

ENVIRONMENTAL IMPACT OF IRRIGATION IN INDIAN AGRICULTURE

Summary

Irrigation is the largest water user worldwide. In the process of storing, diverting, transporting, irrigating, consuming, and draining water, the natural hydrology of a watershed is changed significantly. These changes impact the natural environment. River flows are altered and reduced and sometimes depleted; groundwater levels may be lowered by pumping or raised by over irrigation; wetlands may be created or dried up. Drainage waters from agricultural lands are usually of poorer quality than the applied water and may carry both agricultural chemicals and naturally occurring substances into groundwater, rivers, and lakes. Although many of the environmental impacts of irrigation are negative, irrigation plays a critical role in providing food and fiber for our growing population. Providing the same food without irrigation would likely have even greater environmental impacts. We must educate the public of the benefits of irrigated agriculture and work to minimize the negative environmental impacts.

Keywords: Environment; Irrigation; Soil quality; Water logging; Water quantity

Introduction

Irrigation plays a critical role in providing food and fiber for our growing population. Most of the world's fruits and vegetables are grown with irrigation. Providing the same food without irrigation would likely have even greater environmental impacts. We must educate the public of the benefits of irrigated agriculture and work to minimize the negative environmental impacts. Irrigated agriculture is critical to the global food supply. Although irrigated agriculture has serious environmental impacts, the alternatives would have much greater negative impacts. Although there are undoubtedly irrigated areas that create excessive negative environmental impacts and should be abandoned,

elimination or significant reductions in irrigated agriculture is not an option. We, as scientists and teachers, must help farmers minimize negative impacts and help society understand the tradeoffs so we can make rational decisions.

Environmental impacts of irrigation are the changes in quantity and quality of soil and water as a result of irrigation and the ensuing effects on natural and social conditions at the tail-end and downstream of the irrigation scheme. The impacts stem from the changed hydrological conditions owing to the installation and operation of the scheme. An irrigation scheme often draws water from the river and distributes it over the irrigated area. The impacts of irrigated agriculture may be somewhat different than rainfed agriculture. In the process of collecting, storing, diverting, transporting, spreading, consuming, and draining water; and enabling intensive agricultural activities on otherwise marginal or non-productive lands; water, land, plant, animal, and human resources are changed. Some of these changes are positive; others are negative. It is important that we are aware of the changes and their impacts, so that we can minimize the negative impacts and evaluate the benefits and costs of irrigated agriculture. Irrigation plays a critical role in providing food and fiber for our growing population. Most of the world's fruits and vegetables are grown with irrigation. Providing the same food without irrigation would likely have even greater environmental impacts. We must educate the public of the benefits of irrigated agriculture and work to minimize the negative environmental impacts. Irrigated agriculture is critical to the global food supply.



What Is Irrigation?

Irrigation can also be done extracting groundwater by (tube) wells. As a hydrological result it is found that the level of the water descends. The effects may be water mining, land/soil subsidence, and, along the coast, saltwater intrusion.

1. Environmental Impact Of Irrigation

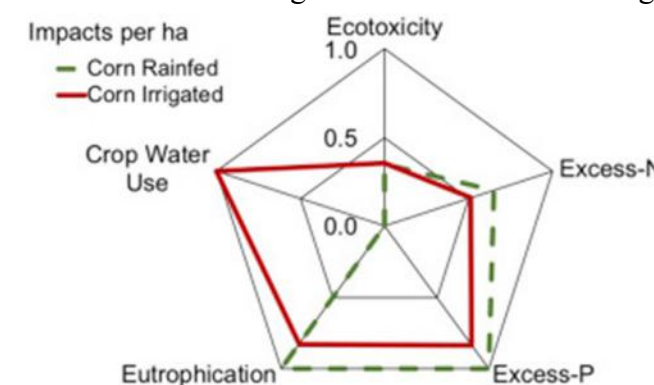
1.1. Direct Impact

An irrigation scheme draws water from groundwater, rivers, lakes or overland flow, and distributes it over an area. Hydrological, or direct, effects of doing this include reduction in downstream river flow, increased evaporation in the irrigated area, increased level in the water table as groundwater recharge in the area is increased and flow increased in the irrigated area. Likewise, irrigation has immediate effects on the provision of moisture to the atmosphere, inducing atmospheric instabilities and increasing downwind rainfall (Hellmich and Simon, 2015), or in other cases modifies the atmospheric circulation, delivering rain to different downwind areas (Pokrovskii and Vladimir 2011). Because irrigation systems deal with redirecting water from rivers, lakes, and underground sources, they have a direct impact on the surrounding environment. Some of these impacts include: increased groundwater level in irrigated

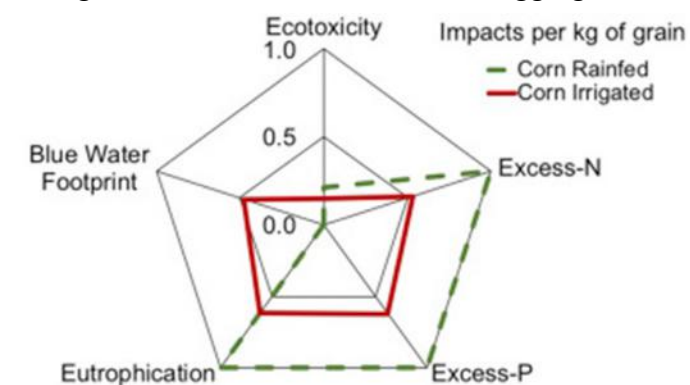
areas, decreased water flow downstream of sourced rivers and streams, and increased evaporation in irrigated areas. Increased evaporation in irrigated areas can cause instability in the atmosphere, as well as increase levels of rainfall downwind of the irrigation. These changes to the climate are a direct result of changes to natural moisture levels in the surrounding atmosphere. Increases or decreases in irrigation are a key area of concern in precipitation shed studies that examine how significant modifications to the delivery of evaporation to the atmosphere can alter downwind rainfall.

1.2. Indirect Impact

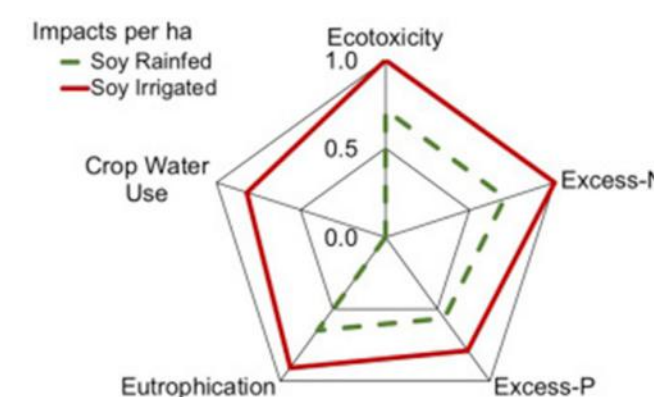
Irrigation systems also have an indirect impact on the surrounding environment. These indirect effects may not be as immediately noticeable as the direct issues. Additionally, these effects take a longer time to develop and produce longer-lasting changes. The indirect effects of waterlogging and soil



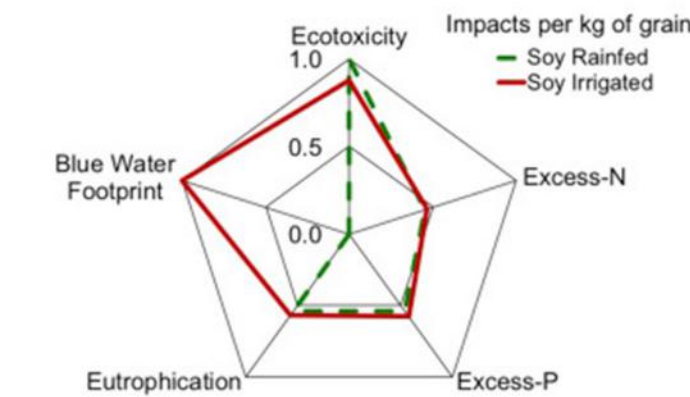
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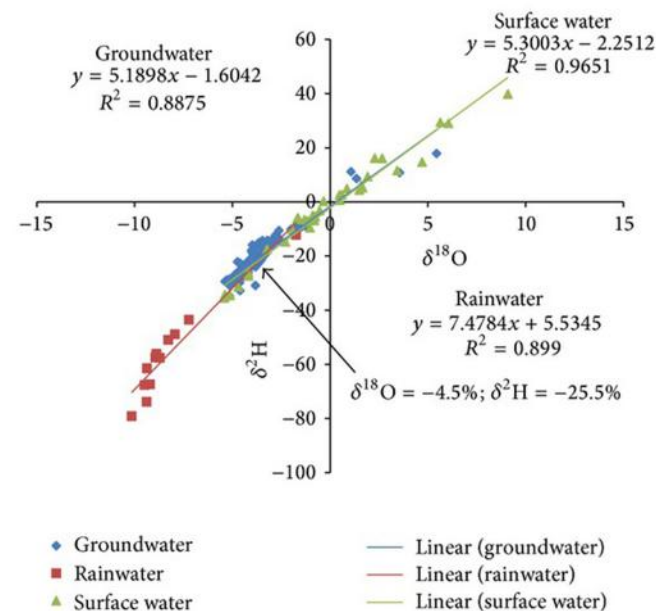
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salination occur directly on the land being irrigated. The ecological and socioeconomic consequences take longer to happen but can be more far-reaching. Some irrigation schemes use water wells for irrigation. As a result, the overall water level decreases. This may cause water mining, land/soil subsidence, and, along the coast, saltwater intrusion. Irrigated land area worldwide occupies about 16% of the total agricultural area and the crop yield of irrigated land is roughly 40% of the total.

2. Negative and Positive Impacts Of Irrigation

2.1 Water Quantity Impacts

Although a portion of the water diverted from rivers for irrigation returns as drainage flows, irrigation diversions always reduce the overall flow in the river system. Reduced flows usually result in reduced aquatic and wildlife habitat. While many of the impacts of irrigation reservoirs and diversions are negative, there are also positive impacts. Reservoirs create habitat for fish and wildlife and recreation opportunities for humans. Hydropower is often generated at irrigation dams. Flood control reduces risks and flood damages for those who live downstream.



2.2 Water Quality Impacts

Drainage water from irrigated fields is nearly always lower quality than the water diverted from the river or pumped from the groundwater. As water runs across and percolates through field soils, it picks up sediments, nutrients, pesticides, and naturally occurring substances such as salts. Drainage water from

rainfed agriculture also carries sediments, nutrients and agricultural chemicals. However, water quality problems may be greater in arid irrigated areas because there is less water to dilute and transport the pollutants. Also, because irrigation application is controlled, there are greater opportunities to control drainage from irrigation.

2.3 Soil Quality Impacts

Soil quality, or the ability of soil to provide sustained high productivity, can be diminished by irrigation. Salt accumulation is usually caused by inadequate drainage, and is often associated with waterlogging. Salt is always imported at some concentration with irrigation water.

Prevention of salinization requires good management of irrigation water, including adequate leaching of salts from the soil, drainage for the removal of salts, and ultimately, transport and disposal of the salts to the ocean or other sinks. When the natural vegetative cover is removed in preparation for cropping, drought and wind can combine to create serious wind erosion damage. Pressurized irrigation systems have allowed cultivation of steep lands that can erode badly during rain storms.

2.4 Impacts on the Quality of Human Life

The purpose of irrigation is to provide food and fiber for a growing global human population. Approximately one-third of the global harvest is from irrigated lands. About 70% of the irrigated land is in developing countries and many populous nations are highly dependent on irrigated agricultural production. Most of the world's fruits and vegetables are grown with irrigation. Agricultural production would fluctuate much more with weather from year to year, requiring greater storage of reserves. The quantity, quality, and dependability of our food supply would decline.



¹Arvind Kumar, ²Vikas Sharma and ³Dr. Ashish Dwivedi

¹Barkatullah University, Bhopal (M.P.)- India Director and Chief Executive, Centre for strategies and leadership

²ICAR-CPRIC, Modipuram Meerut (UP)-India

³Ph.D Agronomy, Research Associate ICAR-CPRS Modipuram, Meerut