Investigating the concept of mountain forest protection and management as a means for flood protection

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Environmental policies have the purpose to protect ecosystems in their structure and function to maintain the ecosystem services they provide. They are based on scientific knowledge at the time they are established, and rarely are those assumptions revisited or is the effectiveness of these policies in protecting or promoting a particular ecosystem service tested. In this study, we revisit the first Swiss Federal Forest Law which protects mountain forests as a means of protection from natural hazards. It was established in 1876 following catastrophic flood events to preserve and restore the protective service of mountain forests by prohibiting clear-cutting and an excessive use of forests. Here, we provide a conceptual and methodological framework to explore the effects of the Forest Law on flood occurrence based on insights from preliminary results of a feasibility study. For the conceptual framework, we summarize the current scientific knowledge on i) forest effects on hydrological regimes and their protection service against floods, ii) reasons for reforestation in mountains and how the law may have contributed, and iii) other watershed changes affecting both reforestation and the forest-runoff interaction. We then develop the methodological framework based on insights from a case study on the Upper Rhone catchments, which serves as a prototype of an interdisciplinary methodological approach to answer the question of whether a forest protection law can serve as a means of flood protection. We explore the feasibility of answering this question given data are at different scales and resolutions. We suggest modeling to fill data gaps and discuss collaboration among natural and social sciences. Specifically, we propose that both natural and social scientists need to collaborate, with frequent exchange, to collect the data necessary to evaluate the relationship between legal forest protection and flood occurrence. We found an environmental historian is needed to evaluate if changes in forest cover can be attributed to mandates by the law, or rather cultural and societal developments. Further, a forest scientist or engineer in collaboration with a hydrologist will need to adapt and improve hydrological models that specifically include forest cover and structure. All scientists need to collaborate to find the information on historical and current forest cover (e.g., maps, postcards, orthophotos) and floods (e.g., archival documents, journal, newspapers, hydrological stations). Our case study indicates that data to answer the overarching question may be available and emphasizes the necessity of a true interdisciplinary approach allowing for consideration and combination of a variety of data sources and different temporal and spatial scales. The interdisciplinary framework we developed can serve as example for other ecosystem
services, where similar questions on the effects of environmental practices and policies arise.