Department of Environment

River Basin Challenges and Management in Iran

Deputy of Human Environmet

Soil and Water Pollution & Waste Bureau

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1- An Overview of Iran

Islamic Republic of Iran with a total land area of 1648000 km^2 is located between 25-40 north latitude and 44-63 east longitude, northern hemisphere in the Middle East region of southwestern Asia. Iran is located in MENA[1] region with an arid and semi arid climate. The central parts of the country, which are covered by deserts, are virtually uninhabited

Nearly two third of the total area of the country suffer somehow from the lack of enough precipitation. Uneven distribution of precipitation in time and space has made Iran a country of drought prone, particularly in the regions with average annual precipitation less than 100 mm. Historically once every 10-11 years, there has been a 2-3 year drought occurrence.

Country Population in 2003 was about 66 million inhabitants. Currently the average rate of population growth is about 1.4% and the estimated population in 2025 will exceed 95 million inhabitants.

1- 1) Iran Topography

About 52% of the country consists of mountains and deserts and the altitude of the country's plains varies from -26 to +2500 meters, but most of them have an altitude of about 1000-1400 meters above sea level. Iran is a mountainous country and mountains surround over 600 of the country's plains with different extension from some 10 to a maximum of about 5000 km^2.

Considering the extent and relief topography of Iran, the country's climate varies from one region to another. In general Iran has 8 major climate zones varying from extremely dry to very wet. The average annual precipitation of the country is about 252 mm which varies considerably from 50 mm in the eastern and central parts (25 mm/year has also been recorded) to more than 2000 mm in the northern areas.

1-2) Catchment Basins characteristics

Iran is divided into six major hydrological basins as follows:

1- The Caspian Sea basin in the north, which consists of 7 sub basins
2- The lake Orumieh basin in the northwest
3- The Persian Gulf and Oman sea basin consists of 9 sub basins and extends from northwest up to southeast of the country
4- The central plateau basin, which has 9 sub-basins, extends from the northwest to the southeast of the country and covers 5 dry deserts which two of them (Lut and Central Kavir) have nearly 390000 square km area both together
5- Hamoun basin in the east with 3 sub-basins
6- The Sarakhs basin in the northeast

[1] MENA: Middle East and North Africa

All these basins except the Persian Gulf and Oman sea are interior basins. The 30 sub-basins are also divided into 148 minor basins. More information about the country's six major basins is given in Table 1.

The internal renewable water resources of Iran are estimated to be 128.5 km^3/year. The surface runoff represents a total of 97.3 km^3/year and ground water recharges are estimated at about 49.3 km^3/year.The country also receives 6.7 km^3/year of surface water from external sources (mostly from Aras river in Republic of Azerbaijan and Heirmand river in Afghanistan); while the surface runoff to the sea (Caspian, and Persian Gulf and Oman sea) and neighboring countries is estimated at 55.9 km^3/year. At present the water resources per capita is 1380 km^3/year. With an area of 1.1% of the world lands and nearly 1% of the world population, Iran enjoys only 0.38% of the world's freshwater. At present Iran is using 74% of the total renewable freshwater while due to the international norms the upper limit of related usage should be 40%.

Almost 93% of accessible fresh water is used in agricultural activities which are quite far from its average in the world (69-70%). Domestic consumption of accessible freshwater is 6 % and industrial usage is 1 %.

Table 1: Catchments Basin information

Basin	**Total area**	**% of total area**	**Rainfall (mm/year)**
Central Plateau	832000	51	165
Persian Gulf & Sea of Oman	431000	26	366
Caspian Sea	178000	11	430
Lake Hamoun	106000	7	142
Lake Orumie	57000	3	320
Sarakhs	44000	2	90
Total	1648000	100	252

2- Water Resource challenges

Iran is among water stressed countries. The average annual precipitation is 252 mm (Less than one third of the world's related average; 860 mm) and the average water consumption is 1700 m^3/capita. Being among water scarcity countries in 2025, Iran will suffer a serious environmental degradation unless an adequate environmental management does apply.

Some of the factors affecting water resource quality are as follows:

- Non-uniform precipitation distribution
- Fast population growth
- Urbanization development
- Low efficiency irrigation systems
- Inadequate treatment of industrial discharges

The most polluter Sectors

Because of arid and semi arid climate, most of industrial and agricultural areas are located near the rivers. As a result heavy degradation of natural resources has occurred in the river basins. In 1997, an investigation was carried out to determine the pollution contribution of different industries regarding water resource (

Figure 1).

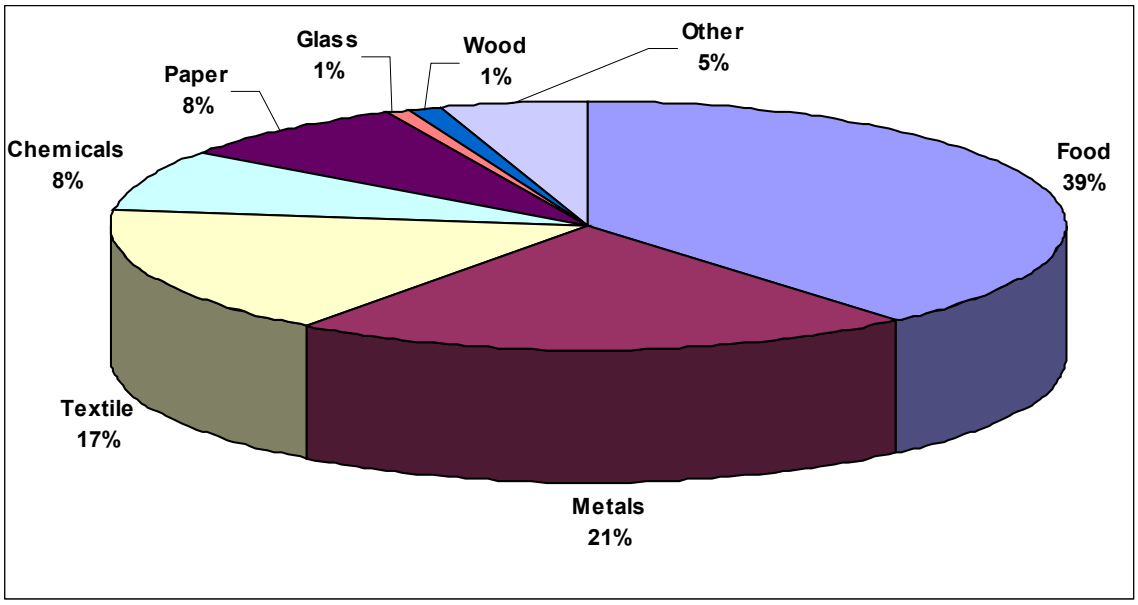

Figure 1: Contribution of Different industries in water resources pollution, 1997.

Surface and ground water contamination due to drainage discharges is much higher than related contamination caused by industrial untreated effluents. The main problems in agricultural sector are as follows:

- High water intake from the rivers and other water resources

- Unsuited farming practices
- Excessive usage of fertilizer and pesticides

Pesticides, Nutrients (N and P) and salts are the main pollutants caused by agricultural activities.

3- Water Resource Management

The latest activities of DOE regarding water resource management are as follows:

3-1) Water Resource Pollution Prevention Strategy

Presently the water resource information such as monitoring networks, quantity and quality data of available resources, characteristics of polluter/users and their water discharges is not easily available.

On the other hand there is no adequate information about available opportunities or potentials inside or outside the country to assist the government in managing water resources.

Therefore in 2003, Departement of Environment decided to develop the water resource pollution strategy. Figure shows the main factors need to be reviewed in this strategy.

3-2) Enactment: pollution reduction and prevention in the main rivers of the country

Upon this enactment which was approved by cabinet members on Dec 2003, Department of Environment in consistence with other ministries involved in water issues, was responsible to prepare a pollution prevention plan for the most vital rivers in the country.

A guideline was prepared by DOE to specify the characteristics of vital rivers in each province. Based on this guideline, DOE divisions in provinces will determine their important rivers and provide information about their quality and quantity situations.

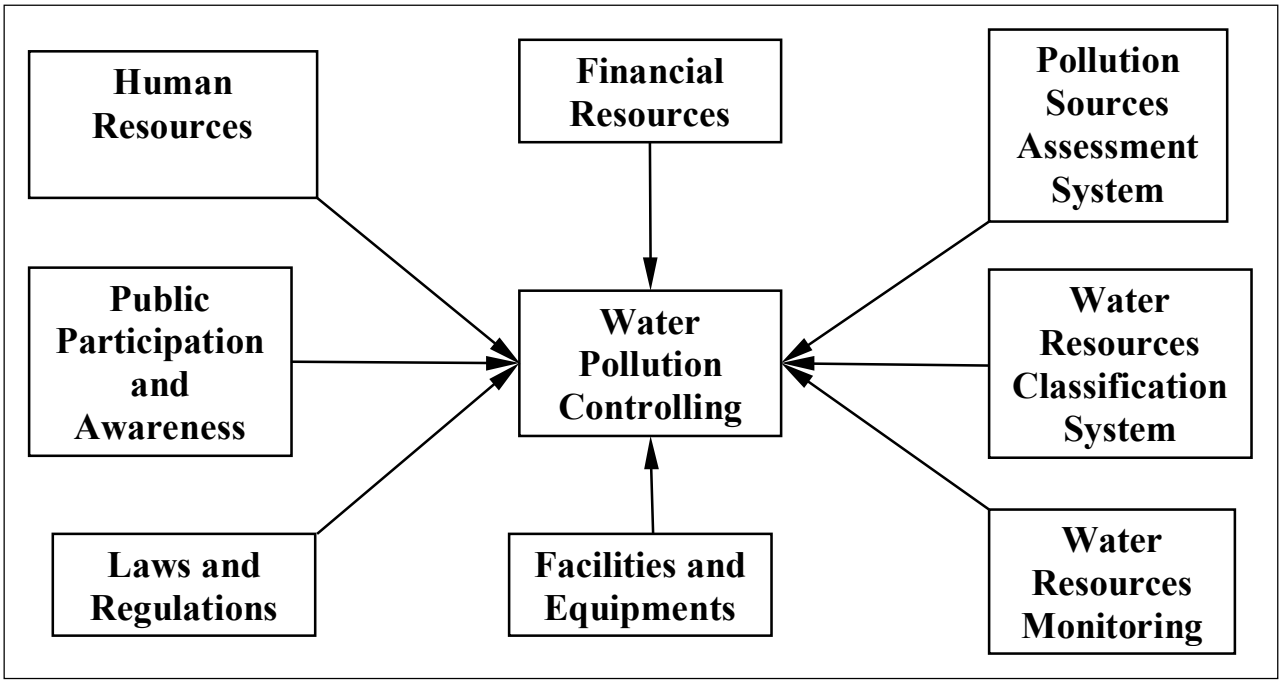

Figure 2: Key factors of water resource strategy

In the next step, using an evaluation system, the rivers will be ranked based on their characteristics. Finally pollution prevention plans will be proposed for the rivers with higher ranks.

Then local authorities will create a committee composed of representatives from related ministries such as Agriculture, industry and mining, and hydro. This committee will assess available budget and facilities for supporting proposed projects regarding water pollution reduction in the rivers prevention in the rivers.

3-3) Case study: Karoon River

Karoon River with the lenght of 890 Km and cachtment area of 66930 Km^2, is the longest river in the country which flows along many industrial and agricultural zones. Karoon water is used for water supply of Ahwaz city, the capital city of Khozestan province. However the discharge of untreated urban wastewater and industrial effluent, the drainage from agricultural lands, and the uncontrolled discharge of solid wastes directly into Karoon River and its tributaries have considerably degraded the water quality of the river. DOE division in Khozestan province proposed a 10-year plan for pollution control of Karoon river.

Integrated plan for pollution reduction in Karoon River was carried out in 3 steps:

1- In the first step the characteristics of surface water and groundwater quality and quantity were determined. In addition the different pollution sources such as urban, industrial and agricultural discharges were determined. Finally the pollution distribution pattern was simulated by using QUALE2E model.
2- In the second step the pollution contribution of each sector was determined by using the AHP[1] algorithm.
3- In the third step which was the main part of the plan, the required projects for pollution reduction and their cost estimation were determined by cooperation of different institutions, organizations, and sectors.

Figure 3 shows different sectors affecting water quality of Karoon River, their water consumption, their pollution contribution, and the proposed projects for each sector. It is predicted that by the end of plan performance, the pollution of Karoon River will be reduced by 50%.

3-4) Environmental Management Support Program

The objectives of this program which is supported by the World Bank are as follows:

- Building environmental capacity in Iran
- Creat a Better Environmental Management System

One of the project components in water section is the strengthening of institutional capacities for monitoring and enforcement of water quality standars. Training and public awareness on improving water quality is another component of the project. This program is expected to be completed by the year 2008.

[1] Analytical Hierarchy Process

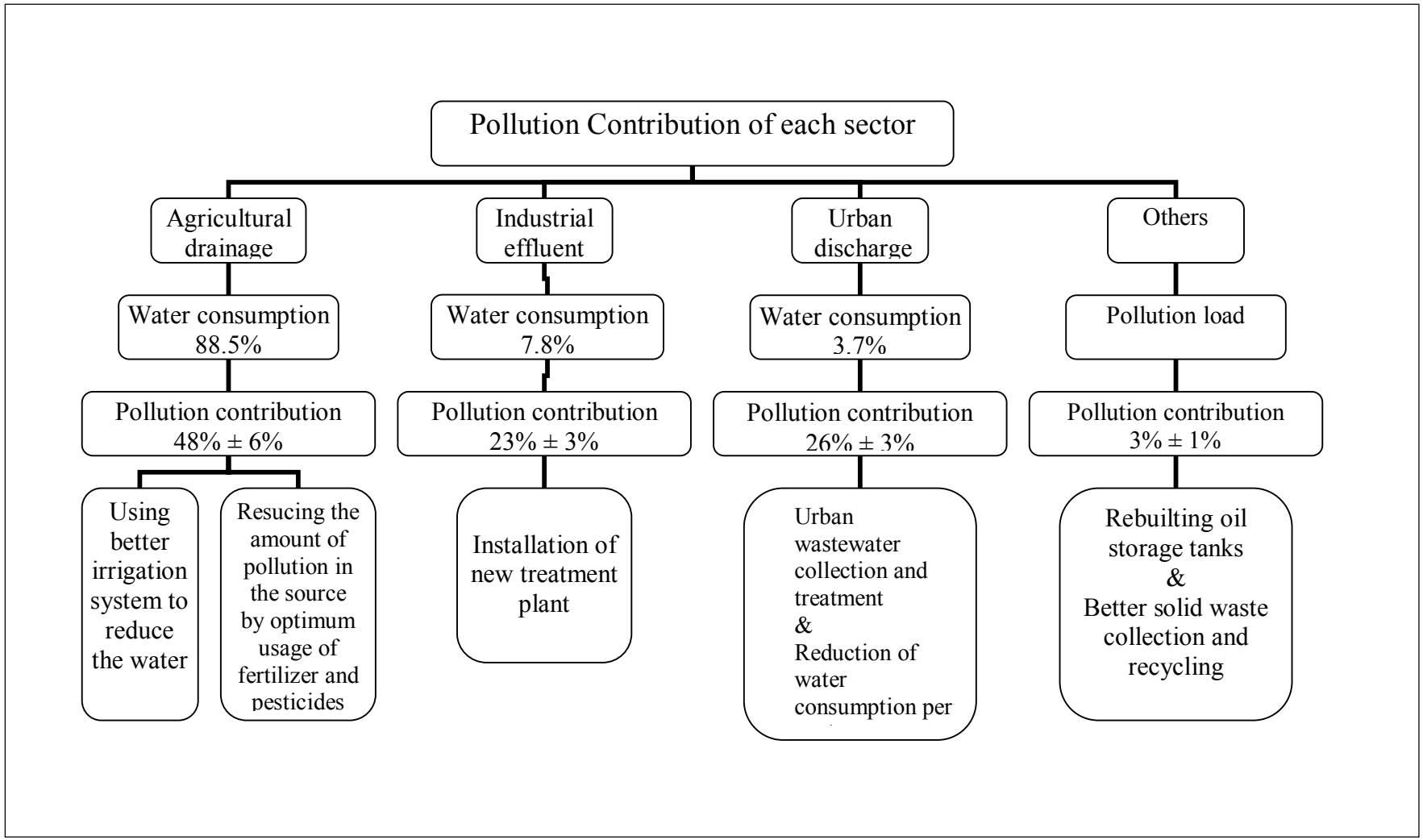
Pollution Contribution of each sector
Agricultural drainage
Industrial effluent
Urban discharge
Others
Water consumption 88.5%
Water consumption 7.8%
Water consumption 3.7%
Pollution load
Pollution contribution 48% ± 6%
Pollution contribution 23% ± 3%
Pollution contribution 26% ± 3%
Pollution contribution 3% ± 1%
Using better irrigation system to reduce the water
Resucing the amount of pollution in the source by optimum usage of fertilizer and pesticides
Installation of new treatment plant
Urban wastewater collection and treatment & Reduction of water consumption per
Rebuilting oil storage tanks & Better solid waste collection and recycling

Figure 3: different steps of pollution reduction plan

Refferences

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