Laboratory and Field Measurements of Bed Load Using Self-Generated Noise (SGN) – Project Update

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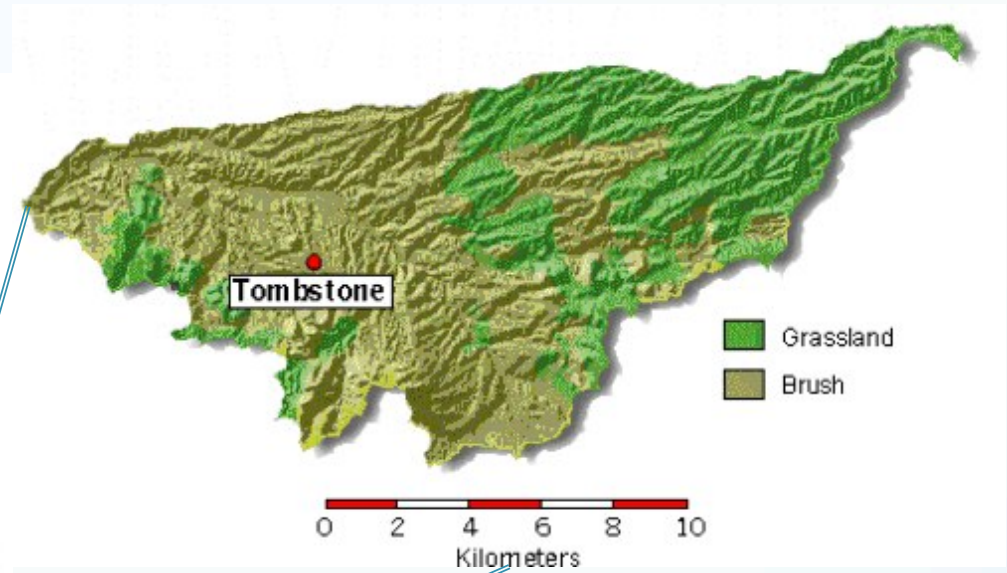
Goal and Approach

- **Goal:** Yield improved methods for using SGN as a measure of bed load transport rates in fluvial settings
  - Deliver high-quality field-based dataset of self-generated noise (Walnut Gulch, AZ)
    - Validate SGN measurements with physical sampling
    - Lucky Hills 9.1ac subwatershed with Santa-Rita flume
    - Hydrophones + Traversing Slot Sampler + Pit Trap
  - Provide supporting laboratory investigations of self-generated noise processes (Oxford, MS)
    - Continuation of USBR project
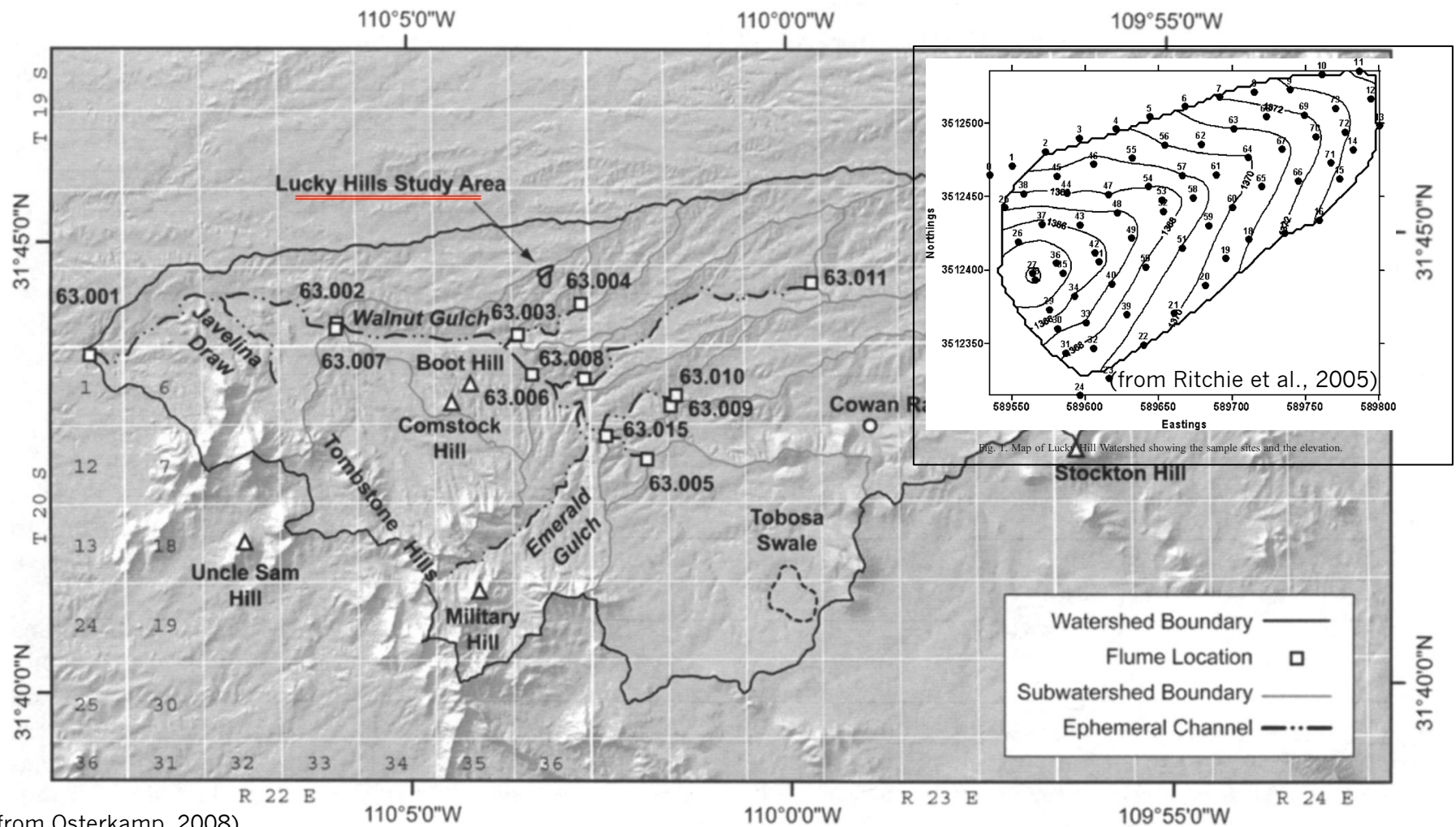   - Bottom-Up Experiments – One rock to many

Laboratory Studies...

- **Ongoing...**
  - Verifying basic physical model
  - Improving measurement chamber
  - More from D. Wren...

Walnut Gulch Experimental Watershed

Runoff Season: July-September

Luck Hills Subwatershed

Fig. 1. Map of Lucky Hill Watershed showing the sample sites and the elevation.

(from Ritchie et al., 2005)

(from Osterkamp, 2008)

Luck Hills 103 Subwatershed

- 9.1 acres, 3.7ha

- Soil: Lucky Hills-McNeal Sandy loam, sandy loam with high fraction of fragmented rocks (Ritchie et al 2005)

- Supercritical Santa-Rita flume installed in 1963
  - Traversing slot sampler (<10mm particles)
  - Downstream sediment pit trap

- 250mm-500mm rainfall annually
  - 2/3 (~250mm) during monsoon (July-Aug)
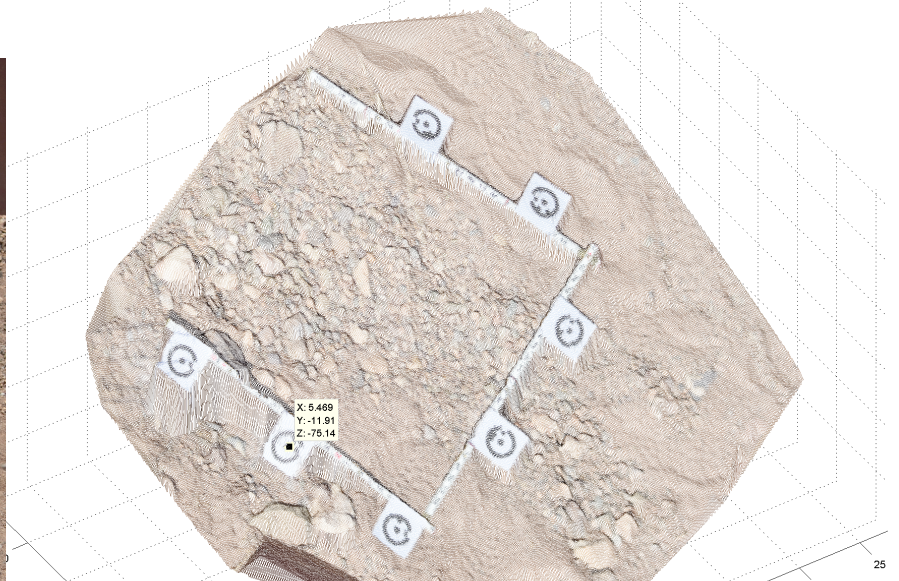 - Between 2 and 12 runoff events expected
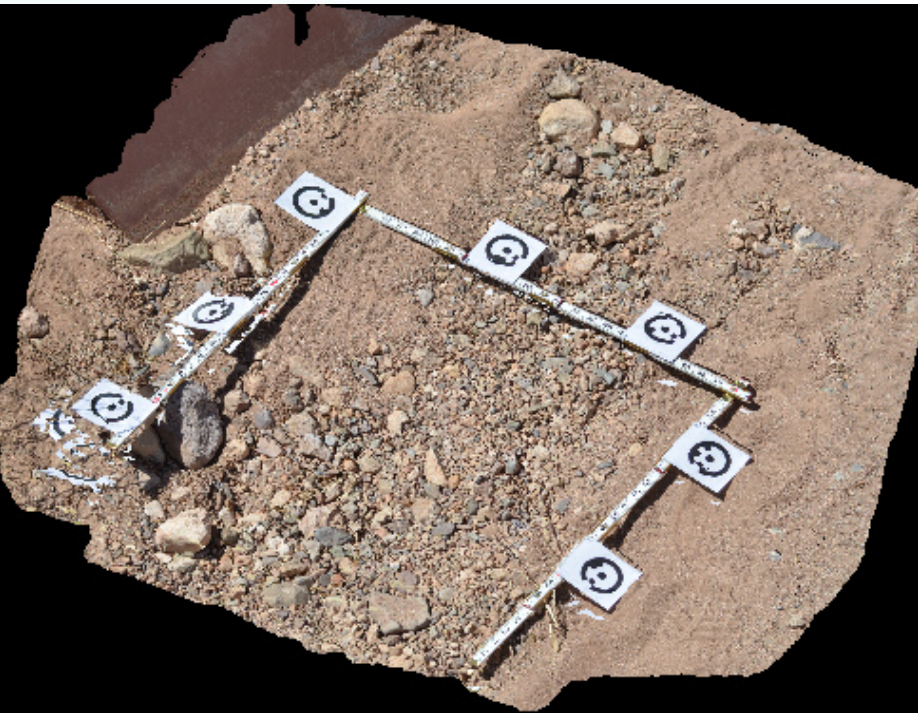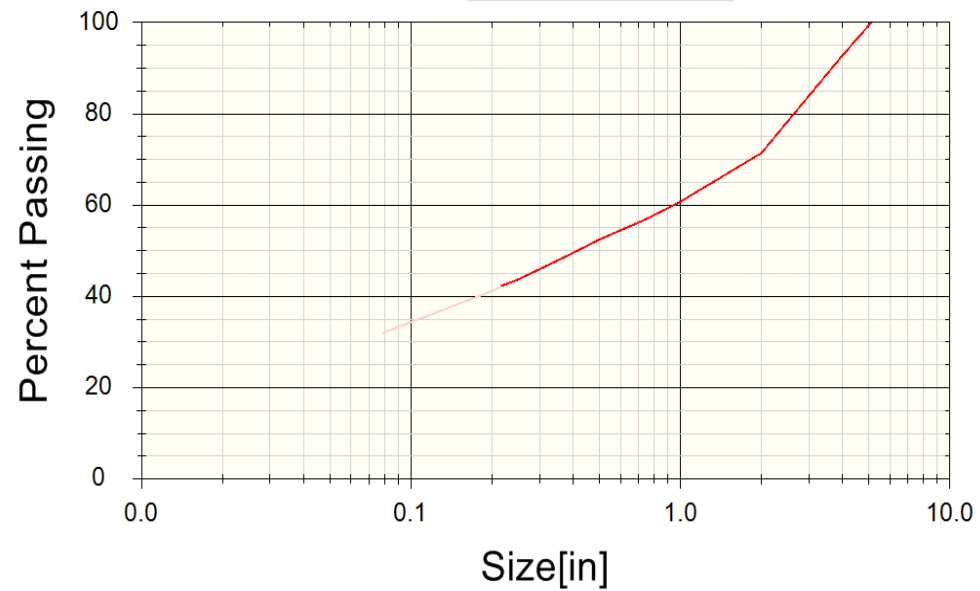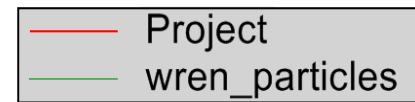
Scouting Trip

9-11 April 2014

View: Downstream

View: Upstream

hydrophone mount

hydrophone mount
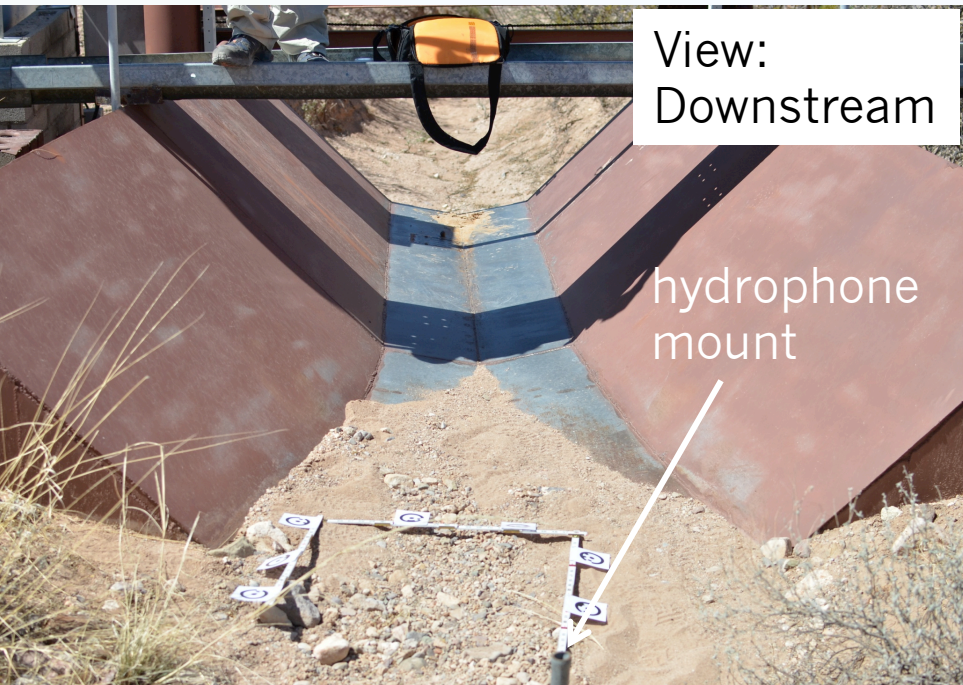
Bed Material

Size Distribution

Channel Conditions

Channel Conditions/ Processes

Research Plan

- June 2-4 2014
  - Deployment in Lucky Hills 103

- July – August 2014
  - Laboratory Studies (see Wren pres.)
  - Data collection (Walnut Gulch, AZ)
    - Technician on storm duty

- Late Aug – Early September
  - Retrieve equipment
  - Process data

- Sept – Dec 2014 – Data analysis and Final Report

Potential Challenges

- Number of Events
  - Expect 2-12 quality events (hope for 12, plan for 2)

- Water depth
  - Sampler triggers at 6cm, deeper better for hydrophones
    - Cutoff frequency
    - Surface noise

- Equipment failure (always possible)
  - Deploying multiple hydrophones for redundancy

Questions?

- References:
  - Ritchie, J., Nearing, M., Nichols, M., and C. Ritchie, 2005. Patterns of Soil Erosion and Redeposition on Lucky Hills Watershed, Walnut Gulch Experimental Watershed, Arizona. Catena 61, 122–130.

  - Osterkamp, W.R., 2008. Geology, Soils, and Geomorphology of the Walnut Gulch Experimental Watershed, Tombstone, Arizona. Journal of the Arizona-Nevada Academy of Science, Vol. 40(2),136-154