




Sinkholes caused by agricultural excess water using and administrative traces of the process

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Abstract

The climate crisis has made the water footprint more important. The imbalances in the current water cycle of the planet are obvious. In addition to the settlement pressure caused by rapid urbanization, increasing population and migration to cities, environmental pollution and distorted changes created by excessive water use also cause ecological damage. The study reveals the striking dimensions of the change in water consumption in recent years with field examples from the Central Anatolia Region. The collapse of the ceilings of the karstic caves is the cause of the sinkhole formations. This is because the overuse of agricultural water has reduced the underground water reserves. We are shown by the administrative records of the research that it would be appropriate to immediately correct the causes and critically reevaluate the apparent results. Otherwise, the process's negative impact on the environment is increasing the natural and social losses.

1. Introduction

The climate crisis has made the water footprint more important. The imbalances in the current water cycle of the planet are obvious. In addition to the settlement pressure caused by rapid urbanization, increasing population and migration to cities, environmental pollution and distorted changes created by excessive water use also cause ecological damage.

2. Material and Method

The study investigates water-related applications in agricultural settings. It also determines the adverse effects of agricultural practices that are inappropriate for the use of field water resources. Additionally, it provides a brief assessment of the advancements in innovative strategies for regulating water use.

3. Results

The most important reason for the environmental problems increasing with the effect of urbanization is the planning and design approaches where the human-nature relationship and interaction are not analyzed and evaluated, and landscape ecology is not considered [1]. In establishing the nature-human relationship, natural

landscape features should be evaluated as a holistic rather than fragmented [2]. A study in which the sustainability indicators of cities [3] are given in tabular form clearly show the problems in artificial areas.

Like urban areas, settlements problems persist in rural areas. In point of fact, field observations are occasionally made, which may reveal even more brutal uses of agricultural water. However, the non-destructive aspects of rural life—its development that is intertwined with nature and places an emphasis on sustainability—should serve as a model for urban life, and its processes should be preserved in this way.

Ecological restoration: It is the process of helping an ecosystem that has lost its property, been damaged, or destroyed, to recover. Often, an ecosystem in need of restoration has been degraded, damaged, transformed or destroyed as a direct or indirect result of human activities [4].

Previously, studies were conducted on dams and ponds and irrigation canals with a focus on planning on the water resources that come to life in Sivas and the visible effects of climate change [5]. The Sivas study could be done in Niğde using similar methods; however, for the time being, the study here focuses on field trips, geography, and field observations.

3.1. Agricultural overuse of water

Because irrigation uses three quarters of the country's water, the most cutting-edge and cost-effective sprinkler and drip systems can be preferred when building irrigation facilities. The fact that agriculture uses more than 75% of the water reserves and that its production levels are rising provides an explanation for the threat that intensive and unsustainable practices pose to the conservation of the resource and its quality (Figure 1). Another significant threat is the illegal collection of water through illegal wells. Agriculture requires a variety of water management strategies because of the rising population's demand for more food production [6].

Since the agricultural economy has entered a product- and profit-oriented course in recent years, particularly prior to the pandemic, by adapting to global conditions, water reserves have begun to rapidly decrease as the emphasis is placed on products that consume excessive amounts of water. When the climate crisis was added to the negative factors affecting the water cycle, sinkhole formations accelerated, particularly in agricultural areas, due to the geological structure.



Figure 1. Agricultural overuse of water [6]

3.2. Other agricultural problems related water

Agriculture, like other land uses, can sometimes have a negative effect on the water's quality. Common Signs That Your Water Is Bad: Pollutants, over-application of nitrogen fertilizer, soil erosion, manure runoff, and excess phosphorus. These sources have the potential to release nitrate into streams, rivers, and lakes as well as contaminate groundwater [6].

3.3. Water Management

Changing management strategies are the most important way to increase agricultural water use and maintain optimal production and yield. It is essential to implement management strategies that improve water use

efficiency without lowering yield. Two examples are improved irrigation scheduling and crop-specific irrigation management [6].

3.4. Sinkholes

Sinkhole formations are collapses in karstic cave ceilings due to the reduction of underground water reserves due to excessive use of agricultural water. Agricultural excessive water use is the main reason for the decrease in groundwater reserves [7].

The study reveals the striking dimensions of the change experienced in recent years with some field examples from the Central Anatolia Region and the East of Mediterranean. Especially the Konya-Karapınar and Niğde sinkhole formations are remarkable. A sinkhole in Niğde is given in (Figure 2).



Figure 2. A Sinkhole in Niğde-İtulumaz mountain around [8]

As the dam ponds in Niğde were increased in number, the underground water level decreased considerably (Figure 3).



Figure 3. The dam ponds in Niğde

Despite this, there have been more wells and boreholes dug, and the vineyards and gardens have dried up. The city's strategy of expanding westward has increased construction pressure to such an extent that it poses a threat to Fertek. As depicted in (Figure 4), Niğde Akkaya Dam Pond has also entered the drying drive. Recent researches also looked at changes in the amount of water that is available at Niğde-Akkaya Dam Pond [9].

The production of white head cabbage in Nide province ranks second. The Bor District of Niğde is where Kaynarca cabbage is grown. Around Kaynarca Village, cabbage farming is predominant. However, the collapses in the village settlement caused by the Municipality's drilling wells necessitated the evacuation of Kaynarca village due to its excessive water use.



Figure 4. Akkaya Dam Pond

Another obvious planning calculation error is the decrease in water in the Mersin-Silifke Göksu Delta. The water from the Göksu spring has recently split and begun to be artificially transferred toward Karaman from a location close to the spring. The number of dams in Karaman is constantly increasing. Wild watering may always be detected by these indicators. In Karaman Province, DSI has invested 6 billion TL over the past 18 years to construct two drinking water facilities, eight dams, eight ponds, one artificial feeding facility, eleven irrigation facilities, and seven flood protection facilities (Figure 5) [10]. It was right to construct a closed irrigation system in Ayrancı. A closed irrigation system should always be used in these basins.



Figure 5. The dam ponds in Karaman

4. Discussion

We are shown by the administrative records of the research that it would be appropriate to immediately correct the causes and critically reevaluate the apparent results. The study's findings and recommendations are summarized for this purpose. Otherwise, the process's negative impact on the environment is increasing the natural and social losses.

5. Conclusion

28.07.2010 UN General Assembly recognized water and sanitation as human rights. Turkey opened the chapter on environment in 2009. By publishing the Basin Management Committees Communiqué in 2013, it laid the

groundwork for the committees. However, the fact that it is a bureaucratic and centralized formation has been the subject of criticism, and energy production and flood planning in the basins has remained a singular view and has been criticized [10]. Basins need to be protected in a planned and sustainable way. Access to water is a human right, and a right to life for all living things.

After 1980, national dynamics adapted to global market conditions, as can be seen from the field examples above, have been turned into products and profit-oriented services, in short, they have been commodified. It has been observed that the farmers in the agricultural basins are given weight to the products that consume excessive water in the plantings that are left unsupervised.

The agricultural economy has remained under the control of neoliberal policies and international monopolies, especially since the 1980s. In this way, national dynamics adapted to global market conditions have become product and profit oriented. It has been observed that due to the uncontrolled cultivation of the farmers in the agricultural basins, the products that consume excessive water have been given weight. Since illegal wells and underground water reserves decreased rapidly in this way, sinkhole formations increased. Uncontrolled drilling and illegal wells pose a serious threat to groundwater reserves.

Negative factors affecting the water cycle are not limited to these. The importance of agricultural areas has been forgotten, as energy production has taken precedence over agricultural production. While the underground waters are extremely valuable, the ecological balances based on the water cycle have been upset with the dams built on the karstic of ground (For example, The dam ponds in Niğde).

In the case of Sivas, the city's founding area is wider than Niğde and further away from the Kızılırmak shore. Because Niğde remained in a constrained space, obstructed the flow of water with dams, and kept it there. Under the dams, the city grew toward the plain. Despite the fact that the Hançerli Dam reveals that water escapes despite all insulation, even from the ground, where it is impossible to control the flow. Drillings cannot be used to locate water in this karstic landform. It has tried to spend too much money on a treasure hunt that can't be called water management. The treasure hunt involves inefficient, random, and overly complicated drillings that will make it easy for water to escape to lower elevations. In a city with scientists, all of this can be done for years without any discussion, which is quite thought-provoking.

In addition, air, water, and soil pollution created by the deterioration of environmental conditions caused by industrial activities also caused a decrease in the quality of life (For example, leaving the Niğde Akkaya Dam Pond to dry).

The increasing number of sinkhole formations in and around Konya-Karapınar over the years is the main indicator of how uncontrolled the administrative dimensions of this process are. Uncontrolled drilling and illegal wells pose a threat to groundwater reserves.

In this sense, the formation of the sinkhole on the skirts of İtulumaz Mountain in Niğde is also interesting. It is quite thought-provoking that large apple orchards are also allowed near the sinkhole. It may be possible to use these pasture areas, where animals need to be grazed, to be privately owned, resulting in excessive irrigation due to excessive apple production. In addition, the reason for the collapse of Kaynarca village is the wells opened by the Municipality and the water drawn in the area between Sazlıca and İtulumaz.

The decrease in the water of Göksu, which spills from Silifke into the sea by making a delta, has reached a level that will destroy the delta in recent years. This situation is also a result of the transfer of the resources that feed Göksu to other places.

Suggestions

Since the ecology of Niğde is not well understood, most of the dam works may have been in vain, and serious risks may arise in terms of disaster for the settlements at the lower elevations of the dams. The unnecessarily overgrown city is in deep intoxication of rent. Imaginary prospects for the city's water supply, on the other hand, may pose quite different risks. With a small climatic trigger, the risks will always increase over time. The cost of not planning according to the land structure and excessive concentration is quite large.

In addition, not only Karapınar, but leaky wells should also not be ignored. Uncontrolled irrigation should not be allowed over the existing wells to use excessive groundwater.

The cultivation of crops that cause excessive agricultural water use should be prohibited in unsuitable land conditions and all production processes should be strictly controlled. Instead of these, the planting of alternative crops should be immediately recommended. A support model should be introduced for the most suitable products per basin.

Natural water reserves should not be put at risk by excessive cultivation of unsuitable sites and crops. Existing excessive use must be limited. Agricultural land use permits should not be also granted in inappropriate places. Pastures should also be protected (For example, on the skirts of İtulumaz Mountain in Niğde).

Settlements at risk should be moved to suitable reserve areas by planning (For example, Village settlements with sinkholes in Karapınar).

There should be more EIA procedures, EIA procedures ought to be applied to municipal and institutional drilling as well.

Within the framework of the situation analysis within the scope of Strategic Plans, it should be emphasized that environmental awareness and sensitivity should be increased in rural and urban settlements and legal regulations regarding environmental measures should be made.

Scientific research activities and projects should be encouraged to design ecological settlements. Eco-technological systems that benefit from solar and wind energy should be used for electrical power to be used for lighting and irrigation purposes.

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Conflicts of interest

The authors declare no conflicts of interest.

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