



Compounding Hazards Facing Nepalese Villages due to Glacial Lake Thulagi, Extreme Monsoons, and Landslides

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Thulagi Tsho is listed by ICIMOD as among the most hazardous glacial lakes in Nepal. The listing is warranted by the physiography and downstream vulnerabilities. Tal Village—along a major trekking route—and a hydroelectric dam and reservoir are notably at risk due to the potential for a glacier lake outburst flood (GLOF), an extreme summer monsoon, extreme spring snowmelt, landslides, and rockfalls. Tal is downstream from Thulagi Lake just a couple meters above river level, and ordinary monsoons already cause an approach toward flood conditions, according to residents. A high flood stage due to an extreme monsoon or unusually rapid springtime melting of a thick winter snowpack could be catastrophic. Two significant mass movements occurred recently in Tal, one having buried some structures in the village in June 2012. In a favorable note, satellite image analysis shows that Thulagi Lake has slowed its elongation in the last couple years. Furthermore, any tsunami or other flood surge would have to traverse and erode a wide end moraine in order to generate a GLOF. On the other hand, remote sensing and field observations show that wasting of Thulagi Glacier has debutressed the northern lateral moraine, which is slipping toward the growing lake and the thinning/retreating glacier. The landslip itself is not necessarily a bad thing: it is causing a loss of gravitational potential energy of the lateral moraine, and if that process continues gradually, it will result in diminished instability. However, the debuttreasing and moraine slip signifies that the moraines are unstable. Will a rapid mass movement dump into the lake? Triggers could include seismicity, extreme rainfall, or a small landslip. The risk of a serious GLOF exceeds that of Imja Lake due to Thulagi Lake's large hydrographic head and the shape of its downstream end, which could funnel and amplify a potential tsunami generated by a large mass movement into the lake. A moraine collapse into the lake would not necessarily generate a tsunami or a GLOF; however, a GLOF is possible. We have undertaken preliminary bathymetric echosounding and a side-scan sonar survey of Thulagi Lake and have found that the lake volume is similar to that of the better studied Imja Lake. This poster will emphasize Thulagi Lake bathymetry. The convergence of multiple natural hazards is not unique in Nepal, but this situation is precarious and needs study and planning. Accordingly, we have consulted with villagers and with local officials and national experts. The local villagers, including the principal of a children's school, are aware of the natural Earth hazards, so we are not alarming them with anything they do not already know qualitatively. We have distributed a whitepaper to experts and officials who should now be aware of the situation. Of course the officials have to balance other situations all across Nepal where infrastructure and people are at risk. After all, the country straddles a convergent tectonic plate boundary and has some of the highest relief and highest precipitation regimes in the world. Supported by USAID and NASA.