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**Technical Session I: Ramsar and Water Document 1**

# The role of wetlands in the water cycle

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## Introduction

1. When the text of the Ramsar Convention was adopted in February 1971, part of the rationale for protecting sites was the "fundamental ecological functions of wetlands as **regulators of water regimes**".

2. Later on, the Ramsar Convention Manual (1996) in defining wetlands would include the important statement that:

   "Wetlands are areas where **water** is the <u>primary factor</u> controlling the environment and the associated plant and animal life."

3. Despite this clear statement, the Convention Bureau and successive Conferences of Parties have paid relatively little attention to the **hydrologic features** that determined which ecosystems were being listed under the Convention.

4. Over the last decade, governments and international conservation agencies have become increasingly aware of the significance of the World's water resources to sustainable human development. Global water withdrawals by people for domestic, agricultural and industrial purposes have grown 35-fold in the past century; and a further predicted increase of 30-35 % by 2025 will result in severe water stress for up to 1,100 million people (IUCN, 1997).

5. Potable water supplies are already in serious deficit in many countries and water is becoming scarce for so much of our agricultural activity, inland fisheries production and aquiculture, wildlife protection and recreation, that we talk about a Global 'water crisis'.

6. In June 1997, a Special Session of the UN General Assembly instructed the Commission on Sustainable Development to make water a priority issue. In 1998, the Commission urged governments to address the role of ecosystems (including wetlands) in the provision of

freshwater resources and to improve their understanding of the availability and variability of water resources (Bergkamp et al, 1998).

7. It is significant, therefore, that the Ramsar Convention deals with most of the World's water-based ecosystems. The Bureau has already responded to global concerns through several initiatives, including participation in the 1998 International Conference on Water & Sustainable Development with a presentation on "The key role of wetlands in addressing the global water crisis" (Ramsar, 1998). This Technical Session continues the debate by reviewing ways in which the wise use of wetlands can provide solutions to water supply problems.

**The Water Cycle**

8. Examination of the water cycle, should remind us that the major part of the World's water is found in the atmosphere and the oceans, with a smaller but significant amount temporarily locked up in ice sheets. A comparatively minor amount is to be found on the land as 'surface water'. This water may be stored on land or be in process of running off into the sea, while a portion is entering or leaving the groundwater.

9. A diagram of the water cycle is simplistic, but is important because it shows:

    a. There is a very small component of the total water budget that is accessible to us.

    b. There is only a small component over which we can exert some degree of control, and

    c. this component is the **freshwater** on which human survival and much of our economic activity depends.

10. Furthermore, this freshwater component is found in rivers, lakes, marshes, swamps, floodplains, estuaries and deltas – all of which are by definition wetland types.

11. It becomes obvious, therefore, that wetland conservation has a vital role to play in alleviating the global 'water crisis', because wetlands are the places where that accessible water occurs.

12. Of the global total wetland area estimated at 5.7 million km$^2$, the greatest part (approximately 88%) is occupied by wetlands in **freshwater** environments. This is confirmed at existing Ramsar sites, where five major wetland system types are recognized, over 80% of which are freshwater-dominated (Table 1):

Table 1. **Wetland types at Ramsar Sites** (after Frazier, 1996)

| Type | % | |
|---|---|---|
| - PALUSTRINE (marshes, swamps, bogs) | 30.0 | Freshwater |
| - LACUSTRINE (lakes & associated types) | 23.8 | " " |
| - RIVERINE (wetlands along rivers) | 15.9 | " " |
| - ARTIFICIAL (man-made wetlands) | 10.5 | " " |

| | | |
|---|---|---|
| - MARINE (coastal areas) | 10.6 | Saline water |
| - ESTUARINE (deltas & tidal areas) | 9.2 | Brackish water |

13. This distribution is consistent in all major Ramsar Regions.

**Wetlands as Hydrologic Systems**

14. The Criteria that Parties to the Convention use for identifying Wetlands of International Importance include a brief, but frequently overlooked, mention of a wetland which ‘plays a substantial **hydrological role** in the natural functioning of a major river basin or coastal system (Criterion 1C). A great deal of attention has been focussed on other criteria, such as those for waterfowl (Criterion 3) and fish (Criterion 4), and consideration was given to the importance of aquatic vegetation at the 6th Conference of Parties. However, the role and importance of water per se has been largely neglected.

15. The working definition states that wetlands are ‘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 metres’. In accepting this definition, there is general agreement that **hydrologic character and function** determine not only which ecosystems are to be managed under the Ramsar Convention, but the ecological and economic values to be obtained from those Ramsar Sites. However, very few hydrologists are involved with the management of Ramsar Sites and hydrologic data is sparse.

**Wetlands as Hydrologic Regulators**

16. The value of water resources is directly dependent of their quantity and quality. Interactions between physical, biological and chemical components of wetlands enable them to perform certain functions; some of which are shown in Table 2.

17. These functions are important to the water budget within a catchment or river basin area. They will also vary across a country, because of changes in geographical conditions, but also affect those conditions; including providing climatic benefits at the macro and micro level. They can influence neighbouring countries and, to a certain extent, influence the global water cycle.

18. Despite these well known functional linkages, few national wetland programmes measure or monitor any of the hydrologic factors involved.

19. Conversely, there are many reports of the impacts of wetland disturbance or loss on the availability of good quality water (Ramsar, 198).

20. It would be instructive and valuable to rank national wetlands in terms of their roles in water storage, flow regulation and quality control. This would aid in selection of key sites for conservation protection. However, methodology is poorly developed for this and the Ramsar

Criteria for selection of sites based on hydrologic function needs better definition and clear supporting guidelines.

**Table 2. Important functions of wetlands related to the water cycle**

| WATER STORAGE | |
|---|---|
| Surface water holding | Groundwater recharge |
| Flow regulation | Groundwater discharge |
| Flood mitigation | |

| WATER QUALITY CONTROL |
|---|
| Water purification |
| Retention of nutrients |
| Retention of sediments |
| Retention of pollutants |

| LOCAL CLIMATE REGULATION |
|---|
| Stabilization of local climate |
| Regulation of rainfall & temperature |
| Reduction in evapotranspiration |

21. We should note that the economic value of wetlands as water resources can be readily appreciated by national planners. Protecting, and where necessary restoring, wetlands would be seen as a means of sustaining supplies of water for a range of human uses.

**The Ramsar Convention and Water Conservation**

22. Notwithstanding the above, it is important to keep the global water 'crisis' in perspective.

23. The work of the Ramsar Bureau must not be diverted by treating wetlands solely as sources of water that can be abstracted for domestic, agricultural or industrial use. Water is the fundamental component that supports production of all the wetland resource types which are used in subsistence and commercial economies. The socioeconomic value of wetland resources, other than water, is considerable.

24. For example, when giving values for forest products and forage resources, Dugan (1990) reported that one swamp forest species in Indonesia, the 'Ramin', had a resource value of approximately US$53m annually; that grazing on Zambia's Kafue Flats supported 250,000 cattle and 50,000 Lechwe antelopes; and the Brazilian Pantanal marshes supported over 5 million cattle.

25. He reported also that commercial small mammal trapping in Canadian wetlands had a market value in excess of US$16m annually. Other values reported for wetland wildlife include crocodilian skins and meat in Venezuela valued at US$9m (Thorbjarnarson, 1991), while

inland wetlands of Africa are reported to produce 1.5m tonnes of fish annually and support one million fishermen and about five million ancilliary fishery workers (Bernacsek, 1992). In Asia alone, more than two billion people depend on wetland crops and fish as their main staple and protein source (Ramsar, 1998).

26. It is obvious, thus, that f**or the millions who depend on wetland resources, water for people is the same as water for wetlands** (IUCN, 1997).

**Water-dependent ecological processes**

27. The maintenance of wetland production and wetland biodiversity depends on more than the presence of a quantity of water. Thus, it is not sufficient just to allocate part of the water budget to wetland areas. Emphasis must be placed on an understanding of the water cycle, particularly the regime – because it is the seasonal fluctuations that regulate many ecological and economic processes.

28. For example, the cycle of crop and livestock production and exploitation in Niger Delta wetlands is related to rainfall and river discharge characteristics. Similarly, inland fish production and fishery activity in the Amazon is related to flood regime characteristics. Non-fishing periods are vital to resource recovery.

29. In a similar way, primary production by aquatic vegetation; growth, flowering and fruiting cycles; and decomposition rates are regulated by seasonal fluctuations in water level and quality. Faunal reproductive cycles are frequently tied in intimately to the seasonal water regime, as in the case of the Swamp Snail, Pomacea, in a Trinidad swamp; to the extent that population growth is hampered by disturbance of natural water level changes. Feeding and migration behaviour in many waterfowl species is highly sensitive to flood cycles and inundation levels in freshwater wetlands.

30. Thus, allocation of water to wetlands in the national or river basin budget must include regulatory mechanisms that maintain seasonal changes in quantity and quality of flows (Lal, 1999). Guidelines for achieving ecologically sensitive water flows will need to be developed as our experience in this area is limited.

**Coastal wetlands**

31. Although this paper has concentrated so far on inland wetland systems, because of their importance to freshwater resources, it is important not to lose sight of the freshwater requirements of estuarine and coastal wetlands.

32. The productive functioning of mangrove and other coastal wetlands is dependent to a significant degree on fluvial inputs. These determine the salinity gradients, nutrient and particulate content and sedimentation pattern. As in freshwater wetlands, plant growth and phenology, and faunal reproductive cycles are influenced by land run-off and its seasonal characteristics; as is the suitability of coastal wetlands for fish nursery.

33. Reduction in downstream flows through inland water use could have serious implications for coastal processes, coastal ecosystem functioning and commercial marine fisheries production. Budgeting for water use should include allocating freshwater to sustain estuarine and coastal wetlands at the seaward margins of river basins.

## Conclusions

34. This brief presentation has reviewed the role of wetlands in the water cycle. But, more importantly, it has been a reminder that freshwater wetlands are a fundamental component in the accessible and manageable portion of the global hydrologic cycle.

35. Wetlands are the sites within river basins from which a major part of the water resources essential for sustainable human development will come. But they are also sites which, because of their hydrology, support a wide variety of resources which are significant in socioeconomic development nationally.

36. Our challenge is to develop a methodology for managing wetlands in such a way that water availability is maximized while water-dependent resource use and wetland biodiversity are sustained. This Technical Session should be aware of the many roles and values of wetlands in the water cycle and how these can be sustained for the benefit of all peoples.

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