Recovery of Dewatered Upland Habitat Following Dam Removal

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“Bathtub ring” at Lake Mead, 2007

(Photo: K. Dewey)

“Bathtub ring” at Sandy River, 2011

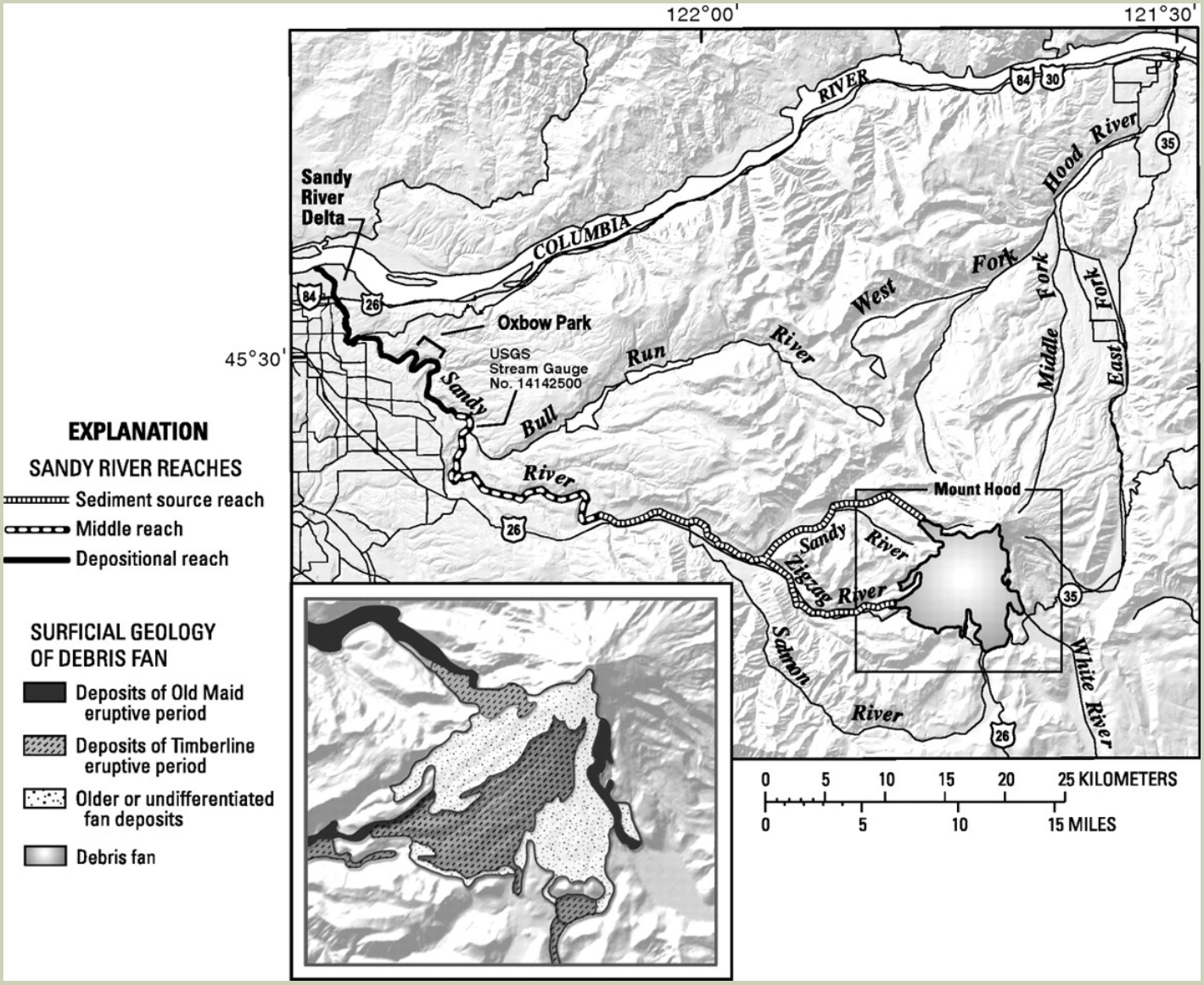
“Bathtub ring” at White Salmon River, 2012

OBJECTIVE

- Determine the physical, chemical, and biological changes in dewatered, abandoned sediments following dam removal.

- Estimate the successional pathways and time to equilibrium

The Sandy River at Mount Hood, Oregon



Pierson T C et al. Geological Society of America Bulletin 2010;123:3-20

MARMOT DAM

1908-2007; 14.3 m, concrete

(Photo: PGE)

http://www.djc.com/news/ae/12023010.html

October 2010

March 2011

SOIL RIPENING

- *Rijping:* maturation (Dutch)
- **Ripening:** The initial soil formation processes that render a soft alluvial deposit or peat suitable for agricultural use.
- Can be estimated by "assessing the depth to which a man sinks into the mud"
- The extent to which a rod, falling from a fixed height, sinks into the soil surface. This method was used about 1000 years ago when inhabitants or Peru were ordered by the Inca Gods to measure the friability of the soil by dropping a golden rod before founding a new settlement, the town of Cuzco

SOIL RIPENING

- Physical Ripening Index (*n*) (Pons and Zonneveld 1965):

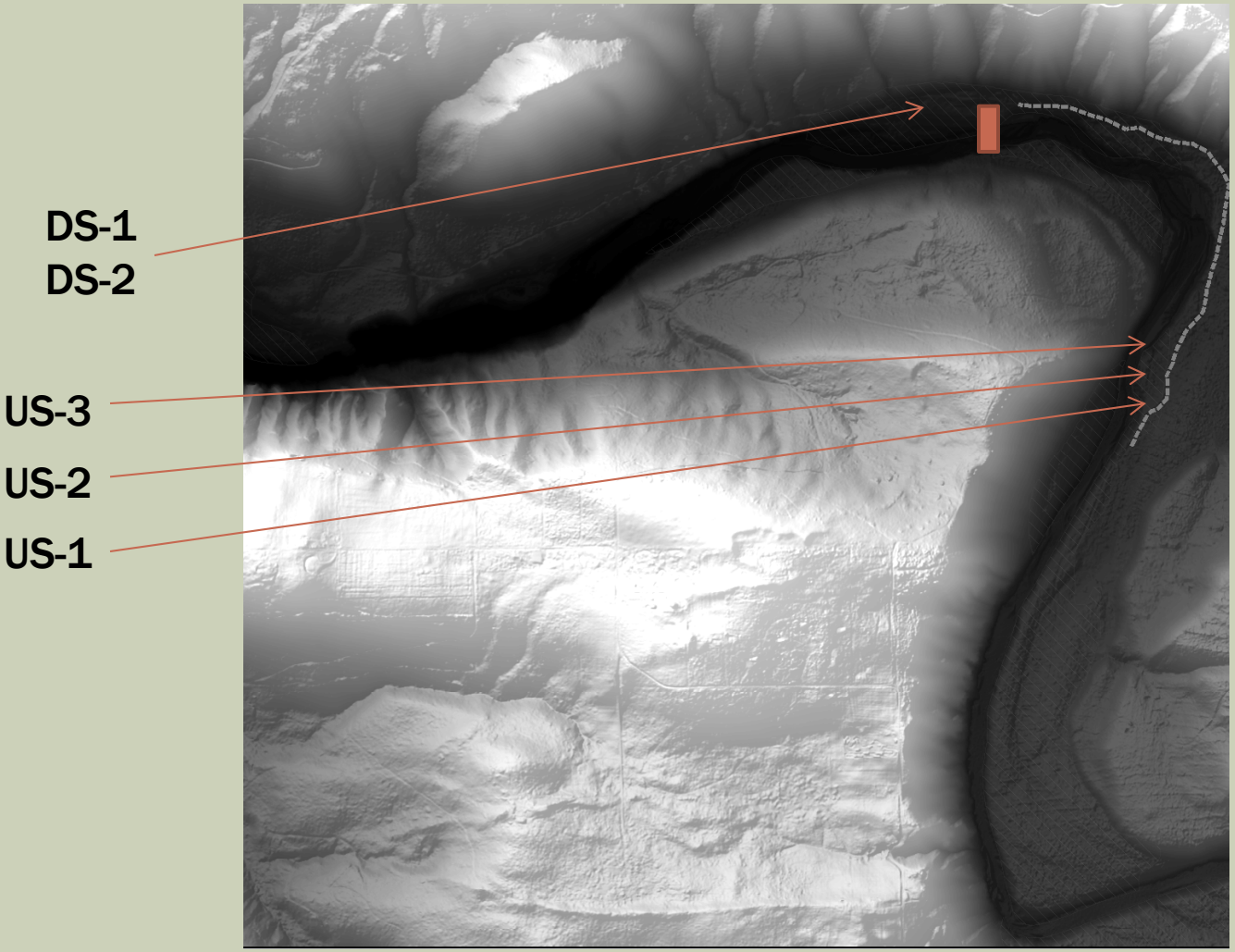
$$n = \frac{(A - 0.2R)}{(L + bH)}$$

Where:

- A is field moisture
- R is the percentage of sand plus silt;
- L is percentage of clay;
- H is the percentage of organic matter;

- Values less than 0.7 considered ripe
- Sensitive to sandy or clayey texture
- Values as high as 3.0 have been reported for recently exposed salt marshes
- Currently, there is no index for chemical or biological ripening

SOIL PIT LOCATIONS



Downstream sample locations

Cobbles from DS-2, sizes over 200mm across the b-axis

DS-2 – Downstream terrace

Horizon	Depth (cm)
Oi	7-0
A	0-19
Bw	19-51
Cu	51-90+

Site of upstream sample locations

US-1

Horizon	Depth (cm)
A1	0-11
A2	11-16
Cu1	16-23
Cu2	23-114
Ab	114-126
Bwb	126-134
Cgb	134-165+

Upstream accumulated sediment over “preupland” soil

US-2

Horizon	Depth (cm)
A	0-2
Cu1	2-65
Cu2	65-106
Ab	106-118
Bwb	118-139
Water	


US-3
A
0
-
1
1
Bw
1
1
-
2
6
Cg
2
6
-
1
0
5


0·2
0·4
0·6
0·8
1·0

PHYSICAL RIPENING

Upstream	Depth (cm)	Color	Texture	Sand	Silt	Clay	Field Moisture	OM %	*n* value
A1	0-11	10YR 6/3	Sand	85%	10%	5%	15%	1.6	**-0.4**
A2	11-16	10YR 5/3	Loamy Sand	88%	8%	4%	17%	2.3	**-0.2**
Cu1	16-23	2.5Y 5/2	Fine Sand	94%	1%	5%	6%	1.1	**-1.6**
Cu2	23-114	2.5Y 5/1	Fine Sand	97%	1%	2%	9%	0.7	**-2.8**
Ab	114-126	10YR 4/1	Fine Sand	97%	2%	1%	27%	0.8	**2.1**
Bwb	126-134	10YR 5/2	Fine Sand	95%	4%	1%	24%	0.7	**1.4**
Cgb	134-165+	2.5Y 5/1	Fine Sand	93%	7%	0%	24%	0.9	**1.4**
Downstream	**Depth (cm)**	**Color**	**Texture**	**Sand**	**Silt**	**Clay**	**Field Moisture**	**OM %**	***n* value**
A	0-19	10 YR 3/2	Coarse Sand	97%	1%	2%	8%	1.0	**-2.5**
Bw	19-51	7.5YR 5/2	Fine Sand	91%	8%	1%	19%	1.0	**-0.2**
Cu	51-90+	10YR 5/1	Coarse Sand	98%	1%	1%	9%	0.9	**-3.1**

CHEMICAL AND BIOLOGICAL RIPENING

	Depth (cm)	Munsell Code	Color	pH	C:N
A1	0-11	10YR 6/3	Pale Brown	5.8	13:1
A2	11-16	10YR 5/3	Brown	5.7	15:1
Cu1	16-23	2.5Y 5/2	Grayish Brown	6.2	54:1
Cu2	23-114	2.5Y 5/1	Gray	6.3	39:1
Ab	114-126	10YR 4/1	Dark Gray	5.4	15:1
Bwb	126-134	10YR 5/2	Grayish Brown	5.6	42:1
Cgb	134-165+	2.5Y 5/1	Gray	5.6	17:1

	Depth (cm)	Color	Color	pH	C:N
A	0-19	10 YR 3/2	Dark Grayish Brown	5.9	28:1
Bw	19-51	7.5YR 5/2	Brown	6.1	29:1
Cox	51-90	10YR 5/1	Gray	5.7	26:1

“Bloom” from nitrates released by dewatered soil

Bacteria feeding on reduced, soluble (ferrous) iron released by dewatered soil behind the former Hemlock Dam on Trout Creek.

Primary succession of red alder despite high nitrate levels

Post-logging bank surface

Current floodplain

Pre-logging bank surface

- Leatherwood Branch
  - Mechanically logged
  - Settled areas
  - Low catchment mean slope angle
  - Relatively small catchment
  - Half the catchment burned
  - Weak rocks
  - Low circularity

Thank You

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