Debris Flow Mapping Through Time
Data Management using ArcGIS and
Implications for Fish Research

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Boise Aquatic Sciences Lab
Boise Lab Disciplines

Fisheries

Watershed
Middle Fork Boise River Native Trout

Threatened Bull Trout

Redband Rainbow Trout
Channel Reorganizing Events

- Debris Flows
- Hyper-concentrated Flows
1. The rapid, downward mass movement of particles coarser than sand, often including boulders one meter or more in diameter, at a rate ranging from 2 to 40 kilometers per hour. Debris flows occur along fairly steep slopes.
Hyper-concentrated Flow

Finer material
Debris Flow Causes

- Rain on snow events
- Heavy rain
Research Questions

1) Where are the debris flows? How does their spatial distribution change over time and does this dynamic influence fish populations?

2) Do fire and management activities influence debris flow occurrence?

3) How do debris flows and fire affect stream temperature?

4) Is there a relationship between debris flows and presence/absence of fish, such as bull trout?
Middle Fork Boise River Watershed

Boise National Forest
Middle Fork Boise River
Landscape
Debris Flow Mapping Process
Photo Interpretation

Debris Flow
Photo Interpretation Facts

- Approximately 1,200 photos
- Full time work for one summer temporary employee
Mapping Debris Flows
Two Options

On-screen digitizing

Attribute existing streams
Map Debris Flows on TARDEM Streams

Streams derived from Digital Elevation Model (DEM)
TARDEM Streams

- Software developed by David Tarboton – Utah State University
- Streams derived from DEM data
- Output in ArcInfo coverage format
- Coverage contains useful stream characteristics attributes
- TauDEM – ArcGIS plug-in

http://www.engineering.usu.edu/dtarb/
Process and Attributes

DEM

Attribute table

TARDEM streams
Related Tables

- Relate has two separate tables – 8 and 16 fields respectively.

**TARDEM Attribute Table (8 fields)**

**Debris flow dBase attribute table (16 fields)**
Editing the dBase Table
One to Many Relationship
Create dBase Table

File > New > dBase Table
Create Fields

Right click > Properties
Add dBase Table to Map Document
Applications
Research Question

1) Where are the debris flows? How does their spatial distribution change over time and does this dynamic influence fish populations?
Recurrence of Debris Flows
Spatial Correlation – 1969

Probability that both segments are disturbed given that one is disturbed

Network Distance (km)
Spatial Correlation – 1996

Probability that both segments are disturbed given that one is disturbed.
Research Question

2) Do fire and management activities influence debris flow occurrence?
Relationship to Fire

Legend
- Debris Flow - 1996
- Burn Intensity
  - High
  - Medium
  - Low

0  10  20 Kilometers
Research Question

3) How do debris flows and fire affect stream temperature?
Stream Temperature

Legend
- Debris Flows
- Thermograph
Research Question

4) Is there a relationship between debris flows and presence/absence of fish, such as bull trout?
Fish Occurrence and Debris Flows

Legend
- Debris Flow
- Bull Trout Present
Bureau of Reclamation Radio Tagged Fish
National Fire Plan

Burned

Unburned
Summer 2003 Sample Site Selection

Legend
- Filtered Segment – Burn Intensity
  - High
  - Medium
  - Low
  - Unburned

[Map showing various burned intensities with a scale of 0 to 20 kilometers]
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