

Environmental Consequences of Water Resources Instability in the Zayandeh-Rud Basin

Saeid Salehian

PhD in Geography and Rural Planning, Shahid Beheshti University, Tehran, Iran

Abdolreza Rahmani Fazli*

Associate professor of Human Geography, Shahid Beheshti University, Tehran, Iran

Received: 28/01/2017

Accepted: 08/02/2018

Extended abstract

Introduction

Water has been a major issue for sustainable development in the twenty-first century. It has been so essential that some experts believe that water issues will become a major crisis in the coming years and will result in regional wars and even a world war to gain dominance over water resources. Instability of water resources resulted from drought or water shortage has affected many countries throughout history, especially in the arid regions. This instability had caused many losses and resulted in many severe consequences in the economic, social and environmental sections. Zayandeh-Rud basin in central Iran is highly encountered with water problems. Zayandehrood River originates from Zardkuh Bakhtiary Mountains. It is the most important river of this region for the development of agriculture, a necessary supply for industry and an important supply for drinking water. It can also feed all of the economic activities. Climate instability in recent decades caused increasing pressure on the river by depleting too much water from that to compensate for the water shortage. This pressure led to instability of agricultural water resources and droughts in recent years. This research has tried to study the environmental consequences of water resources instability in the river basin by using analysis of land use changes on two different time periods to assess the changes in the number of wells and the exploitation of the groundwater reservoirs. We have also distributed questionnaires to analyze the effects of drought downstream the basin.

Materials and methods

In this research, we have applied library research data from book, papers, and basic written resources from National Forest and Land Organization and also Iran Water Resources Management Co. Field survey have also been employed using observation, interview with experts and distribution of the questionnaire. Accordingly, three different methods have been used in this research:

Detection of changes in land use: All of the basic data of this section are prepared by “Land Use National Plan” from the “National Forest and Range Organization”. In addition, the experts’ views were used in all of the phases of the research. These maps were created between 2002 and 2013 and their authenticity was confirmed officially. The study area in this research is

*E-mail: ar_rahmanifazli@sbu.ac.ir

Zayandeh-Rud River Basin. The zone of the study area was specified based on the defined goals of research and experts' views. Then, this zone was mapped in "Google Earth" and the study border area of the research was defined from the basic map of National Forest and Land Organization of Iran". The Study area of the research was divided into three sections. The Land use basic map in "National Forest and Land Organization" had twenty-two items that were merged into nine land-uses. Change detection analysis was conducted by ArcGIS software using Union program and are shown by the maps, tables and descriptive information.

Changes in groundwater: The basic data of this section were gathered from "Iran Water Resources Management Co. and Esfahan Regional Water Authority. Changes in the number of wells, Qanats and springs and also the depletion level of the groundwater and also changes in reservoirs of groundwater aquifers in the Zayandeh-Rud basin is processed in two statistical years 2006 and 2011.

Consequences of water resources instability on environmental indicators: The statistical population of this research is the villages of a region downstream Zayandeh-Rud basin. The sample was selected based on Cochran formula and in the form of Stratified Probability sampling. The study area downstream the river, from Isfahan city to Gavkhoni marsh, is divided into two parts, Western and Eastern, according to geographic, socio-cultural and political indicators. Out of 33153 rural households, 380 people completed the questionnaires and by removing the incorrect questionnaires our cases became 323 people during the study. The estimated sample of rural settlements is 25 villages. Using the questionnaires in the study area, we can analyze and compare these indices before and after the drought. In the following, average values of research triple indices are analyzed in SPSS software. Then, the results are analyzed by one sample T-test and compared in significant differences of impact of drought in various rural districts with ANOVA test.

Results and discussion

The comparison of land use maps in 2002 and 2013 of the study basin indicates that dry farming, agriculture, forest, residential settlements and marshland uses have been increased while water surface, canebrake, and deserts as well as rangelands have been decreased during this period. Examination of groundwater indicates that after water sources instability has increased level the exploitation of groundwater aquifers is intensified. It increased in the middle and downstream sections of the basin where the river flow is not permanent. The water shortages by drought are intensified by drilling and exploitation of water from wells. In this context, in 2006-2011 up to 9277 numbers of new wells are drilled. During these five years, average depth of wells is added 4.8 meters and groundwater level has dropped about 5 meters. Analysis of qanat statistics indicate that due to droughts, the qanats water resource is drained almost halved and the number of springs has also declined. To assess the environmental effects of Water Resources instability, we used 13 indices. The highest impact of drought on environmental indicators is in drying qanats, wells and springs, reducing the amount of surface water and increasing the depth of water wells, decline in groundwater levels. The least effect is seen on the indicators as follows: increase in fire in the natural environment of the region and reduction of medicinal plants. The average values of environmental impacts of droughts are 4.24. The results show that there is no significant difference between rural districts in study area

in terms of the impact of drought; this means that the rural districts in study area are relatively similar to the impact of the negative consequences of drought in various aspects.

Conclusion

This process of development is dangerous for human and environmental sustainability in Zayandeh-Rud river basin. The development of the human residence and overuse of the natural resources give rise to the destruction of nature and the natural ecosystem. The disruptions in the ecosystem in such a short time have misbalanced the sustainability of water resources and have negatively affected plant, animal and human ecology. The continued development of residences and the alteration of the land use will heavily damage the sustainability of the environment in Zayande Rood Basin. Increase in exploitation of the aquifers can escalate the cycle of water resources instability, drought and ecological unsustainability.

Keywords: *environmental consequences, land use changes, Zayandeh-Rud Basin, groundwater, instability of water resources.*

Archive of SID