Causes of Catastrophic Flooding in Bangladesh

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Abstract - The annual rhythm of flooding in Bangladesh is natural, necessary, and welcome. Water molds the culture, shapes the land, and sustains all life; yet, it may also bring great destruction. Bangladesh is a country with scarce relief, large riparian floodplains, and extensive coastal lowlands. Remotely sensed imaging of Bangladesh’s Meghna River region provides a unique look into a unique landscape frequented by "monsoon" (banna) and catastrophic (bona) floods. An analysis comparing the monsoon flood image and the dry monsoon image reveals that 40% of the land inundated with water returns to dry land during harsh floods, while, as much as 70% of the land may be inundated during bona floods. The principal causes of annual, normal flooding in Bangladesh are basin morphology, monsoon climate, and orographic effect. Catastrophic flooding is a consequence of a flood-prone landscape, coupled with cyclic activity and poor (but often unavoidable) land use practices. Despite long-standing attempts to structurally control major flood events in Bangladesh, the discharge rate, extent, and severity of successive cyclical floods is increasing. During the catastrophic floods of 1998, 2007, and 2012 alone, more than 42 million people in Bangladesh were affected. Many of those affected were forced into homelessness. Floods are intensified by poor land use practices. Rampant urbanization, deforestation, and agricultural clearing increase peak flows, creating favorable conditions for heightened flooding. Vegetation naturally impedes and absorbs runoff, thus reduces peak flood flows. Less than 10% of the forest cover remains in Bangladesh today.

Purpose: 1) To determine the causes of flooding, 2) To resolve why the frequency and magnitude of bona floods are increasing; and, 3) Illustrate the tenacity & adaptability of the people of Bangladesh.

Physiographic Causes of Flooding

1) Bangladesh Largely a Floodplain (80% floodplain/20% less)
2) 2nd Largest Drainage Basin (42.5000 km² drainage 1.5 mil km²)
3) Monsoon Climate (concentrates extreme rainfall)
4) Orographic Precipitation (mountains force/concentrate rainfall)
5) Spring Snowmelt (rapid increase in discharge)
6) High Frequency of Cyclones (topographic funnels cyclones)
7) Climate Change (coastal flooding increases landward)

Rapidly rising humid air in the low pressure system will condense, and very heavy rainfall will ensue over Bangladesh and southern India. The second of these processes occurs during the winter dry monsoon. Land and the air above it become cooler than the adjacent heat-retaining ocean. A stable continental high pressure forms, reflecting the seasonal reversal of the South Asian wet monsoon, that begins in late May. The first burst of rain signaling the start of this season causes a stir of celebrations. Flooding is intensified by poor land use practices. Rampant urbanization, deforestation, and agricultural clearing increase peak flows, creating favorable conditions for heightened flooding. Vegetation naturally impedes and absorbs runoff, thus reduces peak flood flows. Less than 10% of the forest cover remains in Bangladesh today. Structural flood control often fails because earth artificial levees can be poorly built and lack upkeep. Well built but during catastrophic flooding and harm people who believe they are "protected" (see Figure 6 and 12).

Anthropogenic Causes of (Increased) Flooding

1) Rapid Population Increase (157 mil people/pooforeced into flood zones)
2) Rapid Increases in Impervious Features (increases peak discharge)
3) Overurbanization on Structural Protection (slum dikes & piers)
4) Deforestation in Bangladesh & Headwater Areas (90% deforested)
5) Increased Soil Erosion/Accretion (reduces capacity of channel flow)
6) Proliferation of Tube Wells (water table rises/lush subsidence)
7) Climate Change (coastal flooding increases landward)

Perhaps there is no place on Earth where the immediate relationship between culture and environment is more strongly evident than in Bangladesh. Bangladesh is a developing country with a large population of 157 million people. Population pressures drive desperate farmers into known flood-prone areas. Repeated years of flooding have forced greater numbers into even more marginal lands. Bangladesh’s population is expected to double in 46 years, thereby forcing greater numbers into even more marginal lands. Floods are intensified by poor land use practices. Rampant urbanization, deforestation, and agricultural clearing increase peak flows, creating favorable conditions for heightened flooding. Vegetation naturally impedes and absorbs runoff, thus reduces peak flood flows. Less than 10% of the forest cover remains in Bangladesh today. Structural flood control often fails because earth artificial levees can be poorly built and lack upkeep. Well built but during catastrophic flooding and harm people who believe they are "protected" (see Figure 6 and 12).

Conclusions: Bangladesh is a land of water that fosters a culture that is both susceptible to and reliant upon flooding. Damage and homelessness caused by recent floods continues to worsen; thus, Bangladesh must continue to develop its long-term strategy regarding flood control.

Solutions: 1) Flood protection shelters (and evacuation plans); 2) Flood proof storage for food and grains; 3) Well built/artificial levees and coastal embankments; 4) Afforestation programs; 5) Regulations (mitigation building), 6) Early warning; 7) Post-flood aid, 8) Raising community awareness.