Flood Control in Taiwan

A typical retention pond in the upper reaches of a watershed. Photo: Author.

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Taiwan is a mountainous island country, often confronted with floods and droughts. Torrential typhoons are responsible for an annual rainfall of some 2500 mm, which often leads to massive soil movement, concentrated runoff and large peak flows that cause a lot of damage downstream. Efforts to control these floods have focused on controlling the water flow at the bottom of the watershed using large and costly engineering structures. In the Wudu watershed area, however, a different approach has been tried. Small-scale water harvesting structures have been installed in the upper reaches of the watershed in order to reduce the runoff.

The case of the Wudu watershed

In the Keelung River Basin, Wudu watershed, a low impact development concept was integrated into the flood protection programme with the aim of reducing the flood hazard down stream.

Scattered small-scale runoff retarding structures such as pits, pools, farm ponds and dugouts were installed throughout the watershed to promote the infiltration of runoff water. The runoff retardation structures installed in the upper and middle reaches of the watershed proved to be very effective in reducing the flood burden downstream. With a conventional check dam constructed down stream, a flood peak reduction of 20 percent could be expected. With small-scale retarding structures installed throughout the watershed, a flood peak reduction of 30 percent was achieved at considerably lower cost.

The infiltration enhancement structures and retardation ponds will intercept large volumes of runoff, but a large amount of sediment is also delivered with the water. As the sediment will rapidly reduce the capacity of the infiltration structures, some changes in land use are necessary. For example, providing forest cover around the structures can reduce runoff volumes by up to 50 percent. Sediment reduction is even more significant and can reach as much as 95 percent. This result shows that proper land use and soil conservation measures are essential to ensure maximum runoff interception and minimum sediment load reaching the retardation structures.

The collection of runoff upstream will increase the availability of water resources for farmers downstream. This water can be used for irrigation, livestock, aquaculture, the introduction of high yielding cash crops or the reclamation of wastelands. It also provides other indirect benefits. These include depressing flood peaks, diminishing soil erosion, providing large sediment storage space, and improving the operation of reservoirs and channels.

In Taiwan, the upstream parts of a watershed are usually government owned and often forested. In heavily populated cities located in the downstream river basin areas, acquiring land for public infrastructure becomes increasingly difficult as property values rise. Upstream runoff retardation measures are the most feasible flood mitigation solution for future urban storm water management.

Lessons learnt

In rainfall-abundant watersheds with steep terrain, torrential rainstorms often result in accelerated soil erosion and runoff, causing irreversible damages downstream. Storm water collection using small infiltration enhancement structures and retention ponds has proven to be extremely effective in runoff reduction and flood control. Storm water is controlled in the upstream parts of the watershed, along with the disaster-bearing sediment load. Although small-scale runoff retardation facilities may not be able to prevent large storm runoff events, they may reduce the problem considerably. Besides flood control benefits, increased infiltration and runoff storage will increase the availability of water resources.

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