
- Policy Briefing #17 – Restructuring National Agriculture Research System (NARS) – the Case of NARS Balochistan (NARS-B)
- Policy Briefing #18 – Growth of Agricultural Tubewells and State of Energy in Pakistan – Is Subsidy a Sustainable Option for Helping Farmers?
- Policy Briefing #19 – Mogha Command Management for Enhancing Water Productivity and Sustainability of Indus Basin Canals in Balochistan
- Policy Briefing #20 – Sailaba and Khushkaba Farming Systems of Balochistan – Policy Support for Changing Land Use and to Avoid Infrastructure Damages Caused by Flash Floods

15 A disk detailing all the outputs of the TA Grant Project can be obtained from Dr Shahid Ahmed, Member Natural Resources, PARC, Islamabad. The circulated disk is dated 10th November, 2008.

- ❑ Policy Briefing #21 – Water Productivity and Economic Efficiency of Tubewell Irrigated Farms in Balochistan – Issues and Policy Reforms
- ❑ Policy Briefing #22 – Abiana Assessment and Recovery in the Canal Commands of Balochistan – Policy Issues and Reforms
- ❑ Policy Briefing #23 – Sustainable Development of Rural Water Supply Schemes in Balochistan, Pakistan – Key Issues, Scheme Selection Process and Policy Reforms
- ❑ Policy Briefing #24 – Karees – A Cultural Heritage of Natural and Agricultural Sectors and an Interminable System of Harvesting Groundwater in Balochistan
- ❑ Policy Briefing #25 – Restructuring and Strengthening of Water Resources Planning, Development and Monitoring Directorate of Irrigation and Power Department, Balochistan
- ❑ Policy Briefing #26 – Promising Crops and Water Efficient Cropping Patterns for Irrigated Farming Systems of Balochistan, Pakistan – Key Issues and Policy Reforms
- ❑ Policy Briefing #27 – Renewable Energy Resources – Assessment and Utilization for Multiple Water Uses in Rural Balochistan
- ❑ Policy Briefing #28 – Pakistan Water Apportionment Accord: Water Entitlements and Key Issues – National and Balochistan Perspectives
- ❑ Policy Briefing #29 – Water Apportionment of Hub Dam: Water Conflict and Strategy for Resolution
- ❑ Policy Briefing #30 – Conjunctive Water Use and Management for Minor Perennial Irrigation Schemes in Balochistan – Key Issues and Revised Strategy for Investment
- ❑ Policy Briefing #31 – Re-assessment of Water Resource Availability and Use for the Major River Basins of Balochistan – Study Findings, Policy Issues and Reforms
- ❑ Policy Briefing #32 – Potential Recharge Zones of Over-drawn Basins of Balochistan, Pakistan
- ❑ Policy Briefing #33 – Social and Farmers' Institutional Impacts on Water Rights, Allocation Rules and Availability on Lower Riparian in Spate Irrigation of Balochistan

The Pakistan Asia Pacific Network Study on Climate Change and Water Resources, 2003 was an initial attempt to highlight the water scenario in South Asia. This study includes detailed data on all South Asian countries and highlights water resource challenges in the context of climate change (see 'Climate Change and Water Resources in South Asia' - proceedings of Year End Workshop Kathmandu, 7-9 January, 2003 Mohammed et al). There are several compendium studies published in the Science and Culture Journal India and in the form of a book titled 'Climate and Water Resources in South Asia: Vulnerability and Adaptation' which cover field studies conducted in Mirpurkhas (Sindh) and Bahawalpur (Punjab) Hydrological Units.

A report on the Tarbela Dam and related aspects of the Indus River Basin Pakistan by the World Commission on Dams (2000) provided a useful data synthesis on the historic experiences of large dams in Pakistan. It also cautioned about the likelihood of changes in long-term river flows and their repercussions on Pakistan's economic performance.

The World Bank report, titled 'Pakistan Water Economy Running Dry, 2005', presented a lucid analytical review of the water situation. The core study and 18 different background papers, including some on large dams, agriculture, and the environment, highlight the magnitude of the global warming phenomenon and its likely impact on the water resources of Pakistan. It paints a rather bleak picture of its catastrophic consequences and urges a pragmatic approach to the problem. This widely cited report is highly critical of the ways in which the water sector is being managed and warns about a looming crisis that will be further exacerbated by climate change.

A recent report (2008) by the Government of Pakistan, titled Draft Report 'Impact of Climate Change on Water Sector', by the Water Sector Working Group on Climate Change, has been produced by the Ministry of Water and Power. It provides detailed coverage of Pakistan's vulnerability to climate change, adaptation strategies, and comments on the national plan of action, and lists a national financial investment portfolio within the context of water and climate change. It also includes a set of policy recommendations and starts by stating that "the main objective of climate change policy relating to Water sector is to assess the likely impact on water resources and to formulate well thought-out adaptive strategies for various sub-sectors of water to face the future challenges of Global Climate Changes". The document notes the following salient objectives of the policy:

- Develop an infrastructure designed to store more water for utilization during lean flow periods. To that end, there is a greater need than ever before to develop and forge a national consensus on establishing a cascading system of dams on the river Indus, utilizing all the available sites to discharge our liability to coming generations
- Expedite work on the construction of mega dams, small dams and water-harvesting projects. The financing factors impeding the construction of mega dams should be addressed on a war footing, and all available avenues of funding should be explored

- Stop the wastage of water and resort to efficient water use
- Develop an appropriate rainwater-harvesting system commensurate with local needs
- Construct a series of water storage reservoirs for the retention of flood waters for their effective utility
- Protect life, property and infrastructure from floods through a comprehensive and long-term flood protection plan. Develop a flood response plan and make sure that the general public is aware of this plan and, if necessary, the public awareness level should be raised through the use of electronic and print media
- Develop and implement a regulatory framework for groundwater use. Encourage users to employ the latest techniques for the extraction and skimming of fresh groundwater without disturbing the underlying saline water
- Establish an institution to carry out research into the future availability of water, especially under Climate Change conditions. As the climate change phenomenon is slow and long-term, it requires a long-term commitment
- Establish linkages between different water sector organizations for data and knowledge sharing
- Ensure the water rights of the provinces in accordance with the 1991 Water Accord
- Establish a database system for water sector information
- Develop public awareness about the importance of water

It appears that WAPDA's response is infrastructure biased and most solutions to climate change and water involve expansion of the infrastructure. The policy objectives seem to ignore the demand management side of water and the necessity of making the institutional and managerial improvements so essential to conserve water. Likewise, the document is silent on how rights and entitlements to water would change as the climate changes.

Similarly, there is also a report under completion by the sub-group on Water under the Food Security study by the Planning Commission (2008), as well as a report by the Task Force on Climate Change, headed by Dr Ishfaque Ahmed, that is under preparation and likely to be available by end-December or early 2009.

Incorporation of Climate Change Aspects into Core Documents

Pakistan's draft water policy and the water apportionment accord are two core documents that need to be updated by including the climate change perspective. While the Indus Water Treaty is an international agreement, there is still room to view it in the light of the evolving circumstances of climate change.

Commit your waters or lose them!

On several occasions WAPDA's former chairman has reiterated that Pakistan needs to conserve its water surpluses (about 25 MAF), which run uselessly into the sea. Since water is fast becoming short every neighboring country is carefully watching how Pakistan is managing its scarce water resources. While there is rightly a hue and cry over India's water projects on the Chenab and Jhelum rivers, the total water involved is only 0.2 MAF. The urgency of the situation merits immediate attention at the highest level of government policy formulation.

The draft water policy has been presented to the cabinet for approval but there are some controversial viewpoints about infrastructure projects that are still open for discussion and in need of widespread acceptance and ownership within the government, public, private and civil society.

The draft policy document is being reviewed from the perspective of its shortcomings and gaps. Where appropriate, comments have been inserted and suggestions made about the inclusion of possible text relevant to climate change concerns.

Pakistan Water Policy 2005

In its preamble the policy notes that by 2025 the population of Pakistan will increase by almost 50% and therefore the demand for water will increase proportionately.

Agricultural yields have stagnated or slowed down. Consequently, the growth rates for most crops will show low or neutral growth. It is unlikely that growth rates for major crops like wheat will maintain a 3% annual increase to keep pace with the high population growth rate. However, the livestock and horticulture crop sectors are reported to show high growth rates in the range of 6-7%. This combined effect could help stabilize the overall agricultural growth rate (Mellor, 2008 personal communication).

In its needs assessment the policy also recognizes deteriorating water quality as a significant issue. The National Water Policy aims to achieve the following objectives:

- Efficient management and conservation of existing water resources
- Optimal development of potential water resources

- Steps to minimize time and cost overruns in completion of water sector projects
- Equitable water distribution in various areas and canal commands
- Measures to reverse rapidly declining groundwater levels in low-recharge areas
- Increased groundwater exploitation in potential areas
- Effective drainage interventions to maximize crop production in water-logged areas
- Improved flood control and protective measures
- Steps to ensure acceptable and safe quality of water
- Minimization of salt build-up and other environmental hazards in irrigated areas
- Institutional reforms to make the managing organizations more dynamic and responsive

Comment: As can be noted from the above policy objectives, the recognition of the climate change phenomenon is totally missing. This is a serious flaw and in recent conferences and discussions, both nationally and internationally, climate change has been acknowledged as a serious threat to Pakistan's water resources. The section on objectives should be revised and a statement to this effect should be incorporated.

In this identification of core issues the document is silent regarding the impacts of global warming and changing climates. As can be seen below, apart from noting the high level of variations in the availability of water resources, the document does not identify any cause (i.e. global warming), in the absence of which it does not adequately reflect the rapidly changing impacts on water resources.

Key Issues

- Growing need for water to meet the requirements of a rapidly growing population, and socio-economic demands
- Very high variations in the availability of water resources, in terms of both space and time
- Reduction in the availability of surface water due to silting of dams
- Lack of proper maintenance of the canal system, leading to unsatisfactory service
- Water-logging and salinization of areas near various canals of the Indus Basin System
- Lack of commitment on the part of various organizations about the need to create drainage networks as a part and parcel of the irrigation network
- Over-exploitation of groundwater resources, rendering large areas out of the reach of poor farmers, and leading to depletion of groundwater aquifers
- Pollution of aquifers, due to the lateral movement of saline water or the upward movement of highly mineralized deep water
- Lack of disposal of saline effluents
- Contamination of river water, due to the influx of industrial waste, household waste water and field overflows contaminated with fertilizers and pesticides
- Inadequate involvement of consumers
- Frequency of floods and drought
- Lack of an inter-provincial consensus on development strategy and mistrust between provinces over the equitable distribution of water
- Proper pricing/valuation of water
- Quality of water in all sub-sectors

Comment: The climate change perspective is indirectly noted in regard to the high variation of water resources, water-logging and salinization of various command areas and the frequency of floods and drought. While not explicit, the document indirectly acknowledges that the key issues have a close relationship with climate as a significant driver.

A projected consequence of climate change is the higher frequency and intensity of floods and drought (see IPCC, 2007).

Likewise, extreme events, such as hurricanes, storms, cyclones, tsunamis, rising sea-related water intrusions/rise in sea levels, etc., and the probability of their occurrence, are all consequences of climate change and should be so identified in the issues.

The draft policy document alludes in its reviews to the Dublin Principles, which set the stage for water resource analysis. The document includes basic data on water, which is not reproduced here[16]. Seldom does a policy document contain such detailed data and action plans, an obvious anomaly that needs to be corrected in the final version as it gains acceptance. A policy is typically a concise statement of the broader guidelines to achieve a set of desired goals and objectives within a clearly existing and anticipated environment. An action plan details the actions required to achieve the desired targets. The rest should form part of an implementation plan.

Significant Cross-Sectoral Recognition

Pakistan's agriculture depends on artificial irrigation and almost 90% of the agricultural output originates from irrigated areas. The policy notes that irrigation has to be accorded the highest priority.

The policy also notes that both irrigation and agriculture are provincial responsibilities, while the federal

16 Also see presentation on Water Policy by Shahid Ahmad included in the disk outputs of TA Grant Project - (TA-4560 PAK).

government has the responsibility to monitor, conserve and develop water resources for the use of the nation.

The policy document took into account recent vision statements, planning commission reports, and draft materials for new initiatives in the pipeline.

FUTURE WATER VISION - YEAR 2025

Reviewed the historical performance of the water sector, including the success and failures of past strategies, and was also based on consultations with relevant stakeholders at the federal and provincial level.

Reviewed the international context of water policies and agreements. The three detailed volumes on which the draft policy is based include:

- Volume I. Analysis of Key Issues
- Volume II. Water Resources of Pakistan: Availability and Requirement
- Volume III. Institutional Aspects

INCORPORATION OF CLIMATE CHANGE ASPECTS INTO SPECIFIC POLICY AREAS OF THE DRAFT POLICY

Policy Section 1: Integrated Planning and Development of Water Resources

1.1 Incorporate clause relevant to Climate Change

1.5 Prepare and adapt conservation and water management strategies, including public awareness programs to reduce water requirements (without compromising productivity) across sectors

1.10 Assess and monitor the impacts of climate change on water resource development and account for these impacts in future water development strategies

1.2 Needed incorporation of Climate Change in this section (proposed)

a. Accord high priority to analyzing, quantifying and projecting the impacts of glacier melt and the medium to long-term impacts of precipitation, based on advanced regional Climate Change Models and the experiences emerging from other South Asian countries.

b. Highlight the need for immediate and urgent storage capacity on the Indus and in the form of small dams that can store the projected large water flows likely to come from increased glacier and snow melt and erratic and intense monsoon activity. At the same time, accept that reservoirs are water security instruments and need not be filled to their full capacity as argued by some less informed stakeholders.

Policy Section 2: Irrigated Agriculture

2.1 Incorporate clause relevant to Climate Change

2.15 Encourage farmers to grow low delta crops with higher returns

2.16 Promote and support research and development of water conservation techniques and improved irrigation methodologies

2.2 Needed incorporation of Climate Change in this section (proposed)

Irrigated agriculture will be the sector most heavily impacted by climate change and, therefore, it requires a careful inventory of adaptation strategies, measures and actions that lead to the saving of water through the adoption of conservation technologies (i.e. raised bed furrow, sprinkler, drip irrigation, bubbler, zero tillage, rain harvesting, etc.) which clearly recognize that climate change will result in both abundance (floods) and scarcity (droughts) and requires specialized knowledge for management.

Agriculture should be recognized as a beneficiary of higher rates of CO_2 gases. With growing concerns about methane (mainly contributed by livestock and rice), water resource management should strike a healthy balance in the mitigation of these gases, which contribute to global warming. In particular, the water allocation to high delta crops like rice, sugarcane and cotton needs to be revisited from the perspective of water use efficiency, virtual water and the contribution of different crops towards climate change.

Increase in monsoon intensity will open up significant windows of opportunity in rainfed agriculture, which should be explored through well modeled adaptation plans.

Policy Section 3: Municipal, Rural Water Supply and Sanitation

3.1 Incorporate clause relevant to Climate Change: None identified

3.2 Needed incorporation of Climate Change in this section (proposed)

Climate change will increase the incidence of water-borne diseases, particularly malaria and diarrhea, and affect the management of water supplies and sanitation. Investments should take this perspective into account. Note: This should also be incorporated into the drinking water and sanitation policy.

Climate change will put extra stress on mega-centers and townships, thus straining drinking and groundwater resources and reducing their quality. Promoting filtration facilities that utilize renewable (i.e. solar) energy should be encouraged both in public and private sector planning.

Policy Section 4: Water for Industry

4.1 Incorporate clause relevant to Climate Change

4.2 Reserve and make available sufficient supplies of water for industry on a priority basis to promote industrial development and economic growth

4.3 Encourage industries to treat waste water on-site to remove toxic chemicals and other pollutants according to the new improved standards and legislation and the 'polluter pays' principle

4.2 Needed incorporation of Climate Change in this section (proposed)

Industrial policy will enforce mitigation measures which promote healthy design processes that reduce carbon emissions, and those industries that are sensitive to such concerns will be allocated water on more favorable terms.

Water metering and pricing will help check demand and the wastage of water in water-scarce areas.

Policy Section 5: Water for Hydro-power

Relevant clauses: None found during review

5.2 Needed incorporation of Climate Change in this section (proposed)

It must be recognized that hydro-power is a low-cost and most environment-friendly source of power with negligible carbon emissions compared to other sources of energy for power generation (oil, coal, etc.). In Pakistan the cost of hydro-power is stated to be as low as 14 paisa/KWatt (Shamsul Malik, Ex-Chairman WAPDA - personal communication); from Tarbela it is calculated at 25 paisa/KWatt, while other sources could reach Rs 15/KWatt.

Policy Section 6: Water Rights and Allocations

All policy statements important from a climate change perspective:

6.2 Needed incorporation of Climate Change in this section (proposed)

Draft water allocations and entitlements under conditions of extreme water stress and scarcity due to climate change should be based on projections of glacier melt, floods, droughts and other extreme event situations and should be done only after stakeholder consultation and within an acceptable and transparent legal mechanism that balances the 'losers and gainers' from climate change. Traditional entitlements may need to be revised, based on changing populations, rapid urbanization, bio-fuel production, and the changing comparative advantages of agriculture vis-à-vis other sectors in the wake of the world trade and energy crises and long-term projections of precipitation and rises in temperature.

Policy Section 7: Economic and Financial Management

Incorporate clause relevant to Climate Change

7.1 Climate Change perspective ignored

7.2 Needed incorporation of Climate Change in this section (proposed)

Emphasize the economic and social costs associated with climate change in the medium to long run. Economic costs will be in the form of reduced productivity, changing opportunities, possible resettlement/re-location of populations, and so forth. The social costs will be increased inequality and poverty amongst the marginalized groups.

Climate change is a phenomenon primarily created by the developed Western countries and further exacerbated by the newly emerging economies of China and India. Pakistan has to make a strong case to ensure that much of the social and economic costs are dealt with within its own domain while the adaptation costs are largely borne by those who have created the problem.

Since almost 70% of GDP is contributed from agriculture, livestock and related industries, the bulk of the financial resources would have to come from these industries, which contribute the most to global warming, and they may have to be taxed accordingly. A proposal for a national Climate Change Adaptation Fund should be floated and this fund should be further supplemented with donations from the international community.

Following Bali and Poznan, the United States, under its newly elected president Barack Obama, will become a major player in climate change and carbon emission mitigation. Pakistan should formulate a special assistance package (through USAID) that addresses its special resource needs to combat climate change.

Pakistan should also explore the possibilities of urgent multidisciplinary technical assistance to cater to the water resource challenge under climate change on the same pattern as the 1960's initiative for water-logging and salinity.

Policy Section 8: Ground Water

Incorporate clause relevant to Climate Change

8.4 Promote groundwater recharge wherever technically and economically feasible.
Comment: Groundwater recharge is likely to be reduced by 30-40%, based on the present glacier melt

estimates. Reduced river flows mean reduced groundwater. However, any increase in monsoon rainfall intensity could be reflected in a higher recharge.

8.7 Encourage optimal pumping in water-logged areas to lower the water table.
Comment: Climate change that leads to higher temperatures will result in a lowering of the water table in water-logged areas with possible positive impacts on crops grown in such areas (i.e. wheat). Almost 13% of the area under water-logged and saline soils could benefit from a climate change-associated temperature rise. However, this logic should be interpreted with care as some sodic soils may become even worse off under this scenario.

8.8 Delineate areas with falling water tables to restrict uncontrolled water extraction.

8.2 Needed incorporation of Climate Change in this section (proposed)
Groundwater resources are likely to be substantially improved in the medium term due to glacier melt and more intensive monsoon precipitation. Leveraging the advantage of underground water reserves depends on regulation and the cost of pumping. In a climate change scenario, areas prone to drought will experience unsustainable mining of the aquifers. After completing a groundwater inventory, regular monitoring and water resource use plans must be developed to ensure the continuity of agriculture as water flows in the Indus river system decline.

Policy Section 9: Stakeholder Participation

Incorporate clause relevant to Climate Change

9.1 Create an enabling environment for active stakeholder consultation and participation at all levels and in all aspects of the water sector, including irrigation, drainage, rural water supply, flood protection, and drought activities.

9.5 Evolve public awareness programs to highlight the objectives, namely that farmers would receive more secure deliveries, government agencies would experience cost savings, and government staff would be re-allocated to new assignments both within the government and with the new water-user organizations.

9.7 Promote modern water resource management and its emphasis on community and individual confidence and participation in the performance, operation and ownership of water assets.

9.2 Needed incorporation of Climate Change in this section (proposed)
Investment in public awareness programs at all levels on future water shortages and the need to conserve and store water should become an integral part of the overall national mass communication strategy. The most important stakeholders are those in school and others who will face the bulk of the severity from climate change impacts. Improving understanding on how water resources will be impacted by climate change will require adopting modern means of communication and educating schoolchildren, illiterate/semi-literate adults, women and disadvantaged groups on the value of water and its significance for the long-term survival of civilizations.

Policy Section 10: Flood Management

Incorporate clause relevant to Climate Change

10.6 Make effective use of non-structural measures, like flood forecasting and early warning systems to minimize flood losses through better forecasts. Promote and support research into a better understanding of the monsoon systems causing Pakistan's high-magnitude floods, including the travel of weather systems from the Bay of Bengal, and their interaction with westerly currents from the Arabian Sea and the Mediterranean vis-à-vis seasonal lows over Balochistan, the Tibet Plateau pressures, wind velocities and other relevant weather factors.

10.7 Create a flood response plan and ensure that the public is fully aware of the plan. In flood warning, the factors of major importance are (i) the level of awareness (2) the time of the flood warning, and (3) the reliability of the warning and credibility of the warning organization.

10.2 Needed incorporation of Climate Change in this section (proposed)
Climate change will exacerbate the occurrence of flooding as a result of the influx of water from increased glacier and snow melt into the major rivers. Monsoon precipitation will increase and intensify, while its duration will be shortened. Cross-boundary induced climatic changes in the Himalayas will pose a special threat to Pakistan, whereby excess water that neighboring countries are unable to store will be unleashed into Pakistan at short notice and with widespread damage to our assets and agriculture. Collaborative arrangements for developing regional

flood warning systems must be encouraged.

Improve the linkages between the meteorological department, the Flood Commission and disaster relief departments to develop synergies that help combat floods in the plains. Take into account special measures to cope with Glacier Lake Outburst-induced floods where experience is lacking. Close monitoring of newly formed glacier lakes needs to be done on a priority basis.

Accelerate investment in completing canal, barrage/dam projects which could help utilize flood water economically and lead to a saving of life and property downstream.

Policy Section 11: Drought Management

Incorporate clause relevant to Climate Change

11.2 Plan and expedite measures to carry surplus river flows through diversions and other structures to drought-prone areas.

11.3 Pay serious consideration to the need for construction of carry-over storages, which is the only effective way of overcoming water shortages during drought years.

11.5 Encourage and support provinces to prepare Drought Management Plans (DMPs) for various drought-prone areas.

11.2 Needed incorporation of Climate Change in this section (proposed)

The frequency and intensity of drought are projected outcomes of climate change. As global warming increases, a rise in temperatures is postulated that will make arid areas more arid and increase hardship for man and beast.

Initiate steps to engage public-private sector partnerships aided by civil society to plan and invest in water saving technologies that encourage adaptation measures during droughts.

The creation of Food & Feed Banks (for both humans and livestock) and the provision of insurance and loans to marginalized groups would help reduce the burden of droughts. Capitalizing on the recent experience with drought in Balochistan and Sindh, augmented by an international review of strategies followed elsewhere, would better prepare authorities to put in place a workable relief and adaptation strategy.

Climate Change is likely to result in a greater need for water security and storage and its emergency extraction at designated emergency centers. Development of such strategic points will receive high priority in future planning.

Policy Section 12: Drainage and Reclamation

None of the clauses are directly relevant to climate change

Needed incorporation of Climate Change in this section (proposed)

Climate change will require re-thinking asset formation for drainage and reclamation works because of the long-term reduction in river flows, changes in the salt complex and reclamation of water-logged and saline lands.

Policy Section 13: Water Quality

Incorporate clause relevant to Climate Change

13.1 Make improvement of the water quality in rivers, reservoirs, coastal areas and other water bodies, including groundwater, a national priority, so as to achieve acceptable standards by 2025 through improved agricultural drainage, municipal, rural and industrial wastewater treatment and effluent disposal. Achieve full compliance with EPA standards for drinking water,

13.2 Needed incorporation of Climate Change in this section (proposed)

Water quality will be directly impacted due to an increase in temperatures and higher precipitation. The salt imbalance is likely to render water in certain areas no longer fit for human consumption (sea intrusion, brackish water, and waste water). Climate change adaptation measures must ensure that they do not cause a further deterioration in the quality of water through an improvement in the understanding of water biochemistry under temperature rise.

Resettlement in hotspots due to climate change will be monitored carefully to ensure that this does not lead to deterioration in the quality of water.

Policy Section 14: Wetlands, Ecology and Recreation

Incorporate clause relevant to Climate Change

14.3 Promote afforestation, soil conservation and improvement in land use of the catchment areas of storage reservoirs.

14.4 Minimize downstream as well as upstream environmental impacts and embody appropriate remedial measures in the design of reservoirs and other development works.

14.5 Ensure that sufficient fresh water is flowing through the rivers into the sea to maintain a sound environment for the conservation of the coastal ecosystem and for fresh and brackish coastal fisheries. Environmental needs must be addressed while framing

'release rules' for water from the major storage dams for hydro-power and irrigation purposes to ensure the sustainability of areas such as the Indus Delta.

14.9 Promote programs for raising public awareness and community education about environmental needs and conservation.

14.2 Needed incorporation of Climate Change in this section (proposed)

- Climate change will impact water resources in Pakistan in an unprecedented manner. Our wetlands and diverse ecologies provide an opportunity for storage of monsoon water, and efforts must be made to ensure sufficient environmental flows to cater to the needs of our rivers, wetlands and fragile ecologies in the Indus Basin, with special attention to the needs of the Delta.
- Ensure scientific management of wetlands, which are a source of high methane emission, and make them more eco-friendly.
- Climate change implications for Pakistan need to be shared continuously with the public in a manner that helps preparedness and allows communicating with all stakeholders who can help adapt to such challenges.

Policy Section 15: Information, Management and Research

Incorporate clause relevant to Climate Change

15.4 Strengthen, promote and support public and private research organizations and universities in the development of appropriate ecologies, or to carry out research for:

- Conjunctive use of water
- Soil conservation, catchment management and watershed protection technologies
- Disposal of saline effluents
- Water conservation measures and techniques
- Maximization of resources
- River training and erosion control
- Land and water resource management
- Curtailing conveyance losses
- Improving irrigation efficiencies at distribution and at farm levels
- Conservation of the ecology of the Indus delta
- Weather forecasting, rainfall prediction, flood forecasting and drought forecasting

15.2 Needed incorporation of Climate Change in this section (proposed)

- Develop the necessary linkages within domestic and international institutions involved in informatics, management and research to promote an understanding of the 'Pakistani postulated impacts'; and initiate much needed action in the form of programs, projects and research agendas that directly reflect the challenges of reduced water supplies and rising temperatures which could lead to floods and drought. Give special attention to the creation of 'Centers of Excellence' in various aspects of climate change within Pakistani academia and link them up with international centers of repute.
- Climate change will strain water supplies and requires a high quality management response that is based on the best scientific know-how. Special efforts are needed to train such managers and impart the skills that are needed for better supply and demand management under changing climates.
- Invest in state-of-the-art interpretive equipment linked to international meteorological resources (i.e. satellite and radar coverage, regional meteorological resources in South Asia, the World Meteorological Organization, etc., with the necessary expertise for tehsil-level weather monitoring/ forecasting), which will better help forecast, predict, and alert managers and the general populations to climate changes, associated phenomena and the delineation of hotspots.
- Pakistan's Disaster Relief Plan and its related institutions must be dramatically upgraded to cater to climate change-related extreme event threats in the future. It must be brought under the direct control of the chief executive (President), reinforced with highly trained management and allocated separate resources sufficient to address this challenge.

Policy Section 16: Trans-boundary Water Sharing

Incorporate clause relevant to Climate Change

16.1 Work with co-riparian national administrations as well as with neighboring countries to better understand the overall river basin potentials and to develop appropriate strategies for their optimal usage and operation at all times, particularly during drought and flood conditions.

16.2 Work with neighboring countries through international agencies, such as UNDP/Global Environment Facility (GEF), to prevent chemical and biological pollution by effectively managing industrial, domestic and agricultural effluent disposal. Flooding in rivers located on the upper riparian, can push these pollutants into lower riparian countries.

16.2 Needed incorporation of Climate Change in this section (proposed)

Climate change will put greater pressure on, and test relationships

with, neighbors and bring into question the long-term sustainability of past treaties and agreements. The recent conflicts with India over diverting waters claimed by Pakistan will be further exacerbated as the water resource picture changes on the Chenab and Jhelum rivers[17].

Policy Section 17: Institutional and Legal Aspects

Clause relevant to Climate Change: None found during review

Needed incorporation of Climate Change in this section (proposed)
The idea of a high-level Water Council is commendable. However, there appears to be considerable duplication in mandate and authority when it comes to water institutions. The separation of irrigation (under WAPDA) and agriculture (under the Ministry of Agriculture) itself leads to potential conflicts and mismanagement of these precious resources.

Water needs to be carefully studied within the context of a climate change scenario and continuously monitored for dramatic shifts and unexpected extreme events. All institutions need to be reviewed from this perspective and upgraded to encompass the widespread ramifications of climate change.

Pakistan's legal fraternity needs to be educated about the legal implications of climate change in the future. Steps must be taken by the relevant ministries, in close cooperation with their international counterparts, to provide legislative training in handling potential conflicts related to climate changes that impact water (domestic and international) and appropriate legal instruments must be created based on a review of the relevant international literature.

Besides the draft Water Policy, there is the Indus Apportionment Accord and Indus Water Treaty, which are frequently consulted when dealing with water policy in Pakistan.

INDUS WATER APPORTIONMENT ACCORD

The Apportionment Accord of 1991 sets the stage for sharing the waters of the Indus amongst the four provinces. Pakistan can take pride in the fact that as a start it has an instrument that allocates water equitably amongst all the provinces. Signed on March 16, 1991, and represented by the Federal Government and all four provincial Chief Ministers, the water allocation agreed upon is as follows:

Punjab 37, Sindh 37, Balochistan 12 and NWFP 14. These waters are above the agreed upon allocation of river supplies of 114.35 MAF. Since flows have been less than used in the projections there is always the issue of trust and transparency between the upper and lower riparians. This has resulted in considerable tension amongst the provinces with the net result that certain projects are now being jeopardized by this tug of war.

The document is silent on the SOP's if the overall water resources change unexpectedly, under extreme glacier melt, significant changes in timing, intensity and the pattern of precipitation from a worldwide phenomenon like global warming and climate change, and on the terms of the Accord under *force majeure* conditions. Also see Majeed Kazi's 'Overview of Water Crisis in Pakistan' at www. Pakissan.

The document should be revised through discussions with key stakeholders after taking all parties into confidence. The Accord's historical development is covered in the copy attached in annexure and provides interesting reading. An amendment needs to be made on water allocations under a climate change scenario, after a careful and detailed analysis of water rights protection and the agriculture food security of the country, and a conflict resolution authority needs to be established to address a situation where there is a high level of water variability due to uncertain conditions that may have permanence.

IUCN should bring up this issue and facilitate discussion. The actual revision of the document can only be attempted after it gains acceptance by all stakeholders and is reviewed at the level of various provincial water forums and a National Water Council (or similar body) and is subjected to vetting by the parliament.

INDUS BASIN TREATY

The Indus Basin Treaty, signed between Pakistan and India with the support and good offices of the World Bank, established water rights for India over the Eastern rivers (Sutlej, Beas and Ravi) and for Pakistan over the Western rivers (Indus, Chenab and Jhelum). In addition, there was compensation paid to Pakistan for undertaking development works in Pakistan that were further financed by the World Bank. **TheTreaty clearly states that "India should not store any water or construct any storage works on the Western Rivers except as specified in Annex-D."** This provision and its interpretation is the main bone of contention between the two countries, leading to serious threats and counter-threats in recent years. India is undertaking a hydro works and water storage project on

17 Pakistan has been protesting vigorously against India's water diversions through damming on the Chenab and Jhelum Rivers. IRSA has taken the lead in lodging such complaints at the highest level of government and in international forums (see widespread coverage on the Internet for past 6 months). During 2008 the President of Pakistan has already requested his Indian counterpart to intervene in this very serious matter which has the potential of turning into something ugly.

the Chenab and is also charged with diverting waters from the Jhelum. Pakistan has enforced certain clauses of the Treaty by requesting the appointment of neutral experts and is raising a considerable hue and cry about why certain water storage projects are being constructed in contravention of the provisions of the Treaty.

While this aspect continues to be a bone of contention, the Treaty has nothing to say about the drastic natural changes to river flows anticipated from climate change. This is an area that requires an in-depth study and is beyond the scope of this consultancy. Suffice it to say that as climate change brings more and more waters during floods to India it will store what it can and release the rest to the detriment of the lower riparian (Pakistan). One recent example is the 2008 floods in the Sutlej that played havoc with Pakistan's agriculture. In another instance, Pakistan is claiming that due to upper storage construction on the Western rivers (which belong to Pakistan), it is being deprived of almost 0.2 MAF water so critical to Punjab's agriculture. Pakistan has hinted it will seek compensation from India over the stoppage of this water (IRSA, Nov 2008—TV interview of Jamaat Ali Shah).

The current energy demand scenario of India (almost 600 million inhabitants are without access to electricity - communicated at TERI meeting, November, 2008) is consistent with its 8-9% growth rate.

The Indian demand scenario, Climate Change, and Pakistan's position on India's water storage and development works on the Western rivers all suggest a careful re-look (possible re-negotiation under a *force majeure* clause) to address the serious emerging trends that will have widespread consequences for the two countries. In Pakistan there is a strong lobby that considers the Treaty sacrosanct and argues that since Pakistan is the lower riparian and it took almost 10 years to arrive at this Treaty, opening up the issue again is not in Pakistan's interest (Shams ul Mulk, Amir Muhammed and Jamaat Ali Shah - PTV interview November 26, 2008). This rigid view may be appropriate under a 'business as usual' scenario, but Pakistan must take a very serious look at its options in the context of postulated climate changes and the changing regional political situation (i.e. the recent terrorist attack in Mumbai and its effects on India-Pakistan relations, November, 2008)

While discussion on the scope of the Baglihar Dam project (Chenab river)

and the Kishanganga project design (Jhelum river)[18] are beyond the scope of this study, the lesson to be drawn is simple: In extreme situations, such as that of unexpected extremes in water resource availability, countries will be forced to revisit (sometimes even revamp) treaties. Climate change is unfortunately such an unexpected extreme case!

(A copy of the Indus Water Treaty is placed in annexure.)

OTHER RELATED POLICIES

Drinking Water and Sanitation Policy: Pakistan now has a drinking water and sanitation policy that is placed in annexure. A salient feature of this policy is the recognition of the right of drinking water for all at the lowest price.

Objectives

1. To reduce the incidence of death and illness caused by water-borne diseases by ensuring sustainable access to adequate and safe drinking water for all;

2. To improve the quality of life of urban and rural populations by facilitating affordable and convenient access to water for hygiene, sanitation, and other essential domestic uses;

3. To encourage water conservation by facilitating provincial regulatory authorities to assess the life cycle costs of water supply services and set appropriate tariffs for the discretionary uses of municipal water[19]; and

4. To facilitate identification of programs for the protection of watersheds and groundwater, and partnerships for maintenance of stream flow, groundwater recharge and quality that reduce the investments required for water diversion and treatment.

Comment: The drinking water policy deals with provision of, access to, and the quality of safe drinking water. A number of strategies are proposed to achieve the objectives under the MTDF and meet the MDG's. The Drinking Water Policy is silent on the future impacts of climate change on the availability of drinking water and possible changes in water quality, as already noted in the draft water policy and its duplication pointed out.

Since the policy statement is short and crisp (10 pages) the recognition of climate change should be added in the introduction and also followed up in the proposed strategies and action plans.

Environment Policy: While this gap analysis is restricted to agriculture and water policy and the TOR's do not require the consultant to look at environment policy in totality, it is interesting to note the issues and strategies identified and proposed in the environment policy. The only place where climate change is explicitly mentioned is in section 4.7 reproduced below:

"4.7. Climate Change and Ozone Depletion

In order to effectively address challenges posed by climate change and to protect the ozone layer, the government shall:

- ❑ Develop and implement the national climate change action plan.
- ❑ Establish National Clean Development Mechanism (CDM) Authority.
- ❑ Develop and implement policy and operational framework for effective management of CDM process.
- ❑ Promote the use of ozone friendly technologies.
- ❑ Phase out the use of ozone depleting substances in line with the provisions of the Montreal Protocol.

Comment: The perspective is rather narrow and only focuses on a Clean Development Mechanism, and is essentially restricted to the urban interface of air quality - only one of the several manifestations of climate change. This mitigation aspect of the environment policy is a noble objective but rather limited in terms of the proper recognition of climate change as an extremely serious issue. It also does not identify how the UNFCCC's first communication and the Kyoto Protocol are built into the document as response strategies.

Water Supply and Management

To provide sustainable access to improved water supply and effectively manage and conserve the country's water resources, the government shall:

- ❑ Develop legal and policy framework for promotion of safe drinking water in Pakistan.
- ❑ Increase coverage of water supply and water treatment facilities.
- ❑ Establish a water quality monitoring and surveillance system.
- ❑ Make installation of water treatment plants as an integral component of all drinking water supply schemes.
- ❑ Promote low-cost water treatment technologies at the community and household levels.
- ❑ Promote appropriate technologies for rain water harvesting in rural as well as urban areas.

18 See "The Baglihar Dam- Inventory of Conflict and Environment (ICE) Case Study.htm" There are several articles on the Kishanganga Project that serve as a background to this issue.

19 Derived from GoP, Planning Commission, 2005, MTDF, Section 10.4.

- ❑ Launch programs for artificial recharge of groundwater/aquifer.
- ❑ Promote metering of water consumption to discourage the indiscriminate use of water for industrial and municipal purposes.
- ❑ Enact 'Water Conservation Act' and relevant standards to foster water conservation.

Comment: There is an overlap when it comes to the promotion of rainwater harvesting technologies, programs for artificial recharge of groundwater/ aquifers and strategies to cater to management of the demand side. However, the issues identified fall short of a proper appreciation of the emerging trends in climate change that will impact water supplies in immense ways and this needs to be recognized in the Water Policy document.

4.3. Agriculture and Livestock

To achieve sustainable agricultural and livestock development, the government shall:

- ❑ Promote organic farming.
- ❑ Launch programs and projects to prevent soil degradation and to restore and improve degraded lands.
- ❑ Promote integrated pest management and safe use of insecticide, pesticides, weedicide, fungicide and herbicides.
- ❑ Develop strategies and programs to tackle desertification in line with the National Action Program to Combat Desertification and Drought.
- ❑ Establish National Desertification Control Fund.
- ❑ Encourage ecologically compatible cropping systems.
- ❑ Enhance existing livestock production through development of new technologies, scientific methods of farming and improved management interventions.
- ❑ Promote recycling of agricultural products associated with livestock production, and use of livestock sector as an outlet for recycling of appropriate urban wastes.
- ❑ Encourage high productivity varieties of livestock.

Comment: The policy recognizes the importance of developing strategies to combat desertification, an area that will be directly impacted by climate change. Likewise, it stresses ecological sustainability in a broader sense that could be linked to adaptive strategies under climate change.

In addition to water supply and agriculture, the policy also recommends drought disaster management centers. This aspect more closely relates to the National Water Policy and can be linked to one of the more serious outcomes of climate change in South Asia, and especially Pakistan and India.

(A copy of the Environment Policy is placed in annexure.)

The above analysis of water policy in Pakistan shows that there are clear gaps in terms of the climate change perspective. The suggestions made for each document should be reviewed in a seminar mode, critiqued and then submitted for formal inclusion in the draft version of the Policy. In the case of the Water Accord and Indus Basin Treaty, a more detailed analysis needs to be undertaken and the sponsors of such documents consulted about inclusion of the climate change scenarios and their implications for the signatories.

IV. Conventions, Protocols Relevant to Agriculture and Water

Pakistan is a signatory to several international conventions and associated protocols. It has also recently provided leadership at the Bali Conference on Climate Change (2007) that reportedly resulted in a dramatic shift in the position of the lead polluter, the United States, which agreed to radically change its position and join the international community. Despite minimal progress, there is every hope that after the stated position of newly elected US President Barack Obama the US will play its due role in mitigating carbon emissions. Likewise, it is expected that the present low priority given to climate change in the US will be revisited and the country's international commitments revitalized. This could have major funding implications for the implementation of past treaties, including the issues in the South Asian hot spot that includes Pakistan. It is noteworthy that Pakistan ranks 12th in the list of countries that will be most seriously impacted from climate change while its carbon emissions are negligible in international terms (ranked 135th).

Selected international agreements and conventions related to climate and environment

Agreement/Convention	Status–Date
Convention for the Protection of the Ozone Layer (Vienna Convention) -1988	Accession - 18 December 1992
Convention on Biological Diversity	Signed - 05 June 1992 Ratified - 26 July 1994
The Cartagena Protocol on Bio-safety	Signed - 04 June 2001
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Accession - 20 April 197 Entry into force - 19 July 1976
Convention on the Conservation of Migratory Species of Wild Animals	Entry into force - 01 December 1987
Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (Basel Convention) – 1992	Accession - 26 July 1994
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)	Entry into force - 23 November 1976
Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa - 1994	Signed - 15 October 1994 Ratified - 24 February 1997 Entry into force - 25 May 1997
International Treaty on Plant Genetic Resources for Food and Agriculture -2001	Accession - 02 September 2003
International Plant Protection Convention – 1952	Ratified - 10 November 1954
Plant Protection Agreement for the Asia and the Pacific Region - 1956	Adherence - 08 January 1958
United Nations Convention on the Law of the Sea	Signed - 10 December 1982 Ratified - 26 February 1997
Male Declaration on Control and Prevention of Air Pollution and its Likely Trans-boundary Effects for South Asia	Endorsed - April 1998
United Nations Framework Convention on Climate Change (UNFCCC)	Signed - 13 June 1992 Ratified - 01 June 1994 Entry into force - 30 August 1994
Kyoto Protocol	Accession - 11 January 2005 Entry into force - 11 April 2005

Source: ICIMOD Web Page on Pakistan, 2008

The Ministry of Environment has very kindly provided a listing of current protocols relevant to Climate Change and Environment (personal communication, 2008).

Conventions/Protocols Related to Environment

S. No.	Name of Convention	Date of Signing	Date of Ratification	Dealing Wings of the Ministry
1	**RAMSAR Convention on Wetlands**	1971	Jan 1976	I.G. (F)
2	**Convention of Migratory Species**	1971	Dec 1987	I.G. (Forest)
3	**Convention on International Trade in Endangered Species (CITES)**	1973	April 1976	I.G. (F)
4	**Convention on the Law of Seas**	Dec 1982	Feb 1997	D.G. (Env)
5	**Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste**	May 1992	Oct 1994	J.S. (IC)
6	**Montreal Protocol on Substances that Deplete the Ozone Layer**	Jan 1989	Dec 1992	J.S. (IC)
7	**United Nations Framework Convention on Climate Change (UNFCCC)**	June 1992	June 1994	J.S. (IC)
8	**Kyoto Protocol to UNFCCC**	Dec 1997	Jan 2005	J.S. (IC)
9	**Convention on Biological Diversity (CBD)**	June 1992	July 1994	I.G. (F)
10	**United Nations Convention to Combat Desertification (UNCCD)**	Oct 1994	Feb 1997	I.G. (F)
11	**Rotterdam Convention on Prior Informed Consent (PIC) for certain hazardous chemicals and pesticides**	Dec 2001	July 2005	J.S. (IC)
12	**Stockholm Convention on Persistent Organic Pollutants (POPs)**	Dec 2001	Not yet ratified	J.S. (IC)
13	**Cartagena Protocol on Bio-safety to the CBD**	June 2001	Not yet ratified	D.G. (Pak-EPA)
14	**Vienna Convention on Substances that Deplete the Ozone Layer**	Jan 1989	Dec 1992	J.S. (Admn)

In addition to the above, the Male Declaration has also been a key convention aimed at air pollution controls that falls within the purview of mitigation and under which Pakistan is making considerable progress[20].

Kyoto Protocol: The Kyoto Protocol, which followed the UNFCCC (United Nations Framework Convention on Climate Change), was agreed upon in Rio De Janeiro, Brazil in 1992. The Convention's prime focus is on 'stabilization of greenhouse gas concentration'. Its emphasis is on a flexible mechanism like emissions trading and the CDM mechanism (See Wikipedia, Kyoto Protocol for greater detail). An excellent resource for all readers wishing to update themselves on the UNFCCC and the Kyoto Protocol is the UNFCCC website, which provides information on the Convention, its members, communications from each of the countries and much more on the status of the Convention and its future plans (see http://unfccc).

Initially, Pakistan was rather reluctant to sign this Protocol, but as noted earlier it agreed to the Protocol in 1992 in Brazil and finally ratified it in 2004. While Pakistan is not a major polluter it is facing unwarranted consequences in the form of floods and drought. Pakistan has already sent the first

20 Also see Male Declaration on Control and Prevention of Air Pollution and its likely trans-boundary effects for South Asia (Male Declaration, Internet).

communication to UNFCCC and is currently working on the second UNFCCC communication. Details pertaining to the first communication can be found on the UNFCC website and have also been included in the accompanying disk. Pakistan is preparing for the COP 14 meetings in Poznan, Poland and has already circulated a position paper to this effect. This focuses on presenting Pakistan's case for adaptation capacity enhancement, funding to fight climate change challenges (see Ministry of Environment/IUCN TAP meeting handouts November, 25, 2008, which highlighted the key issues and provided technical input and guidance for the delegates attending this forum).

At the President's directive, Pakistan has formed a Task Force to provide a detailed analysis of the Climate Change policy perspective. It is preparing an interim report under the leadership of Dr Ishfaque Ahmed, Chief Scientific Advisor to the President and the Planning Commission. This report, to be submitted in December, 2008, lists Pakistan's achievements to date on fulfilling the Kyoto Protocol and UNFCCC agenda in terms of identification of challenges, impacts, adaptation and mitigation, and future plans to address climate change in the areas of water, agriculture, energy, economic threat, mass awareness, etc.

Bali Convention: Pakistan played an important leading role in the conference held in Bali, Indonesia, in 2007. The main outcome, the creation of an action plan (See Net Decision-/CP 13 under Bali Plan), is based on taking cognizance of the IPCC warning that climate change is inevitable and that delays in reducing emissions significantly could lead to a higher risk of even severer impacts. The action plan will remain in force till 2012 and possibly beyond.

It focuses on mitigation measures that are **measurable, repeatable and verifiable.** Thus the emphasis is on quantitative assessment and the monitoring of changes with respect to CO_2 emissions and their impact on climate change.

A major recommendation and achievable goal was to establish a **trust fund** that will ensure the long-term resource mobilization needed to address the emerging problems of climate change.

Some important aspects of the above conventions and protocols that need to be revisited, based on comments made by professionals interviewed, include:

1. Participation in international conventions and meetings often is restricted to government officials and officials of ministries. Frequent staff transfers tend to break the continuity in the effectiveness of the country's participation. In many cases, too, it is non-technical people who attend meetings and they are unable to present a persuasive case for Pakistan.
2. There is a strong argument for first clarifying Pakistan's ground realities through discussion and debate before taking any decision on positions. At times, 'moving with the tide', i.e. following what others do, is counter-productive and not in the best interest of Pakistan. For example, an over-emphasis on adaptation alone, while ignoring mitigation, does not create much goodwill for Pakistan among the international community.
3. While drafting policy documents, the relevant protocols and compliance clauses must be highlighted. More specifically, potential conflicts between international agreements and Pakistan's stated positions must be resolved through mutual consultation. Where avoidance is costly or impracticable (e.g. a drastic cutback in the ruminant population to reduce methane emissions, or a marked reduction in rice production), the inability to meet such requirements should be spelled out upfront, citing national interest as a priority.
4. As emerging trends in climate change will require new conventions and treaties, many within a trans-boundary context (e.g. water and waste management), it is important to expose a large number of ministries and departments (provincial and federal) to the skills needed for data collection, preparation of background documents, negotiation, use of Internet resources and the drafting of internationally acceptable documents.
5. A centralized unit must be established to serve as a repository of all documentation on conventions and protocols relevant to climate change, the environment, water and agriculture. Likewise, it would be appropriate to establish focal points at the provincial level to address specific issues related to a given province, along with sub-committees comprised of participants representing the multiple stakeholders.

V. Way Foreward and Recommendations

Climate Change challenges in Pakistan are mainly in the realms of glacier melt, global warming, and increased, intensive and short-interval precipitation during the monsoons, which will negatively impact our water resources, agriculture, health, livelihoods, energy demands and ecology. Rises in sea levels will lead to significant productivity issues in the Indus delta, and affect the fragile ecosystems and wetlands elsewhere, through shifts in the flora and fauna in the country. The prevalence of floods and droughts is expected to increase.

Pakistan's economy is dominated by agriculture and our overall economic performance is determined by how well the agriculture sector is performing. During recent years crop sector growth rates have stagnated, or at times even shown negative trends. Climate change will impact this sector even further in unprecedented and unpredictable ways as temperatures rise to critical levels. Water resources are under threat, with every likelihood that Pakistan will move from a water-stressed to an outright water-scarce country. Developing and implementing policies to address challenges in the areas of water and agriculture are fundamental to Pakistan's economic survival. The government has been pursuing a policy agenda that aims to bring efficiency in these two areas.

Pakistan is a signatory to the UNFCCC convention and many others, as elaborated in chapter 4. The policies it follows are also a reflection of its commitments to the international community on how it will deal practically with the challenges of climate change. The processes of mitigation and adaptation to such changes are still at an evolutionary stage. The review of various policy documents on agriculture and water highlighted the need for more explicit recognition of climate change concerns, the incorporation of new policy statements that address the issue explicitly, and the rectification of various anomalies (such as the identification of specific issues within each of the 8 agro-ecological zones that need redress) and shortcomings that either intentionally or unintentionally have been reflected in the policy documents.

RECOMMENDATIONS:

1.1 Agriculture

1. Pakistan does not have a clear, updated Agriculture Policy document, as revealed by this gap analysis and further noted in the SAARC agriculture policy website. Based on the available information, it is recommended that Pakistan review, develop and promote to stakeholders a policy document that reflects the current realities and takes into account the ramifications of climate change.
2. In the Medium-Term Development Framework, the Vision Statement and annual development plans should incorporate statements (suitably modified) that have been identified in the relevant sections of this report.
3. The following three broad statements should be added after suitable modification:

A. Agriculture policy will implement measures that help preserve our agriculture, protect the productivity and sustainability of farm communities, and ensure economic welfare by adapting to climate change with the use of relevant technology, know-how and experience.

B. Agriculture policy will address climate change amongst farms, agribusiness entities, producers and consumers by providing information and know-how on finding ways and means to adjust by shifting/ substitution to new crops, crop rotations, livestock species, fisheries and forestry that ensure sustained growth on our farm systems.

C. Climate change will alter the comparative advantages of certain productive enterprises. Research organizations and economic analysis institutions will need to be supported to evaluate the postulated impacts on each of the dominant enterprises within the 8 climatic zones and to propose modifications in enterprise mix, technology, input use and incentives. Modeling policy proposals will help simulate present, future and predicted impacts under various scenarios.

1.2 Water

4. Further debate should be initiated on the proposed incorporation of text suggested in chapter 3 in the relevant clauses of the draft National Water Policy.
5. In-house discussions on the Indus Water Treaty and an evaluation of the effectiveness of the Treaty under various climate change scenarios identified in IPCC, 2007, should be initiated and supported by newly emerging evidence.
6. The shortcomings in the Water Apportionment Accord should be addressed in the light of the anticipated climate changes and all the provinces taken into confidence on suitable fallback proposals.
7. Pakistan met the challenge of water-logging and salinity with international help in the sixties. The present water resource challenges posed by climate change require a similar response that brings together some of the best minds in the world to address a problem of such serious magnitude. The possibility of acquiring high-level Technical Assistance with highly specialized expertise (like, for example, the Roger Revelle Report under President J. F. Kennedy) to review and recommend action and seek international help should be seriously explored with the new US administration.
8. Conserving water must become a national duty and not be left to any single department or institution. A strong advocacy program backed by experiences in the field must be launched immediately.
9. On trans-boundary matters, an analysis should be conducted on how India has managed to develop more than 10 large dams

on its river system, the relevant factors, and what mechanisms it has in place to harness its excess water resources. Likewise, neighboring China is constructing more than 100 dams under an extremely diverse set of circumstances.

10. A sufficiently articulated draft water policy is in place. It should be made succinct and flexible enough to serve as a guiding document for pragmatic decision making.
11. Investments in water should be linked directly to benefits derived from zero carbon emissions in hydro-power generation. International financial assistance should be sought with this as the thrust argument in the context of climate change.

General Recommendations

12. Upon incorporation of the relevant statements, clauses and articles into the Agriculture and Water Policy documents, suggestions should be solicited from a wide array of stakeholders at federal and provincial levels before the finalization of the documents. This is the ideal opportunity to undertake this exercise as the Water Policy exists only in draft form, while there is no current agreed upon agriculture policy.
13. Policy seminars (agriculture and water) should be held at the Planning Commission and in provincial government P&D departments, involving planners, policy makers, progressive farmers, agribusiness concerns and decision makers from both government and the political arena.
14. A mechanism for continued feedback from important stakeholders should be developed. This could be in the form of a dedicated website on 'Agriculture and Water Policy under Climate Change'.
15. Action should be initiated to develop the necessary legal framework/legislation in response to climate change-related litigation, both national and international, and the legal community kept apprised of emerging trends in international law that will apply to Pakistan under the various covenants of treaties and conventions (UNFCCC, Kyoto, Bali) and the need to keep abreast with such changes.
16. Pakistan is under obligation to produce various convention communications (e.g. second UNFCCC communication), WTO implementation agreements, etc. Who should be made responsible for input from the Water and Agriculture sectors based on the comparative advantages of their related institutions and knowledgeable manpower? There is a need to take a holistic view of such obligations with input from multiple stakeholders. The present indifferent state of affairs results in very poor representation of Pakistan's viewpoint at international forums.
17. The print and TV/radio media should be encouraged to educate the general public about the challenges of climate change and facilitate a policy dialogue amongst the concerned stakeholders.
18. Economic, financial and social prediction, projection and forecasting capabilities should be evolved to create adaptation measures that address the effects of climate change on agriculture and water. Social research organizations should engage academia to develop a long-term capacity to analyze such issues and propose prescriptions in the light of available data that is relevant to Pakistani conditions.
19. Allied policies related to drinking water and sanitation, inland fisheries, livestock, forestry and the environment should also be reviewed to ensure that climate change is adequately incorporated and agreed upon by all stakeholders.
20. The existing draft water policy and agriculture policy (1991) should be revisited and much shorter versions (perhaps less than 10 pages) prepared, and a distinction should be made between a national policy document and government planning documents.
21. It is recommended that Pakistan take the initiative to draft a National Climate Change Policy[21] after widespread consultation with stakeholders from all walks of life.
22. There are major difficulties involved in retrieving policy-related information from government organizations. The Planning Commission may look into ways to simplify document procurement procedures and also develop a mechanism to ensure the monitoring and evaluation of all policies being implemented. Promotional bulletins and synthesis leaflets in all local languages and case examples should be made available for widespread distribution.
23. Perhaps the single most important policy Pakistan needs is an **'Implementation Policy'.**

Way Forward

The above recommendations suggest that the way forward lies in moving from careful analysis (based on international community concerns

21 A good example can be found on the supporting disk provided with this report – Draft Policy Sao Paulo (Brazil) Climate Change.

raised in IPCC, 2007 and its earlier assessments) and Pakistan's own findings to the establishment of an Adaptations Center that addresses Climate Change impacts on Agriculture and Water. Equally important is to understand the ecological imbalances resulting from human activity that are often ignored when postulating the impacts of climate change. There are no 'single silver bullet' solutions to the overall problem of climate change. The core problem has to be analyzed piecemeal with most major hot spots and agro-ecological zones modeled and prioritized for close monitoring and adaptation.

Worldwide evidence signals that the rate of increase of climate change is much higher than anticipated earlier (global warming, rising seas, precipitation, etc.). This is extremely serious and needs to be highlighted in all discussions and documentation. The views of those who dispel climate change as 'climate variability' must be listened to carefully and responded to with scientific data and evidence. It is equally important for the government to be cautioned against extreme responsive measures, such as bio-fuels and costly irrigation expansion projects that spread water too thin, and poorly chosen policy instruments that have uncertain results. In the face of dwindling water resources, growth must be vertical and measures to achieve this will require a diametrical shift in thinking (knowledge, technology and investment) that traditionally focuses on 'more and more' unplanned infrastructure.

Serious consideration must be given to bringing agricultural produce (e.g. vegetables, milk and other high-demand items to urban centers and perhaps through skyscraper (vertical) expansion of the agriculture resource base. This is important as almost 60% of Pakistan's population will be living in urban areas by the 2030's and will cause serious problems of pollution and over-crowding. This close proximity of agricultural production to city centers (urban agriculture) is an emerging area for research & development and can help reduce high transportation costs, improve retail efficiencies, and enhance quality, thus resulting in major savings in carbon imprints. Besides expanding our public forest areas, which remain almost 50% under-stocked, Pakistan can contribute significantly to reducing CO_2 emission problems by expanding on-farm forestry near water channels and on homesteads. This could be an important strategy that would mainly require knowledge and motivation of farmers and would result in huge pay-offs.

Finally, widespread awareness campaigns can help spread the message that past assumptions on agricultural productivity and water availability may be seriously undermined by climate change. Fresh thinking, based on good science, is needed, **where the supply of high-cost, first-class water is linked to high-tech, first-class agriculture.** This should be the overriding challenge for policy and decision makers. This will hold true for both irrigated and dry land agriculture. This should be reflected in the development resources allocated between agriculture and water.

VI. Documents Consulted

Address by the Prime Minister of Pakistan - Syed Yousaf Raza Gilani at the launch of the 'Indus Entrepreneurs', Islamabad Chapter - June 2008

Prime Minister's address to the nation - July 19, 2008

'Let us make South Asia the Granary of the World': Address of the Prime Minister of Pakistan, Syed Yousaf Raza Gilani at the Inaugural Session of the 15th SAARC Summit, Colombo - August 2, 2008

Ahmed S. and Praful Patel, 'South Asian Region - The World Bank': World Bank Website - Pakistan page

Planning Commission. Medium Term Development Framework - Planning Commission, Government of Pakistan - May 2005

Government of Pakistan, 1988, Report of the National Commission on Agriculture, Ministry of Food, Agriculture and Livestock, Islamabad

Ahmed, Nazir. 'Water Resources of Pakistan', Lahore - Shahzad Nazir publisher.

National Agricultural policy, 1991. Ministry of Food, Agriculture and Cooperatives, Government of Pakistan, Islamabad

Global Water Partnership, February 2000. The Framework for Action (FFA) for Achieving the Pakistan Water Vision 2025. Pakistan Water Partnership, Islamabad

Pakistan Water Partnership, 2001. Supplement to The Framework for Action for Achieving the Pakistan Water Vision 2025. Islamabad, Pakistan

Planning Commission of Pakistan: Glacier Behavior under Climate Change and its Impact on Agriculture in Pakistan. Seminar proceedings: held on June 4, 2008

National Action Plan on Climate Change - Government of India. Published by Prime Minister's Council on Climate Change (no date)

International Conference on Climate Change - Science and Impacts, Nov 19-21, 2008, held at Jeju, Korea - Abstracts

IPCC. 2007. Climate Change 2007 Synthesis Report. Also visit their website IPCC.org for earlier reports that provide continuity to the climate change argument within a historical context

IWMI.2007. 'Water for Food, Water for Life' - A comprehensive assessment of Water Management in Agriculture

Sheikh Ali Tauqeer, 2008. A way forward on Climate Change. LEAD Pakistan (Mimeographed notes circulated at meeting of Task Force on Climate Change)

Draft National Water Policy, 2005, Government of Pakistan. Internet version

Science –based Agricultural Transformation towards Alleviation of Hunger and Poverty in SAARC Countries - New Delhi, India, March 5-7, 2008

'Tarbela Dam and related aspects of the Indus River Basin Pakistan' - Published by the World Commission on Dams, South Africa and Asianics Agro Dev Islamabad, Pakistan

The Water Accord -1991. See Pakistan Water Gateway on the internet

National Agriculture Policy - Ministry of Agriculture, Department of Agriculture & Cooperation, Government of India

Global Change Impact Studies Centre - Several Studies on their Web Page. Islamabad, Pakistan

Government of Pakistan, 2008. Draft Report on Impact of Climate Change on Water Sector. By Water Sector Working Group. Ministry of Water & Power

Amir, P., 2008. Climate Change and Emerging Opportunities in Agriculture. Presented at IUCN Seminar held at Royal Palm, Lahore, August 30

Amir, P. 'Climate Change, Water Resources and Implications for Agriculture', paper presented at National Conference on Water and Agriculture, held at NARC, August 26-27, 2008. In workshop proceedings forthcoming

Amir, P., 2008. 'Glacier Melt and Agriculture - Are we running against time? Need for a Science-based Response'. Lead presentation made at Planning Commission of Pakistan, June, 5, 2008. Islamabad, Pakistan

Amir, P., 2008. 'Water and Political Economy of Food in Pakistan within a climate change context'. Oxford University, UK, April 3-4, 2008 - forthcoming Conference proceedings on Food Security

Amir, P., 'Climate Change in dry lands and response through adaptation of risk and diversification - case of Pakistan'. Presented at 'Science-based Agricultural Transformation towards Alleviation of Hunger and Poverty in SAARC Countries'. New Delhi, March 5-7, 2008

Amir, P., 2008. 'Challenging Climates: adapting to Change'. Consultancy Report submitted to British Council, Islamabad

Amir, P., 2007. 'Climate, water and agriculture interactions and people's livelihood' - Pp 58-63. In Climate and Water Resources in South Asia: Vulnerability and Adaptation. Editors Amir Muhammed, M. M. Qader Mirza and Bonnie A. Stewart. APN, START and Fred J. Jansen Institute for World Peace, Islamabad, Pakistan

Amir, P. and M Munir Sheikh, 2007. 'Droughts in Pakistan: Causes, Impacts and Remedial Measures' - pp 78-94. In Climate and Water Resources in South Asia: Vulnerability and Adaptation. Editors Amir Muhammed, M. M. Qader Mirza and Bonnie A. Stewart. APN, START and Fred J. Jansen Institute for World Peace, Islamabad, Pakistan

Amir, P., 'Water Dams and Irrigation Infrastructure in Pakistan', 2006. Presented at the conference on Future of Water - State, Agribusiness and Society. Pani Pakistan and LUMS, Lahore , Pakistan (In proceedings)

Amir, P., 2005. 'Economic Analysis of Trade-Offs between Agriculture and Environment and related aspects in Sindh and Punjab'. Prepared for Study III Environmental Concerns of All Four Provinces, Federal Government, and Islamabad, Pakistan

Amir, P., 2005. 'Role of Large Dams in Pakistan'. Paper prepared for the Country Water Assistance Strategy, the World Bank, Washington, D.C., USA

Amir, P., 2005. 'Modernizing Agriculture through water management'. Paper prepared for the Country Water Assistance Strategy, the World Bank, Washington D.C, and USA.

Amir, P., 2005. 'Socio-economic aspects of drought in Bahawalpur and Mirpurkhas Hydrological Units of Pakistan'. Science and Culture. Vol 71 No. 7-8, July-August, 2005. The Indian Science News Association. New Delhi

Amir, P., 2003. 'Micro-level field surveys in Bahawalpur (Punjab) and Hyderabad (Sindh) in the drought affected regions of Pakistan' presented at Workshop/Seminar on Global Changes Associated Vulnerabilities of South Asian Water Resources and Impacts on Himalayan Mountain Regions APN, San Diego, USA

Bhatti, M. A., 1997. 'Climate Change Assessment and Adaptation Strategies for Pakistan in Water Sector'. PSF, Islamabad

Faruqee, R. 1995. 'Structural and Policy Reforms for Agriculture Growth -the case of Pakistan'. World Bank, Washington, D. C., USA

National Conference on Water Shortages and Future Agriculture Challenges and Opportunities. Organized by Agricultural Foundation of Pakistan. August 26-27, 2008, at NARC, Islamabad, Proceedings

LISTING OF RELEVANT SEARCHES REVIEWED (PROVIDED AS SEPARATE CD)

Draft Sao Paulo (Brazil) State Policy on Climate Change

Briefing paper for Pakistani Parliamentarians (brief7eng.pdf)

Climate Change caused extinction of many species

GEF program in Pakistan

Pakistan Impact of climate on Ag in South Asia

Past climate change drove mass extinction in Pakistan

Regional hydrological Impacts

The Bagliar Dam - inventory of conflict and environment

The Heartland Institute Proceedings 2008

UNFCCC

Technical Committee on Water Resources (Nisar Memon)

Ag Policy 1991

Agriculture and Food Security in Pakistan

Annual Plan Chapter 6 (Agriculture)

Annual Plan Chapter on Water

Climate change and agriculture

Climate change and food production in Pakistan

Climate Change – sub-committee report

Conventions and protocols

First Communication by Pakistan UNFCCC

Pakistan Agriculture in Global Perspective

Increasing resilience of poor countries to cope with impacts of climate change

Vision Statement on Agriculture 2030

World Bank Report on Agriculture 2008

List of acronyms and glossary

Pakissan.com

Pakistan Zardari for ensuring food security

Reforming the government's role in Pakistan's agriculture sector

SAARC Agriculture Policies

Scientists Join Hands to Combat stem rust

7 issues of water resources in Pakistan

Basal Convention

Challenges WS

India's National Agriculture Policy

Indus Water Treaty 1960

Pakistan Drinking Water Policy

Pakistan Water CAS World Bank - presentation

Pakistan Water CAS - Full report

Sri Lanka Ag Policy

And several others

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VIII. Volume II
Annexure

1. Vision Statement 2030
2. Agriculture Perspective and Policies
3. Ag Policy of Bangladesh
4. National Agriculture Policy of India
5. Pakistan National Water Policy
6. National Environment Policy of Pakistan
7. On Status of International Conventions and Protocols in the Field of Environment
8. National Drinking Water Policy
9. Water Accord, 1991
10. Indus Water Treaty

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