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The Ethical Implications of Groundwater Use

The use of groundwater for human consumption dates back to thousands of years ago, with early evidence dating back to the neolithic Chinese with functioning water wells around 1000 B.C. (5). There is no doubt that groundwater is an irreplaceable resource for many of Earth's population, especially in developing nations. The UN estimates that 50% of the world's drinking water comes from groundwater (8). Due to its accessibility, groundwater is more commonly used than its surface variant. The less visible nature of groundwater allows it to be more easily overused and exploited as a resource as well (4). There are several detrimental consequences in the exploitation of this resource, even discounting the consequences surrounding the reduction of water accessibility in general. For example, groundwater overuse around the city of New Orleans, Louisiana has led to aquifers being compressed and ground levels dropping, being one of the reasons the city remains below sea level today (7). In an ethical sense, upkeeping modern groundwater use rate will result in a detrimental lack of water resources for future generations; however, there is also no doubt that shifting away from groundwater use improperly will result in negative consequences for many workers in the agricultural sector in the short term.

As technology has progressed, the use of groundwater for agricultural purposes has risen exponentially to satisfy economic needs. According to P.S. Datta in his 2005 paper, "nearly 40% of global food production is attributed to irrigated abstraction, and 70% of the world groundwater withdrawals are used for irrigation purposes" (3). This is leading to situations where groundwater depletes much faster than it regenerates. In different parts of India, growth rates of groundwater development reached 60% in various cities to 106% in Delhi. The groundwater tables decreased from .2m to as much as 10m in these areas (6). This led to a significant increase in the costs of pumping groundwater, which in turn led rich farmers to start over pumping water, exacerbating issues (3). It is clear such a system is unsustainable. Even in areas where subsidized surface water for irrigation is available more cheaply, some farmers still choose to utilize groundwater (1). Why is this so?
There are two main reasons why farmers would keep using groundwater as a source of irrigation for their crops. The first advantage is defined by groundwater's convenience. With aquifers oftentimes being present directly over a farmer's property, all one has to do is pump water in order to hydrate their crops. This bypasses the negotiations, regulations, and paperwork associated with obtaining surface water. This allows agricultural workers to have more control of their water supply, allowing individuals more autonomy in general (1). The second advantage supplied by groundwater usage, however, is the more significant reason. The fact remains that groundwater usage is a more reliable source of water, as dry seasons don't impact the availability of water as much as it does with subsidized surface water (1).

Farmers as a whole don't need to worry about the quality of water from the ground and very much prefer the storage provided by the mechanized pumping and aquifers (3). M. R. Llamas describes the transition to groundwater as a "Silent Revolution" for farmers, since "the relatively low pumping costs, and the protection groundwater provides against drought, have allowed poor farmers to gradually progress into a middle class status, enabling them to provide a better education for their children" (1). If usage of groundwater has created such a significant advantage for farmers, how can countries transition out of it and minimize the consequences said transition in the process?

Regulation is a common approach to this issue. The United States uses several different systems depending on the state. The Reasonable Use Rule allows extraction of water, but does not allow excessive extraction to the point of damaging the local environment (9). While regulations such as these may sound good on paper, the fact remains that it is extremely difficult to obtain reductions in groundwater use due to the nature it is extracted. Since the amount of water pumped from aquifers is only decided by the individuals who need it, groundwater remains as a resource very easily exposed to exploitation (2). Central Mexico has attempted to regulate groundwater use in several ways: direct state control, markets, energy pricing, and user self regulation; nearly all policies failed to reduce groundwater exploitation significantly (2). Action is required beyond just passing laws- and oftentimes, there is no alternative to
groundwater. This is especially true in developing nations and dry lands. Oftentimes, farmers in dry, poor countries have no choice but to take water from the ground to feed their crops (3). What can be done?

Solutions are split into suggestions for both short term and long term problems of this phenomenon. For countries that can afford it, MR Llamas (2005) suggests that investing in infrastructure which makes surface water more available and advantageous than groundwater would be a large step forward, as the markets would encourage the agricultural sector to use less groundwater as a result (1). By taking this route of action, agricultural workers would not be suffering any consequences in the short term, and groundwater usage would significantly decrease, at the cost of government money and time. The largest issue with such a solution is public reluctance towards these types of investments (1). That is why raising awareness of such policies is also a large step forwards towards combating groundwater availability in the long term as well. As for short term solutions, Datta P.S. (2005) suggests policies which will help conserve water usage over time. Laws which force industries to adopt water efficient technologies would aid in the effort. Encouraging the production of less water intensive crops would be a large step towards conserving water use too (3).

Our water usage will drastically increase in the coming decades as the human population grows in numbers of hundreds of millions. This is why it is important to design a system which ensures our groundwater reserves are still present for future generations. According to the NSPE code of ethics, it is important for us as engineers to "hold paramount the safety, health, and welfare of the public" (10). A decreasing water table has severe implications if not approached cautiously, as groundwater is an integral part of both agriculture for irrigation and urban life as a source of irrigation and drinking water, respectively. Nonetheless, simply ending groundwater consumption would drastically impact the lives of agricultural workers in many states despite the long term impacts of continuing to do so. This is why it is important to formulate both a long term plan in the form of infrastructure and short term plans in the form of policy changes to alleviate both issues with minimal consequence. Only a solution which alleviates the
long-term impacts of groundwater overuse coupled with strong short-term policies would effectively combat this problem.
References


