Three concerns about Oak Creek bed-load study
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The following figure is from Buffington and Montgomery, 1997, the three points in the dotted oval are from Oak Creek near Corvallis, Oregon. Why are the Oak Creek points an outlier?

A comparison of the original distribution of the sizes of three Oak Creek armour measured using area-by-weight to the distribution after converting to grid-by-number (Wolman pebble count) are in the figure below.

Topics in this poster
There are three topics considered in this poster that may help explain why the Oak Creek points in the Buffington and Montgomery figure are an outlier. The two most important are:
1. Sampling and quantification of bed-surface material (armour) size.
2. Specific gravity of Oak Creek bed-material

The third topic may not be important in the Buffington and Montgomery analysis but could be important in other studies.

3. Change in median size of armour with time resulting from the discharge time series

The fourth topic is to put the Oak Creek sampling period in perspective relative to the possible bed-material movement in other years.

4. Oak Creek sampling period in a long term time series

Sampling and size quantification of bed-surface material

The three most common approaches to bed-surface material sampling are the Wolman pebble count, and area sampling where the size distribution is either by counting the particles in a size range or weighing the particles in a size range. Kellerhals and Bray, 1971, presented an argument on the best sampling method to use for a given study and how to convert between the methods. The factors used in the conversion are below. D is the size of the particles. See Kellerhals and Bray for details.

<table>
<thead>
<tr>
<th>Conversion to</th>
<th>Grid by number (pebble count)</th>
<th>Area by weight</th>
<th>Area by number (barred sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid by number</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>Area by weight</td>
<td>D/2</td>
<td>D*</td>
<td>D*</td>
</tr>
<tr>
<td>Area by number</td>
<td>D*</td>
<td>D*</td>
<td>D*</td>
</tr>
</tbody>
</table>

The Oak Creek study used area by weight sampling. It is possible most of the other points on the Buffington and Montgomery figure used an approach that gave results closer to the pebble count than area-by-weight.

Specific gravity of Oak Creek bed-material

The bed material is a basaltic material derived from the Tholeiitic Siletz River Volcanics (Snavely et al,1968). Snavely et al analyzed samples collected in the Corvallis area; three of the samples are from areas about equidistant from the Oak Creek watershed. Using the average composition data from Snavely et al and specific gravity information given in Dana’s Manual of Mineralogy a theoretical specific gravity of 2.93 to 3.07 was calculated.

Change in median size of armour

The bed-surface material in Oak Creek did change during the bed-load sampling period. This table is from Milhous, 1973. The representative particle sizes for armour material in Oak Creek near the sediment trap are shown in the following table.

<table>
<thead>
<tr>
<th>Date</th>
<th>Medium size of grouped samples, cm</th>
<th>Range of Median size of samples, cm</th>
<th>D65, cm</th>
<th>D35, cm</th>
<th>D65/D35</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 October 1969</td>
<td>4.8</td>
<td>4.0-5.0</td>
<td>5.8</td>
<td>4.1</td>
<td>1.42</td>
</tr>
<tr>
<td>26 October 1970</td>
<td>5.2</td>
<td>4.6-6.3</td>
<td>5.9</td>
<td>4.3</td>
<td>1.37</td>
</tr>
<tr>
<td>29 January 1971</td>
<td>6.3</td>
<td>4.3-8.4</td>
<td>7.3</td>
<td>5.2</td>
<td>1.43</td>
</tr>
<tr>
<td>27 July 1971</td>
<td>6.3</td>
<td>4.5-7.6</td>
<td>7.4</td>
<td>5.2</td>
<td>1.42</td>
</tr>
</tbody>
</table>

The time dynamics of bed-surface material size would be worth modeling. There are two possibilities for Oak Creek. One is that the smaller sizes were removed during high water in January leaving the larger particles as the surface material. The second is that larger sizes were transported from upstream into the study reach.

Oak Creek sampling period in a long term time series

An index to the ability of the river to maintain its channel is used to obtain some idea about the annual potential of the river to move the bed-material. The equation used in the present analysis is:

\[ \text{CMCI} = \frac{\sum Q_d(i) - Q_{crt}}{Q_{ref}} \]

where CMCI is the Channel Maintenance Capacity Index, Qd(i) is the daily discharge in day i, Qcrt is a discharge below which the streamflows contribute little to the maintenance of the channel, Qref is an arbitrary reference discharge. The summation is over the n days the daily discharge exceeds the critical discharge.

Streamflow data for the Luckiamute River near Suver, Oregon is used to obtain some idea about the potential of bed material movement in the region close to Oak Creek. The Luckiamute River is found to the north of the Oak Creek watershed. The critical discharge was assumed to be the discharge at which the average channel velocity was 1.5 fps. In the Luckiamute River this is a discharge of 1530 cfs. Shear stress moves the bed, if the river slope and unit weight of water are constant the shear stress is proportional to the depth which is roughly proportional to the Q^2/3; therefore β in the equation is 0.5. The reference discharge used was 1000 cfs.

The * on the diagram indicates the year with the bed-load samples. The Oak Creek bed-load samples were obtained in a year that probably had higher discharges than average and total potential of movement was much larger than normal. This may have explained why the bed-surface material changed during the year.

Reference
