THE CRITICAL ANALYSIS OF IMPLEMENTATION OF CONVENTION ON BIODIVERSITY IN PAKISTAN

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Nematodes
Biodiversity of nematodes
Industrial Hygiene
Medicine, Industrial
Industrial & medicine

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Submitted in partial fulfilment of the requirements for the MS in Environmental Science at the Faculty of Basic and Applied Sciences, Department of Environmental Sciences International Islamic University Islamabad.

Supervisor: Professor Dr. Irfan Khan 4 October, 2009

IN THE NAME OF ALLAH, THE MOST MERCIFUL AND BENEFICIAL

DEDICATION

Dedicated to my parents whose efforts, encouragement, support and prayers enabled me to complete this work.

Critical Analysis of Implementation of Convention on Biodiversity in Pakistan

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Abstract

This year 2009, national year of environment, is very crucial for Pakistan as it will be preparing for the 2010 "Year of Biodiversity". The overarching aim of this work was to carry out a critical analysis of implementation of CBD in Pakistan and the specific objectives were to evaluate: the progress of government towards achieving 2010 targets; the response of other organizations towards 2010 targets; the measures taken by the Government and other relevant intra governmental organizations to achieve 2010 targets; and finally, to give some recommendations for achieving the 2010 targets.

This research was qualitative and therefore the data source included documents and text, interviews and questionnaires. The progress and measures taken by government and other relevant intra governmental organizations; towards achieving 2010 targets was analyzed through studying of national implementation reports submitted to CBD. The trend of organizations towards 2010 targets was analyzed through questionnaire and discussions.

The critical analysis of the implementation of CBD was done in the context of the 2010 biodiversity targets. The scope of the project was exclusive to analysis of only one focal area out of seven *i-e* focal area number three; addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change. The subsequent goals and their sub-targets are analysed in detail in separate chapters.

This thesis suggests that action plan needs review and some issues e.g. (Invasive Alien Species, Climate change) that are neglected ; should also be included in future BAP. Furthermore the organizational structure for the implementation of CBD in Pakistan is also inadequate.

The important finding of research was that it is unlikely for Pakistan to achieve all of 2010 targets however target 6.2 "Management plans in place for major alien species that threaten ecosystems, habitats, or species" and target 7.2 " Reduce pollution and its impacts on biodiversity" are achievable. The targets cannot be achieved until inventory of major flora and fauna is formed and national indicators are developed. The progress is towards the targets but is rather slow. There are opportunities to implement CBD activities while coordination in other multilateral agreements would be highly beneficial to get the maximum desired results .e.g. climate change mitigation and adaptation activities are mutually beneficial and synergistic, and that contribute simultaneously to the United Nations Framework Convention on Climate Change and its Kyoto Protocol and the Convention on Biological Diversity.

Similarly the UNCCD is helpful in saving the biodiversity along with maintaining the fertility of soil. The related conventions should be taken as reaching single goal through different means, all within broader National development objectives.

ACKNOWLEDGEMENTS

First of all I am thankful to Allah Almighty, who has provided me strength and opportunity to carry out this thesis.

I am grateful to Dr. Irfan Khan, my supervisor, for his complete guidance, advice and interest in completion of my thesis.

I owe my gratitude to my parents for supporting and encouraging me to pursue this degree.

My sincere gratefulness is for all of the staff members of Ministry of Environment for their availability and valuable contribution in my thesis. Furthermore I would like to express my gratitude to all those who provided their time for interviews, discussions and questionnaires.

Harmain Rukh

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ALGAS	Asia least cost greenhouse gas strategy
BAP	Biodiversity Action Plan
BOD	Biological oxygen demand
CABI	Centre for Agriculture and Biosciences International
CBD	Convention on Biological Diversity
CDA	Capital Development Authority
CDM	Clean Development Mechanism
CRPRID	Centre for Research on Poverty Reduction and Income Distribution
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species of Wild Animals
COD	Chemical Oxygen Demand
COP	Conference of Parties
EIA	Environmental Impact Assessment
GCISC	Global Change Impact Studies Center
GEF	Global Environment Fund
GHG	Greenhouse gases
GTZ	German Agency for Technical Cooperation
IAS	Invasive Alien Species
IEE	Initial Environmental Examination
IIUI	International Islamic University Islamabad
INCCC	Initial National Communication on Climate Change
IRSA	Indus River System Authority

IUCN	International union for conservation of nature
JICA	Japan International Cooperation Agency
LEAD	Leadership for Environment and Development
MACP	Mountain Areas conservancy Project
MDG	Millennium development goals
MEAs	Multilateral Environment Agreements
MELGRD	Ministry of Environment Local Government and Rural Development
NAP	National Action Program to Combat Desertification
NARC	National Agriculture Research Centre
NASA	National Aeronautics and Space Administration
NCCCD	National Coordination Committee to Combat Desertification
NCCW	Nation council for conservation of wildlife
NCPC	National Cleaner Production Centre
NCS	National Conservation Strategy
NEAP	National Environment Action Plan
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan (Pvt) Limited
NIPGE	National institute for Biotechnology and Genetic Engineering Faisalabad
NIRs	National Implementation Reports to CBD
NPCC	National power construction corporation
NUST	National University of Science and Technology
ODS	Ozone Depleting Substances
PAMP	Protected Areas Management Project

PEPA	Pakistan Environment Protection Act 1997
PEPC	Pakistan Environmental Protection Council
POC	Parties of the Convention
RDA	Rawalpindi Development Authority
SDPI	Sustainable development policy institute
SLM	Sustainable land management
SMART	Self Monitoring and Reporting Tool
SPM	Suspended Particulate Matter
UNCCD	United Nations Convention to Combat Desertification and Drought
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nation Development Program
UNEP	United Nations Environmental program
UNFCCC	United Nation Framework Convention on Climate Change
VOCs	volatile organic compounds
WASA (R)	Water and Sanitation Agency Rawalpindi
WAPDA	Water and Power Development Authority
WB	World Bank
WSSD	World Summit on Sustainable Development
WWF	World Wide Fund for Nature

CHAPTER 1
INTRODUCTION

This year 2009, declared as national year of environment, is very crucial for Pakistan as it is preparing to submit its fourth national report to Convention on Biological Diversity (CBD) as well as getting ready to emerge as active protector of its rich biodiversity for the 2010 "Year of Biodiversity". Obviously the focus will be on seeing the CBD from the perspective of reduction in the rate of loss of biodiversity for poverty alleviation. The CBD defines biodiversity loss as "the long term or permanent qualitative or quantitative reduction in components of biodiversity and their potential to provide good and services, to be measured at the global, regional and national levels". It's well agreed that biodiversity has huge contribution in human well being and sustainable development. Provision of free of charge services like clean water, pollination , pure air, crop pest control , soil formation and protection , food, fuel , fibers and drugs, by biological diversity every year are worth billions of rupees and are crucial for the sustainable development and well fare of Pakistani society. To lose biodiversity is similar to losing those life support systems on which we, and other species, depend completely (GoP, 2000) .

The main drivers of biodiversity loss and ecosystem services identified by Millennium Ecosystem Assessment are climate change, unsustainable resource use in the form of over-exploitation, pollution and habitat destruction and Invasive Alien Species (IAS). Rapid depletion of habitats, uncontrolled spread of IAS, and pollution has greatly increased pressure on ecosystems hence ecosystem resilience is weakening and their ability to adapt to conditions due to changing climate is being reduced as well. This has direct impact on services provided by ecosystems. The activities identified above are anthropogenic in nature. The Millennium Ecosystem Assessment found that in the last 50 years humans have changed the earth's natural ecosystem more rapidly and extensively, than in any other period. In the absence of checks and balance, this problem is likely to expand.

It is felt that any review or analysis of implementation of CBD in Pakistan has not been done so far. Analysis of Biodiversity Action Plan (BAP) is required to be carried out after some selected time period, so that actions or plans can be revised and modified in the light of national experiences, lesson learned and emerging concepts. Critical analysis can also bring forward the flaws of the implementation process and can thus bring in notice of implementing agencies so that effective implementation can be carried out. This thesis critically analyzed the efforts and devotion of Pakistan so as to establish some valuable information on how efficiently the implementation is being carried out. Under the CBD convention article number 6, Pakistan is obliged to mainstream the biodiversity concerns in its policies and planning. So this thesis not only analyzed the success of implementation of CBD in Pakistan through 2010 targets but also presented the scenario in which these efforts are being carried out and the challenges faced by Pakistan. Since 2010 targets bring in focus the actual actions which are taken to halt the loss of biodiversity therefore one focal area from the framework provided by Conference of Parties (COP 6) was chosen, so that the implementation process could be observed from the perspective of goals and targets to be achieved.

Ultimately efforts were made to find a viable solution and give guidelines to the guardians of biodiversity. This research suggests that action plan needs review and some issues e.g. (Invasive Alien Species, Climate Change) that are neglected ; should also be included in future BAP. Furthermore the organizational structure for the implementation of CBD in Pakistan is also inadequate.

In this thesis, I have analyzed the goals coming under the selected focal area in separate chapters. Discussion follows the chapters containing analysis of each goal and its sub targets separately. BAP in the context of selected subject focal area was analyzed in discussion since it is the main document that is of high importance as far as the actual implementation of CBD in Pakistan is concerned. The discussion also brings in focus the CBD institutional structure

in Pakistan, as it is in the hands of the institutions to implement CBD successfully. The last chapter *i-e* chapter 6 gives the recommendation for every goal.

1.1 The CBD convention and 2010 targets

International community realized that biodiversity serves as a foundation in supporting the human life. As a result of concerns over the rapidly declining biological diversity, the Convention on Biological Diversity, was opened for signature at the Earth Summit Rio de Janeiro in 1992 . It entered into force in 1993, however the international dialogue begun a decade earlier by the World Commission on Environment and Development (known as the Brundtland Commission). The CBD is holistic in nature as it covers all aspects of biodiversity, and was the first international legally binding treaty to acknowledge the role of biodiversity in sustainable development. The Convention consists of three main objectives: the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The recognition that humans, themselves exhibiting a diversity of cultures, are an essential component of ecosystems underpins the convention's three objectives. Same storehouse of biodiversity is available to all nations, whether rich or poor, living on planet earth (SCBD, 2006).

Multilateral environment agreements (MEAs) comprise of two important phases; policy developments and their implementation. CBD at its sixth meeting of the Conference of Parties (COP-6) moved a step ahead and shifted its focus on implementation by adopting 2010 targets under the CBD process by decision vi/26 of the COP-6. 2010 targets bring in focus the actual actions which are taken to halt the loss of biodiversity.

1.2 Efforts of Pakistan

Pakistan recognized significance of biodiversity and the important role it plays in the economy of country hence, the CBD was signed by Pakistan in 1992. Later on it was ratified by cabinet in 1994. After ratification Pakistan was obliged under article no. 6 to prepare the biodiversity action plan. This plan was the first significant step towards creating the awareness and capacity building in Pakistan. The other major milestone was the preparation of Pakistan's first National Report. Pakistan has also prepared several important documents on biodiversity. Most important steps taken and documents related to CBD prepared by Pakistan are given in the table 1 below:

Table 1. Important Achievements Related to CBD

CBD signed by Pakistan	1992
CBD Ratified by Pakistan	1994
Biodiversity Action Plan	2000
1st National Implementation Report	1999
2rd National Implementation Report	2001
3rd National Implementation Report	2006
4th National Implementation Report	Due in March 2009 (but was not submitted)

The preparation and submission of these reports, in such limited resources and lack of availability of baseline data is an achievement of Pakistan.

According to Pimm and Raven (2000), despite of the fact that CBD has been implemented in a very short period as compared to other conventions, it has been undergoing significant difficulties in meeting its objective of conservation of biological diversity. The global rate of extinction has rather increased instead of slowing down as a result of ratification of CBD while it is expected that there would be further acceleration in extinction rates due to intense global development patterns and increasing human population.

In the light of above statement and from review of literature, it can be inferred that we are also losing out biodiversity ; whether it is in the form of ecosystem , habitat or genetic level the deterioration is obvious at all levels.

Many individual project documents and annual reports of various organizations can be found on different projects working on implementation of CBD but no significant conclusion can be made that whether our progress is towards conserving the biodiversity or there is an increase in loss of biodiversity?.

Currently the mechanism of the preparation of National Implementation Reports (NIRs) ; submitted to the secretariat of CBD is serving wide purposes which are diverse in nature ranging from cooperation among organizations to review and from assessing progress to implementation of CBD itself. This mechanism is insufficient to deal with the issue of biodiversity which is complex and diverse. As implementation structure is a prerequisite for implementation process itself, therefore it is affecting the performance of biodiversity specialists in Pakistan.

1.3 Biodiversity targets for 2010

A strategic plan was adopted by Conference of parties of the convention in 2002, with the mission of achieving, by 2010, "a significant reduction of the current rate of biodiversity loss at the global, regional and national level, as a contribution to poverty alleviation and to

the benefit of all life on Earth". 190 nations agreed upon this target and later in 2001 European Union also made a commitment for reducing the loss of biodiversity by 2010. This 2010 target was subsequently endorsed by the Heads of State and Government at the World Summit on Sustainable Development in Johannesburg, South Africa. Later on, world leaders meeting at the 2005 World Summit of the United Nations reiterated their commitment to meeting the 2010 target.

For assessing the progress towards the 2010 Biodiversity Target, the COP has established supporting goals and targets and identified indicators for evaluating biodiversity status and trends, (SCBD, 2006). To guide action Parties of the Convention (POC) agreed on a framework of focal areas. In 2004 COP the seven focal areas were, adopted in decision VII/30. These seven focal areas are as follows:

1. Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems; (ii) species and populations; and (iii) genetic diversity;
2. Promoting sustainable use of biodiversity
3. Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change;
4. Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;
5. Protection of traditional knowledge ,innovations and practices
6. Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources; and
7. Mobilizing financial and technical resources especially for the developing countries, in particular the least developed countries and small island developing states among them and countries with economies in transition for implementing the convention and the Strategic plan.

Indicators were identified by COP for each of the seven focal areas of the framework for assessing biodiversity status and trends, and outcome oriented goals and targets (see appendix A for complete details about the goals , targets and sub targets). Such clear and long-term targets, relating to concrete outcomes, can help create the conditions under which all actors, whether Governments, the private sector, or civil society, have the motivation to develop solutions for meeting agreed-upon challenges. Targets also form the core of the United Nations' Millennium Development Goals, providing a commonly agreed focus for activities by all countries and stakeholder groups to meet the needs of the world's poorest people (SCBD, 2006).

In Pakistan the information on 2010 targets can only be found in third national implementation report submitted by Ministry of Environment, Government of Pakistan. Little work has been done in this regard. Although various groups (NGOs, intra governmental organizations etc.) are working for the conservation of nature and its sustainable use but the information is in scattered form and does not establish any valuable information to assess the progress of Pakistan towards the achievement of 2010 targets. As Pakistan was also actively involved in these commitments it requires ambitious actions to fulfil them. The choice of policy for preserving the world's existing stocks of biodiversity has already been made and it is clear now that what needs to be done however the pertinent question at this juncture is how it is now going to be achieved (Annah *et al*, 2008). The above statement is also true as far as Pakistan is concerned; as Pakistan has passed through the stages of policy making in the form of BAP, National Conservation Strategy (NCS) and various other policies that include conservation of biodiversity. Now the need is to actively take such measures that would convert all these commitments and coded work in to appropriate actions successfully, so that Pakistan can continue to successfully participate globally in conservation of biodiversity.

In this backdrop, there is a need for the assessment of the current status of implementation of CBD in Pakistan in order to draw a road map for future to facilitate its implementation. Therefore, this work has been carried out.

1.4 Objectives

The overarching aim of this work was to carry out a critical analysis of implementation of CBD in Pakistan and the specific objectives were to evaluate:

- The progress of government towards achieving 2010 targets;
- The response of other organizations towards 2010 targets;
- The measures taken by the Government and other relevant intra governmental organizations to achieve 2010 targets; and finally,
- To give some recommendations for achieving the 2010 targets.

1.5 Methodology

This research was qualitative and therefore the data source included documents and text, interviews and questionnaires.

The progress and measures taken by government and other relevant intra governmental organizations; towards achieving 2010 targets was analyzed through studying of BAP and national implementation reports submitted to CBD.

The trend of organizations towards subject 2010 targets was analyzed through questionnaire. The questionnaire only focused on the awareness and opinions of relevant organizations about 2010 targets so as to find out how effectively the organizations are committed towards achieving 2010 targets.13 organizations were visited and various relevant persons were interviewed. Total of 18 interviews were conducted. A structured questionnaire was used for those officials who were willing to fill it while a semi structured questionnaire was used for other high officials to get their complete insight about 2010 targets. The table below provides details about organizations visited and number of interviews carried out.

The list of organizations interviewed regarding implementation of CBD in Pakistan

Table 2. Organizations visited

Central administration	
Ministry of Environment	1
Biodiversity directorate	1
Forestry wing	1
Multilateral environment agreement (MEA) Secretariat	4
Nation council for conservation of wildlife (NCCW)	2
WASA (R)	1
Total	**10**
Intra governmental organizations	
IUCN	1
Pakistan wetlands program (PWP)	1
Total	**2**
NGOs	
CABI	1
National Cleaner Production Centre (NCPC)	1
Total	**2**

Scientific community	
IIUI	2
Fatimah Jinnah University	1
NUST	1
Total	**3**

For analysis of goal five secondary data, like relevant polices and law, implementation reports, progress reports of various projects, were used. Some relevant people were interviewed as well.

Goal six, which is related to invasive alien species, only three organizations namely Ministry of Environment (MoE), Centre for Agriculture and Biosciences international (CABI) and International Union for Conservation of Nature (IUCN) were found to be relevant. The data sources were secondary and included various reports released by the governmental and nongovernmental organizations. Other textual materials included newspaper articles and websites. The interviews and discussions conducted with various relevant governmental and on governmental officials involved semi structured interviews and meetings. Since very little work has been done in Pakistan and awareness is quite low in this area therefore secondary data was used to assess the amount of work that has been carried out. it not only helped to see the situation in Pakistan but also enabled us to identify the future needs and research areas. The semi structured interviews brought in light the issues related to IAS in the country while careful review of the literature enables us to focus on other species that are being imported and have behavior similar to that of IAS but are not being dealt properly. Further secondary data was used to correlate the international researches and

similar species being introduced in Pakistan hence valuable information was established which can form basis of identification of pathways of IAS, institutional realignment and reforms.

Goal seven (climate change and pollution) and its sub targets were analyzed mainly through secondary data. The material was searched with focus on main studies conducted in Pakistan on pollution and climate change. The recommendations provided in these studies were closely observed with relevance to recent ongoing projects. The project reports were studied along with observation used as a tool to identify the progress, success and coordination. Since few major projects were stared for pollution control so project reports were studied. Recent projects were studied by keeping in mind the recommendations given in previous major studies conducted so as to get insight of pace of progress. Climate change is yet another challenging area in which Pakistan has yet to achieve deep understanding. The climate related target was analyzed through secondary data and meetings.

1.6 Scope of work

The analysis of implementation of CBD is a very broad term. In the situation of limited time and resources, and as per requirement of thesis it was necessary to confine the research work. Therefore the critical analysis of the implementation of CBD was done in the context of the 2010 biodiversity target. The scope of the thesis was limited to analysis of only one focal area out of seven *i-e* focal area number three; addressing **major threats to biodiversity mainly arising from invasive alien species, climate change pollution and habitat change**. This not only confined the project realistically but also helped us to establish some valuable information. Finally the conclusion was made that "whether we are moving towards or away from achieving the 2010 targets".

This particular focal area was chosen because it not only endorses focal area no. 1, 2 and 4 but it also covers several MDG (see appendix B). If some solution is found in addressing this area significant progress will be seen in other focal areas as well. So this focal area somehow forms the core as far as environment and its sustainability is concerned.

Another important reason behind the selection of this particular focal area was that it has direct impact on the economy of Pakistan. It's really important for us to address such threats to our biodiversity because if appropriate measures are not taken in time whole country will suffer in the form of barren lands, shortage of food and water and severe climatic conditions. We will not only leave nothing for future generations but the survival of present generation will be put under threat. As such it is felt that economic aspect of biodiversity is most important for a country like Pakistan where people are more worried about bread on the table rather than contamination of environment. Although institutions exits to address these issues in government and non-government sector and relevant law exits too but most of biodiversity related issues remained unsolved up till now 15 years after ratification of CBD. Absence of complete set of indicators related to biodiversity shows that relevant departments are sleeping over the issue of 2010 targets and have placed biodiversity in a non priority list. This dissertation will help in raising awareness among organizations about 2010 targets and biodiversity as commitment and greatest need of Pakistan. The CBD process require periodic review to take account of the implementation so that some information can be gathered which can form basis of future updating and measures towards betterment of situation. Further more such review or critical analyses are done in other countries but not in Pakistan and no documents could be found which point towards experiences in implementing BAP or lessons learned. The year 2009 is a high time for looking into the work and progress of Pakistan towards its commitments.

The goals and targets under the subject focal area include:

Subject Focal Area: Address threats to biodiversity

Goal number 5: Pressures on biodiversity due to habitat loss, land use change and degradation and unsustainable water used should be reduced.

- **Target 5.1:** Rate of loss and degradation of natural habitats decreased.

Goal number 6: Control the threats arising due to invasive alien species

- **Target 6.1:** Pathways for major potential alien invasive species controlled.
- **Target 6.2:** Management plans in place for major alien species that threaten ecosystem, habitats or species.

Goal number 7: Address challenges to biodiversity from climate change and pollution.

- **Target 7.1:** maintain and enhance resilience of the components of biodiversity to adopt to climate change
- **Target 7.2:** reduce pollution and its impacts on biodiversity

1.7 Outline of thesis:

The contents of the proceeding chapters will include following;

Chapter 2: The analysis of the goal number 5 is carried out in chapter 2. As its sub target is concerned with the natural habitats therefore two habitats which are degrading most rapidly are chosen which are forests and wetlands. The goal and sub targets are analyzed by focusing the state of , land use change and degradation, unsustainable water use, forests and

wetlands, in Pakistan, international commitments of Pakistan's and response of the Government.

Chapter 3: This chapter contains the analysis of the Goal number 6. The nature of the problem, the international commitments of Pakistan regarding invasive alien species is given in detail before identifying potential IAS in Pakistan. The sub targets are analyzed by looking into the performance of concerned intra governmental agencies.

Chapter 4: The analysis of goal 7 is carried out in chapter 4. State of climatic changes and pollution in Pakistan is described along with International commitments of Pakistan. Actions taken at national level will be listed out so that insight can be developed that whether our 2010 targets will be achieved in time or not.

Chapter 5: The chapter contains the results of thesis and detailed discussion about major gaps in biodiversity action plan, organizational structure, limitations in implementing CBD in Pakistan and trend of organization towards achieving 2010 targets. Political, economical and social challenges faced by Pakistan in achieving 2010 targets are also discussed so that whole scenario and the side aspects in which implementation process of CBD is being carried out becomes very clear to us , if we go beyond 2010 in chase of achieving these targets.

Chapter 6: This chapter contains the conclusions and recommendations. The recommendations are given separately for each goal and sub targets.

CHAPTER 2

ANALYZING THE TRENDS IN FOCAL AREA THREE; GOAL 5: PRESSURES FROM HABITAT LOSS, LAND USE CHANGE AND DEGRADATION AND SUSTAINABLE WATER USE REDUCED

2.1 Introduction:

The loss of habitat is considered as the main cause of depletion of biodiversity. The available habitats are reducing and hence there is no proper place for the species where they can flourish and breed successfully. This is true both in the case of plant and animal biodiversity. The aquatic species and the terrestrial species all are under stress due to degradation of their habitats. However the area, where population density is high has affected the biodiversity the most. The current trend is that habitats are degrading; land use is changing which in turn is badly affecting biodiversity. The use of water in the country is quite unsustainable which again exerts pressure on the aquatic biodiversity. All three issues; habitat loss, land use change and unsustainable water use, are being discussed in more detail because of diversity in the nature of the issues.

2.2. Habitat loss

The term habitat refers to the place where an organism lives. For an animal, this place must contain features necessary to sustain life: food, water, space, and shelter. There are many different types of habitats, from forests to grasslands to oceans and even cities. Different habitats support different communities of plants and animals, (USDoI, 2004).

Many types of natural disasters occur in Pakistan like; Seasonal / Flash floods, droughts, twisters, earthquakes, landslide, sudden fires etc. The major natural disaster that occurred in Pakistan during last 3 years includes;

- The last drought, one of the most severe in over 40 years, affected parts of Sindh and Baluchistan in 1999-2000 and extended till 2002 in certain area.
- "The earthquake on 8 October 2005 caused huge destruction in Pakistan administered Kashmir and eastern parts of the North-West Frontier Province, killing approximately 80,000 people and leaving 2.8 million without shelter. The areas affected suffered extensive damage to economic and social infrastructure. A Damage and Needs Assessment estimated costs for relief, livelihood support and reconstruction at US$ 5.2 billion" (European Union, 2008).
- Monsoon rains created havoc around the country and the North West Frontier Province (NWFP) turned out to be the worst hit by landslides and flash floods in August 2006.
- The storm and floods in various districts of Balochistan province during July 2007 affecting many people.

So such changes that occur suddenly can affect a population or an entire species e.g dramatic change in habitat can occur in overnight due to floods and heavy rains while hurricanes kill numerous plants and animals directly. In 2005, the earth quake destroyed trees, plants, river habitat along with thousands of people, whose estimates are yet to be made. Usually after such events the healthy populations of wildlife recover naturally, but the rare or endangered species and fragile habitats may require special assistance to rebound. "People also initiate some habitat changes for different purposes, like urbanization, agricultural development, manufacturing, recreation, or transportation. Many of these changes are obvious, such as building a new shopping center in a forested area or building a road through a meadow" (USDoI, 2004) .

Pakistan is an agricultural country however ever since its separation from India more and more industries have been started so as to meet the daily needs of the ever increasing population and to give Pakistan economic upholds. The trend is; more people shifting to cities for better facilities and thus increasing pressure on cities. To meet the needs of people more and more area is being brought under construction for various purposes like industrialization, shopping plazas, road systems, dams, canals, new cities, schools and hospitals. This is a positive sign of development but it has some long term effects which are totally neglected for the reason that in spite of having good environmental law structure in Pakistan it has not been streamlined with other development policies. While in cities this trend continues the villages too bring more and more land under cultivation and exert pressure on biodiversity through extensive use of fertilizers, pesticides and insecticides. Due to lack of education and proper facilities rural life of Pakistan is under so much stress that they can hardly imagine about protection of environment.

The goal number five is quite broad and addresses various issues each of which covers a wide scope (Figure 1). It determines that loss of habitats, change in land use, and unsustainable use of water; all are exerting pressure on biodiversity therefore it should be reduced. The sub target however considers only degradation of habitats and requires that rate of loss of natural habitats should be decreased.

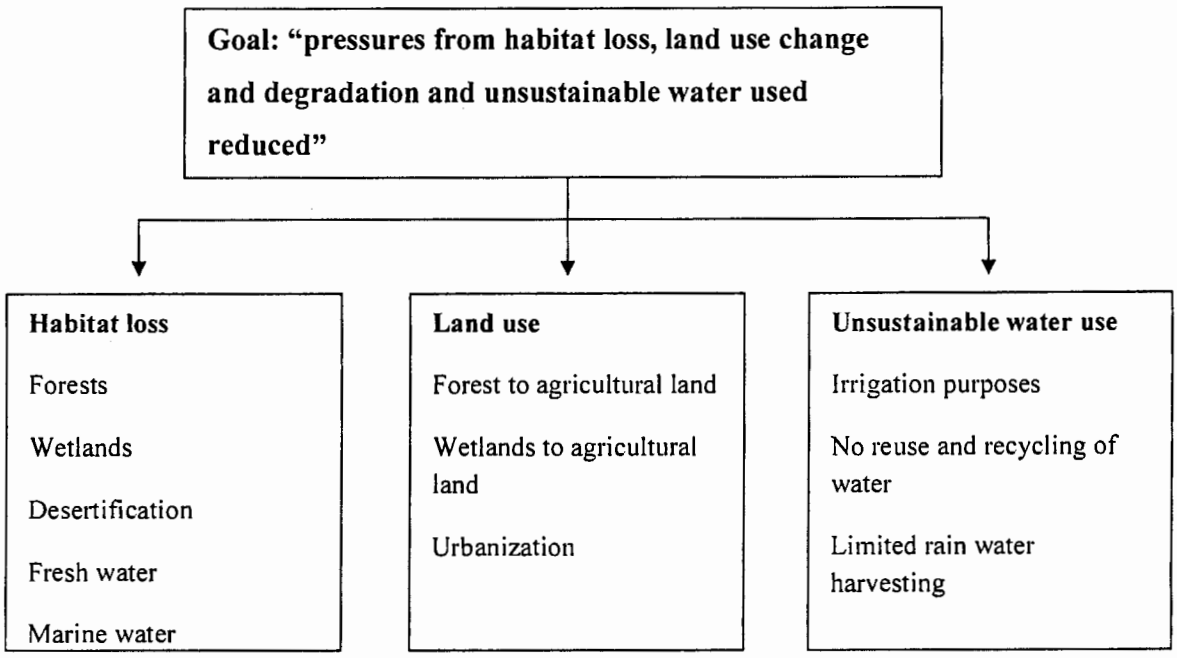

Figure 1. Diverse Areas Covered by Goal 5

Pakistan has to look more closely into this goal in order to achieve it. For convenience it can be further divided into habitat loss, land use, and sustainable water use. Then these major divisions can be narrowed down into more detailed set of issues. So if we look at the goal in this way (Figure 1) it will give us a clearer picture of areas requiring work and progress. This goal will be analyzed under these divisions. Each division is still a separate area combined with different social and economic concerns making this goal more complicated to deal with and more difficult to achieve.

Under habitat loss the issues which are of the immediate concern are deforestation, detitoriation of wetlands, desertification, degradation of Indus delta etc. It's obvious from documents like state of environment report 2005, National reports of CBD implementation and the recently published book; biodiversity of Pakistan, that habitat are under degradation.

As described in Biodiversity action plan (BAP) of Pakistan, continuing loss, fragmentation and degradation of the natural habitats are the ecological trends that are of greatest concern in Pakistan. The forests, rangelands, freshwater and marine ecosystems are greatly being affected due to this. The continued decline in many species of plants and animals in the form of extinctions and becoming internationally threatened species is of utmost concern. The Indus delta , in the remaining upland, scrub and mangrove forests, inland watlands, arid and semi-arid rangelands and coastal water are the main examples of the trend. Same problem is mentioned in state of environment report 2005, of Pakistan Environmental Protection Agency (Pak-EPA). So it can be inferred that, from 1998 to 2005 loss could not be halted. Although awareness has increased now and lot more projects have started but again the loss is still there. Now the question of 2010 targets is there when Pakistan has to achieve certain targets and the statements on government part are very encouraging ; these issues need to be looked in to more detail and in-depth analysis is required. Habitat loss as mention before is obvious at all levels however, only forests and wetlands are discussed in this project as they are under greatest change.

2.2.1 Forests

Pakistan is gifted by nature with rich natural resources. The most important natural resource for maintaining the health of biodiversity is forests, which not only provide us the chance to witness the beauty of nature and a sense of tranquillity but also give us the magical natural benefits. The timber of deodar *Cedrus deodara* is best in the world and is used in the country for various purposes including commercial uses as well as fuel food by the adjoining community. The rate at which this valuable asset is depleting is alarming and will leave us deprived of its silent contributions towards the welfare of mankind in the form of fuel wood, timber furniture, doors windows, medicines, food and their aesthetic and cultural value. They support biodiversity and are home to thousands of species including insects, plants, animals, microorganisms and many other territorial species. Other forest functions and services such as recreation, health and social welfare and mitigation of climate are though known but not

well understood in Pakistan but their importance as components of sustainable forest, management and forest biological diversity cannot be ignored.

The desired growth of forest is 25% but due to neglect and ignorance most of the forests are plundered and there is no sign of sustainable forest management. Forests are very important for Pakistan; the reason is not only ecological but economic as well.

There are many ongoing debates about the forest cover, the high rate of deforestation and the conservation measures taken by government as well as other independent organizations. This issue is the focal point in habitat loss goal number five as well as part of United Nations millennium development goal (MDG) in which Pakistan has promised to increase forest cover to 5.7 percent by 2011 5.7 percent and to 6 percent by the year 2015. So to maintain the forest cover becomes more than an economical requirement. It takes the shape of ethical and religious form in a country like Pakistan. Many *hadiths* of the Prophet Muhammad (PBUH) impressively advocate plantation e.g.:"Muslims will always earn the reward of charity for planting a tree, sowing a crop and then birds, humans, and animals eat from it" (Al-Bukhari). This *hadith* shows the importance of plantation in Islam that even if birds and animal use the tree fruit as food the person will be rewarded.

Prophet Muhammad (PBUH) organized the planting of trees and date groves on migrating to Medina. The forest and green spaces were made conservation areas called sanctuaries (*hima*). Example is strip of land twelve miles around Medina was declared as a conservation area. He proclaimed certain other areas as sanctuaries as well. As a religion Islam gives high protection to all living creatures and promotes conservation of nature, and discourages its extensive use or wastage (Ozdemir, I.).

So the Pakistani society is bound in all spheres from its international commitment to Pakistan's own needs; from ethical and social responsibility to religious duty and eternal benefit. Now the question arises if these factors are so much obvious and many projects are under work to increase the forest cover why there is ongoing depletion in forest cover?

Pakistan is slowly moving away from its target of 6% forest cover by 2015 under the MDG and it's hard to imagine if Pakistan will ever be able to have 20-25% of its land covered with forest.

The projected consumption and growth of forests in Pakistan depicts a rapidly growing pressure on forest resources. According to the forestry sector master plan, forests scrubs and trees on farmlands cover 4.2 million hectors or 4.8 percent of the country. The deforestation rate has been estimated as 0.2%- 0.5% per anum which is world's second highest rate of deforestation. If we carefully calculate the statistics of economic survey of Pakistan 2007-2008 it gives a horrible picture of depletion of forest at the rate of 1.5% per anum. Review of Economic survey of Pakistan 2007-2008, shows continuous improvement in the forest cover and tries to second the estimations given by Pakistan MDG Report 2006, Centre for Research on Poverty Reduction and Income Distribution (CRPRID), Planning Commission. Long lists of afforestation and conservation projects can be seen in official websites and other documents and it is quite clear that at least more and more initiatives are taken by government. However the review of other stakeholders like media, academia and NGOs give a negative version of the progress in forestation. The dilemma is that instead of taking strict actions the government itself is hiding the real data and there is no neutral body within the forest management system that can put the truth before public so that appropriate actions can be taken in time. Furthermore there is a continuous trend of blaming each other. Like many independent surveys show that encroachment and wood cutting for fuel use is not noteworthy where as the timber mafia, the permits issued by government and commercial use of wood is the real cause of continuous forest loss. Whereas some resources put blame on people living around forests, for its degradation. Recovery and improvement of remaining forests and its protection from degradation through forest department which already exists since British time, is dire need of the country at this time. Although, the forest department is covering every inch of the country and they are responsible for the looking after of trees and maintain the required area under forest cover, the depletion of forests could not be controlled.

The existing law including the North West Frontier Province Forest Ordinance are more focused on penalties and punishments while the most important factor which is providing alternatives or incentives for compliance to local adjoining community are totally ignored. According to Ahmed and Mehmood (1998), "most forest policies, until recently, have viewed people as the prime threat to the forests, and have attempted to exclude groups other than the government from decision making."

Such an approach greatly affected the sustainability of the livelihood strategies of the local people further it enhanced the vulnerability of the marginalized section of the local communities. This situation ended in unsustainable management of natural resources and depletion of forests (Shahbaz, B., *et al*, 2006). Inadequate attention was given to participatory approach in management of forests and the social and cultural aspects were not given due consideration. Until the sustainable livelihoods of stakeholder is not take care of the policy initiatives cannot achieve their objectives. According to Geiser (2000),"in practice, forest resources are made inaccessible for the poor and marginalized sections of the communities, whereas the influential along with members of the timbre mafia consumed these resources at their own sweet will. This dichotomy created a sense of lack of ownership among the marginalised sections not only adding to their miseries but also encouraged them to adapt illegal means to meet their needs from forest resources." (Shahbaz , B., *et al* 2006) .

The economic survey of Pakistan 2007-2008 also claim a recovery of 42% of the forests in a period lesser than 60 years which means that forests can be restored through the methods of conservation and afforestation within 20 years up to the level of 20-25% area under forestation which Pakistan can grow and maintain under normal evolutionary process. Since Pakistan has a semi forest hospitable topographical area therefore it can contribute towards the ultimate goal of controlling global warming.

Review of official reports GoP (2000) and GoP (2005) , also brings in light the threats to people; highlighting increased soil erosion, declining soil fertility and severe flooding. Other threats like global warming, role of forests as carbon dioxide sinks, decline in

water tables, and threats to wildlife of which forests are home and many such things need studies in depth and their proper projection to the public and policy makers is essential. Mostly the economic role is in the spot light whereas the ecosystem approach is neglected. This attitude leaves gap in policy making and its proper implementation, in turn not only Pakistan has to suffer but the world will suffer as the forests wildlife and water are internationals assets.

The review of literature also confirms that Pakistan needs an increase of 1.2% of the forest cover i-e more than one million hectares of new land has to be brought under the forest cover over a period of 10 years but the information about percentage of natural destruction of forests (e.g. through fires, flooding, earthquakes and heavy rains), national requirement of wood, percentage of inhospitable land on which forests cannot be grown, area recovered by afforestation and many such important things cannot be found.

2.2.1 (a) Indicators for forest biodiversity :

Indicators for forest biodiversity which are in used by many countries worldwide are; total forest area, total forest area as a percentage of total land area, percentage forests cover by forest type (primary, secondary or plantation), list of flora and fauna, percentage protected area of total forest area ,reforested and afforested areas reforested and afforested areas, conversion of forest land to other land uses area and percentage of forest area affected by anthropogenic effects , percentage of forest managed for wood production , area and percentage of forest area affected by natural disasters (insect attack ,disease, fire and flooding), wood harvesting intensity ,number and extent of invasive alien species, managed forest ratio , per capita wood consumption ,estimate of carbon stored, percentage forest land managed for recreation and tourism to total forest area, number of forest dependent species whose populations are declining, area and extend of degraded lands reclaimed through forest operations, area and percentage of forests managed for catchment protection ,ratio between exotic species and native species in plantation area, forest conservation affecting rare

ecosystems by area, area and length and numbers of biological corridors (CBD,SBSTTA,2003).

Few indicators like total forest area, total forest area as a percentage of total land area, percentage forest cover by forest type (primary, secondary or plantation), List of flora and fauna are used while other highly important above mentioned indicators are totally ignored. Forestry department has no plans in near future to use these important indicators. The result based indicators must be used by forest department or some other independent body within the Ministry of Environment and the data should be available to all stake holders and public. The major issues regarding forestry are:

- Ineffective management practices by the forest department and slow pace of policy reforms
- Forest cutting for commercial use
- Cultivation of land around forests and encroaching on these lands
- Exploitation of forest by local people for fuel, wood and other purposes
- Inadequate forestry information system resulting decision-making difficult;
- Inadequate investment in forestry, no t-commensurate with its role in sustainable development
- insufficient space for private participation
- targeted research on forestry is highly outdated and insufficient
- Growth in population and urbanization

2.2.1 (b) Potential areas:

In northern areas there is a natural forest growth which needs less attention while in southern areas the forests are very rare and hence need special attention and technically designed forest growing plans. The government should acquire more land for growth of forests in the southern areas. The plan should include selection of suitable trees in selected area and provision of water. Like in coastal areas coconut, date and palm trees can be grown while in Baluchistan more fruit gardens can be grown. The Suleiman range has world's largest pure forests of Chilgoza *(Pinus gerardiana).* These *Chilgoza* forests are of high importance for the locals since they bring good market price to them. According to Natura (2008), the growing demand for *Chilgoza* nuts in places like Dubai , Muscat, Jeddah, London and even Israel means high prices for nuts, which are usually consumed in the winter months. Already each family in the area makes around Rs 50,000 per year from selling the *Chilgoza* nuts. There is a great potential for growing apples, grapes, cherries and pomegranates in Baluchistan. "Balochistan has the largest area under fruits in Pakistan as nearly one million tons of fruits are annually produced from 0.239 million hectares. In this way, Balochistan's share in country's fruit area and production is 32.6 per cent and 17.4 per cent, respectively. The production of deciduous fruits (particularly apple) in Balochistan has a special significance among other fruit growing areas. Apple is the largest planted fruit in Balochistan and it is second most produced fruit after dates in the province because of the favourable environmental conditions." The poor communication system, lack of infrastructure development and storage facilities has resulted in higher post harvest losses (Shah and Farooq, 2006).

Currently the fruit gardening industry is in few rich hands of the society. The people of the area are poor and unaware and the practices exercise by them on approachable areas is greatly criticized. In such a situation only incentives based instruments can work where the interest and devotion of government is a prerequisite. The resultant can be joint venture of government with private sector in the direction of prime purpose of poverty alleviation.

The Chilgoza forests have come under threat recently from the over collection of timber for sale and for fuel wood. The issues must be identified and the solution should be addressed at governmental level and such assets must be on the agenda of every government that comes in power.

In the plains of Punjab mango industry can be properly developed. The mango of Multan is best in the world and is already earning huge foreign exchange. If the industry is further developed and international standards are met in its packing and sale it can surely contributes towards lowering unemployment as a contribution to poverty reduction. Likewise many other nuts, fruits trees and other local threatened trees provide income to farmers by non-destructive exploitation e.g. Lassura (*Cordia dicholama*) and Amla *(Emblica officinalis)* . There are strengths of our area where we are living and it would be very unwise of us if we do not take advantage of these God gifted assets.

2.2.1 (c) Organizations responsible for afforestation:

Ministry of Environment is headed by a Federal Minister while the Federal Secretary holds the administrative charge. It comprises five wings namely Administration, Development, Environment, International Cooperation and Forestry.

The Forestry Wing holds the authority and responsibility to carry out coordination and monitoring of forestry sector development in the country. The main concerns of this department are to form forest policy, plan and implement it. Furthermore the international coordination, research, training and education in the field of forestry are also the concerns of this wing.

The Attached Departments include Pakistan forest institute Pakistan Peshawar, national Council for Conservation of Wildlife Islamabad (NCCW) , Zoological Survey department Islamabad along with Sindh forest department , Punjab forest department , AJK forest department , Northern Areas forest department , Soil Conservation department, Rawalpindi

development Authority (RDA) and Capital Development Authority (CDA), Provincial and district governments

Other organizations and projects carried out by them having same objectives of forest management and conservation include:

- Watershed Management Project Mangla carried out by Water and Power Development Authority (WAPDA)
- Rachna Doab Afforestation Project carried out by Pak Army
- Forestry Sector Research & Development Project carried out by PFI, Peshawar

Civil society, NGOs and other companies like Pakistan Tobacco Company Limited also carry out plantations campaigns at suitable times of the year.

2.2.2 Wetlands

The Ramsar Convention on Wetlands was signed in Ramsar Iran in 1971, and to which Pakistan is a party since 1978. The focus of this convention is, wetlands of international importance being important habitat of water fowls. Pakistan has adopted the definition used by the parties to this international agreement "Areas of marsh, fen, peat land or water, weather natural or artificial, permanent or temporary, with water that is static, flowing, fresh, brackish or salt, including areas of marine water in depth of which at low tide does not exceed six meters."

Wetlands are important natural resource of Pakistan with more than 225 significant manmade and natural wetlands spread over approximately 10 percent of the country. Nineteen of these sites have been internationally recognized by the Ramsar Convention Bureau as being of global importance. The diverse assortment of marine and fresh water wetlands found in Pakistan support unique collection of biodiversity.

Usually wetlands are of two types; manmade and natural. Canals, lakes, dams and other water reservoirs that are formed as Indus basin irrigation system of Pakistan are considered to be manmade while the peat lands ,streams ,marshes, mudflats ,estuaries ,rivers are natural wetlands. In Pakistan the natural wetlands occur in the coastal, arid, semi-arid and alpine areas.

Ecological and socio economic value of wetlands: wetlands provide numerous benefits of which most of the people in Pakistan are unaware. They are as follows;

- Provision of irrigation water
- Water for fisheries
- Creation of vital habitat for wildlife, especially migratory water fowl
- Abatement of pollution and maintenance of water quality
- Soil erosion and control of floods
- Regulation and maintenance of both surface and groundwater supplies
- Provision of tourism, outdoor education, sport , re-creation and livelihood
- And contribution to global climate control and stability

2.2.2(a) State:

The Ramsar Scientific and Technical Review Panel (STRP) has revealed that, the degradation and loss of wetlands is more rapid than any other ecosystem. The status of costal species especially the status of freshwater is deteriorating faster than species in any other ecosystem. Wetland dependent biodiversity in many parts of the world is under great decline. It is expected that climatic changes at global level are going to further exacerbate the degradation of wetland biodiversity including species whose habitat is restricted to wetlands

only .The migratory species are also going to be negatively affected since they rely on wetlands during different phases of their life cycle.

Wetlands and the resources linked with them contribute in Pakistan's economy. This contribution is, however, not much recognized. The primary drivers of wetland loss and degradation are land conversion and infrastructure development; water draining, reduced water discharge, eutrophication, salinity and water logging and water pollution and over-exploitation.

The demand for ecosystem services is also increasing with the increase in population. However the continuing loss and degradation of wetlands are leading to reduction in the delivery of wetland ecosystem services. Current use of two wetland ecosystem services i-e freshwater and capture fisheries depend on natural reproduction. In Pakistan at some wetland sites this use is now in excess of levels that can hardly be sustained even at current demands. The future supplies of these services are much at risk. The continued loss and degradation of wetlands will result in further reduction in human well-being, especially for poorer people living in rural areas whose livelihoods are associated with the provision of goods and services of wetlands.

2.2.2(b) Response:

After ratification to Ramsar Convention only few studies were conducted by Provincial Wildlife Department, the zoological survey department and the Pakistan forest institute. The MoE and WWF-Pakistan developed a Wetland Action Plan, officially adopted by the Government of Pakistan (GoP) in 2000. In the recent years Pakistan implemented a GEF funded project for the convention of wetlands in collaboration with WWF-Pakistan and Provincial governments. This initiative was of high importance since it not only consisted of development of policy, institutional and technical framework for mainstreaming the conservation of wetlands but also implementation of management plans for conserving the wetlands.

In 2008 a National Report prepared by the GoP on the implementation of the Ramsar Convention was submitted to the 10th meeting of the conference of the contracting parties.

Very few projects are being conducted to assess the water quality of major rivers and streams in Pakistan and there is no compulsion by MoE about some specific time period after which the water quality must be monitored. The mitigation measures that the relevant agencies provide are not followed properly. Although there is a well defined national environmental policy and legal framework to control the water pollution but lack of coordination among enforcement agencies and private sector further affects the condition of wetlands, in a negative way.

Currently no specific and comprehensive wetland legislation exists in the country, national wetland policy does not exist in our country but the draft national policy is in pipeline. The laws which are most related to wetlands conservation and sustainable uses are the provincial wildlife laws. Besides that fisheries laws and Environment Protection Act, 1997 also considered wetlands protection under some provisions. The lack of compliance and regulation of these laws hampers the effective management of wetlands and hence the desired results are either on achieved at all or delayed.

The wetlands in Pakistan are not governed by a single specific legal statute but fall within the domain of Wildlife, Environmental and Fisheries legislation. As the wildlife laws designated some of the wetlands as wildlife sanctuaries and game reserves, hence the wetland conservation and wise use could only be promoted to some extent through regulatory measures taken under the jurisdiction of wildlife departments. There is also a lack of coordination among various sectoral policies. It is a fact that most of the policies e.g fisheries, agriculture etc. do not contain any provisions for conservation and management of wetlands. This gap has a great impact on the ecology and economy of wetlands.

2.2.2(c) Factors affecting the wetlands of Pakistan:

The wetlands are continuously in the proves of degradation due to illegal release of pollutants, negligence by uncontrolled access of visitors to these fragile ecosystems, illegal hunting, illegal cutting of mangrove forests, encroachment of public land and irrational change in land use in order to serve the interests of social groups .

Uncontrolled land use planning has negative impact on the wetland ecosystem. Like wetland drainage, forest clearing for agriculture, tube well pumping exceeds the rate of ground water recharge, changing erosion and silt flow patterns dumping of untreated agricultural, industrial and urban waste in water bodies. An economic incentive for development and urban sprawl is another main cause of wetlands loss. The subsidy on power tariff and for installation of tube wells degraded the ground water quality, which further directly or indirectly deteriorate the wetlands.

Another hurdle in the conservation and wise use of wetlands is the absence of appropriate wetland inventory up till now. A number of surveys are conducted by Wildlife Departments with the help of other organizations (WWF, IUCN, Birdlife International etc) from time to time but these surveys were specified usually to assess the population status of particular specie. For example, the survey of Indus Dolphin and the mid-winter waterfowl counts are mostly done at regular basis. However the quality of wetland, the area covered by it ,services provided by it in present and past and such other direct parameters are rarely used. Pakistan Wetlands Programme is now making an effort to develop a comprehensive wetland inventory based on GIS. Additional surveys are required at different time intervals to check the status of resident species of other aquatic fauna and flora as well as habitats.

2.2.2(d) Agencies related to wetland conservation:

At the federal level, the agencies that deal with the wise use and conservation of wetlands include Nation Council for Conservation of Wildlife (NCCW), Indus River System Authority (IRSA), Pak EPA, Water Section & Environment sections of Planning and

Development Division, WAPDA and Marine Fisheries Department. At the provincial level the wildlife and fisheries departments, Environmental Cells in Punjab irrigation and development authorities (PIDAs), provincial EPAs, water and sanitation agencies are dealing wetland related issues and concerns.

Disorganized reports, insufficient information, incomplete and obsolete data relevant to the management of wetlands is another serious issue in our country. According to the Ramsar Bureau, all the contracting parties have to submit their country reports after every three years .NCCW is responsible for the submission of reports to Ramsar Convention. Almost all the reports submitted to the Bureau did not contain the fundamental supportive information. The reports were filled with general approach not satisfactorily. The basic deficiency found in reporting included;

- lack of coordination among implementing agencies and the reporting agency,
- confusion among the distribution of duties
- technical, institutional and financial constraints to update the record,
- reluctance to disseminate the experiences and knowledge among other competent personal of the department,

2.3 Land use change and degradation

Land is a very important natural resource and its sustainability is also in question same as other natural resources are. The land use change has become more obvious in last 15 years due to increasing human population, industrial developments and agricultural practices in Pakistan. The land use and decisions made today are very important as they lead to long term environmental issues. The ever increasing population has exerted enormous pressure on countries' natural resources. The growing populations demands more food , more place to live and more opportunities to work . For this reason cities are expanding, more and more industries are established and more area is brought under cultivation. The rate of

industrialization, urbanization and agricultural practices has doubled due to increase in population and to meet its needs. Land degradation in Pakistan is due to land pollution, involuntary resettlements, droughts, floods, urban slums, overgrazing, degradation of soil and land through erosion, water logging and salinity etc . Such degradation of land puts enormous pressure on biodiversity as well as creates hurdles in the sustainable production capacity of agriculture sector. It is crucial for Pakistan to address this issue of land degradation and land use in such a way that it not only alleviates poverty but also enhances the economic growth in a sustainable manner.

"Pakistan is predominantly a dry land country where 80 % of its land area is arid or semi-arid, about 12% is dry sub-humid and remaining 8 % is humid. Increase in population and greater competition for improved crop production has placed lot of pressure on largely fragile areas. As a result country is faced with the daunting challenges of land degradation and desertification" (GoP, 2005).

2.3.1 Land use change

The land of Pakistan includes seas shores, rivers, springs, high mountains, deserts, pleatus etc. Such diverse topographical conditions are hardly found anywhere in the world. The uses of land are as diverse as its forms; like housing, industrialization, roads and transport system support, farms and agricultural lands, spiritual needs and recreation. Nowadays another use of land is to protect it from various activities for certain species. So all types of lands along with their different uses makes land use decisions a very complex issue. Furthermore the rights of owner ship allows owner to manipulate their property in whatever way they want.

Land developers are racing towards a dead end and are not thinking that what will be the consequence if all the fertile land is utilized for urbanization. Today in Pakistan there is a ruinous trend of investing in property. There is no planning for allocating land for residential purposes and agricultural needs. Fertile lands are being eaten up for residential purposes. The driving force behind housing schemes is only profit oriented and long term sustainability is

totally lacking. As far as policy is concerned no such land use management policy exits however few policies are under way to address this issue. The resettlement policy and land law take into account the negative impacts of land use on environment and gives power to the state to stop any such activity but no proper enforcement exits. It is a very positive sign of progress towards management of land use by government that National Action program to combat desertification (NAP) has been devised. But developing a policy or action plan is one thing and implementing it in an effective way is yet another huge task.

The lack of adequate planning in land use coupled with lack of supporting legislation is a major barrier in sustainable management of land resources in Pakistan. Land use planning or management has never been high on Pakistan's agenda. Islamabad, the capital of the country, is the only city which has a proper land use plan; no other city in Pakistan has been planned in such a way not even mega cities like Karachi and Lahore. Land use plans do not exist at national, provincial, district, tehsil or local levels.

Proper land use planning ensures that land is allocated for those uses which best serve the needs of people on sustainable basis. It prevents incompatible uses of land and land degradation. However it seems to be a difficult task to implement at federal level. The provinces need to develop their own land use policies according to requirement of their own area and implement it accordingly.

2.3.2 Land degradation

Land pollution is a problem that has found no solution even in cities like Islamabad. No proper mechanism for waste collection and disposal exists in the country. Most of the waste generated is biodegradable but no proper mechanism exits for composting or manufacturing of chemical free fertilizers from biodegradable waste. Rather billion of rupees are being spend on the import of fertilizers every year. The huge heaps of garbage can be seen on each and every road of the country which plays a role in spreading various diseases. While government service is insufficient, the involvement of private sector is totally lacking

in Pakistan. To date not a single composting plant or recycling plant is present which could reduce the pressure on land degradation and hence on biodiversity. Most of the garbage thrown in water bodies destroys life there as well. Legislation exists but implementation is not ensured.

The poor drainage system and mismanagement of water resources have also resulted in soil degradation and an increase in water logging and salinity. "A third of the agricultural land surveyed is affected by water, wind erosion, or salinity and sodicity. A staggering 96 percent of arable land does not contain the full spectrum of organic matter needed for optimum agricultural productivity (ALGAS, 1998). Waterlogged area is not a big problem in Pakistan anymore due to prolonged drought and excessive mining of ground water reserves. Conservative estimates which were presented in (PSCEA, 2006) suggested that environmental degradation costs Pakistan at least 6% of GDP or Rs. 365 billion per year. It is obvious that these costs fall disproportionately upon the poor. This estimate is expected to go higher if the toxic waste disposal , depletion in biodiversity, the deterioration of river and coastal resources ,are also considered .the most prominent causes of environmental damage identified in this report are as follows;

- Premature mortality and illness caused by indoor and outdoor air pollution (50% of the total damage cost)
- Typhoid and diarrhoeal diseases from insufficient water supply ,hygiene and sanitation (around 30% of the total)
- Reduction in the agricultural productivity because of soil degradation (almost 20% of the total)

2.3.3 Pakistan's response:

(a) United Nations Convention to Combat Desertification and Drought (UNCCD):

Pakistan responded to this problem by signing UNCCD in 1994 and ratified it in 1997. UNCCD is the only internationally recognized, legally binding instrument that

addresses the problem of land degradation in dry lands. The objective of UNCCD is: "to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas".

Taking notice of the serious challenges faced by Pakistan, the MoE has launched huge a project named as:"Sustainable Land Management to Combat Desertification in Pakistan" (with the assistance of UNDP and GEF). The project aims at protecting the ecosystem and associated services through combating the desertification and land degradation, as a contribution in poverty reduction. Pakistan has constituted a National Coordination Committee to Combat Desertification (NCCCD), and project preparation unit to coordinate implementation of the convention. The project in its initial stages has completed the formation of baseline data, resource assessments, meetings with line agencies and other stake holders (GoP ,2005) .

So far no actual activity has been carried out for soil reclamation, water or soil conservation. There is limited understanding of land degradation issues , information and knowledge gaps further creates problem as very little is known about the present land uses in arid and semi arid areas of the country. It is also not known that which technique will be applied in which area of Pakistan. Other information gaps such as policy impediments and sustainable land management indicators cause hindrance in successful management of land. The review of the sectoral polices and gap analysis of NAP has not been done. Whatever measures or activities have been carried out at local level provide insufficient information and quantitative data relating to extent of land degradation is also not available.

2.4 Sustainable water use

Water is now becoming a scarce source that is essential for our survival and our water supplies are coming increasingly under pressure mainly due to overuse and pollution.

"In Pakistan, water will remain a critical resource for sustained economic development. There is also a long-standing dispute between provinces over the growing water shortage and harnessing of hydroelectric power. With Pakistan likely to face severe water shortages by 2010, disputes over this essential resource could potentially become a root cause for conflict and a source of internal and external instability. The problem is compounded by a rising need for household water to supply rapidly expanding urban populations" (European Union, 2008).

Our government has started to work in this direction of water conservation but the concept is still alien for most of the population. Increased billing charges in the country with extreme shortage in many parts of the country has caught the eye of people in a way that water should not be taken as granted but need proper management and designed allocation. It is very important that urgent action should be taken the reasons being;

- More population growth more demand of water
- The huge cost of developing new water infrastructure like dams, storm water management systems, water recycling and conservation projects
- The controversy of provinces over water allocation leading to instability in the country
- The Indian violence of Indus Basin treaty and problems faced downstream in Pakistan
- The effects of climate change like extreme flooding and extended droughts

If we want to ensure sustainable supply of water in the future it is critical that we conserve water and develop new ways of harnessing our water resources. Shortage of water is not a problem now but it can emerge as major problem if it's not managed properly. We need to ensure that water is supplied to each and every area of Pakistan with some restrictions imposed so that availability of water should not become a problem for future generations.

2.4.1 State:

In the urban area of Pakistan the current water use is not sustainable. Pakistan is faced with the overwhelming issues of growing scarcity of water, water distribution inequalities,

water pollution, loss of aquatic ecosystems, depletion in water quality and the generation of effluents (Kamal S., 2005).

The old pipelines not only lead to leakage of water but tend to mix the pollutants from surrounding environment into the drinking water which in turn leads to many diseases especially in children. The concept of using storm water is although in use but to a very small level. It can be used for non-portable purpose but it is not given much of thought other than a waste product.

2.4.2 Pressure:

Presently the irrigation sector is utilizing 93% of the water. The remaining is supplied to urban and rural population and industry. However according to the estimated 50% increase in population of Pakistan by the year 2025 the demand of water supply will increase dramatically. This would result in increased pressure on already deficient water resources (GoP, 2002).

According to a recent World Bank report, Pakistan is fast moving from being a "water stressed country to a water scarce country", mainly due to its high population growth, and water is becoming the key development issue (World Bank, 2006).

The current pattern of water use and population growth will eventually necessitate damming new rivers at enormous environmental and economic costs. Dams have always been a controversial issue in Pakistan with Punjab needing more water due to ever increasing agricultural practices, being largest province by population, more industries; raising issue like biased distribution of water.

Approximately 60% of the current population has access to municipal water supply (85% in urban and 55% in rural areas). Inadequate wastewater infrastructure exits in Pakistan few sewage treatment facilities were started few years back which are now non-operational. poor quality water reaches the consumers as a result of leaky distribution networks. The quality of water supplied at the consumer point is poor as a result of contamination in the

leaky distribution networks. Heavy and urgent investment in sector is required as lack of operational sewage treatment facilities further pollutes water bodies, and deplete aquatic biodiversity (GoP, 2002).

Sindh and Baluchistan are also in more demand of water as these problems (agricultural and industrial needs) though in low magnitude are also present. So water distribution and dam construction have been great issues in Pakistan; the failure of Kala Bagh dam is one such example. Furthermore the limited utilization of storm water for non-portable uses and waste water treatment enhances pollution loads to water ways.

2.4.3 Response

a) National drinking water policy addresses sustainability of the water in terms of sustainable water supply and financial sustainability and establishes that high quality drinking water must be supplied to all citizens in Pakistan in a sustainable manner. The goal of the national drinking water policy is to ensure that safe drinking water is supplied to entire population at an affordable cost in an equitable , efficient and sustainable manner .

This policy has included sustainable water use concept in the following points:

- Surface and ground water resources need protection as they offer sustainable sources of supply for the local communities in both urban and rural areas.
- Rainfall harvesting schemes for augmentation of municipal water supply should be encouraged

The research section of the policy provides a room for new and innovative ideas that can improve access efficiency, effective use and sustainability of water. Appropriate legislation still doesn't exist and no penalty for any institution or individual who doesn't adhere to the standards exists in the country. The action plan of how this shall be achieved is yet to be made and no clear estimation of how much money is needed and how much will be allocated can be found in the documents.

b) National sanitation policy 2006 also includes sustainable use of water. It establishes that there should be safe disposal of liquids and solid wastes. It realizes that;

- Sewerage must be treated before releasing into the water bodies and thus minimum sewerage treatment should be of biological treatment and retention time should be calculated, so that the effluent produced will be in keeping with the national environment quality standards (NEQS). The effluent from treatment plants in the rural areas should be used for agricultural purposes.
- The disposal of storm water in arid regions can be combined with sewerage disposal provided the sewerage can bypass the treatment plants during rain.
- The disposal of raw sewerage into natural bodies will not be permitted

c) National Water Policy of Pakistan (draft) is a general policy on water and has been developed through extensive consultations with key stakeholders. According to this policy water should be conserved for the self-sufficiency in food and alleviation of poverty in a sustainable manner. Also the National Water Policy aims to achieve efficient management and conservation of existing water resources. It also states that "By 2025, Pakistan should have adequate water available, through proper conservation and development. Water supplies should be of good quality, equitably distributed and meet the needs of all users through an efficient management, institutional and legal system that would ensure sustainable utilization of the water resources and support economic and social development with due consideration to the environment, quality of life, economic value of resources, ability to pay and participation of all stakeholders".

However this policy is unable to address issues like unequal distribution of water upstream and downstream reaches of water channels. There is no comprehensive policy that addresses the issues regarding proper allocation of water during abundant and low periods

No policy can be found which addresses the issues of proper allocation of water to various sectors. No law exists in the country to support the existing water related policy. These policies have also emerged as response to ensure that the MDG are met, in which

drinking water and sanitation are important issues to be addressed. Pakistan's draft national water policy is very efficient in including all the issues related to water however its approval and implementation is yet to be achieved. It cannot be said with certainty that up to 2010 water issues will find their solutions through this policy. If before 2025 this policy is effectively implemented positive results can be gained and will be help full in supporting economy of country and hence welfare of people.

In all above policies the stress on treatment plants, use of storm water and recycling of water for agricultural purpose has been laid. But the action plan for sustainable use of water and relevant law is still missing. How many treatment plants and recycling plants, of what nature and where they should be installed must be determined. This is a high time to resolve the differences and achieve consensus on a national water policy as implementing it would be another huge challenge for Pakistan.

The main water sector institutions in Pakistan are grouped largely within the purview of the Ministry of Water and Power that has the responsibility for water and power sector. Other institutions include;

- Water and Power Development Authority (WAPDA)
- Inter-provincial coordination on water and drainage
- Federal Flood Commission
- Indus River System Authority (IRSA)
- National Engineering Services Pakistan (Pvt) Limited (NESPAK)
- National Power Construction Corporation (NPCC)
- Pak Engineering Council

CHAPTER 3
GOAL 6: CONTROL THREATS FROM INVASIVE ALIEN SPECIES

3.1 Introduction

The rapid spread of Invasive Alien Species (IAS) poses a major threat to biological diversity. To attain the goal of minimizing the decline of biodiversity by 2010 Pakistan this threat needs to be addressed.

Globally the IAS are considered to be second major threat to biodiversity (IUCN, 2000) .The human kind has greatly benefited from the introduction of alien species (e.g. potatoes and maize in Europe, etc.) in the past and this trend is likely to continue. However some alien species become invasive in their new environment and cause significant damage to native species and ecosystems with significant economic consequences. The Millennium Ecosystem Assessment identified IAS as important driver of biodiversity loss with increasing trend (European Union).

As a result of global trade and travel one of the emerging threat to mankind and the biological diversity is increased occurrence of IAS. One of the most negative results of introduction of alien invasive species is the loss of diversity in species. It could lead to marginalization or even complete removal of the native species. They may also change the structure (number of species, composition of population etc) and function of an ecosystem (e.g water provision, decomposition, nutrient cycles etc.) completely therefore resulting in large-scale changes in the environmental conditions of that area.

It is very important to recognize this global threat at the national level. The mobility of people and goods results in the increased mobility of other species as well and hence presenting serious risks. IAS does not recognize any physical or manmade boundaries. This is a shared problem of various countries however action at national level has clear added value and helps in management of IAS. IAS as defined by IUCN "Alien species is a species, sub-species or member of a lower taxon that has been introduced outside its normal past and

present distribution; the definition includes the gametes, seeds, eggs, propagule or any other part of such species that might survive and subsequently reproduce" or "Alien invasive species means an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity" (IUCN, 2000).

3.2 Nature of the problem:

The opportunities of introducing alien species into the environment have increased due to accelerated international trade, tourism and movement of people. It also includes the risk that the species could become invasive and damage native biodiversity. This could in turn result in that the ecosystem may not provide good and services in a manner as it was providing before the invasion of alien species. The risk increases many fold as the pressure on ecosystem increases due to pollution, habitat destruction, land degradation and climate change.

IAS are considered to be one of the main direct drivers of biodiversity loss at the global level. Increasing domination by a few invasive species increases global homogenization of biodiversity, reducing local diversity and distinctiveness (CBD). The IAS often have irreversible ecological effects and are very costly to control or eradicate. The threat of IAS varies considerably, based on the invading species in question, the extent of the invasion, and the vulnerability of the ecosystem being invaded. It may also be difficult to determine if an alien species is invasive prior to its introduction to new locations and/or ecosystems (Rankin, C., 2004).

a) Environmental impacts

Today, alien invasion is second only to habitat loss as a cause of species endangerment and extinction (Lowe S., *et al*, 2000). IAS could negatively affect biodiversity by causing extinction of native species, being a reservoir for parasites or a vector for pathogens .They can also hybridize with a related species or varieties. Further negative impacts they can have on native biodiversity are as follows;

1. They compete with other native organisms e.g. eucalyptus is believed to compete with local flora for nutrients and out spaces all other in drawing water from deeper soils, resulting in the drying up of the sub soil water tables.

2. They predate on native organisms e.g. Fauji khagga , rainbow trout and brown trout etc.

3. They are responsible for altering the local food web e.g. mesquite has occupied a niche by replacing the local flora. Some wildlife is known to prefer mesquite plantations for refuge

4. They can be an ecosystem engineers, altering the nutrients and energy flows, as well as physical factors in habitats and ecosystems e.g. freshwater bodies of Pakistan are badly affected by invasion of some alien species like water fern (*silvinia molesta*) ,water hyacinth (*eichhornia crassipes*) and water lettuce (*pistia stratiotes*)

5. The hydrology of entire ecosystem can be altered due to IAS e.g. eucalyptus , due to its fast growth and high transpiration rate, it is responsible for lowering the water table

b) Economical impacts

Loss in biodiversity also leads to economic loss. IAS effects economics in terms of money spent on their prevention, control and eradication.

As such no study on monetary losses by invasive species has been done in Pakistan as in other countries however; lot of revenue is being spent on cutting paper mulberry in Islamabad but is not effective as it continues to stage a comeback. Range lands are being affected by alien weeds like *Xanthium strumarium*, lakes and water channels are choked by weeds like *Salvinia molesta*, crop yields are being affected by weeds like *Emex spinosa, Lolium temulentum*, and plants like *Parthenium hysterophorus* are hazardous to livestock. Certains bugs, snails and worms have been reported to be invasive alien species and are adversely affecting the crops and plantation in Pakistan.

c) Social impacts

IAS cause human health problems which result in socio-economic problems. Invasive plants or animals may bring with them allergies such as pollens of paper mulberry (*Broussonetia papyfera*) cause severe respiratory allergy to Islamabad residents. Similarly choking of sewerage line in the urban setup is also attributed to paper mulberry.

If we consider the agricultural sector of Pakistan the adverse effects of IAS become double. IAS not only destroys livelihoods by destroying crops they also affect international trade through rejection of produce at the borders of potential export markets. The damage to ecosystem services has not been quantified in Pakistan at all.

Although the number of IAS in Pakistan is much less than as reported in other countries but we cannot claim immunity against the problem of IAS, and so an efficient strategy to mitigate this threat is a national challenge.

3.3 International commitments of Pakistan:

This issue is becoming more and more prominent as more and more countries are facing the consequences of alien invasions. Internationally a lot of work has been done and many conventions and treaties have been signed globally and regionally to address this problem. Many countries have identified pathways and many have made action plans as well. Currently no legal or comprehensive institutional framework is present in the country to address this issue. However, Pakistan is obliged under Article 8(h) of the CBD to take actions as far as the issue of IAS is concerned. Article 8(h) of the CBD states that "Each contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". The Conference of the Parties (COP) acknowledged the urgent need to address the threat of at its fourth meeting (decision IV/1), in 1998.

Other MEAs and agreements that oblige Pakistan to undertake necessary control measures to prevent the spread of invasive alien species, pests and diseases are as follows:

- **Convention on Migratory Species of Wild Animals Convention (CMS)/Bon Convention**

  CMS was adopted in 1979 and it came into force in 1983. Pakistan signed it in 1971 and ratified it in December, 1987. The CMS aims to conserve terrestrial, marine and avian migratory species. IAS are considered a threat to migratory species and are addressed in article III, 4c, which says "to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species". Furthermore the article V gives guidelines for further agreements between states to protect some specific migratory species, one of the guidelines described in V5e of the CMS establishes that conservation and, where required and feasible, restoration of the habitats of importance in maintaining a favorable conservation status, and protection of such habitats from disturbances, including strict control of the introduction of, or control of already introduced, exotic species detrimental to the migratory species.

- **RAMSAR convention**

  Ramsar Convention was adopted in 1971 and it came in force in 1975. Pakistan signed it in 1971 and ratified it in January, 1987. The aim of the Ramsar Convention is the wise use and conservation of the wetlands and resources associated with it. In the 7th meeting of the Conference of the Contracting Parties to the Convention called upon Contracting Parties to wherever possible address the environmental, economic and social impact of invasive species on wetlands within their jurisdictions.

- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**

  It was internationally adopted in 1973 and came into force in 1975. Pakistan signed it in 1973 and ratified it in April 1976. The main aim of the CITIES is to make sure that international trade of wild animals and plants does not threaten their survival. According to a provision in article XIV the parties of the convention are

allowed to take local actions restricting or prohibiting .In Europe this provision has been used to address some IAS.

- **United Nations Convention on the Law of the sea (UNCLOS)**

  It was adopted in 1982 and came in force 1994. Pakistan signed it in December 1982 and ratified it in February 1997. According to UNCLOS, states are required to protect and preserve the marine environment from intentional and unintentional introduction of alien species. This convention can prove to be highly useful in dealing with IAS in Pakistan.

3.4 Response at national level and achievements:

In BAP action 6.6 points towards the problem of invasive alien species and says that measure should be taken to control IAS of flora and fauna and further introductions should be prevented, however it does not provide any information on how to control invasive alien species or what actions should be taken to prevent introductions.

A black list on invasive species (Figure 2) in Pakistan was prepared by IUCN and Centre for Agriculture and Biosciences International (CABI) in 2000. In that list 15 vascular plants were listed as invasive alien species.

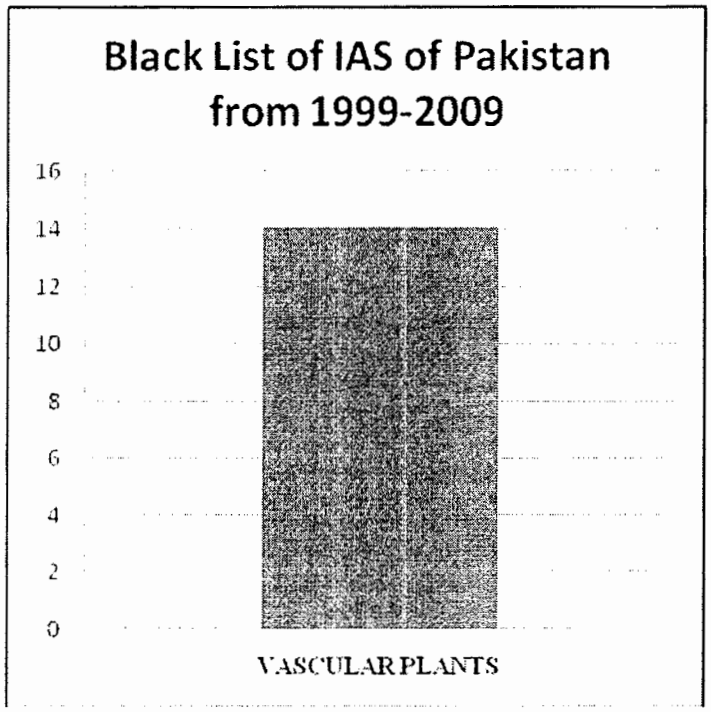

Figure 2. The Number of IAS in Pakistan

The above indicator is being used in South Africa and represents number of IAS per country. This indicator was selected because it is fundamental to Goal 6 of the CBD 2010 Biodiversity Target (Control threats from invasive alien species). Without this status indicator as a baseline it is not possible to measure progress towards achieving this goal.

So far only vascular plants have been studied for being invasive in Pakistan. In case of birds and mammals no IAS has been reported. As far as marine and fresh water organisms are concerned it is feared that many IAS do exist but due to lack of studies no valuable information could be established (Figure 3).

3.5 Potential IAS in Pakistan:

According to IUCN guidelines for the prevention of biodiversity loss caused by IAS; Intentional introduction means an introduction made deliberately by humans, involving the purposeful movement of a species outside of its natural range and dispersal potential. (Such introductions may be authorized or unauthorized.) Unintentional introduction includes a large number of sectors, such as fisheries, agriculture, forestry, horticulture, shipping, ground and air

transportation, construction projects, landscaping, aquaculture, tourism, the pet industry, game-farming, etc. While Unintentional introduction means an unintended introduction made as a result of a species utilizing humans or human delivery systems as vectors for dispersal outside its natural range.

Intentional and unintentional introduction of exotic species is common practice in Pakistan. Many exotic species tend to become invasive as they establish themselves in new ecosystems. The review of first, second and third national implementation reports of CBD show that there are certain other species that have been identified by MoE of having the potential of becoming invasive species. Due to lack of baseline data it cannot be said with clarity that what exactly environmental and socio-economic impacts of IAS are.

Timely detection of potential invasive species reduces costs and also helps in determining what type of method should be used for control or eradication or whether such an eradication is feasible or not. It gives us time to study in detail that which control method should be applied; mechanical, physical or chemical. Field surveys for early detection of some specific IAS should be carried out however it is important to design such surveys first as they can be of varying nature depending on ecology of area, species of concern and biodiversity and associated local livelihoods. The area rich in biodiversity should be of special concern. So far such surveys have not been done in Pakistan so there is no certainty about the extent of damage or changes brought in our ecosystems, by these exotic species.

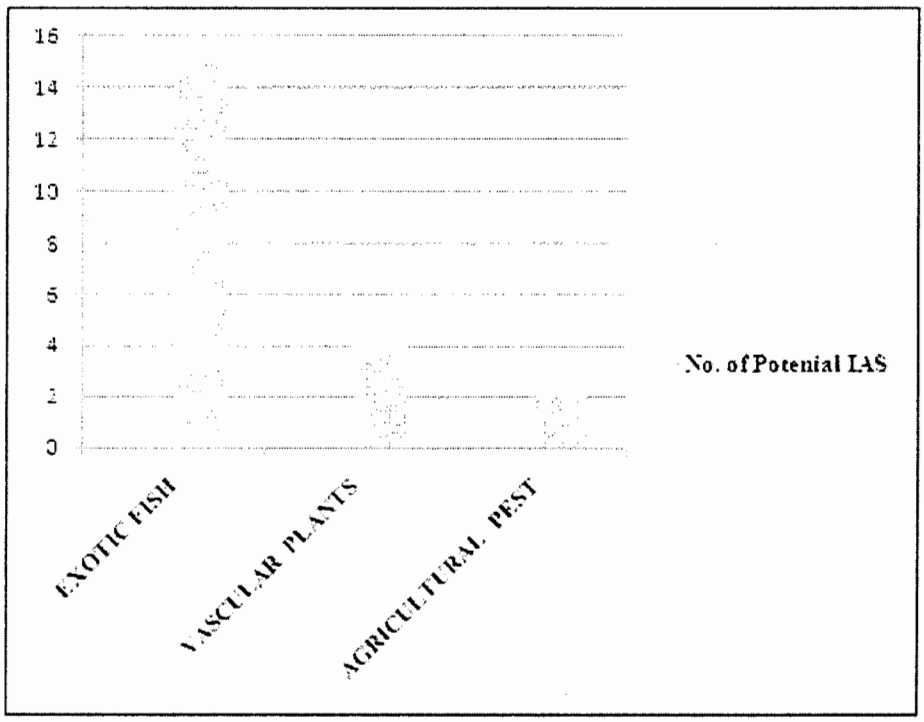

Figure 3. Number of Potential IAS in Pakistan.

There are fifteen exotic species of fish which have been listed out in biodiversity of Pakistan, for becoming invasive. Out of these fifteen rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) are internationally listed in "100 of the world's worst invasive alien species ". Their impact on the aquatic habitats in Pakistan has not been studied properly and no such study can be found which tell us that which native species they are damaging the most and what changes they are bringing in our aquatic ecosystems. However according to global invasive species database, *Salmo trutta* has been introduced around the world for aquaculture and sport fishers. This specie is blamed for reducing population of native fish populations, especially other salmonids, through predation, displacement and food competition. It is also a popular angling fish. According to global invasive species database, *Oncorhynchus mykiss* are also one of the most widely introduced fish species in the world. They are native to western North America , and have been introduced to numerous countries for sport and commercial aquaculture. It is a highly valued sport fish .There are rising concerns about the effects of introduced trout in some areas, as they may affect native fish and invertebrates through predation and competition (Lowe S. *et al* ., 2000).

There are four vascular plant species that have been identified as invasive alien species by MoE namely; *Ailanthus altissima, Robinia pseudoacacia, Prosopis glandulosa, Eucalyptus camaldulensis.*

Pakistan is the fourth largest producer of cotton in the world and the third largest consumer. Cotton is one of the main exports for Pakistan making up 60% of the total export revenue. 3.1 million Bales of cotton have been ruined by cotton mealy bug. Over the past three years this bug has caused massive economic loss to cotton crops and as a result, the Pakistani government has cited mealy bug as a high priority threat to the nation's agriculture (CABI). The attack of American Bollworm *(Heliothis armigera)* on Pakistan's cotton crop has badly affected the economy of country. As reported by khatoon *et al.*, (1999), American Bollworm is an aftermath of the introduction of Deltapine variety of cotton form America in late 1960s.

3.6 Discussion:

From BAP to latest third national implementation report of CBD, it can be seen that not only that this issue has been given a low priority but overall no management plan exists.

To date no pathways are identified and no management plan exits. No measures are undertaken to prevent the introduction of, control or eradicate, alien species which threaten ecosystems, habitats or species. Only a ban on the planting of eucalyptus and mesquite has been imposed for plantation in natural forests in most of the provinces. Pakistan has not involved itself in mechanisms for the international cooperation including the exchange of best practices (decision v/8). Ecosystem approach and precautionary bio-geographical approaches as adopted in decision v/8 are also not being used. No processes have been initiated at federal or provincial level to develop a necessary mechanism under the guidelines given in decision VI/23.

The list of IAS prepared by IUCN contains only 15 vascular plants but the invasive alien species in animals, non vascular plants, birds, insects cannot be found.

The guiding principles provided by CBD are also not adopted for the management of IAS. IAS have not been much in amount as in other countries but they are increasing in number as more and more studies are being carried out and more species are identified. It could be the reason for being in a low priority list, however it is feared that sufficient studies are not being carried out in this area due to lack of funds and capacity. This could result in worst situation of danger being there all the times it's just our inefficiency to detect it.

CBD provides several indicators regarding IAS; these indicators can be helpful if some sort of inventory existed. These indicators collected from CBD documents are as follows:

Trends in IAS

- The number of IS per country over time
- Number of operational management plans in place relating to IS
- Number of countries party to international agreements regarding IS
- Impact of IS on species' conservation status

Goal number six of 2010 target demands that, threats from IAS must be controlled and it further targets that pathways for major potential IAS should be controlled and management plans should be in place for major alien species that threaten ecosystems, habitats or species. The related projects so far were done in response to certain damages caused by IAS to crops mainly and to vegetation secondly. The damage done by these species to public health is yet to be determined. So the response of the government varies from crop to crop and project to project. The indicators mentioned above cannot be applied in Pakistan since no significant work has been done.

Potential areas can be identified and they should be prioritized. Since there is lack of resources and funds it would be good strategy to focus on few pathways which are prominent. Such as import of various varieties of cotton and other seeds. The case of import of foreign cotton varieties and other seeds for agricultural purpose is very critical and some assessment should be carried out before their import. Pakistan is an agricultural country and livelihood of majority of population depends on agriculture. Any havoc in this area even at small level, is likely to have many direct and indirect impacts. Freshwater ecosystems such as rivers, lakes

and wetland habitats are also the potential areas. We already know about Water Hyacinth (*Eichhornia crassipes*). It is one of the 100 most IAS of the world. This South American native is one of the worst aquatic weeds in the world. It is a popular ornamental plant for ponds for it beautiful large purple flowers. It is now found in more than 50 countries on five continents. Water hyacinth is a very fast growing plant, with populations known to double in as little as 12 days. Infestations of this weed block waterways, limiting boat traffic, swimming and fishing. Water hyacinth also prevents sunlight and oxygen from reaching the water column and submerged plants. It's shading and crowding of native aquatic plants dramatically reduces biological diversity in aquatic ecosystems (Lowe S, et *al.*, 2000).

Similarly wetlands may also be an important potential area. Covering about 10% of Pakistan wetlands are very rich in biological diversity (notably amphibians, reptiles, aquatic invertebrates, insects and aquatic vegetation) and are vital staging and resting areas for migratory birds. Although it cannot be said with certainty that which wetland is effected by which IAS but review of literature shows that the alien species threatening wetlands include vascular plants, such as Water Hyacinth, water fern, water lettuce and unintentionally introduced fish.

Currently only CABI and IUCN have worked on this issue whereas over all awareness of the issue in government as well as in public is lacking. An initial step towards this threat has been taken. CABI and IUCN have formed a group together with the MoE and have gathered, assessed and presented the evidence that invasive species are a major threat to biodiversity in Pakistan .However what action needs to be taken have not been pointed out. Ecological impacts, economic impacts, and the ecosystems invaded by IAS have not been assessed which was a very crucial step. Much less work has been done in this area. A national strategy is required to assess the full scope of the threat of IAS and deal with it in efficient and cost effective manner. Pakistan has the advantage to few number of IAS at this stage so if timely appropriate actions are taken, threat to biodiversity can be reduced significantly.

IUCN guidelines are very effective containing complete frame work of prevention, eradication and control, re-introduction of species, knowledge and research issues, law and institutions. A tool kit of best prevention and management practices for IAS has been

designed internationally. It outlines steps involved in building a national invasive alien species strategy, identifies list of pathways for alien species introductions and suggests methods for intervention and management of IAS. An invasive species assessment protocol has also been made. It is designed for assessing the biodiversity impact of those species considered non-native in a specified region of interest. Also subsidiary body on scientific, technical and technological advice presented a report on existing international procedures, criteria and capacity for assessing risk from invasive alien species in 2001 which can be used in making our own action plan or policy. Many countries have also identified their pathways and made their action plants. So there is a flood of knowledge available which can be used to develop capacity and to raise awareness in Pakistan.

According to MoE the problem of invasive species is not so high however this statement cannot be relied upon until and unless some baseline data is generated. There is a trend of increase in spread of IAS. As more and more exotic species are introduced without any assessment they tend to become invasive in the context of changing climate and degraded ecosystems. If we have to meet the 2010 targets we will have to identify pathways in our own country, make some management plan or action plan. The management plan should focus prevention, early detection, control and eradication and some long term planning with the aim of reducing the current rate of loss of biodiversity. Native flora and fauna need to be protected from IAS. There is need of political commitment to spend the resources required over time to achieve the desired results. Bureaucratic inertia or lack of capacity to respond might amplify the situation in future. Decision makers should be motivated and made realized that it's their responsibility e.g. high officials related to fishers and agriculture. There might be a possibility that these were the ministries which were responsible for introduction of IAS in the past. Such a sensitive situation needs careful handling based upon the culture of Pakistan in provinces and fragments with in provinces.

Pakistan should not take the threat of IAS lightly just because their number in Pakistan is much less than other countries. Pakistan should study this threat in its own domain and try to gain help of developed nations in the form of technology and finance. Coordination and the exchange of information between scientists and management agencies of developed and developing nations, about alien invasive species, control methods should be enhanced.

As techniques are continuously changing and improving it is important for Pakistan to stay up to date and apply new and efficient method.

CHAPTER 4
GOAL 7: ADDRESS CHALLANGES TO BIODIVERSITY FROM CLIMATE CHANGE AND POLLUTION

4.1 Introduction

Pollution and climate change pose major threat to biodiversity not only globally but within Pakistan too. Pakistani government and communities must place an appropriate value on conserving biodiversity within a changing climate and ever increasing pollution. According to Pakistan Initial National Communication on Climate Change (INCCC) issued by the MoE in 2003, climate change and its imminent effects are not hypothetical anymore. As climate change has demonstrated its devastating impacts in countries like Bangladesh it will do so in Pakistan. The global change in temperature expected in this century is going to affect our agriculture and water resources and hence the vast services provided by our ecosystems. These effects won't be unnoticeable; the effects of pollution and climate change have already demonstrated their effects on species like the Indus dolphin and migratory birds. For example the Uchalli Wetlands Complex (Uchalli, Khabbaki and Jahlar) which is Ramsar site (number 818 declared since 1996). A number of globally threatened bird species visit these wetlands. During a study conducted by Zulfiqar Ali, Climatic factors were measured at Uchalli Wetlands Complex from 1992 to 2004. It was found that, Water spread areas of three lakes have considerably reduced during last ten years because of drought conditions prevailing in the Salt Range. Rainfall data depicts that almost 50% decline in rainfall has reduced the morphometry of lakes up to 73%. Population trends in water birds populations at Uchalli Wetlands Complex is of negative trend in all species that is heavily correlated with change in the morphometry of the lakes and rainfall (Zulfiqar A., 2005) .

According to experts, the least developed countries of the world contribute only 10 % to the annual global carbon dioxide emissions. Although they are least responsible for climatic changes but due to the lack of resources ,expertise to identify and extent of changes and capability to adopt to those changes along with geographical locations make them more

vulnerable to the ramifications of climate change. It is predicted by the experts that the situation will become worse as poor people are more dependent on natural resources and they have less ability to adapt to changing climate, they will be hardest hit by the extremities of climatic changes (LEAD).

Goal number seven endorses climate change and pollution; both are independent areas but some connections can be established. Pollution ultimately leads to change in climate. Internationally four main drivers are considered for bringing changes in climate. These drivers of climate change are;

- Increased greenhouse gases (GHG emissions)
- Increased air temperature and water vapor
- Increased water temperature
- Increased sea level

However there are certain other drivers as well which are now being considered as the cause of climate change such as land use, ever increasing population, agriculture etc. Here only air pollution will be considered, with the perspective of changing climate and maintaining the resilience of our ecosystems, so as to stay within boundaries of the selected topic. The impact of above mentioned changes in climate have direct impacts on all levels of biodiversity including gene level, species level and ecosystem level. These direct impacts are functions of individual organisms (e.g. growth and behaviour), modification in population (e.g. size ,age and structure), changes in ecosystem structure and functions (e.g decomposition, changes in nutrient cycling , water flows ,species interactions etc.), (IPCC,2002). The water pollution and land pollution are more linked with the increase in the vulnerability of habitats and ecosystems to stresses of changing climate.

According to NASA (2007), the greenhouse gases released by vehicles and industries caused temperatures to rise between 0.6°C and 0.9°C (1.08°F to 1.62°F) over the past century. The rate of warming in the last 50 years was double the rate observed over the last 100 years. Temperatures are certain to go up further. The air pollution is believed to be the main cause of global warming.

As it is generally known that, increase in the amount of gases such as carbon dioxide, sulphur dioxide (SOx) and nitrogen oxide (NOx) in the atmosphere is occurring because of emissions from anthropogenic activities such as the burning of fossil fuels like coal , oil ,gas etc. and degradation of natural sinks such as forests. These increases are sufficient to lead on average to substantially increased warming and thus disturbing the green house effect. Scientists believe that global warming may be responsible for important changes in the world's climate and the environment. Global warming has direct impacts on melting of glaciers, which in turn bring significant changes in climate.

A two day regional conference , "Climate Change: Challenges and Opportunities for South Asia" held at Islamabad, Pakistan, 13 January, 2009 organized by International Union for Conservation of Nature (IUCN) brought in light valuable information regarding changes in climate change and their impacts. According to experts the climatic changes include; global warming, increased precipitation and its uneven distribution, melting of glaciers and snow, sea level rise, increase in frequency of extreme weather events.

So far only few studies have been conducted in Pakistan. Deep scientific research is required about what climate changes are likely to occur in Pakistan. It must be clear that what we are adapting to. Then it is another important issue that how we should adapt, mitigate and reduce impacts of climate change? Which animal and plant species are more vulnerable and more sensitive to climatic changes and how we can make them adapt to stress of climatic changes? Mitigation is costly for Pakistan and if we don't adapt, the cost of mitigation will increase. Similarly it is very important to reduce pollution and its impacts on biodiversity. Pak-EPA is mainly responsible for control of pollution; however other organizations need to work in close collaboration with EPA to reduce impacts of pollution. The base line data about what are the impacts of which type of pollution on which species is not sufficient. Still what we have found out has not been given proper response. The trend is still the degradation of habitats mainly due to pollution and hence depletion of biodiversity. It is suggested to work in the field of climate change and pollution on same platform, with the

perspective of maintaining resilience, reduce vulnerability, quick response and hence reduce the current rate of loss of biodiversity.

4.2 State of Climatic Changes and Pollution in Pakistan

a) State of Climatic Changes in Pakistan:

The millennium ecosystem assessment indicates that climate change is likely to become the major and most dominant driver of the biodiversity loss, by the end of the century. As a result up to a million species may become extinct. As in the rest of the world, climate change is also likely to have a significant impact on agriculture and farming in Pakistan. Local agricultural systems may not be able to continue providing enough food for the population. The main reports that have given their assessments related to climate change in Pakistan are; climate changes and water resources in South Asia (2003), INCCC (2003), study on climate change impact assessment and adaptation strategies study for Pakistan (1998) and ALGAS study (1998). The findings of these important studies complement each other and their findings are similar in many aspects. The overall changes and impacts due to climatic changes that are likely to occur in Pakistan are as follows;

- Pakistan will be a water short country after 2025. This will not only put stress on the population of Pakistan but also affect the habitats of many species.
- Another indicator of climate change in Pakistan is the fact that Glaciers in Pakistan have retreated significantly in the recent past. "Comparison of Landsat images of Batura glacier for October 1992 and October 2000 has revealed that there is a decrease of about 17 sq km in Batura glaciers .Biafo glacier has also retreated." (SUPARCO). These changes in the climate show that the frequency of flooding can increase during the next few decades. Over time, this situation will be followed by decreased river flows and droughts.
- A study carried out to analyze trends in temperature and precipitation in the northern areas for the last century found that seasonal and annual temperatures have risen than last century at Skardu. Temperature increase might cause the frost line to shift upward by almost 400 meters. It might alter snow and rain patterns and adversely affect water reservoirs. Observations of the World Glacier Monitoring Service based in Switzerland

indicate that mountain glaciers in the Karakorams have been shrinking for the last 30 years because of more ice melting upstream. This observation is supported by the fact that the flow of water in rivers increased during the decade of 1990-2000 in comparison to 1975-1990 (Municipal Disaster Management Cell).

- Coastal areas of the Arabian Sea in the south of Pakistan will be at high risk due to increased flooding from the sea .
- Pakistan having a predominantly agriculture economy, climate change is estimated to decrease crop yields which in turn will affect associated livelihoods and food production. The decreased yields combined with the current population growth and urbanization, the risk of hunger and food security will become high.
- Mortality due to diseases especially women and children, associated with floods and droughts is expected to rise.
- The impact of climate change will also exacerbate the existing social inequalities of resource use leading to instability, conflicts, displacement of people and changes in migration patterns.

Most of the reports clearly point out that main manifestations of climate change will be the rise in temperature, changes in precipitation, increased frequency of cyclones and droughts. These changes will have their impacts on biodiversity of Pakistan and thus on the associated good and services provide by it. According to first national communication report the following will be the impacts on biodiversity:

Agro-biodiversity: Climate change is expected to have significant impacts on agriculture. Potential impacts which were explored in the sector study were potential vulnerability of crops to heat stress, possible shifts in spatial boundaries of crops, changes in productivity potential, changes in water availability and use, and changes in land use systems.

Forest biodiversity: The possible impacts of climate change on the forestry sector include changes in forest area, productivity changes, or changes in species composition.

Livestock biodiversity: The livestock sector and rangeland management are most likely to be vulnerable to the impacts of climate change in countries like Pakistan with high population

growth rates that compel expansion of grazing into areas of marginal productivity, thereby further stressing the already stressed ecosystem.

According to INCCC, ecosystems likely to get effected due to increase in CO_2, changes in moisture and temperature are marine ecosystems, mangroves, Indus Riverain Wetlands and Mountains of Pakistan. Changing climate would affect competitiveness of species or groups by altering growth and mortality rates differentially as well as the regeneration success rate.

Marine Ecosystem: Climate change has effects on a whole range of marine life, from phytoplanktons and zooplanktons to predators like seabirds and marine mammals. Climate change may alter the composition, abundance, and concentration that would affect the whole range of marine life. It is expected that warmer waters will decrease phytoplankton biomass and alter their composition as nutrients become limiting and nutrient availability to deeper waters becomes limited.

The primary impacts of sea level rise are the direct physical effects on the coastal zone due to changes in coastal dynamical processes because of sea level rise. Such impacts may include the risk of erosion, flooding, inundation and displacement of wetlands and lowlands and salinization of ground and surface water.

Mangroves: Mangroves are very productive ecosystems, providing breeding grounds for many varieties of coastal fish and harboring many rare plant and animal species especially the green turtle, an endangered species in Pakistan. Higher temperatures may affect the composition, distribution and productivity of mangroves, while lower precipitation can contribute to salt stress.

Indus Riverain Wetlands: Freshwater wetlands will face fundamental changes in temperature, water flow, salinity, and geographical patterns due to climate change. Climate warming could result in higher surface water temperatures and extended intervals of thermal stratification. Higher groundwater temperature could increase the river water temperature throughout the year, with adverse effects on freshwater fisheries. In general, the survival of wetland populations would depend upon the severity of climate change and availability of

escape routes to more suitable habitats. The distribution range of many species would increase and that of others would be squeezed, essentially altering their population status.

Mountains of Pakistan: The Mountains of Pakistan are of special concern, given that they support a variety of critically threatened ecosystems, like the juniper forests of Baluchistan and the 'Chilgoza' pine forests in the Sulaiman range. The more direct effects are such that mountains are likely to get warmer and their soils drier, and the frequency of droughts is likely to increase. Increased ice melts at higher latitudes can loosen frozen soil and stones, making landslides and avalanches more common.

Endangered ungulate species like ibex (*Capra aegagrus*) and wild sheep (*Ovis vignei*) that inhabit the dry mountains of Balochistan and Sindh are facing extreme drought conditions for the last three years and are living at the limits of tolerance. If such drought conditions continue to prevail or become more frequent, a drastic reduction in population of such species is expected.

b) State of Pollution in Pakistan:

Goal number seven implies that pollution itself should be reduced as well as its negative impacts, it has already made should also be reduced. According to state of environment report the sources of pollution are many and therefore require a joint effort. The urban air pollution mainly consists of particulate matter , sulphur dioxide (SO_2), carbon mono oxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), and lead. In the rural areas, emission of particulate matter and VOCs from combustion of firewood and biomass are of major concern. Data on concentration of these pollutants are very scarce, and systematic studies on exposure levels for populations at risk have yet to be conducted. The limited data collected indicate that concentrations above levels acceptable for human health have already been reached specially in urban areas (ALGAS, 1998).

The laws regarding the pollution control are sufficient but their enforcement is lacking. The main types of pollution that are of immediate concern in Pakistan, its sources and impacts are given in the table below.

Table 3. Dominant types of pollution, its sources and impacts in Pakistan

TYPE OF POLLUTION	SOURCE	IMPACT
Air pollution	Industries, Power plants, Vehicular emissions	Adverse impacts on biodiversity, health and related social-economic impacts
Water pollution	Industrial effluents, agricultural runoffs, urban wastewater,	Reduction of aquatic biodiversity, water related disease
Land pollution	Solid wastes, rapid and unplanned urbanization, slums	Habitat destruction, species extinction, reduced agricultural production, related socio-economic impacts, spread of diseases etc
Noise pollution	Transport sector, Industries, Aviation, Frequent use of Loud Speakers	adverse health impacts

The above table was prepared using the GoP (2000) and (GoP 2005). Air, water, land and noise are most dominant forms of pollution in Pakistan. These types of pollutions have direct impact on biodiversity of Pakistan.

The monitoring of air pollution and climate has generally been carried out under separate programs at different sites. In Pakistan projects are done to monitor the pollution and its control and the sites are also very selective. However the pollution and its impacts on biodiversity are not well studied. Very few such projects have been carried out and they too address selective specie or habitat. Review of literature shows that pollution levels of air and

water are exceeding the NEQS. According to the state of environment report 2005; the air pollution levels in cities have either reached the threshold values or crossed the safe limits. The factors that contribute to air pollution are: industrial pollution, suspended particulates, indoor pollution, increasing traffic trends, use of leaded petrol etc. One such example is Rawalpindi city. The main industrial centre of the city (Rawalpindi) has many industrial units, all of which release various pollutants into the Lai, making its water filthy and devoid of any sign of aquatic life. About a decade ago the water of Lai was home to *Mashair* fish but now the aquatic biodiversity is nowhere to be found. So far nothing has been done to reduce the pollution of the stream. As such no legislation is enforced here and municipal itself has its drainages that end up into the stream Lai. Similarly the Rawal Lake and River Ravi no longer supports a healthy aquatic biodiversity. All of the water habitats are under stress. Responding to threats due to pollution and climate change requires deep understanding of the nature and extent of their impacts. Monitoring can be used to detect changes in biodiversity. The results can be found which could be used as a base in scientific understanding, policymaking and management responses. It is very important to identify the underlying causes of change in biodiversity before taking some appropriate measure. However this presents problems because ecological interactions are very complex and the impacts of different environmental pressures are very difficult to detangle. The drivers of biodiversity loss are mentioned in BAP to some extent however deeper knowledge is required.

In Pakistan pollution monitoring was carried out under various projects like investigation of air and water quality in three cities (Lahore, Rawalpindi , Islamabad) , report for domestic waste management in Pakistan , in collaboration with Japan International Cooperation Agency (JICA) . Independent researches by academia have been carried out to study the impact of pollution on biodiversity however establishing the relationship of pollution with the loss of biodiversity (any specific specie) has not been done so far. These projects and their results are limited in the since that they are started to fulfill the requirements of university and end up in book shelves in libraries. Their results are not projected in manner so as to catch attention of media or policymakers or law enforcement

agencies. The consequences are low awareness among people regarding pollution and least efforts done in order to control pollution or reduction in its impacts on biodiversity.

According to third national report on implementation of CBD in Pakistan there is a general trend of rising air pollution levels in the cities, ground water and river pollution levels. The water pollution of the rivers Ravi, Kabul, Swat and Lai and Daig nallahs, coastal areas in Karachi is well documented; the BOD and COD levels of these have increased beyond the acceptable levels. The untreated municipal sewage is mostly drained into the rivers and sea. The oil spill of the Tasman Sprit ship in 2003 has raised concerns of the government and the civil society and actions were taken for cleanup and avoiding future accidents. An Emergency Plan has also been formulated.

The system of monitoring and evaluation totally lacks. The focus of major projects funded by JICA and Pakistan EPA is mostly on big cities like Lahore, Islamabad and Rawalpindi. The main industrial areas like Faisalabad, Sialkot and Haripur have not been monitored so far and hence the condition of biodiversity is not known in these areas.

It has been proved by research that there is a direct relationship between the respiratory diseases and the level of suspended particulate matter (SPM) and other gases in ambient air. Direct affects of Air pollution on health (dust allergy, throat irritation and cough etc), climate change, vegetation, rainfall patterns and ecosystem is well established. The World Bank reports that air pollution causes 168,000 premature deaths annually in Pakistan (60 percent of them attributable to Indoor Air Pollution) (Qadir, N.F, 2002).

As far as goal number seven i-e to address challenges to biodiversity from climate change, and pollution and the target number 7.2 which is reduce pollution and its impacts on biodiversity is concerned ; Pakistan needs whole new setup to address this issue.

4.3 International commitments of Pakistan:

Although Pakistan contributes very small percent to the world wide GHG emissions but being an agricultural country it remains severely impacted by the adverse effects of climate change. Therefore it has great interest in protecting the 140 million population from the extremities of climate change. This issue requires international cooperation as well as a pro-active policy at national level (INCCC, 2003).

Pakistan has committed itself to many international conventions and agreements to address the issues related to pollution and climate change. The Vienna Convention on the protection of the ozone layer and its Montreal protocol is closely associated with the United Nation framework Convention on Climate Change and its famous Kyoto protocol for protecting the atmosphere. Both conventions have common goal of protecting the atmosphere by minimizing the anthropogenic emissions, which are a great threat to the environment. Pakistan has ratified both of the above mentioned conventions and therefore has certain international obligations.

- **UN Framework Convention on Climate Change (UNFCCC):** It is an intergovernmental treaty developed to address the problem of climate change. It was adopted in June 1992 by over 180 countries at the Earth Summit in Rio de Janeiro, Brazil. The Convention was signed by 154 states and entered into force on 21st March, 1994.

Pakistan is signatory to UNFCCC as a Non Annex I Party (June 13, 1992 at the Rio Earth Summit). Later on it was ratified by Pakistan on June 1, 1994. Pakistan's contractual obligations under the UNFCCC include reporting on GHGs emissions on a regular basis and the preparation of suitable mitigation projects. UNFCCC is a non-binding legal framework that aims at:

- Stabilization of GHG concentration in the atmosphere at safe level
- Balance the response along mitigation and adaptation measures

The Convention is clearly very important, but perhaps it is not adequate, if major polluter like America is not its member. To inspire national actions and to effectively deal with the unexpected and severe climatic changes , Pakistan along with other developing nations need to raise their voices.

- **The Kyoto Protocol of UNFCCC:** It was adopted in Kyoto; Japan in 1997 . Pakistan signed the Protocol in December, 1997. On January 11, 2005, Pakistan ratified Kyoto Protocol. The protocol is very famous and controversial one as for the first time it sets quantifiable emission reduction targets. Developed countries agreed

that during the period 2008-2012 they would reduce their combined green house gases (GHG) emissions by 5.2% below the levels in 1990. The Kyoto Protocol distinguishes two types of countries:

a) Annex-I countries: these are mainly the industrialized countries with binding emission targets and include Western and Eastern Europe, Canada, Japan, New Zealand, Russia, Ukraine etc.

b) Non-Annex I countries: these are mainly the developing countries with voluntary participation and include China, India, Pakistan, South Africa, Philippines, Uruguay, Brazil, and other developing countries.

- **The Vienna Convention:** This convention on the Protection of the Ozone Layer was agreed upon by the governments of the world in 1985. The Convention aims at protecting the ozone layer whereas a process was also agreed through which regulations could be created by the members to establish control measures. Th e Montreal Protocol on Substances that Deplete the Ozone Layer. Pakistan ratified the Vienna Convention in 1992, London Amendment on Substances that Deplete the Ozone Layer in December 1994 and the Copenhagen Amendment in February in 1992.

- **The Montreal Protocol**: The Montreal protocol was adopted internationally in 1987. Pakistan ratified the Montreal Protocol in 1992. The Protocol was strengthened thrice subsequently. The protocol mandates the phase out of the Ozone Depleting Substances (ODS) according to a specified timetable by all countries. The developing countries are given a grace period. The industrialized countries agreed to meet the incremental costs of developing countries and to promote the transfer of the alternative substances and technologies. There is good progress in gradually phasing out 96 listed substances that are responsible for ozone depletion.

Since Pakistan is party to the Vienna Convention and the UNFCCC, both of which seek to protect the ozone layer, there is a great need for cooperation between these two UN treaties locally. As the experts say that phasing out hydrochlorofluorocarbons (HCFCs), which are highly damaging to the ozone layer, will be mutually beneficial in addressing both the ozone

layer and climate change. Since Pakistan has very limited resources and has to look for the help of developed nations, it is very important for Pakistan to maximize the impacts of the various multilateral environmental agreements, such as above mentioned atmosphere related conventions.

4.4 Actions taken at national level:

In compliance of Article 12.1 and decision 10/CP2, of UNFCCC, Non-Annex 1 Parties are required to submit a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies agreed upon by the Conference of Parties. Pakistan has prepared its national inventory for the year 1994 using IPCC-recommended methodologies. The detail about the findings of the inventory can be found in first national communication report submitted by Pakistan.

During the preparation of INCCC, the effects of climate change and its long term impacts were studied in detail. It is the most comprehensive report that presents conditions as well as solutions regarding climate change. As a result of ratifying the UNFCCC several studies have been initiated in Pakistan which are as follows;

- The Pakistan National Greenhouse Gas Emissions and Sinks Study, 1996
- Asia Least-cost Greenhouse Gas Abatement Strategy Project,1998
- Country Case Study on Climate Change Impacts and Adaptation Assessments in Pakistan
- Study on climate change impact assessment and adaptation strategies study ,1998
- Pakistan National Communication Report,2003

a) Clean Development Mechanism (CDM)

The CDM is an instrument under the article 12 of the Kyoto protocol of the UNFCCC which is meant to initiate the environment friendly and cost effective measures to mitigate the

impacts of the climate change. This mechanism allows industrialized countries with greenhouse gas reduction commitment to invest in projects that reduce emissions in developing countries. It is a less expensive alternative arrangement for developed nations.

The investment in CDM reduces CO_2 emission, which is converted into carbon credits through a pre-determined formula. The carbon credits are saleable commodity and are mostly bought by rich western nations. Already the carbon credit market has become a very successful multibillion-dollar market. Soon after signing the Kyoto Protocol in 2005 the government established a CDM Cell in the MoE to promote investment in the CDM sector.

Prime Minister of Pakistan in February 2006 approved National CDM Operational Strategy, in consultation with many stakeholders for the effective implementation of CDM process in Pakistan. The strategy gives details about policy guidelines and sets criteria for review and approval of CDM projects.

However, significant momentum for investment could not be generated and it has very few registered projects and they too are in their initial stages. The reasons could be lack of awareness , lack of compliance of law and legislations, limited scope of CDM activities, unease of industrialists to shifting or using new environment friendly technologies, instability in the country, insecurity to foreign investors to name a few.

b) Ozone Cell

Keeping in view Pakistan's commitments to the international community by Montreal protocol, an Ozone Cell, entitled "Institutional Strengthening for the Implementation of the Montreal Protocol for the phase-out of Ozone Depleting Substances (ODS)" was established in 1995. The Cell became operational in 1996 and is funded by Multilateral Fund for Montreal Protocol.

c) Other important achievements

To stop the ongoing environmental degradation process, significant mile-stones have been achieved in terms of policy formulation and establishment of regulatory frameworks and

institutions. Environment Protection Act 1997 (PEPA) provides base for Pakistan environmental policy and framework of management. PEPA has two main responsibilities; the creation of institutions and other one is the regulation of activities covering the environment. Under this legislation Pakistan Environmental Protection Council (PEPC) and the Pakistan Environmental Protection Agency, were established. The compliance framework for enforcing the regulations is a mixture of administrative measures, judicial sanctions and active civil society involvement. Section 11 of Pakistan Environmental Protection (PEPA, 1997) deals directly with the pollution and provides that:

"no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards or, where applicable the standards established under subclause (i) of clause (g) of sub-section (1) of section 6."

It is quite clear that Pakistan's law provides enough support to limit the discharges from industries in water bodies and hence gives protection to biodiversity residing there. However the compliance and enforcement of law is quite weak and the accountability is still a major hurdle in full implementation of law and legislation.

Initial Environmental Examination (IEE) and the Environment Impact Assessment (EIA) have also been made mandatory for the public sector development mega projects, under PEPA 1997. This procedure has provided space to environmental concerns weather they are in the form of protecting fertile soil or cutting of trees, disturbance in habitats or redistribution of population. Only if the mitigation measures suggested in project activity are followed with a sense of responsibility the negative impacts of project can be minimized hence development and protection can go hand in hand.

In last few years Pakistan has made considerable progress in further strengthening the institutions responsible for management of environment in Pakistan. The most recent one is the formulation of "National Environmental Policy 2005". Provincial environment protection departments are now more active than before and national concerns about degrading biodiversity are on the rise. Environment section in planning and development division is yet

another important step to mainstream the environmental concerns in development procedures. Establishment of policy framework including formulation of conservation strategies for NWFP, Balochistan and Northern Areas as well as for a few districts and formation of national sustainable development policy are noteworthy steps. It is hopeful now that these policies will be converted into appropriate and timely actions so as to control degradation of biodiversity through pollution and land degradation.

The National Environmental Quality Standards (NEQS) specifying the limits / parameters for domestic or industrial wastewater, air emissions from industries and vehicles and noise level for vehicles have been notified. The standards for noise from various activities, hospitals, for example industrial noise level, noise level for construction activity, hospitals, recreational activities, residential areas have not been framed under the present NEQS. Pak-EPA is the designated authority to implement NEQS in an effective and efficient manner considering the interest of industrialists.

Pakistan environmental Protection Agency launched the Self Monitoring and Reporting Tool (SMART), in 2006, as an effective mechanism on regular basis for reporting compliance to the NEQS by industries. This system is being implemented in the provinces. The Federal EPA has successfully completed a pilot scale programme of SMART. This tool is beneficial in terms of minimizing pollution, reducing its adverse effects on public health and nearby biodiversity, and developing trust worthy relationship between producers and consumers of any industry in Pakistan. However self auditing requires high commitment on part of company which in Pakistan is again questionable as there is lack of awareness, lack of accountability and lack of penalties for those who do not follow the environment quality standards.

According to third NIR Impacts of pollution on specific areas are studied by various research and educational institutions but there is no coordination in this respect. Furthermore Establishment of Effluent treatment plant in Korangi and rapid increase in use of CNG Vehicles(1.4 Million vehicles –No.2 in world) are important steps in this direction.

A huge project related to installation of air monitoring systems by MoE in Lahore ,Karachi , Peshawar ,Quetta and Islamabad was initiated. However it could complete its only first phase successfully second phase is yet to be completed and no regular monitoring reporting system can be found in the light of which appropriate action could be taken.

4.5 BAP and climate change

BAP does not provide any guidelines to address the changing climate issue nor does it give any information on impacts of climate change on biodiversity of Pakistan. It is very uncertain at this stage that how biodiversity of Pakistan will adopt to extremities of climate. It is obvious however that threatened species will face yet another challenge and vulnerability of other species will increase immensely.

National conservation strategy does not consider implications of climate change as well however it does stress renewable energy options.

CHAPTER 5

RESULTS AND DISCUSSION

In this chapter I will discuss the results of my research in relation to three goals and their sub targets coming under focal area three. Further I discuss the essence of the analysis along with circumstances in which the CBD is being implemented in Pakistan, the flaws of BAP in relation to the subject focal area, the organizational structure of CBD directorate, and the limitations in implementing the CBD. The overall challenges faced by Pakistan, the general observation about the trend of organization towards 2010 targets and their opinion about this target will be discussed as well.

5.1 Results:

The findings regarding the progress of Pakistan towards 2010 targets are as follows;

- Since the finances are limited, expertise and awareness is lacking, biodiversity indicators are absent and the components of biodiversity covered under the subject focal are diverse and involve complicated interactions between various governmental and intergovernmental organizations at federal and provincial level, it is unlikely for Pakistan to achieve all of 2010 targets.
- Target 6.2 dealing in management plans for major alien species that threaten the biodiversity was achievable. An inventory for vascular plants exists in the country; it could have been used for initiating management plans. It is a common practice to import various crop varieties and exotic species of fish and release them without any risk assessment .some management plan could be sorted out for this common practice as well.
- Target 7.2 which was reducing the pollution and its impacts on biodiversity are achievable. There were many ongoing projects to monitor and reduce pollution but their progress was slow and none has reached completion by the current year. The coordination of EPA with biodiversity directorate could have brought timely and successful results.

- The progress is towards the targets but is rather slow.
- The targets cannot be achieved until inventory of major flora and fauna is formed and national indicators are developed.

The response of organization was assessed through interaction with different specialists working on biodiversity directly or indirectly. The opinions were taken through general discussion as well as through questionnaire (Appendix C).

Following were the key observations;

- Most of the organizations were aware of 2010 targets and international commitments of Pakistan regarding CBD
- All of them find 2010 targets highly useful
- While governmental departments are very hopeful that Pakistan will achieve it targets the non-governmental organizations are not much hopeful.
- Almost all organizations believe that Pakistan should develop its own national targets and time frame.
- The constrains identified by the people were
  a) Lack of base line data
  b) Lack of coordination
  c) Lack of financial resources

5.2 Discussion

The review of NIRs and other documents (mentioned earlier) showed that loss in biodiversity is accelerating. The critical analysis for the of implementation of the CBD revealed that as such no tangible outcome has been achieved besides protected area managed, Indus dolphin and Markhor conservation.

The approach which is being used is from top to bottom, to implement CBD and is federal in nature. It creates lot of burden on the local communities. Incentive based participatory approach is required which could not only conserve biodiversity but also help the poor of nation to survive in a sustainable manner. The detailed review of the components of

biodiversity related to the selected targets and the scenario in which they are dealt was presented in previous chapters. Immediate national actions are required in terms of reducing impacts of pollution in a changing climate.

The projects are mostly depended on donor agencies. Usually there is a lengthy process through which a proposal has to pass before its approval and then its implementation. It may take many months to get the required grant and actually achieve the desired results. The percent of GDP that is spent on environment has improved in recent years but to achieve the 2010 targets significant finance coupled with technical assistance and broad steps at national level are required. The most important thing is to recognize the ownership of local and they should be an important part of decision making process and its implementation. Their role as different and much more significant from stake holders must be recognized. Furthermore at provincial level very few projects are initiated. The general trend is that the projects are directed from federal level to provincial level. Self motivation of provinces is lacking and they do not utilize the international funds on time by presenting project proposals. The reason could be lack of political will and lack of general awareness on the benefits arising out of conservation of biodiversity. It is important that provinces should be taken in trust and should be communicated in their regional languages so that they can respond in a better way. To increase the participation at local level for conserving biodiversity people should be made aware and educated about the biodiversity and its ecological and economic value so as the demand for conservation projects can be increased. Ministry of environment, local government and rural development (MELGRD) is the focal point of CBD in Pakistan . MELGRD has taken a number of measures to implement the CBD in Pakistan. Important measures taken are as under;

- Submission of 1, 2, 3 National Implementation Reports of CBD in Pakistan
- Protected Areas Management Project (PAMP)
- Asian development bank and Dutch funded forestry sector project in NWFP
- Mountain Areas Conservancy Project (MACP)
- World bank funded Punjab forestry development project

- Water shed management projects
- Some rehabilitation projects of mangroves

5.2.1 Achievement of actions mentioned in BAP

A brief review of BAP specific to actions that are relevant to the subject focal area and its target was done. The findings of the review are as follows;

a) Policy and planning:

- **Action 1.1** of BAP specifies that high level and multi-sectoral support of implementation of BAP must be secured. In spite of consultative workshops and awareness raising by MoE, the provinces did not utilize the international funds efficiently. There is lack of consensus among provinces on this matter due to which many important steps like indicator development and definition of important terms could not be achieved.
- **Action 1.2** specifies that biodiversity policy or wildlife policy should be formulated at federal and provincial level. The NCS at provincial levels have been formulated of which biodiversity forms the core. However the term biodiversity with is broad scope and its Convention covering complex inter related and overlapping issues require separate technical and financial support and that too should be as dynamic as the geographical and cultural aspects of each province are.
- **Action 1.3** stresses that biodiversity strategy process should be institutionalized at all levels. The action 1.3.1 establishes that this process should complement the national and provincial conservation strategies. Processes has to be iterative and cyclic, involving the preparation, periodic review and development of a country strategy and action plan to address the provisions of CBD. The multisectoral involvement at a broad scale and wide participation from all sectors of society must be ensured. The action 1.3.2 requires that coordination must be promoted among the institutions involved in conservation of biodiversity both at federal as well as provincial level.

The action was partially carried out that it does compliment the NCS however there is no periodic review, no further sub action plans to carry out the implementation of CBD. The participation is quite less. Federal is quite active but still the provinces don't coordinate with each other in an efficient manner. The conservation is carried out individually by numerous departments like wild life department, forestry department, fisheries department, NCCW , United Nation environmental program (UNEP) and IUCN to name a few but these organizations seldom coordinate with each other on single plat form with objective of fulfilling the provisions of CBD and its targets.

- **Action 1.4** demands that biodiversity should be integrated into the five year plans and other annual developments and into the relevant sectoral plans, particularly those for wildlife , forestry ,fisheries and agriculture. No significant step has been taken to integrate or main stream the biodiversity consideration.
- **Action 1.5** requires that the preparation of provincial conservation strategies should be promoted along with elements of biodiversity and conservation and cross referenced to five-year plans.

A Comprehensive initiative in the form of the national environment action plan (NEAP) was taken in 2001. The key sub programs defined under NEAP are clean air program, Clean water program, ecosystem management program and the solid waste management program. The main policies and programmes that have been initiated due to NEAP are; quality monitoring air and water, clean drinking water for are, Pakistan wetlands programme, national policy for sanitation, the project for the sustainable land management to combat desertification in Pakistan etc. Two very important objectives of NEAP are;

1) Programmes for addressing deforestation, desertification, and rangeland degradation will be integrated with the existing social mobilization and organization initiatives at the grassroots level

2) Well-defined outputs, measurable indicators and supporting monitoring and information systems will be established to evaluate the achievements.

It is very important that whatever commitments have been made should be accomplished as soon as possible because above mentioned points of NEAP are very relevant to 2010 targets and were suggested before the strategic plan by COP was adopted. It is very disappointing that once law provides support to policy and many institutions do exist in the country then what is stopping to progress in conservation of biological diversity.

b) Legislation

Not even half of the actions mentioned under legislation section of biodiversity action plan were carried out. Currently the legislation related to biodiversity is that, which was adopted before ratification of CBD. For this reason, emerging concepts and community empowerment could not be given due consideration. The complete review of laws as well constitution of 1973 as recommended by BAP was not carried out. Update and rationalize legislation on endangered and exploited flora and fauna in Pakistan is not carried out. The process of reviewing must be carried out in line with CBD and according to the specific requirements of CITES, the Bonn Convention and the other biodiversity related conventions. It is important to note that flora is not given importance side by side as given to fauna of Pakistan. No inventory for flora exists in the country.

c) Identification and monitoring

Very important action recommended by BAP was the action 4.1 which says "a national centre or several provincial centres for coordination in biodiversity identification and monitoring activities, should be established"

This centre could be very helpful in providing guidance, initiate local actions, and serve as centre for all biodiversity related issues. Furthermore it could be the coordination agency which could unite experts on diverse issues of biodiversity in Pakistan. The centre could also serve as a research centre. Many of the problems can be solved if one such centre is established in Pakistan.

No comprehensive website is available to get complete information on biodiversity. The website of natural museum is serving the purpose of hub of knowledge which is highly insufficient. The available information is scattered in chunks with in different departments and their own websites.

d) *In situ* conservation:

The actions recommended under in situ conservation of the BAP mainly give a comprehensive plan to deal with the protected areas. This plan is very useful and if it was adopted and exercised efficiently Pakistan could have achieved some of the 2010 targets before the timeline.

Back in 1970s most of the protected areas (PAs) of Pakistan were formed, less attention was paid to ecological criteria and the requirements of communities. Only few coastal area have been established however there are no marine PAs at all. The lack of research does not allow us to see the magnitude of problem in the marine biodiversity. Furthermore as far as trees are concerned there is lack of responsibility, accountability and stewardship. There is no policy framework to protect the remaining juniper forests in Balochistan.

The BAP recognizes that there are a number of important gaps and needs relating to the management of protected areas in Pakistan, which are;

- Adequate framework for management is not provided by the existing wildlife
- Provincial wildlife departments lack the capacity
- Majority of protected areas lack comprehensive management plans and where the plans have been formulated they are not fully implemented.
- The role of local communities is rare as far as the management of protected areas in concerned

The purpose of identifying the gaps is that they should be given a proper response. Until and unless the previous pointed out problems are not solved new research loses its importance. It is strongly recommended that this action plan for protected areas should be strictly followed and emerging concepts like ecosystem approach should be incorporated and local

communities should be considered as part of ecosystem rather than enemy of ecosystem. This portion of BAP i-e in-situ conservation is crucial as far as focal area number three is concerned and many targets can be achieve if this portion is properly followed.

e) *Ex-situ* conservation

According to BAP, Ex-situ conservation is complementary to the rehabilitation and restoration of degraded ecosystems and promoting the recovery of threatened species. The ultimate purpose of these ex-situ conservation measures is to re-introduce species into the wild. The actions provided under this heading of BAP are again very comprehensive and important and many of them have already been under taken. However lack of inventory on flora and fauna of Pakistan and the access of information remains limited to only the departments of universities or research labs.

5.2.2 Major Gaps in BAP:

Keeping 2010 targets in mind the gaps in BAP were identified. Biodiversity is wide and broad subject and needs coordination from all sections of society. Currently this issue is being addressed at federal level from the capital while it is very important that it should be addressed in each province according to type of biodiversity, nature of issues and culture. Decentralization of the management practices at lowest appropriate level is very important .e.g. trophy hunting and other such programs were successful all because of participation of locals. Such approach is very important while dealing in forestry, fisheries and agriculture sector. In a country like Pakistan where the society is highly heterogeneous in nature BAP at federal level is highly insufficient. The ecosystem approach of the CBD establishes that land water and living resources should be managed in an integrated way, so that it promotes conservation and sustainable use in an equitable way .It recognizes humans as an integral component of ecosystems with their varying and diverse cultures. BAP should be mould and applied to all provinces and management practice must include social preferences and participation. The responsibility of federal will increase as it has to implement CBD as well as resolve sectarian issues in each province. Federal needs to act very dynamically as issues that arise in each province might be diverse in nature. There is a need of capacity

development to deal with queries, questions, confusions and conflicts as far as biodiversity is concerned.

So far the major projects done didn't include economic context of the ecosystem services nor do they include the impact of one project done on other ecosystems. It is important to carry out conservation project keeping in mind its long term ecosystem management objectives. Meanwhile monitoring team should keep a close eye on the overall changes in ecosystem and ensure that there is a balance between use and conservation of fragile ecosystems. Local training must involve the academia of that area.

In Pakistan, provisions of the Convention and the decisions of the COP were translated into actions through Biodiversity Action Plan. As Parties hold primary responsibility for the implementation of the Convention, BAP is central in achieving the objectives of the Convention. In relation to focal area number three BAP action lacks following;

- Actions for Sustainable use of water
- Invasive alien pathways or any framework for management of IAS
- Impacts of pollution on biodiversity and associated services in ecological, economic and social terms. Hence it does not determine how these impacts can be reduced.
- Actions necessary to respond to Climate change and maintain resilience of the system

5.2.3 Institutional structure for implementation of CBD suggested in BAP and the existing Structure : A comparison

The organogram for BAP implementation is basically adopted from Sri Lankan biodiversity action plan. It was correct to adopt it but it has not been brought into real actual practice. Many steering committees have been assigned biodiversity specialists but the committees hardly ever meet. No minutes of meetings can be found, so it's not clear that when they meet and what they discuss.

Biodiversity directorate is the main unit working under forestry wing of the Ministry of Environment. The post of director general, who specifically deals with biodiversity issues,

is vacant for last few years. The most active person was technical officer who does all the coordination and plays important role in the preparation of the national implementation reports. The setup is working well in the provided conditions. If the objective is to fulfill the international obligations on papers only then the current setup is fine but if the full-fledged implementation coupled with resolving the sectarian issues is required then whole new organizational structure is required . Much extended working setup is required to effectively carry out the CBD process, as it is a diverse issue it needs diverse specialists working in one unit.

The development of indicators has not been achieved so far but this is in pipeline and it is hoped that the indicators related to biodiversity will be in use in near future.

BAP can only guide to deal with implementation of CBD provisions but it doesn't ensure that implementation must be carried out in an effective way. In Pakistan only donor based initiatives are taken while community based and incentive based government driven initiatives are highly lacking. Now one question is very important that if donations are absent or lacking what could be the future of biodiversity in Pakistan? So it is essential that BAP should be a key factor in national policy development and planning process.

5.2.4 Limitations in implementing CBD in Pakistan

High population growth, rapid urbanization and inefficient practices resulted in the slow implementation of CBD in Pakistan. The increased demand of natural resources resulted in overexploitation of land, water and soil and hence the human intervention in natural habitats increased many folds.

The limitations that create hurdles in effective achievement of 2010 targets are;

- Weak governance
- Political marginalization
- Cultural heterogeneity
- Biodiversity conservation taken more as international pressure and less considered as having economic value for the country

- Lack of stewardship , responsibility and accountability
- Lack of awareness as far as role of biodiversity in terms of economic terms is concerned

Dr. Balakrishna Pisupati, former Biodiplomacy Programme Coordinator, United Nation University Institute of Advance sciences (UNU-IAS) has written a report named; Effective implementation of NBSP: Using a decentralized approach. The report contains guidelines for developing sub-national biodiversity action plans. The report is very comprehensive as it not only points out challenges faced by different countries (Pakistan , Vietnam, china , Tanzania , Ecuador) in implementing CBD but also contains the summary of constraints and gaps based on assessments of selected countries national biodiversity strategy and action plan NBSPs. Important findings of report about challenges faced by Pakistan in implementing the NBSAP at national and provincial level are as follows;

- Political will lacks
- Lack of coordination among government departments;
- Integrating biodiversity into sectoral policies and plans;
- Legislative reforms are absent ;
- Non availability of technical expertise
- Insufficient finances;
- Lack of community-based initiatives.

Major gaps identified by the development process of implementation of CBD itself, includes;

- Insufficient information on the status of regional biodiversity resources;
- Low awareness about biodiversity;
- Lack of technical expertise;
- Weak knowledge base.

Further the report says that: "The important lesson learnt from the NBSAP process is that there should be greater involvement of local authorities and people." (Pisupati, B .2007). The results of my thesis are in confirmation with this international report. It is now very much

obvious that the limitations identified in this research were found out in global assessment as well.

The convention has a broad scope and thus translating its provisions into policy and practice is extremely challenging for Pakistan. In the first ten years, after entry into force, of the convention, the Pakistani government focused its attention mainly on BAP and the preparation of NIRs. As such no indicators were developed at local level. No research was carried out on how to bring its implementation at local level and the issue remained headache of federal. The BAP should have been communicated to provincial level in their local languages. Conference of the parties has developed a comprehensive body of guidance relating to the conservation and sustainable use of biodiversity but no guideline was adopted. The research in this field is totally lacking and no awareness can be found in the provinces.

5.3 Challenges faced by Pakistan in achieving 2010 targets

Pakistan is a developing country. There are many internal and external problems which Pakistan is going through ever since its creation. It is obvious that biodiversity can be better conserved in a stable economy. Political instability and sectarian violence divert attention of government from implementing the CBD and hence slows the process. A brief overview of economical, political and social conditions of Pakistan is carried out in coming paragraphs so as to gain a crystal clear picture of conditions and circumstances in which this complex process of implementation of CBD is being carried out. It will also help in establishing some opinions about achievement of biodiversity targets.

5.3.1 Economical challenges

The economic challenges before Pakistan are fiscal deficit, limited exports as compared to heavy imports, lack of communication, infrastructure, mismanagement of energy resources social and human crises due to intense security crises and price inflation. The effects of this economic eclipse on the common people are devastating. The integrated prosperity and economically protected environment are poor man's dream in our country.

If a country is economical unstable it will certainly have priorities other than saving biodiversity. It is for this reason that we have to depend on international funds for carrying out our conservation projects. As mentioned earlier that the process of grant approval is quite long which slows down the process of implementation of CBD.

5.3.2 Political challenges

Political instability in Pakistan and lack of political will: In Pakistan we don't have democratic institutions. Whatever we have inherited so far is from dictatorship. Development of a stable democratic policy has been undermined by military interference in political affairs. Public and political accountability are areas which need quick attention and action.

People are not given their due rights; they cannot imagine conserving biodiversity themselves. The lack of demand is certainly affecting the process of implementation of CBD in Pakistan.

War on terror: It is a high time for Pakistan to get out of terrorist grip. If we do not revise our foreign policy we will keep on suffering as the focus of war will be Pakistan. Pakistan in collaboration with the world powers should evolve such strategy that it doesn't become a flash point of war. If we blindly follow the policy of major powers our country will be implicated more and more resulting in loss of economy and manpower and country wide disorders. It is well known that war brings complete havoc to biodiversity of that area. Examples of Sudan , Afghanistan , China and Japan are in front of us.

Religion: The Year 2007 unambiguously illustrated that the flag of extremist Islam continues to flail vigorously and violently across Pakistan, although severe actions have been taken by Pakistan Army and other important agencies but still they appear less in control, and more vulnerable. Our religious leaders are promoting and educating the innocent people to initiate war against non-Muslim countries. At present due to atomic weapons the war, if it breaks out, will cause utter destruction of the planet. Therefore the education of war at present is not

required for the reason that whole world is well aware of its negative aspects and long term effects.

Our effort should be on finding solution of social problems from our holy book and teaching of Prophet (PBUH). The foremost step is the personal example of kind and good behaviours as displayed by Prophet (PBUH) himself. He loved humanity and was given the title of , Rehmat-ul-Almeen, one whose kind to the whole humanity.

It suits our religious preachers to create disparity in the society. Those people who are otherwise unfit to compete in social and economic progress become very poor. They go for guidance and prayer to the religious teachers who are waiting for such an opportunity to create opposing parties of rich and poor.

The remedy of such negative thinking is to provide the religious people the security of food and shelter. The poorest of northern areas much be provided with opportunities. Their kids should also go to school like any other children in the world and elders should be provided with skills and jobs and alternatives so that they do not consider the rich people as their enemies. Religious institutions should be nationalized and such religious people should be given reasonable pay .in this way they would not be able to use the name of Islam for war mongering. The decision of war should be left to our assemblies and not on a single extremist group. The religious people should be directed to be more responsible behaviour for the sake of peace in the world. If our religious leaders can provide guidance to world at large to solve the problems through dialogue and tolerance they will be welcomed by all nations of the world and there is every chance of other people embracing Islam through attraction and influence rather than invasion and threat. There is no reason to deny that Islam teaches the art of war when it's unavoidable otherwise Islam is a religion of peace and teaches tranquillity.

5.3.3 Social challenges

The 2004 UNDP Human Development Index shows that only five countries have lower expenditure on health and education, as a percentage of GDP, than Pakistan. Overall,

Pakistan ranked 142nd out of 177 countries in terms of human development which makes it last in South Asia. Only half of Pakistan's population is literate (European Union).
According to Pakistan Economic Survey 2007-2008, the population is 160 million, with 65% living in rural areas. Around 38 million people, who make 24% of the country's population were below the national poverty line in 2004-2005. GDP per capita is around US $925. Life expectancy is 65 years. One in ten children dies before their fifth birthday

More than two decades of conflict in Afghanistan led to a massive influx of refugees, over 3 million of whom are still Pakistan. Refugees not only received food aid and other humanitarian assistance, but also competed with the local population in developing sustainable livelihoods. Degradation of the rangelands was enhanced due to their livestock along with the increased pressure on other natural resources. For example they used forest resources as means of earning their livelihood and meeting their day to day fuel needs. This issue of refugees is now considered as threat to the country's stability in terms of economy as well as its security. However the problem seems to be amplifying and the solution is still not found.

The rate of Unemployment and underemployment is increasing, affecting particularly the urban poor and rural sections of the population. Since most economic growth is coming in the low paid service sectors which tend to be concentrated in urban centres, jobs opportunities in rural areas are negligible, forcing rural youth and the labour class to migrate to urban areas, further over-burdening the already over-stretched facilities in urban areas.
Ethnically, too, Pakistan is divided between Pashtuns, Balochs, Sindhis, Mohajirs and Punjabis. As a result, we have a society that remains highly polarized along religious, ethnic and economic lines.

The widening of these fissiparous tendencies can pose a threat to national security. At the moment, the country lacks an appropriate social policy and the institutional arrangements wherein ideas, strategies and tactics for enhancing social harmony and accord and building moderate social institutions can be discussed and debated. Although the government is frequently bears the brunt of these divisions it has not taken any concrete steps to deal with them. The resultant social divisions and conflicts have a direct bearing on the natural environment and development in the country.

Positive social change can be brought about by devising and implementing an effective social policy in support of social justice, religious tolerance, ethnic harmony, economic equity, democratic participation and the conservation of natural resources. (European Union)

5.4 Prospects for achieving 2010 targets

The management of biodiversity or the monitoring of various systems consists of certain goals and targets which are to be achieved .The activities relevant to these targets are carried out so that some desired results are achieved and then it can be said that biodiversity is conserved or protected. The monitoring of ongoing projects is done through application of indicators. The most significant way in which we can determine the progress in achieving the targets was development of indicators. The international headline indicators that are developed under this focal area are Nitrogen deposition and Trends in invasive alien species. These indicators have not been used in any project in Pakistan so far.

This research is quite limited to assess the entire progress towards the subject goals and targets. However the prospects for the achievement can be analyzed on the basis of current trends. The plausible future scenarios can be considered to look into the achievements in more detail. The table 3 below gives prospects for progress by 2010; as such an analysis was done as part of the millennium ecosystem assessment and global biodiversity outlook 2.

Table 4. Focal area three; addressing the main threats to biodiversity

Goal 5 : the pressures from habitat loss ,land use change and degradation and unsustainable water use should be reduced		
Serial number	**Target**	**Prospect for progress by 2010**
5.1	Rate of loss and degradation of natural habitats decreased.	As there is unplanned and rapid urbanization the land use change is projected to continue to be the largest driver of ecosystem change and

		biodiversity loss due to rapid and unplanned urbanization. Pakistan has declared almost 11% of land as protected areas. This target is achievable and rates of change could be decreased and, through proper planning, pressures on regions of high conservation value could be further reduced. IUCN red list can be helpful is selection of those areas which are inhabited by threatened species.
Goal 6: Control threats from invasive alien species		
6.1	Pathways for major potential alien invasive species controlled.	Pressures are likely to increase from greater transport, trade, and tourism. However measures to address these major pathways could be enhanced, including through the implementation of existing international agreements (e.g., the International Plant Protection Convention, the International Ballast Water Convention).
6.2	Management plans in place for major alien species that threaten ecosystems, habitats, or species.	Management plans could be developed for key invasive species only. This target is achievable if top most invasive alien species is identified and management plan for it is adopted

Goal 7: Address threats to biodiversity from climate change and pollution		
7.1	Maintain and enhance resilience of the components of biodiversity to adapt to climate change.	There is great uncertainty that which natural habitats, species and genetic diversity is projected to decrease or what extremities the climate change will bring in Pakistan. Thus progress in this target is very challenging it depends on international cooperation and identification and protection of those critical habitats, populations of species and genetic diversity that contribute to resilience in the face of climate change.
7.2	Reduce pollution and its impacts on biodiversity.	The food demand and increase in fossil fuel combustion is likely to increase so the fertilizers containing nitrogen and phosphorus will increase too. Emissions are likely to increase. The important step of law and legislation has been taken however its proper enforcement remains awaited. Increases in fertilizer use efficiency, and the enhanced use of wetlands to denitrify reactive nitrogen, and to remove other nutrients can reduce impacts of pollution. Levels of other pollutants (e.g. persistent organic pollutants, SOx, particulate matter, lead) are likely increase as well as no significant step nationwide has been taken other than

		conversion of fuel from patrol to CNG in many vehicles.

These prospects are given in the light of 2010 targets only and this table was made on the basis of knowledge perceived during the research.

CHAPTER 6

CONCLUSION & RECOMMENDATIONS

6.1 Conclusion:

Conscious efforts are being made by the Government of Pakistan, NGOs and civil society but the challenges of conservation of biodiversity coupled with large population to feed, are hard to achieve. Pakistan has great potential of developing into a prosperous nation in a sustainable manner. Moving towards industrialization we can adopt environment friendly techniques right from the start. Now it is well recognized that economic decisions have direct environmental and social consequences and environmental and social policies in turn have impacts on economics of a country, therefore it is very important for economists of Pakistan to properly build, expand and strengthen connections between economic, environmental and social policies. As the Millennium Ecosystem Assessment found, reversing ecosystem degradation while meeting the growing demand for ecosystem services will require significant changes in policies, institutions, and practices. So it is very crucial that economic planners must realize the ecosystem services underpinning our economy and rural livelihood.

Biological diversity should be realized as an important part of life and one of the pillar of sustainable development in Pakistan. Our and future generation's, use of benefits from biodiversity entirely depend on the pattern of using it therefore it is very essential that our activities should have less impact on structure and function of ecosystem.

According to the Millennium Ecosystem Assessment biodiversity loss, and in particular the loss of species diversity and transformation of habitats, is likely to continue for the foreseeable future, and certainly beyond 2010. It is therefore the dire need of the country to take very huge and timely steps to conserve biodiversity. Even if we are unable to achieve

biodiversity 2010 targets completely, some of the targets must be achieved and some tangible outcome must come to the surface.

There are opportunities to implement CBD activities, meanwhile, coordination in other multilateral agreements would be highly beneficial to get the maximum desired results e.g. the adaptation and mitigation activities associated with climate changes are synergistic and simultaneously contribute to UNFCCC and its Kyoto Protocol, CBD and Ramsar convention. In the same manner the UNCCD is helpful in saving the biodiversity along with maintaining the fertility of soil. The related conventions should be taken as reaching single goal through different means, all within broader National development objectives.

The conclusion should motivate the specialists and policy makers and civil society to act and make some real progress.

6.2 Recommendations

6.3 GOAL 5: the pressures from habitat loss, changes in land use and degradation and unsustainable water use reduced

6.3.1 Forests:

To achieve 2010 targets, related to reducing pressure on habitats, integrated management by the concerned agencies is required. Top to bottom and bottom to top management practices are required simultaneously so that effective results can be achieved in short time. Until and unless there is integration and coordination among various relevant agencies progress cannot be achieved. Furthermore, the three main components of the CBD are the conservation, sustainable use and equitable benefit sharing of biological resources. As a large proportion of Pakistan's biodiversity resides in forests, this sector has to deal with these three objectives simultaneously.

Keeping in mind the subject goals and targets of 2010 further suggestions are given below:

1. Frequent change of forest policies in the years 1955, 1975, 1980, 1991, 2001, 2002 indicates the lack of political will and devotion. The policies are framed by the government officials or some selected NGOs, which are in good terms with the government in power without taking care for the local population. Such policies are changed with the change of governments. If the policy is not sustainable in itself then obviously it cannot ensure sustainable forest management. For the national interest ,there should be a well agreed agenda on which each and every party must remain firm weather they are in power or not. The policy should be made taking into account the ecosystem approach. It is a fact that none of the policy initiative or the policy in itself can be successful and effective without a legal basis. So law must support policy in a way that it not only protects the right of poor people but also keep a check on forest department.

2. Forest management programs should be aimed at identifying the causes of deforestation in much more detail. The reason for the failure of previous polices must be looked into more details and it must be ensured that such problems do not occur again

3. The measures that are taken for conservation of forests must be incentive based. When the people are provided with incentives and alternatives; the pressure will be reduced automatically. Those people who are depended on forests for fuel and livelihood must be provide with alternatives along with awareness , education and participation in forest management, as its hard to make somebody take conservation actions if his livelihood is depending on it. Conservation can obviously not be achieved without public participation.

4. The study of effects of forest deforestation and proper dissipation of information to the government and public as well.

5. Development of new forests, their protection and their proper monitoring. Agro-forestry, organic farming, environmentally sustainable cropping patterns, and adoption of efficient irrigation techniques should be encouraged
6. The forest disaster management should also be in place to achieve the required targets and sustainable use of forest biodiversity must be promoted

6.3.2 Wetlands

Wetlands must be recognized as important natural resource of Pakistan. Recommendations for deriving maximum benefits from this gift of nature are as follows;

- Integrate wetland conservation, including conservation of village ponds into sectoral development plans.
- Efforts for conservation and sustainable use of wetlands should be linked with the ongoing rural infrastructure development projects and employment generation programmes.
- Promote traditional techniques and practices for conserving village ponds or other nearby wetlands.
- Economic valuation should be carried out so as to create awareness among the locals as well as policy makers.
- While developing the protection and management plans for wetland resources the community participation must be ensured and ecosystem approach must be included as much as possible.
- Legal compliance must be ensured, to reduce hunting and illegal trading of animals especially birds and reptiles.
- Introduce alternative livelihood projects so that the pressure on wetland resources is reduced.
- There is a dire need to take measures in terms of formulation of specific law and further modification of previous concerned laws and policies. For the sustainable management and wise use of wetlands, it is important to coordinate in the formulation and implementation of relevant sectoral policies, which requires close cooperation of

significant sectors (like water, industrial sector, environment and other related sectors).A provision under section 11 of PEPA 1997 establishes that emission of any effluent in an amount, which is in excess of the NEQS should not be allowed. This section can be used to stop degradation of wetlands since industrial effluents are one of the main causes of depletion of wetlands in Pakistan.

- A comprehensive training program, which covers both theoretical and practical matters, must be designed to strengthen the capacity of the key government and non-government agencies responsible for the protection and sustainable use of wetlands.

6.3.3 Land degradation and land use

The problem of land degradation needs to be placed on a high priority by the environmentalists, conservationists and policy makers as neglect or delay would result in serious consequences.

The individual landowner, developers and local governments of Pakistan are the main land use decision makers since majority of the land is privately owned .Better management of land consists of; identification of main changes in land use, complete understanding of patterns of current land use, assessment of economic and ecological benefits. The costs that arise from land-use practices, as well as presenting alternatives to locals, can form core of awareness campaigns. Land use requires an analysis of many alternatives, views of many experts and their consensus as well. In a highly fragmentized society like Pakistan consensus is hard but very important to achieve.

To reduce the pressure on biodiversity from land degradation and land use change in a country like Pakistan where such issues have been long neglected it is important to focus the issues in chunks as where and when they occur keeping in mind the overall ecosystem approach and conservation of biodiversity. This would certainly play part in sustainable economic growth.eg

- The land pollution issue can be solved if composters are used. They can not only generate compost which can increase soil fertility and reduce import of fertilizers but also provide employment opportunities hence supporting the economic sustainability.
- Increasing forest cover will not only help solving the issues of soil and wind erosion but can also be helpful in drought, floods, soil fertility and water logging.
- For land use management efforts at government level can help. Only government own land can be managed in desired way. The public property laws are strong enough to allow them to use in a sustainable way. However proper enforcement is required.

6.3.4 Sustainable water use

The World Summit on Sustainable Development (WSSD) in 2002 confirmed the importance of water and its critical relationship to other development issues that underlie efforts to achieve the Millennium Development Goals. A key target agreed at the Conference was for countries to prepare: National integrated water resources management and water efficiency plans by 2005 (Torkil J-C., 2004).

To reduce pressures on biodiversity due to unsustainable use of water a new policy needs to be designed. This policy must be based on;

- Proper allocation of water to various sectors.
- High quality drinking water must be supplied to rural and urban areas while the concept of recycled water is very beneficial for agricultural purposes.
- The industrial sector needs to treat their water before releasing it into the water bodies, so that the biodiversity supported by these water bodies remain save.
- This policy must be supported by appropriate law and should fix penalties for the violators
- The NGOs should also promote water treatments and water recycling projects.

We need to follow an integrated approach towards management of water which should include plans like using storm water and recycled water for industrial and agricultural purposes while supply of high quality drinking water to each and every citizen of Pakistan.

The effective implementation will require the coordination of relevant agencies along with participation of private sector, NGOs, public, media and academia.

6.4 GOAL 6: Control threats from Invasive alien species

The most important step to control the spread of IAS is identification of existing relevant legislation. The laws like fishers, agriculture forestry can be reviewed for including some clauses to address this problem of alien species. Similarly wet land policy is being formulated at this stage it should also include this problem. The harmonization of all relevant laws will be an appropriate action since Pakistan is committed to many international biodiversity related agreements and it has to form relevant laws and action plans sooner or later.

Awareness should be given to students at college and university level. Options for research on IAS should be given to students with more emphasis on economics of IAS in Pakistan. To control the threats from IAS it is very important to take the following steps;

- Stakeholders must be identified and the alliance of environment, health, agriculture and fishers sector must be ensured in the process of modifying existing law, making some action plan or policy making with the perspective of IAS as threat to native biodiversity.

- Inventory must be made and certain organization should be made with a responsibility of making management plans, identifying pathways and overall monitoring of IAS in the country. The destruction they bring in an ecosystem is irreversible therefore there is a dire need to describe the extent of invasion that has already been made, factors that contribute to invasion, their future implications. It should also include threats to ecosystems services, agriculture, forestry, health, and trade by IAS
- The invasive alien species which have been identified should be managed in a proper way by making relevant law or existing laws can be modified to provide support as a response to this problem. Eucalyptus has been reported as IAS and many environmental organizations discourage its plantations however no study has been conducted for its ecological assessment or socio–economic effects.

- Preventing international movement of IAS by rapid detection at borders through inspections of international shipments, customs checks and proper quarantine regulations are less costly than control and eradication .So these processes needs to be strengthened and must be regulated.
- Capacity should be developed to use risk assessment and ecological assessments to address threats of invasive alien species to biodiversity and incorporate such methodologies in environmental impact assessment (EIA) and strategic environmental assessment (SEA). Measures should cover both, import from western countries and trade with in Asia.

- The intentional release of IAS into the wild for economic reasons needs to be controlled and prohibited e.g. release of different types of fish in freshwater water, import of various plants to control water logging, salinization etc. In fact mostly species used in agriculture, forestry and fisheries are alien species. Therefore it is important to distinguish the harmful from the harmless alien species and identify the impacts of the former on native biodiversity. Rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) have been introduced in Pakistan and are considered to be worst IAS international therefore their effects on aquatic ecosystems must be carried out .

- NGOs need to be informed about which plants to use during plantation campaigns so as to stop various incidents as IUCN reports that, The 1999 monsoon tree plantation drive in Sindh was initiated by planting Lignum (Guaicum officinale - a native of S. America), while spring tree plantation of 2000 involved planting Eucalyptus.

For controlling the spread of IAS and its eradication it is important to develop inventory on the basis of agreed and scientific risk assessments. A proper method to control and eradicate is nonexistent in the country. Currently paper mulberry is control by burning it but this method has not been successful since they spread at a much faster rate and re-establish

themselves. There is a need to develop methods for control different types of invasive alien species

6.5 GOAL 7: Address challenges to biodiversity from climate change and pollution

Keeping in view the scope of project and two very important targets 7.1 and 7.2 dealing in maintenance and enhancement of components of biodiversity for adoption to climate change and reducing impacts of pollution on biodiversity recommendations are provided. First the main points for resolving issue of increasing the resilience of the ecosystem is discussed. Later on the recommendations for reducing pollution are given. However this should be kept in mind that maintaining the resilience of the system involves pollution control as well.

According to millennium assessment toolkit, Resilience is the capacity of ecosystems to respond to and cope with changing conditions, and still continue to provide valued services. The components of biodiversity such as habitats, populations, ecosystems, human beings, natural resources can only cope with the changing environmental conditions, if they are dealt in a sustainable manner. To deal with this goal and to meet the targets included under it, a strategy should be designed in such as way that it includes knowledge and research, adaptation, disaster management, emergency preparedness and quick response, mitigation and reducing the impacts of pollution on biodiversity.

A) Knowledge and research:

The climate change is not taught as a subject in most of the universities offering the degree in environmental sciences. It is very important that climate change should not be taught as consequence of global warming but with much broader vision including natural and anthropogenic drivers of climate change, its short term and long term impacts, adoption and mitigation options in the developing nations.

The research studies conducted so far are very few and we need to know in detail what species have been lost and which ecological zones it has damaged. The economic assessments in terms of ecosystem services and their reduction can help in raising awareness among policy makers, bureaucrats and other relevant people. It will not only create awareness but it will also help in establishing valuable information. Especially the research studies relating to impact of climate changes on the threatened species must be encouraged.

B) Adaptation:

Adaptation refers to such actions that are intended to safeguard, people, communities, businesses and a country against the vulnerabilities and effects of anticipated or actual climate change. The concept of adaptation has gained popularity in developing countries as a less expensive option through which vulnerable groups can live and adjust with the changes in the environment and economy that will be caused due to climate change (LEAD). Pakistan completely lacks the awareness about this rising threat at local specially the rural area level. The situation has become worse due to lack in the institutional structure and financial capacity to adapt to climatic changes. It is very important that this area should be given priority at this time, when climate change is unfolding itself and Pakistan has to save itself from severe climatic changes, improve its economic conditions, enhance its ecosystem services and fulfill its international commitments.

The areas that have potential for adapting to new climatic scenarios are as follows;

Water sector: It has the highest potential for the adaptation. If we change use patterns, introduce efficient and acceptable reuse methods and recycle it for agricultural use it will not only help us to adapt to new climate but it will also reduce ecological stress .e.g. if water is reused and recycled human intervention will be reduced and hence the fresh water bodies and biodiversity supported by them will be protected. The humans using those reservoirs will get clean water for use and so they will be protected from water borne disease. In turn money spent on treatment of such patients can be saved too.

Agriculture: This area can also adapt to some extent to new climate conditions. There are two main reasons for this; a) the natural tendency of crops to shift to new suitable zones and

b) advancements in biotechnology (heat resistant varieties, drought resistant varieties, off season fruits and vegetables etc).

C) Disaster management, emergency preparedness and quick response:

- The climate effected site should be identified and the species of special concern (vulnerable or on red list of threatened species) should be conserved through *ex-situ* conservation.
- We need to study our ecological zones with reference to climate change. For this purpose the documentation of species must be carried out in which their complete detail should be given. The ecological indicators should be developed to study the health of ecological zones.
- Priority area most likely to get effected by climate change should be identified through research and in depth knowledge e.g. Pakistan's status as a developing country which is mainly dependent on agriculture makes it particularly susceptible to the effects of climate change.
- Research areas should be identified and species most likely to get effected by climate change should be monitored properly.
- Genetic engineering and climatic changes agencies should cooperate with each other. Heat resistant crops should be developed.
- Climate change site should be identified The areas which are rich in agro biodiversity such as Sargodha, Sahiwal, Badin, Charsada, Faisalabad, Jhang, Okara should be set up with special monitoring systems, which monitor the area specifically with pollution and climate change. The pollution levels of these areas should not be allowed to exceed the NEQS. Rather they should be kept at lower threshold value. So that change is climate is not enhanced with high levels of pollution.

D) Mitigation:

Mitigation means taking actions to tackle the causes of climate change. In other words, it means taking measures to reduce the emission of Greenhouse Gases (GHGs) into the atmosphere and halting the global warming trend (LEAD). Although globally our

contribution to pollution is very low as compared to developed countries. The cost of mitigation is also quite high for Pakistan. However it should be kept in mind that it would be costly and difficult to adopt also if we don't mitigate climate changes locally. There are certain areas in which mitigation can be carried out by changing the use pattern of the natural resources so as to deal with the issue of climate change. These areas where also identified by ALGAS study and GoP (1998), as having potential to get incorporated into the development of policy. The identified potential areas are as follows;

Energy Sector: energy sector (petroleum, coal and gas), According to the ALGAS report the energy sector is the single largest contributor of GHG emissions in Pakistan, accounting for over 82% of CO_2 emissions and almost 100% of CO, NOx, NMVOC emissions. Therefore this sector must be included as far as mitigation is concerned. Options are to introduce renewable energy supply system in Pakistan. Cleaner technologies such as solar power, hydro power, wind power, nuclear power, and bio fuels have not been started commercially in Pakistan. But solar power has been use at a small scale such as solar ovens and geasers. However it is not common practice to use this technology and needs much work .similarly wind power and nuclear has not been started in Pakistan as yet. As far as bio fuels in concerned few local organizations are working on it but their scope is too limited.

Forestry: forests are the carbon sinks and they store carbon in the form of woody biomass. According to ALGAS study In Pakistan emissions from deforestation and land use change constitute 13% of the total CO_2 emissions in the country. So it is the second largest GHG source. It has great potential to reduce emissions. Furthermore it can also help to meet the commercial demand of wood, support biodiversity, protect land from soil and wind erosion.

Agriculture: According to ALGAS study, agriculture and livestock are the most important sources of methane emissions in Pakistan; it would pay to invest in creating or strengthening the research capacity at institutes within the country, such as the National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad, and the NARC, Islamabad

E) Pollution

For dealing with the issue of pollution a two pronged approach is required. One aspect should deal with reducing the pollution and other should be dealing with the reduction of its impacts. However this approach should have central controlling unit which keeps an eye on the implementation quality through use of indicators.

As already indicated by the studies carried out by the EPA, we lack capacity, equipment and technology to deal with the issue in terms of proper identification of levels of air, land, water pollution throughout the country and its control. Only major cities like Lahore, Rawalpindi and Islamabad have been observed for pollution levels so we see only the tip of the iceberg. We remain unaware due to the above mentioned problems from the magnitude of the problem. There is no central databank to share the finding of independent researches and academia. Proper and timely response is required for the better and effective control of pollution. It must be realized that our limitation is not only the scarce resources but also the limited time. Once the biodiversity is lost or any specie becomes extinct the actions plans, documents and established laboratories will be of no importance. They will be criticized as the objective of saving the biodiversity or its certain component could not be achieved.

The treatment plans for waste water, their reuse for agricultural purpose, recycling plants, composting plants and such other measures have been recommended by many agencies. Establishment of such plants will reduce pressure on water bodies and hence the biodiversity. So far whatever recommendations have been given by EPA or other international organizations have not been followed.

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