American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
May 4-6, 2009
Anchorage, AK

Tuesday, May 5
8:30 AM – 10:00 AM
Session 12: Erosion and Sediment Transport

1. Fire Recovery Watershed Runoff Modeling in Warm Springs Creek, Idaho: Developing a Better Model and Implications for a Changing Climate - Jonathan Ambrose, GeoEngineers, Inc., Seattle, WA (co-author: Rob Richardson)

During late August and early September of 2007, approximately 44 square miles of the total 97 square mile Warm Springs Creek drainage basin burned in the Castle Rock forest fire. The resultant change in land cover and soil properties within the burned area will temporarily increase the potential stream discharges in the watershed. The principal element that drives the post-fire runoff process is the transformation of soils in the burn zone to a higher degree of hydrophobicity, or water repellency, which can decrease the infiltration capacity of soils for several years following the fire. Burnt forest soils typically recover to background runoff levels within three to six years The United States Forest Service (USFS) Rocky Mountain Research Station (RMRS) uses the Fire Enhanced Runoff and Gully Initiation (FERGI) model to predict basin runoff response following forest fires. The model has been found to be fairly accurate in the prediction of rainfall-induced runoff events at the subbasin level. FERGI model predictions become less accurate, however, in larger subbasins, subbasins with large storage potential, or where multiple subbasins combine to form larger streams. In the burn zone of interest, the FERGI model most likely does a good job predicting potential runoff at the mouths of smaller subbasins. However, the FERGI model most likely overestimates runoff in the mainstem of the much larger Warm Springs Creek basin. These overestimates occur because: 1) the model does not account for the relative timing of the runoff from the tributary subbasins entering the mainstem, and 2) because flood attenuation in the floodplain along the mainstem is not accounted for in the model. Recognizing the limitations of the USFS FERGI model, GeoEngineers developed a watershed model that accounts for the effects of these additional hydrologic parameters to more accurately estimate potential future storm response in Warm Springs Creek. Higher incidence of fire may be one effect of our changing climate, and developing more accurate approaches for estimating watershed response will be critical to mitigating the impacts of fire.

2. Modeling Sediment Impacts of Training Activities on Military Installations: Approach and Baseline Model Results - Anthony S Donigian Jr, AQUA TERRA Consultants, Mountain View, CA (co-authors: John C Imhoff, Anurag Mishra, Parick N Deliman, Eileen Regan)

Watershed modeling systems are becoming a critical component of efforts to support military readiness and advance the sustainability of testing and training lands. The Strategic Environmental Research and Development Program [SERDP] Ecosystem Management Project (SEMP) identified the need to provide Fort Benning, Georgia (and eventually other military installations) with immediately usable and effective models that can be implemented for compliance and long-term watershed planning and management. SERDP Project SI 1547 focuses on the development of a watershed modeling system for Fort Benning using the U.S. EPA BASINS framework. The objective of this 4-year effort is to identify, adapt, and develop watershed management model(s) for Fort Benning that address impacts on watershed hydrology, sediment, and water quality and related ecosystem processes and outcomes resulting from military activities and natural resources management. The 2005 Base Realignment and Closure (BRAC) decisions realigned thousands of additional troops and hundreds of military vehicles to Fort Benning and other military facilities, increasing the impact of military operations on the base watersheds. Soils within the Fort Benning watersheds, in general, are highly erodible, and a number of streams are currently listed as sediment impaired under the Federal Clean Water Act Section 303(d). Prudent planning is needed using analysis methods capable of linking land disturbance activities to sediment washoff, and instream impacts on water quality and ecological endpoints. This paper presents the preliminary application of the baseline model of BASINS/HSPF to the Fort Benning watersheds, with specific focus on sediment impacts, sources, and transport modeling. The Army Training and Testing area Carrying Capacity (ATTACC) model and its military-developed methodology was used to provide a pivotal metric as the starting point for making adjustments to HSPF parameters. Observed and simulated model results for sediment support specific recommendations for addressing the impacts of training activities, construction projects, prescribed burning procedures (for ESA habitat protection), and other forest management practices.

3. Alaska Erosion: Assessing Vulnerability of Alaska's Coastal and Riverine Communities - Christy Miller, Tetra Tech , Anchorage, AK (co-author: David Broadfoot)

This presentation discusses the 2007-08 erosion assessment conducted statewide for 162 Alaska communities to provide a baseline of information for assessing risk and establishing a ranking priority of need. Erosion is a major water resource and development challenge facing many Alaska communities. Most water resource professionals would concur that having local baseline information on the causes and contributing factors, as well as the magnitude, frequency, and types of natural hazards historically impacting Alaska communities is data needed to properly manage development along the coast and riverine shorelines. In June 2004, a full U.S. Senate Appropriations Hearing was held in Anchorage to take testimony on the widespread erosion problems, feeding into Fiscal Year 2005 Consolidated Appropriations Conference Report stating: "… There is a need for an Alaska erosion baseline study to coordinate and plan the appropriate responses and assistance for Alaska villages in the most need and to provide an overall assessment on the priority of which villages should receive assistance." In 2007 the Alaska District Corps of Engineers contracted with Tetra Tech to develop "Erosion Information Papers" providing a baseline of erosion information. Survey assessments include: • Gradual erosion and/or discrete events. • Factors causing and contributing to the erosion (storm surge, wind, waves, melting permafrost, late forming coastal ice, social factors). • Physical length of erosion area(s). • Importance and usage of the shoreline. • Structures/facilities/infrastructure at risk and estimated or measured distance from the shoreline. • Protective measures taken or installed; maintenance and operation costs. • Structure inventory/facility damage costs. Survey completion often included participation by several community representatives with consensus/information being sought from village elders, tribal and city council members - over 95% completion was obtained on surveys. Many survey respondents were grateful they were being asked for community input and that the erosion threats and damages were being recorded and assessed. The presentation concludes with a discussion of the results of the baseline erosion assessment, and a comparison of the information obtained from previous statewide erosion assessments conducted in 1984, 1989, and 1995.

4. Glacier Dammed Lakes Impacting Different Basins After 30 Years of Changing Climate - Dave Wolfe, Alaska Pacific University, Anchorage, AK

Glacier-dammed lakes (GDLs) form beside glaciers throughout the Cryosphere. GDLs repeatedly drain, often catastrophically, and refill after glacier movement reseals the breach. Outburst floods modify basin morphology and pose potential threats to infrastructure downstream. In 1971, the USGS mapped over 500 GDLs from the Tanana River south to Lake Illiamna and Glacier Bay, Alaska. I used satellite imagery and GIS to update the historic GDL inventory, collecting data on lake position, damming glacier gradient, and ice dam aspect. I document 141 new lakes forming since 1971. New lakes were concentraited between 60°30' and 62°30'. Nearly 45% of glaciers damming new lakes did not previously dam lakes, presenting unknown new hazard flood potential in these drainages. Glacier downwasting is documented in the 100s of m since the 1950s across the study area. This downwasting removed icedams that had formed 34% of the historic lakes. Downwasting produced meltwater that may increasingly reside within glacier systems. Researchers in the Himalayas and Swiss Alps found liquid water increasingly stored within the glacier system in low-gradiant areas during recent climate warming. In the present study, damming glacier gradients averaged ≤ 6° below ±95% of all GDLs. Gradients of 2° or less, where others have found water storage increased in duration and quantity, occurred below about 55% of all GDLs. Three of 4 other studies have found that GDL outbursts flush waters stored throughout the glacier system below the lake. This is further compounded by new lakes forming significantly higher in elevation and further up glacier, providing a greater area to flush below the lakes. I also report preliminary efforts to apply the Strahler stream order system to lake-damming glaciers. New lakes were dammed by glaciers that were significantly higher order at the terminus than were historic lakes that no longer form. Historic lakes that persisted were dammed by higher order glaciers at the ice dam than historic lakes that no longer form. This GDL update serves as a baseline-study for hydrological analyses above new infrastructure and for predicting future trends in these lakes.