

A review of the Environmental Impact of Large Dams in Iran

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Abstract—Water is very important as one of the main factors of human life for drinking as well as purposes related to human life and human nature. Increasing demand of water caused the emerging science of dam engineering and also construction large dams for agricultural purposes, drinking, industry and also flood control, power generation, recreational and tourist use and etc. Large dams can remarkably effect on the environment as a non-stabilizing factor in nature in various stages of construction, operation and end of life by stopping the flow of the river and stored water. However, if the environment cannot tolerate this instability, the results of the destruction of this structure will gradually rise and the objective of dam construction will be lost. The reality is that, the environmental effects are not considered fully and completely for the most dams have been constructed in Iran. In this paper, we will review the environmental impact of construction large dams on some rivers in the country and after that we will investigate some ways to deal with the effects and finally we will separately examine the use of several small dams instead of big dams as an important and effective option.

Keywords— Dam, Environment, Large Dams, Sivand Dam, Getvand Dam

I. Introduction

Water, today, is considered as one of the fundamental basis of development, economic prosperity, and social well-being and its shortage will cause many limitations. Water shortages directly and indirectly affect on sectors such as the control, storage and water supply, distribution types, transmission, factor productivity, planning, conservation management and In this regard, it is considered to be constructed large and small dams and small irrigation networks of rivers in different countries to take advantage of the water potential to meet the needs and objectives such as drinking, agriculture, industry, generating non-polluting hydropower energy, flood control and improved water quality and quantity. In additions, dams provide water during a year; they can be used for boating and recreational opportunities and tourist purposes.

Besides all the benefits mentioned regarding to dam construction and especially for large dams, construction of dams and power plants can be short-term and long-term negative consequences on environmental situation where the dam is constructed directly and indirectly. Some international organizations have done some studies in order to stop water supply projects in developing countries. For this reason, the

cultural, social and economic development is considered in the field of the management of water resources and environmental effects are the result of these studies is getting more important.

II. Environmental Impact of Large Dams

Below are some of the damaging environmental effects of dams according to the guidelines of the International Committee on Large Dams.

1. Physical and Chemical Effects: Creation barrier motion, sedimentation in reservoirs, severe erosion along the river, valve blockage, fog formation and raising the relative humidity, climate changes, ground shaking, increased surface evaporation, rising ground water, changing lands to salinity .

2. Biological Effects: reduce nutrient concentrations downstream of dams, Plankton growth, plant growth, extinction of some species, getting limited fish spawning areas, thermal stratification, production of new species, decline in fish populations, serious changes in water quality, increased opacity of water, Release of toxic substances (pesticides, toxic metals, etc.), increasing the concentration of pollutants in the intake water in periods of water shortage, deterioration of vegetation, Greenhouse gas emissions

3. Health Effects: source of many infectious diseases (such as malaria and blood diseases), creating a favourable environment for oviposition.

4. Economical and Social Effects: increasing urban population, immigration, creation of false jobs, destruction of roads and power transmission lines, lack of access to some of Points of the range, loss of agricultural lands, unemployment, destruction of historical and archaeological sites, destruction of some places with specific topographic

5. Impacts of Dams on Noise Pollution: increasing volume in the construction phase, disturbing the peace, leaving the nest wildlife, increased risk of loss of animals

6. Effect of Dams on Ecosystems of Aquatic Organisms: increasing of BOD in water (at first), formation of anaerobic degradation environment, formation of dark and funky environment, the exceeding of phytoplankton, growing of macro-flora in the water, increasing plant, increasing

evaporation and transpiration, making a barrier to stop fish from passing

As it has been mentioned construction large dams and power plants, has caused large changes in the environment and it will lead to the destruction of many environmental structures and migration of species and the loss of large areas of vegetation. One of the ways to reduce environmental impacts is to identify and systematically evaluate the outcomes of projects, programs and plans on the physical, chemical, social, economic, biological, cultural and environmental components. By conducting these kinds of studies, the method of conducting water resources development projects is getting in line with the objectives of sustainable development and ultimately it leads to optimum utilization of water resources of the country with the least adverse environmental impacts, in order to achieve the objectives of integrated water resources management. The main objective of the integrated management is to achieve sustainability in development.

Therefore, the assessment of the environmental impacts of dam construction projects means to achieve sustainable development, so that, in addition of finding location for different efficiencies based on ecological potential and economic- social needs, it prevents the conducting of the Dam Construction Project that have many great destructive effects on the environment. The major benefits of environmental impact assessment can be summarized as follows: Elimination of Dissent in the community, reducing conflicts between people and government organs, improving environmental quality, integrating conservation and development, determining the effects and possible results and providing correct and logical solutions for natural and human resources.

III. Environmental Problems in Some Dams of Iran :

Sivand Dam: Sivand is a name of great and good weather village which is located at eighty kilometres North of Shiraz, fifteen kilometres North of Persepolis and on the way Isfahan to Shiraz. There is a small river called Polvar which runs the Sivand valley that it floods join to Kor River and from there, it joins to Neiriz Lake (Tashak and Bakhtegan). Both lakes are brackish water and not directly consumed in agriculture (water vapor led to fertility fig and almond trees). Neiriz Lake is the winter habitat for birds which migrate from Siberia and Russia to Iran ((Such as the Flamingo, Crane, sea pigeon, plover, duck, goose, etc.), that they have a valuable role in maintaining the ecosystem and environment.

Other undesirable issues of dam construction are as follows: probability of Pasargadae going underwater and Antiquities sinking in the result of inundation in Sivand valley, demolition of these works in results of being loose and alluvial of region soil after rising groundwater in results of dam inundation, demolition of the works because of calcareous material and absorbing their moisture after changing the climate of region, going under water nomads historical passage and where they were lodged completely, probability of earthquakes in the area after inundation and destruction of antiquities, wiping up about 8000 of 500 year old trees and

hundreds of acres of high quality agricultural land behind the dam, going under water 21 villages,

Destroying thousands of acres of grassland and thus becoming unemployed many villagers and ranchers, lessen water input to the Karkheh River and lessen water of Khuzestan plain.

The other disaster will be a salt lake bed which salt will cover agricultural land like a carpet after blowing each wind and in addition to reducing potential growth; it will be harmful to the health of people living in the city and for both domestic and wild animals and it will increase skin, respiratory and optical diseases.

Getvand Dam: It is one of the largest dams in Iran which is located on Karun River in southwestern of Iran, 380 kilometres away from the outfall Karun River in Khuzestan Province and in 10 km in the northeast of the city Getvand in Khuzestan province. One of the major challenges created regarding to the mentioned dam is the discussion of domes and salt veins around the dam inundation area which is under water after dam inundation and may lead to too much salt in the water in the downstream area of the dam. Environmental experts believe that it is not considered that salt mine is very close to the Upper Getvand dam site in this research project. This mine is located at a distance of 5 km from the dam causes the huge salt mine completely goes under water during inundation and formation the lake behind the dam which its salt has been estimated hundreds of million tons and this matter leads Karoon River water salinity to the highest extent possible. On the other hand, the other minor problems related to the dam inundation are going under water 100 acres of high quality and fertile lands of Aghili plain and some of Antiquities (destruction of caves and saline sinkholes) and wiping up about hundreds of trees.

Other Dams: Social and cultural studies of 7 dams were done (before their running and constructing) in 2004 and 2005. The seven dams were: Zhavah Dam with the destruction of the 8 villages and affecting on 25 villages, Dariyan Dam with the destruction of the 6 villages and affecting on 3 villages, Azad Dam with the destruction of and affecting on 4 villages, Kanisib Dam with the destruction of the 8 villages, Zangabad Dam with the destruction of the 2 villages and affecting on 3 villages and Sardasht Dam with the destruction of and affecting on 11 villages and Shivashan Dam with the destruction of and affecting on 9 villages. The overall construction of the seven dams at their maximum levels destroyed 47 villages; it economically affects on the 33 villages with the loss of part of their farmlands and also has socially had effect on large areas of the villages and several cities.

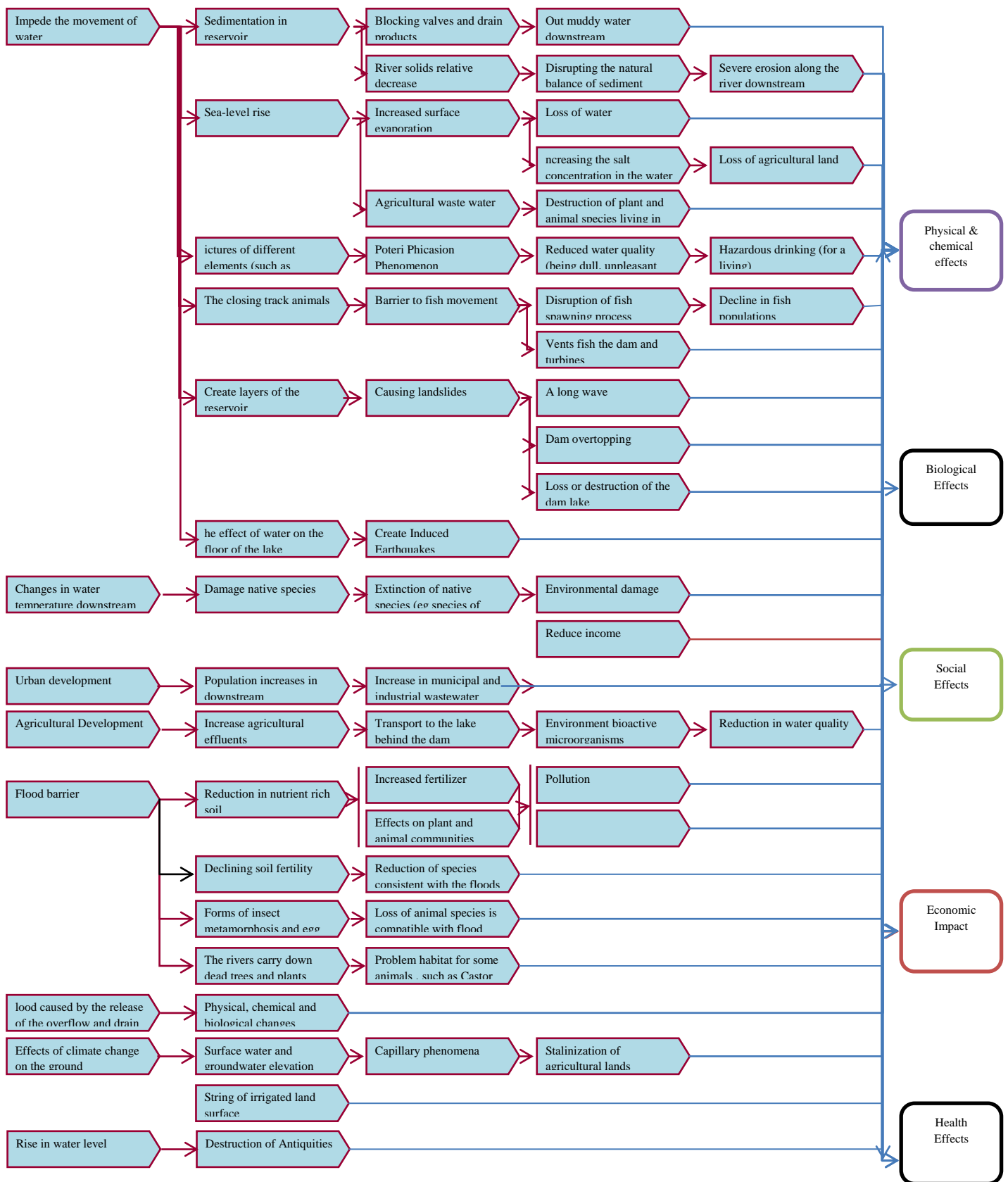


Fig 1: Cause and effect Diagram of damaging environmental effects of the large dam construction:

IV. Suggesting Proposed Solution

It is expected that by considering various factors for choosing a dam site and creating a gravity relationship between them, it will be possible to optimize the number of short dams in the catchment. Regarding the importance of the economic approach in a project and benefit to cost ratio, which is one of the most important parameters in the decision making of stakeholders, in condition that the dams' heights decrease and/or we substitute the large dams with small ones, the drop in benefit of implementation of projects for a big region would be less in comparison with the losses and costs we may face because of reservoir damage or natural resources losses.

Short dam construction, as a strategy, can be used in order to make water reservoirs in some points in the upstream rather than a large reservoir in downstream, it will be effective not only for creating opportunities for development in the upstream but also it will be effective in flood control. Small dams are constructed for water storage for agricultural purposes, control seasonal and possible flooding, aquaculture, tourism and making new job opportunities. One of the other purposes of this project is development and improvement of agricultural lands of downstream. Small dams don't take underwater a large area like big dams and also be constructed with less capital. Geographically, there is also distribution in the construction of small dams and arid have been used. Small dams and bunds also play an important role in reducing water loss. It is also anticipated construction dam short chain also usefully contributes to solve the problems of sediment. (Based on the definition, all dams are called large dams if the definition can be applied to them: 1. Their height is 15 m or more. 2. Height is 10 to 15 meters if it has one of the following conditions: a. Crown length is at least 500 meters. b. Reservoir capacity must be at least one million cubic meters. c. Flood discharges are at least 2,000 cubic feet per second. d. Dam foundation has complex, special and unusual issues. e. The dam has a unique and unusual design. 3. Dams between 5 to 10 meters, with more than 3 million cubic meters of storage capacity. The dam is not large based on ICOLD definition which is called small dams.

v. Conclusion :

One of the effects and interference of human in the ecosystem is constructing large dams on rivers which cause big changes in ecosystems and lengthening project. In addition, dam Projects and lateral structures often have inconsistent and adverse environmental effects and impacts. Adverse and inconsistent impacts of large dams in Iran can be found in precipitation socio – economic, string and soil salinity, lack of proper utilization management, water loss issues, displacement of people and dam lake water problems in order to provide drinking water due to the poor quality. It must be admitted that conceptual for all definitions provided of sustainable development are based on system integration, relationship system of economic, social and environmental factors and emphasis on responding to the needs of the current generation and next generations and accepting capacities and

limitations of environment, so, the only way to achieve sustainable development is enough attention to all ecosystems in downstream and upstream dams that have decided to build them.

Providing a method for deciding the issues in order to diagnosing the best option regarding to choose the Dam site (such as local topography, geology and soil characteristics, rainfall in the region, social issues, etc.), as well as establishing a importance relationship between quantitative and qualitative factors will be the topic of future research for the authors.

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VII. References

- [1] Coad, B. W. 1980. Environmental change and its impact on the freshwater fishes of Iran. *Biological conservation*, 19, 51-80.
- [2] Hooshmand, A., Veysi, S. & Moradzadeh, M. 2012. Investigation of Groundwater Salinity Resources Using GIS (Case study: Gotvand-Aghili plain). *Advances in Environmental Biology*, 6, 629-635.
- [3] Joolae, L., Behrouzi-Rad, B., Esmaili, H. R. & Tabiee, O. 2011. Sivand Dam as an Alternative Wetland for Wintering Waterbirds in Fars Province, Southern Iran. *Journal homepage: www. wesca. net*, 6.
- [4] Kiyani, M., Sadrekarimi, J. & Fakhri, B. 2008. Gypsum Dissolution Effects On The Performance Of A Large Dam (Technical Note). *International Journal of Engineering-Transactions B: Applications*, 21, 143.
- [5] Mcallister, D., Craig, J. F., Davidson, N., Delany, S. & Seddon, M. 2001. Biodiversity impacts of large dams. *Background paper*, 1.
- [6] MCCULLY, P. 1996. *Silenced rivers: the ecology and politics of large dams*, Zed Books.
- [7] Modir Rahmati, A. & Nazareian, A. 2010. Socio-Economic And Environmental Impact Of The Resident Area Inforce To Move Due To Dams Construction: Case Study Dam, S Gotvand Olia On The River Of Karoon. *Environmental Researches*.
- [8] Mojahedi, S. A. & Attari, J. A Comparative Study of Water Quality Indices for Karun River. *World Environmental and Water Resources Congress 2009@ sGreat Rivers*, 2009. ASCE, 1-9.
- [9] Pirestani, M. R., Shafaghati, M. & Dehghani, A. A. 2011. Assessment of the Environmental Destructive Effects of Building Dams. *World Academy of Science, Engineering and Technology*, 5.
- [10] Rosenberg, D., Bodaly, R. & Usher, P. 1995. Environmental and social impacts of large scale hydroelectric development: who is listening? *Global Environmental Change*, 5, 127-148.
- [11] Sadler, B., Verocai, I. & Vanclay, F. 2000. Environmental and Social Impact Assessment for large dams. Final version. *World Commission on Dams (WCD). WCD Thematic Review*, 2.
- [12] Shahidian, H., Hoseini, K. & Afraz, M. A. 2008. Environmental assessment of dams 14th Conference of Civil Engineering Students. *Semnan University*, Semnan.
- [13] Vanclay, F. 1999. Social impact assessment. *Handbook of environmental impact assessment*, 1, 301-326.
- [14] Verocai, I. 2000. Environmental and Social Impact Assessment for Large Dams-Thematic Review from the Point of View of Developing Countries. *Environmental and Social Impact Assessment for Large Dams. Thematic Review*, 2.
- [15] Zafarnejad, F. 2009. The contribution of dams to Iran's desertification. *International Journal of Environmental Studies*, 66, 327-341