

# Analytical Study on Threats to Wetland Ecosystems and their Solutions in the Framework of the Ramsar Convention

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**Abstract**—Wetlands are one of the most important ecosystems on Earth. Nevertheless, various challenges threaten these ecosystems and disrupt their ecological character. Among these, the effects of human-based threats are more devastating. Following mass degradation of wetlands during 1970s, the Ramsar Convention on Wetlands (Ramsar, Iran, 1971) was concluded to conserve wetlands of international importance and prevent destruction and degradation of such ecosystems through wise use of wetlands as a mean to achieve sustainable development in all over the world. Therefore, in this paper, efforts have been made to analyze threats to wetlands and then investigate solutions in the framework of the Ramsar Convention. Finally, in order to operate these mechanisms, this study concludes that all states should in turn make their best effort to improve and restore global wetlands through preservation of environmental standards and close contribution and also through taking joint measures with other states effectively.

**Keywords**—Ramsar Convention, Threats, Wetland Ecosystems, Wise Use.

## I. INTRODUCTION

UNDER Article 1 of the Convention on Wetlands of International Importance especially as Waterfowl Habitat, wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters. Wetlands are of the most important and valuable ecosystems on Earth where the life of human-being and other species depends on them. Wetlands are of many values. In addition to their biological diversity, they are of many other significant values for economic and social development. This importance can be better understood by knowing the fact that two thirds of world population lives along the banks of wetlands, including rivers, lakes and beaches [1]. Wetlands are described as “the kidneys of the landscape” because of their function in chemical and hydrological cycles. They have been called “biological supermarkets” because of the extensive food chain and rich

biodiversity that they support. They play unique roles in the landscape by providing unique habitat for a wide variety of flora and fauna and by regulating water resources for utilization of indigenous community and also tourists [2].

Wetlands have historically been thought of as “unexploited wastelands. Although there are many functions of wetlands, society does not always affix a value on those functions. The value of a wetland will often depend on the dynamic economic circumstances at the time, its location and what the wetland is perceived to be providing. Wetland value in the past has been focused on their potential to be converted and used for more productive purposes such as agricultural uses, urbanization and industrial development [3].

In spite of increase in public knowledge toward importance of natural environments particularly wetlands, there is no real understanding of sensitivity and fragility of these vital ecosystems. Since time immemorial people had viewed wetlands with apprehension. They were seen as trackless wastes in which the traveler could easily be lost and sucked into bottomless mires. To the superstitious they were the haunts of demons, imagined or made real as strange dancing lights. Dwellers on their margins lived in fear of devastating floods. They were considered to be disease-ridden places, their “bad air” blamed for malaria. Traditionally, to most people wetlands were something to be confined by embankments or got rid of by drainage - especially where fertile plains were created for agriculture. Such transformations were irresistible to ambitious politicians. Draining the Pontine Marshes had been an objective of dictators, from the Caesars to Mussolini. Even in democracies the “reclamation” of wetlands could be a vote-winner. Accordingly, in most countries these ecosystems were unfortunately being destructed by human interferences which resulted in considerable loss of wetlands in all over the world [4]. An alarming 50 percent of the world's wetlands have been destroyed in the last 100 years, threatening human welfare at a time of increasing water scarcity. “In just over 100 years we have managed to destroy 50 percent of the world's wetlands,” said Achim Steiner, executive director of the United Nations Environment Program [5]. Besides threats arising from human activities, natural disasters like tsunami, earthquakes and droughts would endanger the life of wetlands which occur inevitably, although human developmental actions may accelerate and duplicate the effect of these threats. There is no way to examine the impact humans have had on the global extent of wetlands except to observe that [6]. In post industrialization, this impact has been more

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destructive, when many countries accomplished many technological and scientific achievements and over-exploited wetlands for their own developments.

Prior to the mid-1970s, the drainage and destruction of wetlands were accepted practices around the world and were even encouraged by specific government policies. Wetlands were replaced by agricultural fields and commercial and residential development. If those trends had continued, these ecosystems would have been in danger of extinction [7]. The interest in wetland conservation blossomed in the 1970s internationally following concern at the rapidity with which large stretches of marshland and other wetlands in Europe were being "reclaimed" or otherwise destroyed, with a resulting decline in numbers of waterfowl [8]. In this regard, efforts have been made to enact rules of law to protect and conserve wetlands against unsustainable and unwise utilization. To this end, the international convention on wetlands, has signed in Ramsar, Iran in 1971. (Referred to as the Ramsar Convention) It is an intergovernmental treaty that provides the framework for national actions and international cooperation for the conservation and wise use of wetlands around the world [9]. Of the most significant goals of the Ramsar convention is prevention of global loss of wetlands and also conservation of remaining wetlands through wise use of these natural resources and this will not be possible except through appropriate policy-making, capacity making, transfer of technology and cooperation among all international actors.

So in this study, efforts have been made to examine challenges facing wetland ecosystems and to suggest solutions in the framework of the Ramsar convention.

## II. NATURAL THREATS TO WETLANDS

Wetlands are among the most threatened ecosystems in the world. These ecosystems often encounter naturally severe threats such as floods, storms, soil erosion and subsidence arising from inevitable naturally occurred processes that have the potential to damage wetland environments. The main natural threats to wetlands are addressed below.

### A. Flooding

Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow down the speed of flood waters and distributes them more slowly over the floodplain [10].

Virtually all wetlands especially coastal and estuarine wetlands are subject to some measure of flooding although its frequency, depth and velocity differ greatly [11]. However, internationally, wetlands have been recognized as important in reducing surge elevation and wave height and flood control, increase in annual floodwaters due to climate change and torrential rains and also because of destruction of wetlands vegetation in the upper reaches, is out of a wetland usual potential and may cause that wetland losses its ability in flood storage and consequently, its additional water would flow out and this will result in lots of damages and the wetland ecosystem shall go underwater and be disappeared gradually.

Particularly during the last 100 years, huge areas of floodplain have been drained and cut off from their rivers by artificial embankments (termed bunds, dykes or levees in different countries). This means water that used to spread out slowly and relatively shallowly across broad floodplains is concentrated into ever-smaller areas. As a result, floods are deeper and more likely to cause damaging – sometimes catastrophic – impacts if and when artificial flood banks are breached. For example, in the middle reaches of the Yangtze River in China, flooding has become more frequent and more damaging as a direct result of floodplain loss, especially when combined with the loss of vegetation cover in the river's drainage basin [12].

### B. Subsidence

Subsidence is another natural threat to wetlands. Land subsidence is an environmental hazard which is caused by overdraft of groundwater or oil extraction and results in gradual settling or sudden sinking of the earth's surface owing to subsurface movement of the materials of the earth. More than 200 occurrences of land subsidence have been documented throughout the world during the past few years [13]. Land subsidence associated with groundwater level decline has been recognized as a potential problem in various parts of the world.

Wetlands are one of the ecosystems on Earth to where subsidence is a major problem. Wetland soils consist of a great deal of water and organic material. These are commonly called peat and muck and, by definition, contain more than 30 percent organic matter. Subsidence occurs when such soil are drained or exposed to air which causes oxidation of organic material. Therefore, roads, fills, and other materials placed on wetland soil also compact the underlying materials, causing it to differentially settle or sink. Foundation crack and water enters. Roads are constructed in wetlands are other subject to differential settling [14].

### C. Soil Erosion

Soil erosion is the removal of soil particles by wind, water, and other forces of nature. This naturally occurring process is accelerated in areas where soil has been disturbed by human activities. Lands used for new crop production are particularly susceptible to soil erosion. Soil particles the leaved disturbed sites are carried by run-off to areas of lower elevation as long as the flow of the water is sufficient to transport them. When water velocity decreases, a portion of the sediment being carried is deposited. Sedimentation is the end result of soil erosion [15].

While natural processes may fill wetlands with sediment, anthropogenic influences have great potential in accelerating erosion, prematurely fill wetlands, and degrade wetland functions. The most severe impact occurs when wetlands are filled with so much sediment is that they no longer pond water; accordingly, such wetland lose their capacity to perform most natural wetland functions. While the loss of wetland functions when basins totally are filled with sediment is intuitive, the relationship of functional loss and degradation

to gradual but chronic filling is less well appreciated and understood [16].

Soil erosion is a natural hazard to wetland ecosystems. Without protection of wetland, soil erosion will cause two physical losses: 1) the waste land caused by soil degradation and desertification; and 2) nutrient contents loss [17]. This may have long-term destroying effects on wetland ecosystems, as follows:

- Wetlands affected by sedimentation can lose their open water areas and become choked with aquatic vegetation. This altered wetland habitat has less diversity and is of much less value to wildlife.
- Sedimentation also smoothes aquatic invertebrates and destroy the habitat they need to survive.
- Sediment suspended in the water columns turns the water red. This cloudy water prevents sunlight from reaching plants and algae, reducing photosynthesis and nutrition levels. The red water also makes feeding difficult for aquatic animals which rely on sight to obtain their food and coats of the gills of fishes, impeding oxygen uptake [18].

#### *D.Drought*

Drought as a climatic event refers to the occurrence and/or persistence of below-normal rainfall. Droughts are a normal part of climate variability and may occur at a variety of temporal scales – from days, months, seasons, or years [19].

Drought is considered as one of the most threatening challenges wetlands are facing with and occurs due to climate change, global warming. Drought also affects wetlands in many different ways. Plants and animals depend on water, just like people. When a drought occurs, their food supply can shrink and their habitat can be damaged. Sometimes the damage is only temporary and their habitat and food supply return to normal when the drought is over. But sometimes drought's impact on the environment can last a long time, maybe forever [20].

Drought is likely to affect wetlands, including wetland soil microorganisms that drive soil biogeochemical cycling. Frequent drought could reduce the ability of wetlands to serve as sinks for global carbon or could eventually turn them into sources of atmospheric carbon in general and methane in particular [21].

During the drought, because of the increase of the temperature and high evaporation rate, aquatic plants need to water would escalate. On the other hand, substantial drop in river flow and surface water resources will decrease their ability to purify pollutants along the way of water flows and consequently, it results in considerable decline in their water quality.

### III. HUMAN THREAT TO WETLANDS

Natural ecosystems, especially freshwater ecosystems in the inland flood plain, are undergoing profound and extensive disturbances by humans worldwide. Key indicator of these disturbances is that humans extensively reclaim natural wetlands to expand their economic benefits. Therefore, most

habitats of natural ecosystems have been changed into farms or urban areas rapidly and continuously.

#### *A. Wetlands Drainage and Conversion for Various Land Uses*

World population growth and increasing need for food and lack of agricultural fertile fields during the recent century provided the ground for drainage and conversion of wetlands for such uses [22].

Draining and converting wetlands to croplands have been well demonstrated to have high impacts on wetland characteristics and functioning. The wetland's ability to attenuate and purify storm flow is greatly reduced, with subsequent impact on downstream water users such as humans or other aquatic systems. The complete loss of wetland habitat is associated with their conversion to croplands. Drainage can also negatively affect dry season water flow and supply. This can have serious effects on downstream biota and on water quality through the concentration of pollutants. The destruction of wetlands and riparian zones increases sediment movement via streams, with the sediment diminishing habitat diversity and destroying ecological corridors in the landscape. The streams in connected wetlands deposit increased sediment loads, which results in severe environmental damage [23].

Water-level drawdown or drainage of wetlands can produce major changes in soil physical, chemical, and biological properties. Organic soils in wetlands develop under flooded conditions where organic matter accumulation exceeds its decomposition. Deposition and accumulation of plant material over time result in increases of soil depth. Maintenance of these organic soils then depends on the continuation of processes that lead to its development. To understand processes occurring after drainage of organic soils, it is important to understand organic matter decomposition and how it is affected by hydrologic conditions (flooding, drying) and effects of decomposition on nutrient generation from organic matter. As wetlands were drained for water control, agriculture, or other uses, the primary processes leading to the development of their organic soils, such as flooding, remove. Thus, these areas subsequently undergo subsidence and became sources of Carbon in the atmosphere. Other major concerns of drainage of organic soils include the release of nutrients contained within the organic matter and their potential loss to proximal aquatic ecosystems [24].

#### *B. Discharge of Hazardous Wastes*

Discharge of urban and industrial waste water, agricultural activities, combustion of fossil fuels, mining and smelting operations, processing and manufacturing industries, waste disposal including dumping, etc., are primary anthropogenic sources of pollution.

Using pesticides and herbicides for agriculture can affect wetlands and their flora and fauna in different ways. Pollution of wetlands by agricultural pesticides can cause different types of damage, from altering the growth of aquatic plants to reducing waterfowl reproduction. This happens when broad spectrum pesticides directed at pests in cropland accidentally

injure plant and animal species in nearby wetlands. However, the worst effects of pesticides on wetlands are those that harm a plant or animal in some way that cannot be observed immediately. These sub-lethal effects are due to pesticide-induced changes in the functions of enzymes, cells, or organs of plants and animals that in turn alter how a plant or animal competes for living space and food, avoids predators, reproduces, etc. Plants or animals harmed by pesticides may show these changes in two ways: altered population structure or altered community or ecosystem structure [25].

Industrialization is a significant factor for economic development of every country. Heavy metal contamination of aquatic environments is a world-wide problem. Heavy metals added to an aquatic system by natural and anthropogenic sources, are distributed during their transport between different compartments of aquatic ecosystems, such as water, sediment and biota. Heavy metal residues in contaminated sediments may accumulate in microorganisms, such as aquatic flora and fauna, which in turn, may enter into the food chain and eventually result in human health problems [26].

### C. Unsustainable Ecotourism

Ecotourism plays a considerable role in the world economy. Nevertheless, it is an intensive human activity that can damage protected areas and disturb ecological balance of wetland. The growing numbers of tourists in wetland areas can contribute to and improve welfare of local people in these areas, but at the same time can cause serious damages to wildlife and biodiversity.

The impacts of tourism on the ecological functions of wetlands derive from tourism-related constructions of transport and other infrastructure projects, construction, maintenance and use of tourist facilities, use of water and treatment of waste water, pollution of groundwater, pressures on land use due to urbanization and a more intensive agriculture, the presence and activities of tourists in wetland areas, illegal hunting or fishing etc. These impacts may be both direct and indirect and differ from wetland to wetland [27].

Tourists using the same trail over and over again trample the vegetation and soil, eventually causing damage that can lead to loss of biodiversity and other impacts. Such damage can be even more extensive when visitors frequently stray off established trails [28].

TABLE I  
IMPACTS OF TOURISM ON SOIL AND VEGETATION

Impacts on Vegetation	Impacts on Soil
Breakage and Bruising of Stems	Loss on Organic Matter
Reduced Plant Vigor	Reduction in Soil Macro Porosity
Reduced Regeneration	Decrease in Air And Water Permeability
Loss of Ground Cover	Increase in Runoff
Change in Species Composition	Accelerated Erosion

This table shows various impacts of tourism on soil and vegetation [29].

### D. Introduction of Alien Invasive Species

Alien species are organisms that have been introduced intentionally or accidentally outside of their natural range. Intentional introductions in aquatic systems are usually brought about through attempts to enhance local fisheries or other food production systems or for the biological control of weeds, other pests or vectors of disease. Alien invasive species are regarded as the most detrimental to pristine ecosystems and their dependent biodiversity [30]. The list of established introduced species grows annually, as does the number of them that cause negative economic and ecological effects.

They reproduce rapidly, out-compete native species for food, water and space, and are one of the main causes of global biodiversity loss [31]. Invasive alien species have devastating impacts on native biota, causing decline or even extinctions of native species, and negatively affecting ecosystems. Their negative impact on the economy costs countries billions of dollars in losses to agricultural production and some trillion dollars of environmental cost worldwide annually. Once established, eradication is the most desirable solution, but it can be very expensive to do. The negative effects of invasive alien species on biodiversity can be intensified by climate change, habitat destruction and pollution. Isolated ecosystems such as islands are particularly affected. Loss of biodiversity will have major consequences on human well-being. This includes the decline of food diversity, leading to malnutrition, famine and disease, especially in developing countries. It will also have an important impact on our economy and culture [32].

TABLE II  
TYPES OF AQUATIC INVASIVE SPECIES IMPACTS  
Types of Aquatic Invasive Species Impacts

Environmental Effects	Economic Impacts	Wildlife and Public Health
Predation	Industrial Water Users	Disease Epidemics
Parasitism	Municipal Water Supplies	West Nile Virus
Competition	Nuclear Power Plants	Cholera Risk
Introduced Pathogens	Commercial Fisheries	Parasites
Hybridization	Recreation Activities	
Habitat Alterations	Shipping	

The table above provides a list of the three classes of adverse impacts caused by aquatic invasive species (AIS). These non-native species impact our environment and the diversity of life on our planet in many ways; in addition to the severe and permanent damage to the habitats they invade, AIS also adversely affect individuals by hindering economic development, preventing recreational and commercial activities, decreasing the aesthetic value of nature, and serving as vectors of human disease [33].

### E. Intensification of the Greenhouse Effect

Increase in greenhouse gasses emission will result in change in world climatic conditions and this may cause global warming which has destructive effects on every single part of our environments. Changes in climate occur as a result of

internal variability of the climate system and external factors (both natural factors such as solar radiation, cloud formation, and rainfall and those resulting from human activities, including increased concentrations of greenhouse gases) in the atmosphere. It must be noted that the impact of human activities in this context is greatly more than natural factors. It appears that climate change will have its most pronounced effect on wetlands through alterations in hydrological regimes: specifically, the nature and variability of the hydro-period and the number and severity of extreme events. Of other negative impacts that climate change may have on wetlands, it can be noted the common changes in the timing of spring activities include earlier breeding or first singing of birds, earlier arrival of migrant birds, earlier appearances of butterflies, earlier choruses and spawning in amphibians and earlier shooting and flowering of plants [34].

Also wetlands are being and will be affected by pressures from global change such as climate change, sea level rise, pollution (including acid rain), and land use or land cover change. Successes in wetland conservation and wise use will need to be measured against the potential impacts of these pressures. Human activities such as burning of fossil fuels and land use and land cover change have caused recent changes in the world's climate systems, and continued emissions of greenhouse gases is projected to result in further climate change which is a potentially large future pressure on wetlands [35].

The Intergovernmental Panel on Climate Change (IPCC) concluded that global-mean sea-level rise will rise through the 21st century and beyond due to greenhouse gas-induced changes of climate and that this could have important impacts on coastal populations and coastal ecosystems [36].

Scientific evidence indicates that global warming could well lead to a sea-level rise. In combination with human activities, it is estimated that a 1 m global-mean sea level rise (SLR) could threaten half of the world's coastal wetlands, which are designated as wetlands of international importance, while those that survive could be substantially changed. Sea-level rise (henceforth SLR) can disrupt wetlands in three significant ways: inundation, erosion, and salt water intrusion. The natural impact of SLR causes coastal wetlands to migrate to upland areas [37].

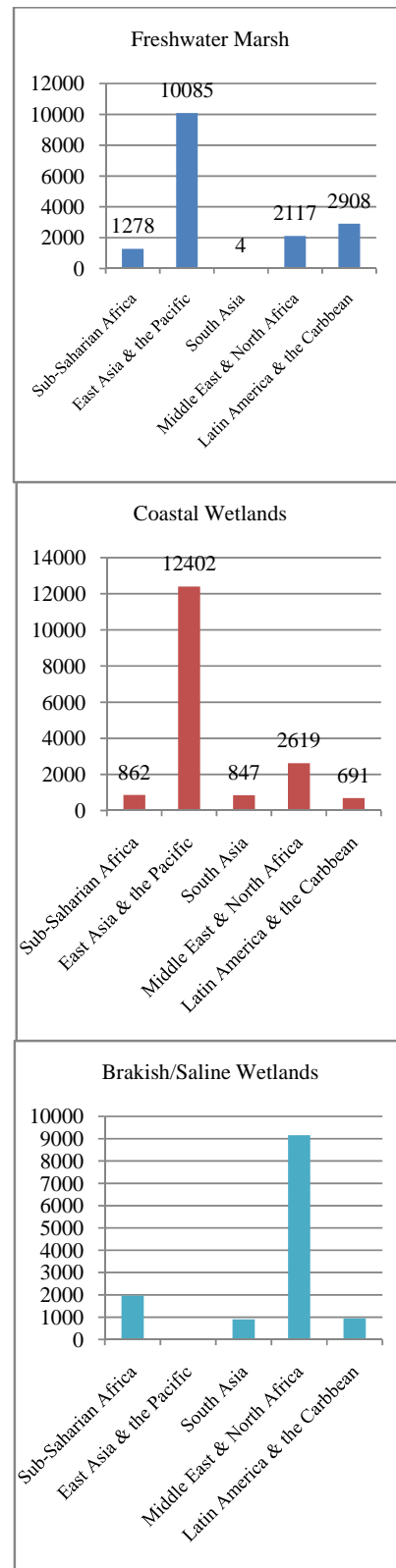


Fig. 1 Lost Wetlands by Types of Wetlands and Regions for 1m Sea Level Rise

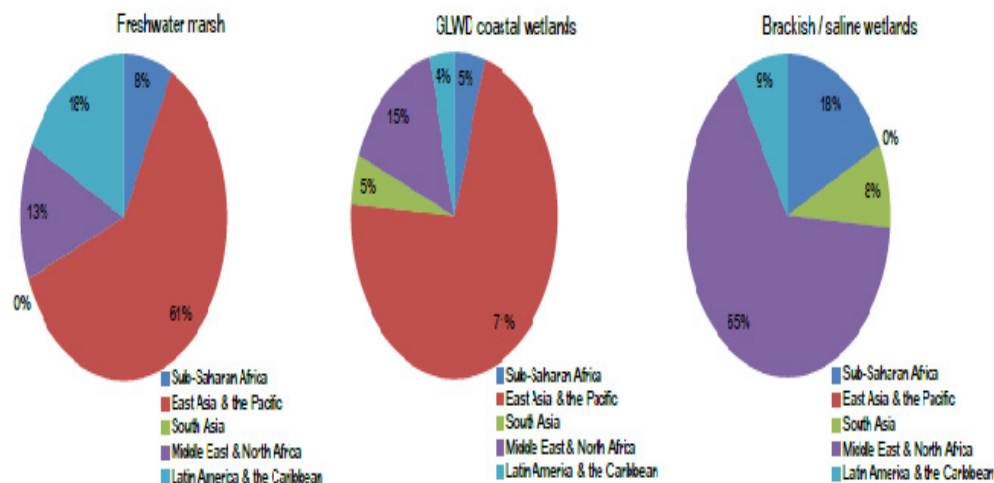


Fig. 2 Distribution of Lost Wetlands by Types of Wetlands across Regions, For a 1m Sea Level Rise

#### IV. ALTERNATIVE STRATEGIES TO WETLAND CHALLENGES UNDER RAMSAR CONVENTION

The vast majority of the world's wetlands are being used by people in a broad spectrum of activities. Through these activities, and factors emanating from activities occurring outside the sites, wetlands are subject to a range of factors which can lead to loss of wetland area and degradation of wetland quality. Not all activities performed in a wetland or its catchment is necessarily wise or sustainable, and it is these activities which can lead to loss and degradation.

Large populations live in the coastal areas where they are exposed to a range of hazards, including coastal flooding. In the developed world, most exposed populations are protected from flooding by various structural measures. In the developing world, flood defenses are less developed and the exposed populations are more often subject to flooding with consequent disruption, economic loss, and in the worst cases—loss of life.

##### *A. Inclusion of International Wetlands in Ramsar List and Maintenance of Their Ecological Character*

Upon joining the Ramsar Convention, each contracting party is obliged to designate suitable wetlands within its territory in a List of Wetlands of International Importance (The Ramsar List). Its boundaries of each wetland should be precisely described and also delimited on a map [38].

Accordingly, under this obligation, contracting parties to the Ramsar convention, made themselves committed to take appropriate measures to inform at the earliest possible time if the ecological character of any wetland in their territories and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. [39]

To this end, the Ramsar Convention considered a list of endangered wetlands known as Monteuix Record in order to maintain wetlands with change in ecological character. The Monteuix Record is a register of wetland sites on the List of Wetlands of International Importance where changes in

ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is maintained as part of the Ramsar List. The Record shall indicate those sites where the Monitoring Procedure has been or is being implemented. Contracting Parties shall provide annual reports on the conservation situation of sites included on the Monteuix Record. The Convention Bureau, in agreement with the Contracting Party concerned, and in consultation with the Scientific and Technical Review Panel, shall remove a site from the Record upon receipt of documents detailing either the remedial actions implemented successfully at the site, or the reasons why the ecological character of a site is no longer likely to change [40]. In the present time 48 sites are included in the list. Iran and Greece are among the countries have the most endangered sites in this list. Till now 32 sites were included in the list were removed from this list [41].

Although The Ramsar convention provided that the inclusion of a wetland in the List does not prejudice the exclusive sovereign rights of the Contracting Party in whose territory the wetland is situated [42]. This does not mean that contracting parties do not have any responsibility in this regard.

The Ramsar Convention attempted to coordinate exclusive sovereign rights on states' natural resources, state responsibility for environmental protection, and rational use. Under the Ramsar Convention, the territorial sovereignty over wetlands of international importance is interconnected with state responsibility for the protection and wise use of migrating waterfowl resources. Since the condition of migrating waterfowl is directly related to the state of their habitat, the above mentioned stipulation can be regarded as indirect evidence of the international responsibility of the Contracting Parties for conservation, management and rational use of wetlands [43].

Up to 2014, all member states to the convention designated 2178 wetland sites of international importance with total



surface area of 208,523,221 hectares in the Ramsar list which shows a big success in this regard [44].

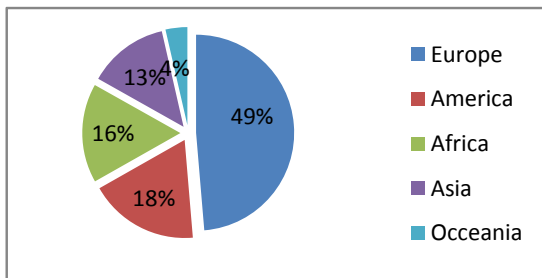


Fig. 3 Distribution of Ramsar Sites by Region

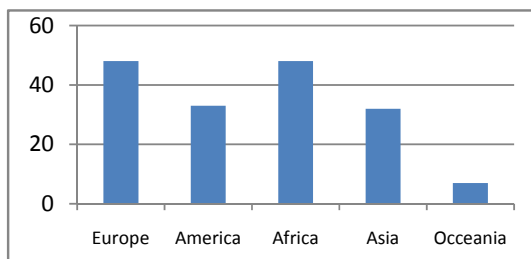


Fig. 4 Member States of the Ramsar Convention by Region

#### B. Establishment of Natural Reserves

However member states to the Ramsar convention have the right to add to the List further wetlands situated within their territory, to extend the boundaries of those wetlands already included by them in the List, or, because of their urgent national interests, to delete or restrict the boundaries of wetlands already included by them in the List. They are obliged to promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening. In this context, there is also a responsibility over each contracting party provided by the convention that expressed, Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat [45].

In order to clarify the scope of this provision, the Monteux Conference recommended in 1990 that Parties should establish national networks of nature reserves in their territory, covering both listed and non-listed wetlands. It further recommended that Parties should ensure that adequate measures for the establishment and effective protection of nature reserves are provided by their legal mechanisms [46].

The Kushiro Conference in 1993 went further in this direction by recommending that Contracting Parties take measures to ensure that the ecological character of Ramsar sites and wetland reserves is not placed at risk. It emphasized the need to develop zoning measures related to larger Ramsar sites and wetland reserves, involving strict protection in key

zones and various forms of wise use, as well as ecological corridors linking Ramsar sites. With regard to Ramsar sites and wetland reserves of small size or particular sensitivity, Recommendation REC. C.5.3 calls on Contracting Parties to establish strict protection measures [47].

#### C. Education, Training of Personnel Competent, Research and Transfer of Data

Under the Ramsar convention, The Contracting Parties should promote the training of personnel competent in the fields of wetland research, management and wardening [48].

In 1980, the Conference of the Parties requested Contracting Parties and competent international organizations to do what they could to enable developing countries to contribute to the Convention and its activities through support for appropriate training programs. Stressing the responsibility of development agencies toward wetlands, the Regina Conference of 1987 urged these agencies to train and educate personnel at project implementation level [49].

In 1990, the Conference of the Parties at Monteux, recalling Article 4.5 of the Convention, recommended that higher priority should be placed on the development and implementation of educational strategies, targeted both at formal school/university systems and at the non-formal education of youth and adults.

The contribution which nature reserves can make to developing public awareness of wetland values was strongly emphasized by the Monteux Conference. Recommendation REC. C.4.4 recognizes the special role played by reserves in promoting conservation education and public awareness of the importance of wetland conservation and the goals of the Convention. It therefore called on Parties to establish conservation education programs linked to the establishment of national networks of nature reserves.

Recommendation REC. C.4.5 recommends that Parties place a high priority on providing educational programs at key reserves which are accessible to a wide spectrum of the population, and encourages Parties to establish special reserves where education is the main objective.

Recommendation REC. C.5.8 of Kushiro "calls on Contracting Parties to develop facilities for promoting public awareness of wetland values at wetland reserves in their own territory" and recommends that special efforts be made to promote international coordination of measures to further public awareness of these values.

Transfer of environmental data and technology is one of the most significant principles of international environmental law which most of international treaties and documents referred to it.

The Ramsar Convention also obliged its contacting parties to encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.

Research and the collection of data have been the subject of several recommendations adopted by the meetings of the Conferences of the Parties. Wetland research and education were dealt with specifically by recommendations 8 to 11 of the Ramsar Conference in 1971. These covered the

development of wetland research, the promotion of hunting research, African wetlands and the Man and the Biosphere Program (MAB) established by UNESCO. In the "Framework for Implementing the Convention" established by the Second Conference of the Parties in 1984, data collection was included amongst the international measures aimed at promoting wetland conservation through international cooperation.

At the Regina Conference in 1987, Recommendation REC. C.3.2 emphasized the need to conduct further research on flyways in order to investigate the severe decline in numbers of waders (shorebirds). Recalling this recommendation, the Monteux Conference in 1990 urged Contracting Parties to cooperate in the management of migratory species.

#### *D. Realization of Wise Use Principle as a Support to Sustainable Development*

Wise use of wetlands is one the pillars and one of the primary obligations of the convention on wetlands. Under this obligation, the contracting parties should formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory [50].

The objective of wetlands protection is conservation. Nevertheless, according to Article 2 of the Ramsar Convention, wetlands conservation is envisaged as being parallel to "wise use". The term "wise use of wetlands" was interpreted by the First Conference of the Parties at Cagliari in 1980 as involving the maintenance of the ecological character of these areas which automatically means that they must not be destroyed, altered or polluted [51].

The Regina Conference in 1987 defined the wise use of wetlands as "their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem". "Sustainable utilization" is in turn defined as "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations" [52].

To work towards achieving the wise use of all wetlands by ensuring that all Contracting Parties develop, adopt and use the necessary and appropriate instruments and measures, with the participation of the local indigenous and non-indigenous population and making use of traditional knowledge, while at the same time ensuring that conservation and wise use of wetlands contribute to poverty eradication, mitigation of and adaptation to climate change, as well as prevention of disease and of natural disasters [53].

Through this concept of "wise use", which was pioneering when the Convention was drafted, the Convention continues to emphasize that human use on a sustainable basis is entirely compatible with Ramsar principles and wetland conservation in general. The Ramsar wise use concept applies to all wetlands and water resources in a Contracting Party's territory, not only to those sites designated as Wetlands of International Importance. Its application is crucial to ensuring that wetlands can continue fully to deliver their vital role in

supporting maintenance of biological diversity and human well-being.

As the ultimate goal of the Ramsar Convention is sustainable development in all over the world, and the realization of such purpose is not possible except through maintenance of wetlands ecological character and conservation and wise use of wetlands, so any unsustainable and harmful utilization of wetlands and their resources can be opposed to this end. Therefore, all states must do their best to prevent such exploitations causing loss and degradation of wetlands [54].

#### *E. Increase of Public Awareness toward Wetlands*

While wetlands provide a range of benefits to humankind, their values, both for conservation generally and economically, have not been communicated effectively to decision-makers, stakeholders, community leaders and the public at large [55].

Lack of awareness of functions that wetlands are providing for human's development, caused these ecosystems to be treated with negligence and ignorance. Unfortunately, it must be acknowledged that lack of understanding of valuable role of wetlands in human's life is not only confined to ordinary people, but also decision-makers and policy makers sometimes cause wetlands destruction and degradation due to such lack of knowledge. Hence, increase of awareness and knowledge toward values and functions of wetlands can be a suitable approach to declare importance of such ecosystems and introduce the benefits of wetlands to the public. In this line, education plays a key role and can bring intellectual progress of societies. To this end, following measures have to be taken:

- a) Holding workshops;
- b) Holding seminars relating to wetlands values and functions;
- c) Celebrating World Wetland's Day;
- d) Disseminating brochure, booklets and wetland manuals;
- e) Taking educational tours for students on different levels;
- f) Multimedia empowerment and highlighting its role in publication;
- g) Allocating appropriate share of Wetland Conservation Fund to the education and public awareness programs.

Education and public awareness programs are essential instruments for successful and sustainable wetland management, and are important tools in countering negative attitudes towards wetlands. It should be noted that initiatives which attempt to conserve wetlands, their biodiversity and their benefits for humankind without the participation of a wide range of people are unlikely to succeed. The Ramsar Convention has emphasized on education and public awareness and noted that, to implement effectively the convention, a concerted program of education and public awareness should be organized and implemented at local, national, regional and global levels so as to increase the knowledge and understanding of wetland values and benefits and so develop action towards the conservation and sustainable management of wetland resources [56].



#### *F. Precise and Complete Implementation of the Ramsar Strategic Plan*

The Ramsar Strategic Plan is intended to provide guidance, particularly to the Contracting Parties but also to the Standing Committee, the Secretariat, the Scientific and Technical Review Panel (STRP), the regional initiatives, and the International Organization Partners (IOPs), as well as the Convention's many other collaborators, on how they should focus their efforts for implementing the Convention on Wetlands over the next two triennia.

The Ramsar Strategic plan was a groundbreaking document, the first plan of its kind for a global environmental convention, and it was seen at the time as a model for emulation by the other major environmental instruments [57].

Up to now, the conference of contracting parties have approved 3 strategic plans for periods of 1999-2002, 2005-2008 and the last one for the period of 2009-2015. Precise and complete implementation of Ramsar strategic plan would help the convention be implemented nationally and internationally. The ultimate goal set by the Ramsar convention is Conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world [58].

The Ramsar Strategic Plan contributes to a common understanding at global, national, and sub-national levels of the Convention's purposes and principles; improved implementation of the Resolutions of the conference of the Contracting Parties through its focus on key elements set by the conference; progress at all levels in the conservation and wise use of wetlands and the related benefits for biodiversity and human well-being; international coordination of national and sub-national efforts to achieve the objectives of the Convention; and a raised profile among other sectors and bodies of the Convention and its objectives [59].

Five goals have been determined by the strategic plan including: promotion of wise use of wetlands, inclusion of wetlands in the Ramsar list and managing them with a view to supporting an international network of Wetlands of International Importance, International Cooperation, Institutional Capacity and Effectiveness, and Membership.

The Plan provides a renewed challenge for all those with responsibilities for, or commitments to, the delivery of the Convention – Contracting Parties; the Convention's bodies, including the Standing Committee, the Scientific and Technical Review Panel, the Ramsar Bureau (the Convention's secretariat), and the Mediterranean Wetlands Committee (Med Wet/Com); the International Organization Partners; and a range of other bodies and organizations with which the Convention works, including in particular the other multilateral environmental agreements (MEAs).

Full implementation of the Strategic Plan will need effective synergies with other MEAs and increased involvement of non-governmental, civil society, and community-based organizations, foundations and other conservation institutes, national science academies and research councils, research and educational institutions, and

national professional scientific and technical societies, as well as significantly increased private sector involvement.

Reports received by the convention's secretariat and conference on the parties show a relatively big success in implementation of the actions requested from all actors. Nevertheless, it should be noted that more focus on the wetlands on their conservation is needed by all.

#### *G. Poverty Eradication as a Constraint to Wetlands Conversion*

Poverty means deprivation of livelihood and well-being [60]. Since wetlands are considered as water and food resources of human being, they play a key role in promotion and improvement of human health and welfare. As destruction and degradation of wetlands is increasingly growing on a global scale, loss of wetland areas results in decline in human health and well-being especially people of less developed countries. On the other hand, growth of poverty rate will be followed by increasing human need for food security which consequently, causes conversion of wetlands to agricultural fields to fulfill their needs.

In addition to wetland loss and degradation impacting upon human well-being, poverty can often result in interventions that impact upon wetlands. These impacts can be both direct (over-exploitation of a natural resource that reduces livelihood options; absence of sanitation, which forces people to use wetlands for waste disposal) and indirect (destructive agricultural practices in the catchment leading to changes in wetland sedimentation) [61].

Accordingly, the Ramsar Convention called upon the contracting parties to take measure to reduce poverty internationally through the following:

- i. Continue to seek to integrate wetland wise use and management, including wetland restoration as appropriate, into all relevant national and regional policies, including in Poverty Reduction Strategies, National Climate Change Strategies (NAPAs), grant transferral programs, and water and sanitation plans and strategies, taking into account the need to base such strategies on an understanding of specific wetlands' current and projected future productivity, particularly where such wetland services may change over time;
- ii. Recognize in their planning and land management policies and strategies the role of wetlands in sanitation and human health, particularly in relation to water-borne and water-related diseases, as well as the increased risks to human health caused by degraded wetlands;
- iii. Collaborate with relevant institutions in developing suitable ecotourism activities in wetlands in general, and especially in designated Ramsar sites, in order to provide opportunities to reduce poverty, whilst also taking into consideration the possible negative impacts of such tourism on wetland integrity and on local cultures;
- iv. Consider wetland services as economic goods so that their use may be included in tax-based economic

- mechanisms such as user pays, and so that these contribute to national poverty eradication programs and investment in sustainable wetland management;
- v. Take measures to safeguard peoples' livelihoods derived from wetlands in areas where mining and other extractive industries are taking place, or are likely to take place, including in the decommissioning phases of the extractive activities;
  - vi. Increase of public awareness of the close relationship between wetlands destruction and poverty;
  - vii. Take measures to involve the poor in process of decision-making and management programs [62].

#### V.CONCLUSION

Wetlands are among the rarest and most threatened ecosystems on the planet. They are also of the most important ones as the habitat for unique and endangered species and are vital for human life. The loss and degradation of wetlands reduce their ability to provide goods and services for humankind and to support biodiversity. They are therefore associated with economic costs and considered as a threat to human life on earth.

While the threats of change or potential change in ecological character of wetlands described above affect most of the remaining wetlands in the world, this is just a "snapshot" of the current situation. Current threats can soon result in wetland loss, and in fact, these losses have occurred at a large scale in the past decades

In most industrialized countries, extensive losses have already occurred; as a consequence, public awareness of wetland values is increasing and legislative and policy measures to reduce wetland loss are being introduced. In certain parts of the developing world, in particular, those with lower population densities, the losses have been less extensive, but the potential for future loss and degradation remains great. Since in such countries, there is a high tendency for exploitation of natural resources in order to fulfil their needs and move toward economic development without paying attention to environmental consequences of such actions.

The rapid and continuing worldwide loss and degradation of wetlands have been the basis for the development of the Ramsar Convention and other wetland conservation initiatives.

The Ramsar Convention was established to address the issue of the loss and degradation of wetlands through concerted and coordinated action by the Contracting Parties, so that wetlands can contribute to the process of sustainable development. Therefore, conservation of wetlands through such actions can be a suitable way to this end. Almost the entire suite of obligations that are undertaken by the Contracting Parties relate to the following issues: the designation of sites to the Ramsar list, maintaining the ecological character of listed Ramsar sites; the establishment of reserves on wetlands, and making wise use of wetlands.

Undoubtedly, the Ramsar Convention has succeeded in raising awareness and the level of actions for conservation of wetlands; yet wetlands continue to be lost and degraded at a

rapid pace in many parts of the world due to selfish over-exploitation of wetlands and their natural resources. So it is a responsibility of individuals from states, international organizations, governors, politicians, scientists and academics-on national and international level, to stand up for the right of present and future generations and by cooperation and contribution through:

1. Adopting a strategic approach to site management including ecosystem-based approach;
2. Establishing programs to monitor change in ecological character; and
3. Publishing and disseminate the information from inventory and monitoring programs to raise awareness.

In general, it should be noted that the recommended solutions here may not be realized unless all states make their best efforts to preserve wetland ecosystems through mutual cooperation and practical measures. Rather than speaking nicely.

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