Beavers and their dams can substantially change the storage and movement of water through a stream reach. The magnitude of this change is, in part, a function of the number and type of dams plus stream characteristics. If beaver activity is to be considered as a flow-management aid, then understanding the locations where beavers currently are building dams and the potential locations and number of dams that beavers could build in the future would help inform how managers approach the management of beaver activity and prioritize habitat restoration actions that may support dam building by beavers.

For this component of the Tualatin beaver study, USGS:
1) Created a partial inventory of beaver dams by conducting strategic beaver dam surveys and compiling existing dam observations from basin partners.
2) Estimated and validated potential beaver dam capacity in Tualatin River basin streams by modifying an existing beaver dam capacity model that accounts for physical controls on where beavers can build dams.

**Methods**

**Beaver Dam Inventory**
- USGS documented 49 dams along 14 km (~9 miles) of 8 urban streams.
- The locations of more than 300 beaver dams and 100 reaches with signs of beaver activity were documented in the Tualatin River basin (Smith, 2017a,b; fig. 2).
- Dams and reaches with beaver activity are present throughout the basin, including on the valley bottom and in streams within the urban growth boundary.
- The beaver dam inventory is a partial inventory of beaver dams between 2013 and 2016, and is not a complete census.

**Beaver Dam Capacity**
- Mcfarlane and others (2017) developed the Beaver Restoration Assessment Tool (BRAT) to estimate the potential density of beaver dams along stream reaches and identify locations for targeting beaver restoration strategies.
- USGS modified the original BRAT model (developed for steep, snow-melt dominated Utah streams) to better account for the hydrology and constraints on beaver dam building in low gradient, rain-dominated Tualatin Basin streams.
- The modified BRAT combines hydrologic, topographic, and vegetation data (table 1) in a fuzzy inference system to calculate potential dam density based on: 1) the presence of sufficient water to build a dam at low flow, 2) the likelihood that a dam is destroyed at high flow, and 3) the availability of vegetation preferred by beavers for food and dam building.
- The modified BRAT results were validated with data from the partial beaver dam inventory.

**Table 1. Inputs for the modified BRAT model.**

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS Regional unaged streamflow equations (Cooper, 2005)</td>
<td>Equations used to estimate low-flow stream power and bank-full stream power</td>
</tr>
<tr>
<td>USGS/USFS LANDFIRE vegetation data</td>
<td>Vegetation data used to assess potential beaver food and dam-building materials</td>
</tr>
<tr>
<td>10 m Digital Elevation Model (DEM)</td>
<td>Data used to calculate stream slope</td>
</tr>
</tbody>
</table>

**Physical Factors Potentially Limiting Beaver Dams**
- BRAT postulates that the density of beaver dams is limited by several physical factors (fig. 4), including:
  - High flow, high stream gradient, and stream power, and/or lack of appropriate vegetation.
  - Excessive depth or velocity in Tualatin River main channel; and
  - Lack of vegetation for building material or food.
- The BRAT results can be used to examine the potential physical limiting factors, thus helping managers to understand where restoration actions might allow successful beaver colonization and dam building.
- Where vegetation is a limiting factor for beaver dam building, an analysis of vegetation restoration potential also can be used to help target stream reaches for restoration (fig. 5).

**Considerations for Future Studies**
- BRAT may be incorporated into management approaches to predict and manage potential conflicts between beaver dam-building activity and human land uses and infrastructure.
- BRAT assumes that the primary factors limiting beaver-dam abundance are flow, gradient, and vegetation. However, other factors, such as predation, trapping, and migration, influence where beavers can build dams. These factors were not considered as part of the analysis.
- Vegetation data are derived from 30-m Landsat data; thus, abrupt changes in vegetation/land-use may not be well represented in BRAT. A comparison of results using unpublished 5-m imagery shows little variation in vegetation type and distribution (for most areas) using finer scale results.

**Literature Cited**

White, J.C., Smith, E. Poor, K. Jones, A. Costello, and S. Rounds, 2018, Tualatin Beaver Poster 2 - Preliminary Results of a Beaver Dam Inventory and Beaver Dam Capacity Estimates in the Tualatin River Basin.

All data and findings are provisional and subject to change.

09-Feb-2018