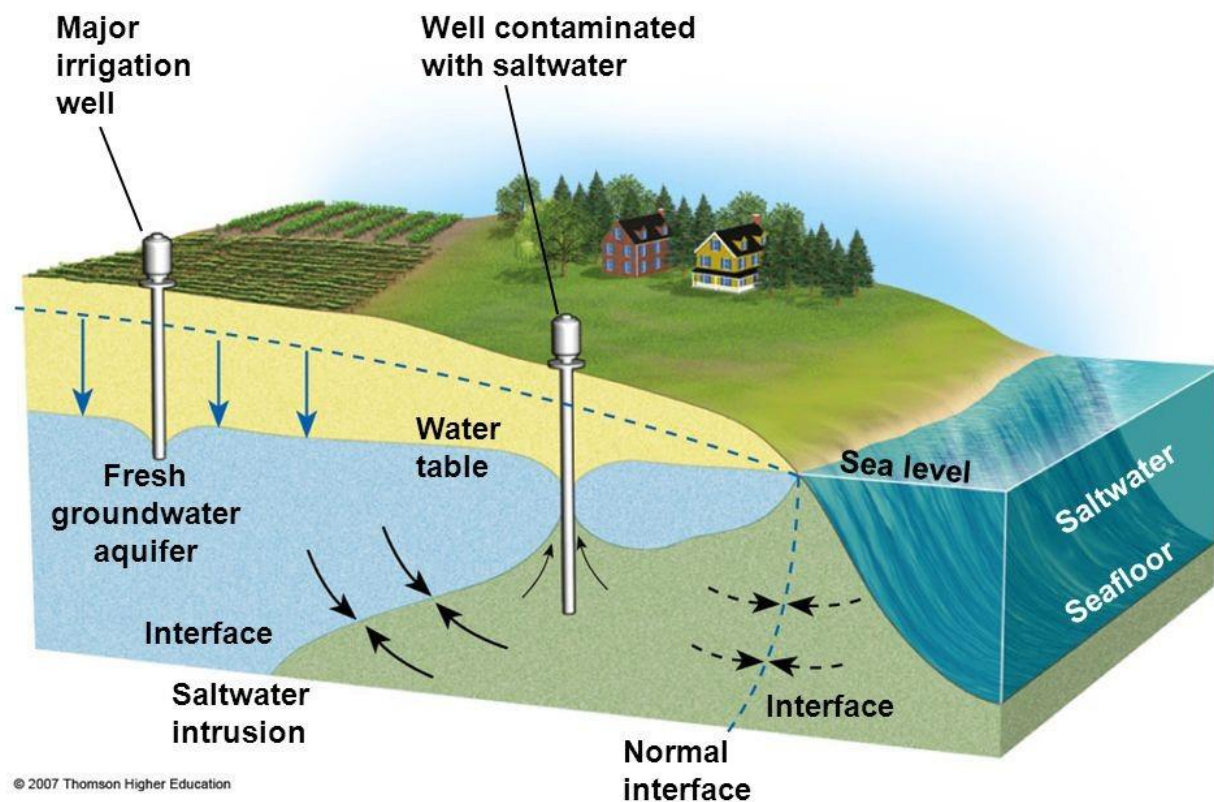


# Understanding the Impacts of Sea Level Rise on Groundwater Resources in Sri Lanka

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## Introduction:

Sri Lanka is an island in the Indian Ocean which is not immune to the far-reaching effects of climate change. Among the numerous challenges posed by a changing climate, rising sea levels stand out as a significant threat, particularly to the country's groundwater resources in coastal stretches. This article delves into the intricate relationship between sea level rise and groundwater in Sri Lanka, exploring the potential consequences and proposing adaptive strategies for sustainable water management.



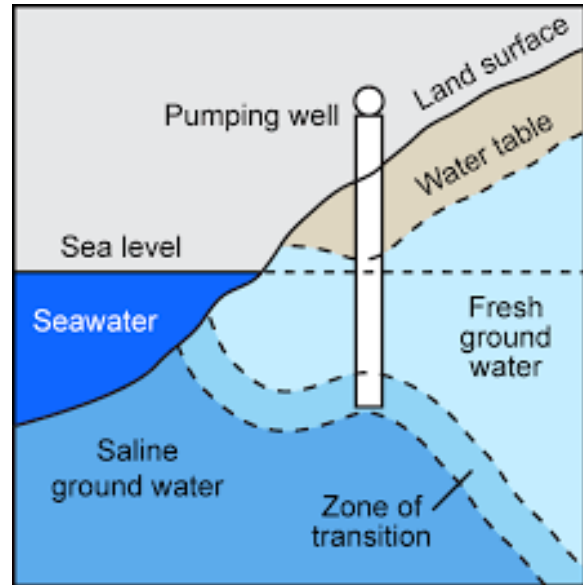
## Groundwater in Sri Lanka:

Sri Lanka heavily relies on groundwater for various purposes, including drinking water supply, agriculture, and industrial activities specially in drought seasons of the country. The island's coastal aquifers play a crucial role in sustaining the water needs of both urban and rural populations in

those regions. However, the delicate balance between freshwater and saltwater in these aquifers is under threat due to the rising sea levels associated with global climate change.

### **Saltwater Intrusion:**

As sea levels rise, saltwater has the potential to infiltrate coastal aquifers, transforming once-freshwater reservoirs into saline-choked sources. This phenomenon poses a serious threat to the quality and availability of water for domestic use and agriculture. Coastal communities, where groundwater is often a primary source of drinking water, are particularly vulnerable to the encroachment of saltwater. The intrusion can render dug wells and boreholes unusable, forcing communities to seek alternative, and often more expensive, sources of freshwater.



### **Reduced Freshwater Availability:**

The pinching of freshwater lenses within coastal aquifers exacerbates the challenge. As seawater advances inland, the volume of freshwater decreases, making it insufficient to meet the demands of a growing population and thriving agriculture. Sri Lanka's coastal regions, where population density is high, face the double-edged sword of increasing demand and decreasing supply. Agriculture is considered the backbone of Sri Lanka's economy, and it is significantly dependent on groundwater. Reduced freshwater availability in groundwater resources due to sea level rise can have dire consequences for crop yields and food security. Besides the sea level rising, the excessive extraction of groundwater near coastal wells will increase the saltwater intrusion into fresh groundwater aquifers. Hence, the delicate balance between irrigation needs and sustainable water extraction must be recalibrated to ensure the long-term viability of agriculture.

### **Land Subsidence and Its Impact:**

Rising sea levels contribute not only to saltwater intrusion but also to land subsidence, a phenomenon where the land sinks, further facilitating the infiltration of seawater. In areas with unconsolidated or poorly consolidated sediments, this subsidence can be particularly pronounced, amplifying the risks associated with saltwater intrusion. Land subsidence poses a dual threat: it

accelerates the ingress of saltwater and increases the vulnerability of infrastructure such as wells, pumping stations, and water supply facilities. Coastal areas experiencing subsidence may find their water supply infrastructure compromised, leading to disruptions in water availability for both urban and rural communities.

### **Increased Vulnerability to Storm Surges:**

Sri Lanka is no stranger to tropical cyclones, and as sea levels rise, the intensity and impact of storm surges amplify. Storm surges can inundate coastal areas, introducing contaminants into groundwater sources and compromising water quality. The aftermath of extreme weather events can leave a lasting imprint on groundwater resources, requiring extensive efforts for remediation. Beyond the immediate physical damage caused by storm surges, the heightened vulnerability to such events underscores the importance of resilience in water supply systems. Robust infrastructure and emergency response mechanisms become imperative to mitigate the impact of storm surges on groundwater resources.

### **Ecosystem Disruption:**

Coastal ecosystems, including mangroves and wetlands, serve as natural buffers against the encroachment of saltwater. They play a vital role in regulating groundwater flow and maintaining water quality. However, rising sea levels can disrupt these ecosystems, leading to the loss of their protective functions. Mangroves, in particular, act as a barrier against saltwater intrusion, and their degradation or destruction can leave coastal aquifers more vulnerable. Conservation and restoration efforts for these ecosystems are integral to preserving the delicate balance between freshwater and saltwater in Sri Lanka's coastal regions.

### **Infrastructure Vulnerability and Human Displacement:**

The vulnerability of water supply infrastructure in coastal areas is compounded by the potential displacement of communities due to sea level rise. As rising waters encroach upon inhabited areas, populations may be forced to migrate to higher ground, adding stress to water resources in the regions they relocate to. Addressing the water needs of displaced communities requires proactive planning and the development of resilient water supply systems in areas prone to receiving climate-induced migrants. Adequate provision of safe drinking water and sanitation facilities becomes a crucial component of climate change adaptation strategies.

## **Adaptive Strategies for Sustainable Water Management:**

In the face of these challenges, Sri Lanka must adopt adaptive strategies to ensure the sustainable management of its groundwater resources. Some key measures include:

- **Managed Aquifer Recharge (MAR):** Implementing MAR techniques can enhance groundwater recharge and mitigate the impacts of reduced freshwater availability. These techniques involve the deliberate infiltration of surface water into aquifers to replenish groundwater reserves.
- **Improved Water Use Efficiency:** Promoting water-efficient practices in agriculture, industry, and domestic use can contribute to reducing the overall demand for groundwater. The adoption of precision irrigation, rainwater harvesting, and water recycling practices are essential components of improved water use efficiency.
- **Coastal Zone Planning and Regulation:** Robust coastal zone planning, and regulation are crucial to managing urban development and infrastructure in vulnerable areas. Implementing setback regulations and sustainable land-use practices can help mitigate the risks associated with land subsidence and storm surges.
- **Ecosystem Conservation and Restoration:** Protecting and restoring coastal ecosystems, including mangroves and wetlands, is vital for maintaining the natural barriers that safeguard against saltwater intrusion. Conservation efforts should be coupled with community engagement to ensure the long-term sustainability of these ecosystems.
- **Infrastructure Resilience:** Upgrading and fortifying water supply infrastructure in coastal areas to withstand the impacts of rising sea levels and storm surges is essential. This includes elevating critical infrastructure, securing water supply facilities, and developing emergency response plans.
- **Community Awareness and Capacity Building:** Engaging communities in understanding the risks associated with sea level rise and promoting water conservation practices are critical. Building local capacity for climate resilience empowers communities to adapt and respond effectively to changing conditions.

**Conclusion:**

As Sri Lanka marks its presence on the global stage, the nation faces the dual challenge of addressing the impacts of climate change while fostering sustainable development. The intricate interplay between sea level rise and groundwater resources demands a comprehensive and collaborative approach. Sri Lanka's journey towards climate resilience must be guided by adaptive strategies that prioritize the sustainable management of groundwater. By integrating scientific knowledge, community engagement, and innovative technologies, Sri Lanka can navigate the complex terrain of rising sea levels and secure a water future that is resilient, equitable, and sustainable for generations to come.