

Impacts of Land Use and Climate Change on Water Resources: Examples from China.

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Summary

The idea that land use planning can significantly impact runoff and flood losses is not a new one. In fact, this knowledge goes back thousands of years. Humans were altering natural runoff by irrigating land as early as 4000 B.C. in Sumeria. (Smitha, 1999) Around the same time, Egyptians were performing flood recession agriculture. Peak flows deposited fertile soil and needed moisture in the Nile basin and the soil that retained moisture could then be farmed. They also learned that by changing the land use, they could alter the runoff pattern and retain water for use when the river was drier later. As the water rose, they trapped the water and lined their water basins with clay, so that it would not infiltrate and be lost. By 3500 B.C., they were building dikes and sluices. In other regions of the world, terracing of hillsides for irrigation was also taking place. In dry regions, people discovered that they could retain water and grow crops better by terracing the hillsides. Others retained water by building walls or mounds that followed the contours of a slope. These walls also trapped sediment and eventually terraces were formed.

Ancient civilizations also understood how land use planning can effect flood losses. The Inca in South America, for example, farmed the floodplains but built their towns on hills off the floodplain. Even the Bible suggests that the man who builds his house on the sand is a fool because the as the winds blow, the rains come down, and the stream rises, the house will come down. The wise man builds his house on rock where it won't be affected by rising streams. (Matthew 7:24-27)

Natural outgrowths of small structures to retain and distribute water are larger structures. In the last century, we have found that large dams and reservoirs are very effective means of retaining and distributing water. They also provide added benefits such as flood control and power. As dams have become the tool of choice, we have forgotten and overlooked more simple options for avoiding flood losses and managing land and water. Dams, though, certainly have their limitations. In many parts of the world the best dam sites have been used and additional dams are much more costly. Many watershed are also overbuilt in that fewer dams in the watershed could produce more water than the current configuration. Finally, environmental issues have swung the public opinion pendulum against dam building.

Increasing populations continue to put increased pressure on land and water resources and new methods must be found to deal with water resource issues. This has led researchers and water managers to find alternative and complementary approaches to existing systems. One of the major areas of research is how land use effects runoff. This approach has been taken up by IIASA's project called "Modeling Land-Use and Land-Cover Changes in Europe and Northern Asia." The current focus of the project is China and the effects of land use and climate change on water resource availability are being studied as input to the project's economic core model. Due to data constraints, hydrologic modeling has been kept quite simple, but can still be used to draw conclusions about how climate and land use changes effect the availability of water resources and impact extreme events. This paper will discuss some of the ways land use is related to hydrology and extreme flow events in the context of modeling water resources in China.