# Hydrological zoning

**Challenge:** Too little water **Adaptation response:** Water efficiency and demand management

**Description**

Hydrological zoning (or simply zoning) is an approach to divide land into different zones based on their hydrological properties. Typically, each type of zone has different land use and development regulations linked to it. This land and water management method aims to protect local water sources from risks of over-abstraction, land salinization, groundwater pollution and waterlogging by managing land use activities based on the assigned hydrological zones. For example, zones with a high groundwater table, large amounts of surface water (e.g. rivers) or high erosion susceptibility will usually have more land-use restrictions in place. Such restrictions may limit irrigation to avoid nutrient loading and sediment runoff into watersheds, but can also limit other activities such as industrial discharge and water abstraction from surface or groundwater sources. Zoning also ensures that irrigation, urban development or other land-use activities take place in the ideal land areas in relation to local hydrology, as well as where environmental impacts can be mitigated.

**Implementation**

Appropriate hydrological zoning is informed by hydro-geological studies of the area, including assessment of soil infiltration rates, the groundwater table, soil characteristics (type, pH, nutrient levels etc.), erosion susceptibility, presence of surface water, presence of key ecosystem services, etc. Geographical information systems can be used to employ models estimating environmental responses to different stimuli (land-use practices) to help decision makers divide the region into zones with different land use regulations. In addition to the science-based hydrological zoning exercise, local land-use, agriculture and construction legislation may require changes to accommodate the new restrictions. This can potentially impact existing uses, for example landowners with now restricted land-use regulations may need to be compensated for income loss resulting from hydrological zoning. Post implementation, environmental and socio-economic effects can be monitored to determine whether regulations in different zones are having the desired effects.

**Environmental Benefits**

- Minimizes risks of over-abstraction, salinization, water logging and pollution.
- Improves groundwater replenishment in hydrologically important areas if there is limited development and land use activities.

**Socioeconomic Benefits**

- Helps improve provision of safe drinking water due to improved groundwater replenishment (from limiting land-use practices).
- Contributes to sustainability of agricultural activities and food security through placement of irrigated agriculture in well-suited land areas.

**Opportunities and Barriers**

Opportunities:

- Numerous environmental and socio-economic benefits across a number of sectors (e.g. agriculture, water supply, etc.)
- Does not completely restrict land-use activities, rather it promotes land-use activities in areas best suited for the specific type of activity
- Can help raise awareness about sustainable water management and environmental conservation amongst citizens and businesses

Barriers:

- Implementation can be a complicated and lengthy process, particularly in areas that are already developed
- Costs related to acquiring land-rights and paying compensation to private land-owners can be high
- Land potentially lost for developers, implying lost income for local governments

**Implementation considerations***

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| Technological maturity: | 4-5 |
| Initial investment: | 1-4 (depending on land-rights and compensation fees) |
| Operational costs: | 2-3 |
| Implementation timeframe: | 2-4 |

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
*Technological maturity*: 1 - in early stages of research and development, to 5 – fully mature and widely used
*Initial investment*: 1 – very low cost, to 5 – very high cost investment needed to implement technology
*Operational costs*: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
*Implementation timeframe*: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

**Sources and further information**

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