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Early Warning Science: A case of Flood Alert System, River Nzoia, Western Kenya

The problem

Reducing the human and economic cost of disasters, while improving resilience to natural hazards, are priorities in Kenya, the third most densely populated country in Africa. The Nzoia River drainage basin in western Kenya covers an estimated area of 12,709 km^2, and descends from an altitude of 4,300 m in the mountainous areas to 1,140 m above sea level towards Lake Victoria. The Water is supplied by River Nzoia and her tributaries make land arable. The arable land attracted high population density in the lower areas of the basin making the resident people vulnerable to frequent flood hazards. Destruction of infrastructure, crop failure, disease epidemics and general environmental damages were also perennial problems in the region. Before implementation of flood mitigation policies, annual loss due to flooding in the Nzoia basin approached US $ 1.8 million and displacement of 12,000 people[2]

The science

Emerging and unequivocal scientific evidence of climate change indicates that it is almost certain that the average temperature will rise, accompanied by more frequent precipitation[2b,3]. The basin is also exposed to higher drought risk.[5] Periods of higher precipitation will overburden the river system, and thus cause flooding. No single project would have the ability to expand capacity enough to provide cost-effective Disaster Risk Reduction. A series of micro-projects were offered to the community to be carried out. This was done on the basis that it can be particularly advantageous to incorporate community elements into disaster risk reduction strategies[6]. Community-based projects would not be sufficient to avert flooding hazard, and would require an effective means of warning populations to move with the risk of flooding through an early warning system (EWS)[8]. To this end, weather stations needed to be placed or modified to allow the Kenyan Meteorological Department (KMD) to make accurate forecasts, and then a means of delivery (local radio) could be used to directly inform the local population in their preferred language[7].

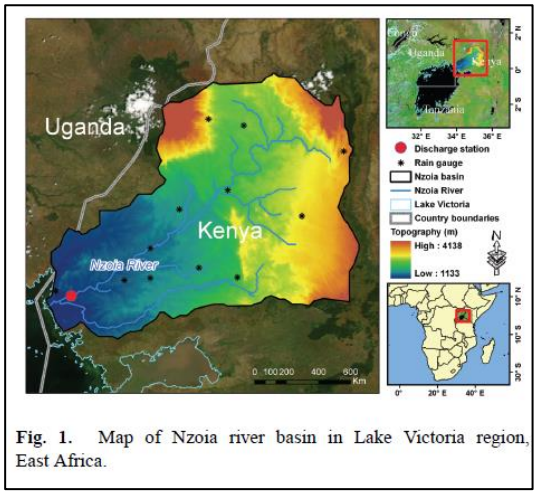

Fig. 1. Map of Nzoia river basin in Lake Victoria region, East Africa.

The application to policy and practice

In 2008 the Kenyan government, with the support of the World Bank, initiated the Western Kenya Community-Driven Development and Flood Mitigation Project (WKCDFMP) to address the problems of flooding in western Kenya[3]. In collaboration with Kenya

Meteorological Department (KMD) (now Service), the Project was to address aspects in the River Nzoia Basin:
In order to empower local communities, to engage in wealth creating activities and reduce their vulnerability to adverse impacts associated with recurrent flooding, WKCDFMP has employed a variety of strategies. The approaches included: training locals in DRR, dyke repairs/construction, and the establishment of community-based Early Warning System (EWS)[2]. Kenya Meteorological Department was charged with championing the EWS[8], and focusing on ensuring the EWS was used effectively by the population as well as improving their understanding of the meteorology involved.

A model for a Flood Early Warning System, covering the entire Nzoia basin, has been developed through KMD. The flood EWS is comprised of hydrometeorological stations and river-gauges that transmit data in real time to a base station at KMD headquarter where the received data is analysed and processed into a bulletin to issue a two- day flood forecast. This forecast is also used by the government, NGOs and other institutions to plan evacuation and response to a potential disaster[2]. The bulletin is delivered via the community radio, Bulala FM[7], which uses the local language Kinyala.
Alongside this EWS, the community were also engaged to actively help prevent disaster. Local people were trained to assist in maintaining the infrastructure for the EWS and physical defences[2]. The engineering had been carried out with the scientific research into the area to make cost-effective defences such as dykes and canals. These defences vastly increased flood capacity, and provided the communities with better control of their water resources

Did it make a difference?

Since the implementation of the flood mitigation policies, cost of damage has plummeted. Since 2009, it was estimated that one million USD have been saved annually relative to the losses before the disaster risk reduction had been implemented. The local dialect-radio has expanded to include information on farming practices, resulting in improved quality of life and better overall development in the basin area[2]. In 2011, one flooding event occurred (due to the heaviest rainfall since 1935) which resulted in no casualties and little damage[2]. *Enhancing community warnings and advice for other hazards, such as droughts*[9] has helped establish an essential communication channel that can be used by other services. The meteorological equipment has not been neglected since being installed, and the Kenyan Meteorological Service continues to improve its forecasting methods and instruments to constantly improve DRR[10].
In summary, although the high-population density areas have remained, the risk to these areas undergoing disasters due to climate and extreme weather have been reduced, and the infrastructure to keep reducing disaster risk has been successfully installed and maintained in the region.

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