Computer model suggests tsunamis could be blunted by coastal trees

November 8 2011, by Bob Yirka

Indian Ocean (Jan. 2, 2005). A village near the coast of Sumatra lays in ruin after the Tsunami that struck South East Asia. Image: Wikipedia

(PhysOrg.com) -- One of the biggest problems with tsunamis is that they are so hit or miss. Major ones only occur every ten years or so, and the likelihood of any one place being hit is extremely small. This results in very little preparation being undertaken for such occurrences by people in areas that could be hit. The end result is that when a tsunami does strike, it's typically devastating. One solution suggested over the years is that coastal communities plant trees between the sea and the community; the idea being that the trees might slow or blunt the force of the waves. Unfortunately, not much work has been done to test this theory, mostly because it's virtually impossible to predict when and where a tsunami will strike. Now however, a group of German researchers has designed a

computer program, as described in their paper published in the *Proceedings of the National Academy of Sciences* that suggests planting trees really might help lessen destruction and loss of life.

To get over the problem of not being able to study tsunamis directly, scientists have been turning more and more to computer modeling. Last year for example, a team from Ireland developed a model that helped explain the pendulum effect that can cause bigger waves in some tsunamis. In this latest study a German group working out of the University of Hohenheim has created a model to simulate the devastating tsunami that struck the Aceh part of the Indonesian island of Sumatra in 2004. They replicated both the geography of the area there and the tsunami that struck and then measured the effects of the tsunami, both with and without protective vegetation.

As expected the model clearly showed a correlation between damage that resulted and distance from the sea shore i.e. those closest to the sea took the brunt of the force of the waves. When trees were added to the model between the community and the sea however, the model showed an average reduction in destruction of five percent. Smaller plants such as cacao or coffee plants provided less protection, just three percent.

The model also showed that if trees are planted behind the community, the destruction tends to be worse as they appear to prevent people from escaping, and provide more dangerous flotsam. It also seems possible that if the trees blunt the force, some of that energy might be bounced back into the community.

Unfortunately, despite these findings, it's not likely that many communities will start covering their shores with dense tree growth, as it would spoil the view; a highly valued commodity in most coastal regions.

More information: Influence of coastal vegetation on the 2004

tsunami wave impact in west Aceh, *PNAS*, Published online before print November 7, 2011, doi: 10.1073/pnas.1013516108

Abstract

In a tsunami event human casualties and infrastructure damage are determined predominantly by seaquake intensity and offshore properties. On land, wave energy is attenuated by gravitation (elevation) and friction (land cover). Tree belts have been promoted as “bioshields” against wave impact. However, given the lack of quantitative evidence of their performance in such extreme events, tree belts have been criticized for creating a false sense of security. This study used 180 transects perpendicular to over 100 km on the west coast of Aceh, Indonesia to analyze the influence of coastal vegetation, particularly cultivated trees, on the impact of the 2004 tsunami. Satellite imagery; land cover maps; land use characteristics; stem diameter, height, and planting density; and a literature review were used to develop a land cover roughness coefficient accounting for the resistance offered by different land uses to the wave advance. Applying a spatial generalized linear mixed model, we found that while distance to coast was the dominant determinant of impact (casualties and infrastructure damage), the existing coastal vegetation in front of settlements also significantly reduced casualties by an average of 5%. In contrast, dense vegetation behind villages endangered human lives and increased structural damage. Debris carried by the backwash may have contributed to these dissimilar effects of land cover. For sustainable and effective coastal risk management, location of settlements is essential, while the protective potential of coastal vegetation, as determined by its spatial arrangement, should be regarded as an important livelihood provider rather than just as a bioshield.