1. Why is groundwater management important for sustainable agriculture and flood safety in large deltas and coastal lowlands?

Many of the Earth’s large deltas are especially vulnerable to global environmental change. In addition, significant amounts of groundwater are often pumped up for irrigation. This can happen at an unsustainable rate (as for example in the Mekong Delta). If aquifers are not recharged it can result in a substantial lowering of the water table, driving subsidence. In addition, the quality of the groundwater can degrade, resulting in public health concerns

1. Why should agriculture be practiced from a drainage basin framework?

A key management approach is integrated watershed management (IWM), embracing a watershed perspective. In contrast to traditional approaches whereby management was oriented around singular purposes (e.g., navigation, agriculture, flood control), IWM is an adaptive approach considering a comprehensive array of functions, including:

1. land cover regulation in the upper basin to reduce downstream runoff and pollution,
2. implementation of environmental flows strategy,
3. making space for flood waters along select riparian reaches,
4. modifying engineering structures to improve ecological functions,
5. stakeholder involvement, and,
6. policy and management aligned across different governmental scales (i.e., local, regional, national, international).
7. How is streamflow influenced by agricultural practices and related hydraulic infrastructure?

Intensive agriculture impacts watershed hydrology, for example the streamflow in a river. The streamflow is supplied by both surface runoff (also called overland flow), and baseflow, which is groundwater that seeps into a river channel. Because land use change from natural to agriculture land can alter runoff, it can also impacts streamflow.

Under natural land cover, such as a forest or natural grassland, forests or grasslands reduce runoff. However, when the natural cover is replaced by agriculture the runoff rates increase, and baseflow declines.

In addition, streamflow is impacted by hydraulic infrastructure; engineering structures that modify landscapes and water resources. Dams and reservoirs can have negative impacts on riverine environments. These include; i) moderation of the natural flow regime, ii) reducing downstream sediment loads to riparian and coastal environments due to sediment trapping behind dams, and, iii) fragmenting watersheds so that aquatic organisms are unable to migrate along the riparian corridor (upstream and downstream). In most instances the environmental flow downstream of a dam is less variable compared to natural flowing rivers

1. Why is ground subsidence of special concern in deltas with intensive agricultural activities and large populations?

Land subsidence is the sinking (lowering) of the land surface. Along lowland floodplains and deltas accelerated land subsidence is one of the most significant environmental impacts related to agriculture, substantially increasing flood risk and increasing the vulnerability of humans and food production systems. Making land suitable for agriculture requires drainage and pumping of groundwater, which abruptly initiates land subsidence.

Land subsidence is especially a problem in lowland coastal areas because minor changes in elevation increase flood risks from rising sea levels and storm surge events.

1. How can concepts of Integrated Watershed Management be utilized to manage the consequences of global climate change?

A key management approach is integrated watershed management (IWM), embracing a watershed perspective. In contrast to traditional approaches whereby management was oriented around singular purposes (e.g., navigation, agriculture, flood control), IWM is an adaptive approach considering a comprehensive array of functions.

The implementation of IWM requires effective policies and institutions to plan, design, maintain, and monitor hydraulic infrastructure that influence hydrologic and associated ecological processes. This is especially important to deal with the complex changes associated with climate change.