Mapping “Natural” Floodplains: An Engineering Perspective
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Natural Floodplain Function Alliance Webinar
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Agenda

- My questions in 2002
- Limitations of FEMA floodplains
- Mapping “geomorphic” floodplains in 2002
- Mapping “natural” floodplains in 2013
- Mapping other floodplain features
- Findings
- Recommendations
- Your questions?
• Is there a way to visualize the natural expression of flooding across the landscape, ignoring the land cover disruptions caused by human interventions?

• If so, how do you delineate these “natural” floodplains?

• How would these “natural” floodplains compare and contrast to the floodplains mapped by FEMA?
Limitations of FEMA Floodplains

- There are about 3.5 million square miles of FEMA A, V, and Shaded X Zones in the U.S.
- FEMA floodplains are focused in areas with population and insurable properties.
- FEMA Flood Insurance Study (FIS) reports have flood profiles showing 10-, 50-, 100-, and 500-year flood elevations; however, only the 100- and 500-year floodplains are mapped.

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Mapping “Geomorphic” Floodplains in 2002

- “Geomorphic” floodplains can be defined by soils subject to flooding.
- Soils data were retrieved from State Soil Geographic Data Base (STATSGO) derived from 1:250,000 scale soils maps.
- These data are coarse and for planning purposes only; i.e., for use above the county level.
Mapping “Geomorphic” Floodplains in 2002

- Geomorphic floodplains delineated based on map units with 10% or more of the soils subject to rare, occasional, or frequent flooding.

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Mapping “Natural” Floodplains in 2013

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NRCS Soils Data

- STATSGO data are compiled from 1:250,000 scale soils maps and are appropriate for state-wide applications but is not precise enough for counties.
- SSURGO data are compiled from 1:12,000 to 1:63,360 scale soils maps and are appropriate for county-level.
- SSURGO data were obtained from the Web Soil Survey.

http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
• Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk.

• These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

• This study focused on A Zones (100-year) and Shaded X Zones (500-year).
FEMA Flood Zone Data

- FEMA DFIRM (Digital Flood Insurance Rate Map) data were obtained from the Map Service Center (MSC) at https://msc.fema.gov.
- DFIRMs provide a digital version of the FEMA flood insurance rate map that is designed for use with digital mapping and analysis software.
- FEMA DFIRM data can be downloaded by U.S. county.
Sacramento County Soils Data

SSURGO Hydric Soils
- Rivers
- Levees
- Sacramento County

Hydric Rating
- Partially Hydric
- All Hydric

SSURGO "Natural" Floodplains
- Rare (1-5% ACE)
- Occasional (5-50% ACE)
- Frequent (>50% ACE)

* ACE = Annual Chance Event

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Sacramento County Floodplain Data

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Mapping Other Floodplain Features

- **Height Above River (HAR)** - ArcGIS tool initially developed in 2010 by University of Nevada Reno (UNR) for riparian/ecological investigations to view heights above a floodplain terrain surface relative to a changing river surface.

- **Flood Inundation Potential (FIP)** – Similar to HAR, but modified to view relative heights and depths from a hypothetical flood profile.


Figure 8: Comparison of a flood height map (left) and high resolution aerial photograph for Mason Valley in the Walker River Basin.
50% ACE Flood Inundation Potential (FIP)

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Findings

- NRCS soils data and FEMA floodplain data are readily available over the Internet for GIS applications.
- NRCS flood frequency classes generally coincide with FEMA data; i.e., 1% ACE (Annual Chance Event), 2% ACE, 5% ACE, 10% ACE, 50% ACE.
- In Sacramento County there are about 370 mi² of FEMA floodplains and 286 mi² of “natural” floodplains, with about 252 mi² of land area where both types of floodplains overlap.
- Other GIS techniques, such as HAR and FIP utilize topography and flood profiles and can indicate “natural” floodplain characteristics of depth and extent and morphology for designated flood events by projecting floodplains landward of flood control features such as levees. Note, however that this does not replace floodplain modeling because projected flood levels do not account for the actual movement of floodwaters.
Recommendations

• Use soils data in investigations of flooding, especially for floodplain restoration projects.

• Apply soils data from the reach scale to the watershed scale and to larger spatial scales.

• Utilize soils data to map “natural” floodplains and augment floodplains defined by FEMA, which are derived for insurance purposes.

• Associate the spatial relationships of flood prone soils and their flood frequency class to observed water surfaces or hypothetical floodplains using GIS tools such as HAR and FIP.

• Utilize HAR and FIP output to provide a topographic and geomorphic context for viewing flood prone soils.
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Your Questions?

“Super-Natural” Floodplains by Rob Gonsalves

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