Developing the Historical Context for Understanding Present Day Land Use-Water Quality Relationships

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Road Map

- Why Think About History?
- Methods Overview
- Methods Examples
  - 1907/1911 – Maps and Surveys
  - 1936/1948 - Aerial Photos
- Preliminary Results

The Ghost of Land Use Past

(Harding et al 1998)

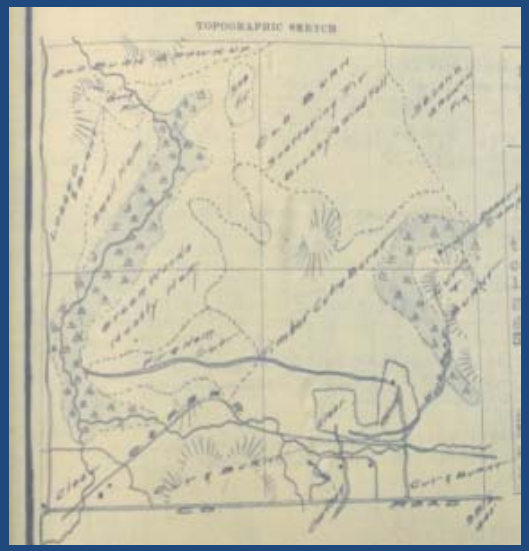
- Present day land use/land cover not always indicative of historic conditions
- Explain water quality impairment patterns
- Insights into system resilience

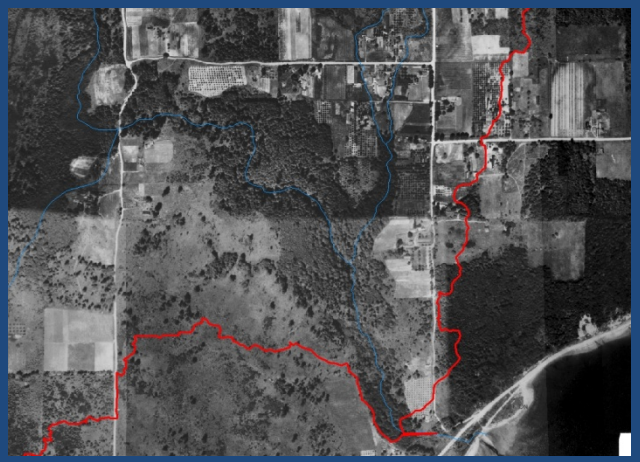
Fisher 1936

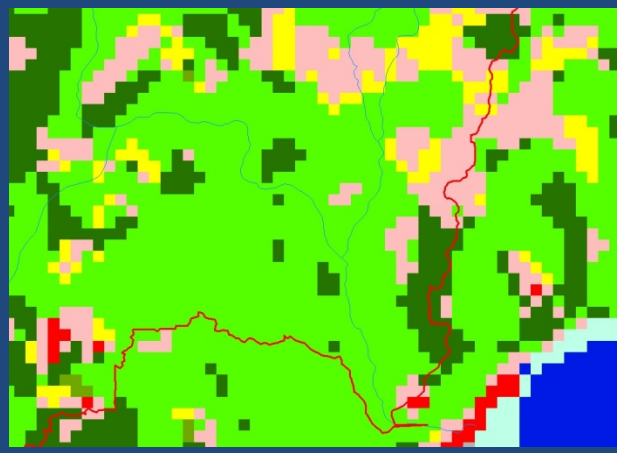
Fisher 2007

Challenges

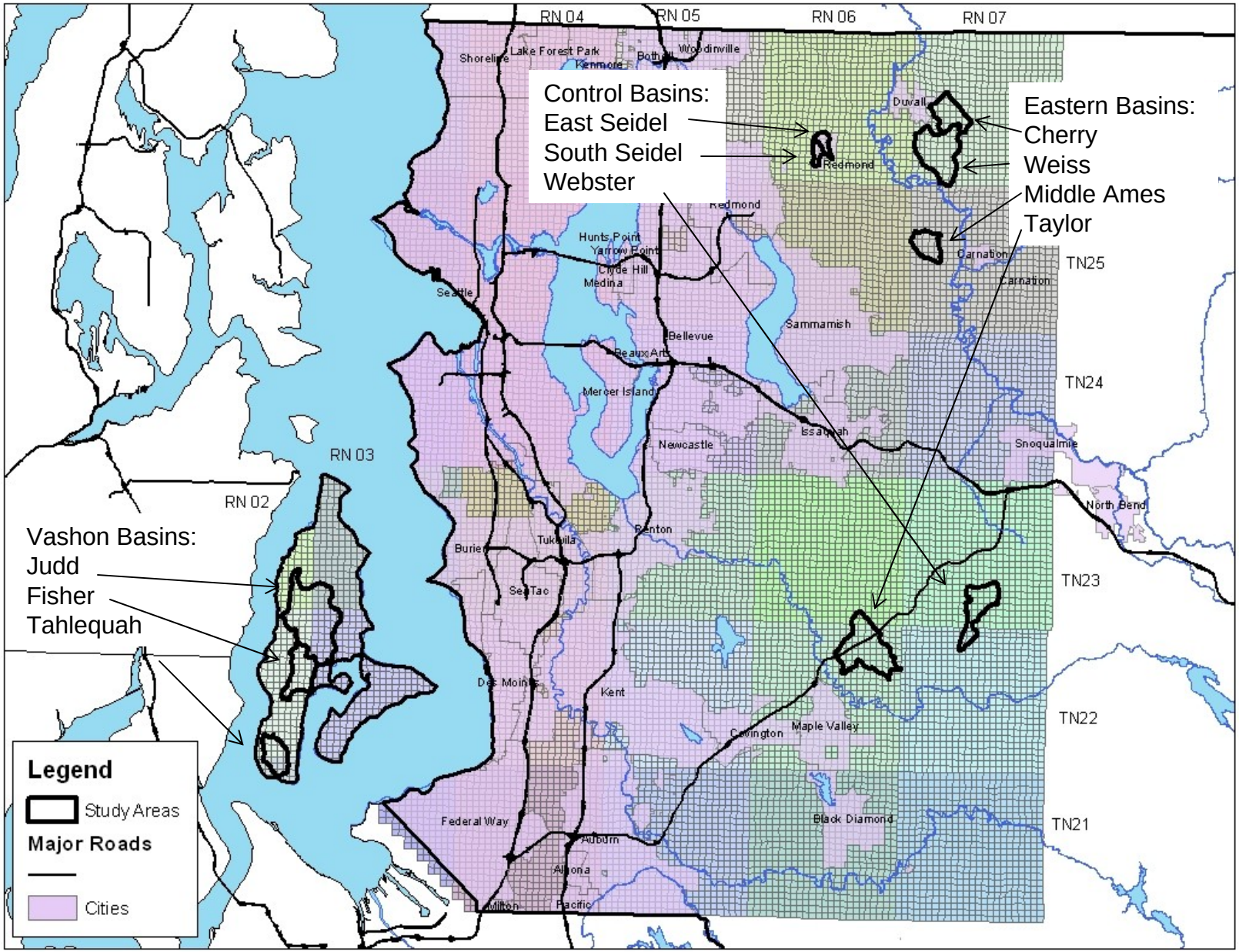
- Finding Useful Data
- Using secondary data
- Processing data into a useful format
- Integrating multiple datasets with different (unknown) accuracy







Study Basins



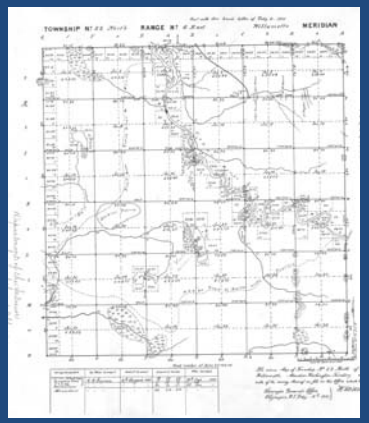
Data Timeline

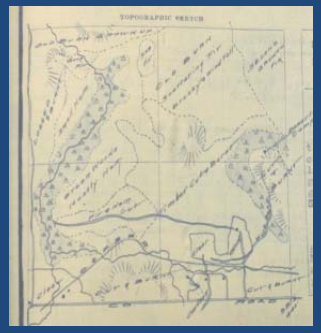
GLO | Timber Cruise (40 acre tract) | Soil Survey 1:125,000

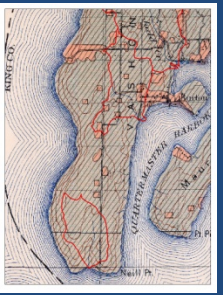
1857 1873 1891 1907-08 1911

Vashon | Seidels Ames | Webster | Eastern Basins | Vashon

Cherry Weiss Taylor







Aerials

1:800 | 1:20,000 | 1:60,000 | 1:12,000 | 1 ft pixel

1936 1948 1965 1995 2007

Vashon, some additional Eastern Basins

All Basins

Land Cover 30 m pixels

1986 1991 1995 1999 2002 2007

All Basins

Approach

- Maps and Photos
  - Georeference maps or photos
  - Hierarchical cover type classification
    1. Classify based on available data resolution
    2. Lump cover types into generic categories
    3. Quantify land cover
    4. Estimate confidence/accuracy
- Satellite data
  - Supervised classification with spectral un-mixing
  - Basic spatial analysis to quantify cover types

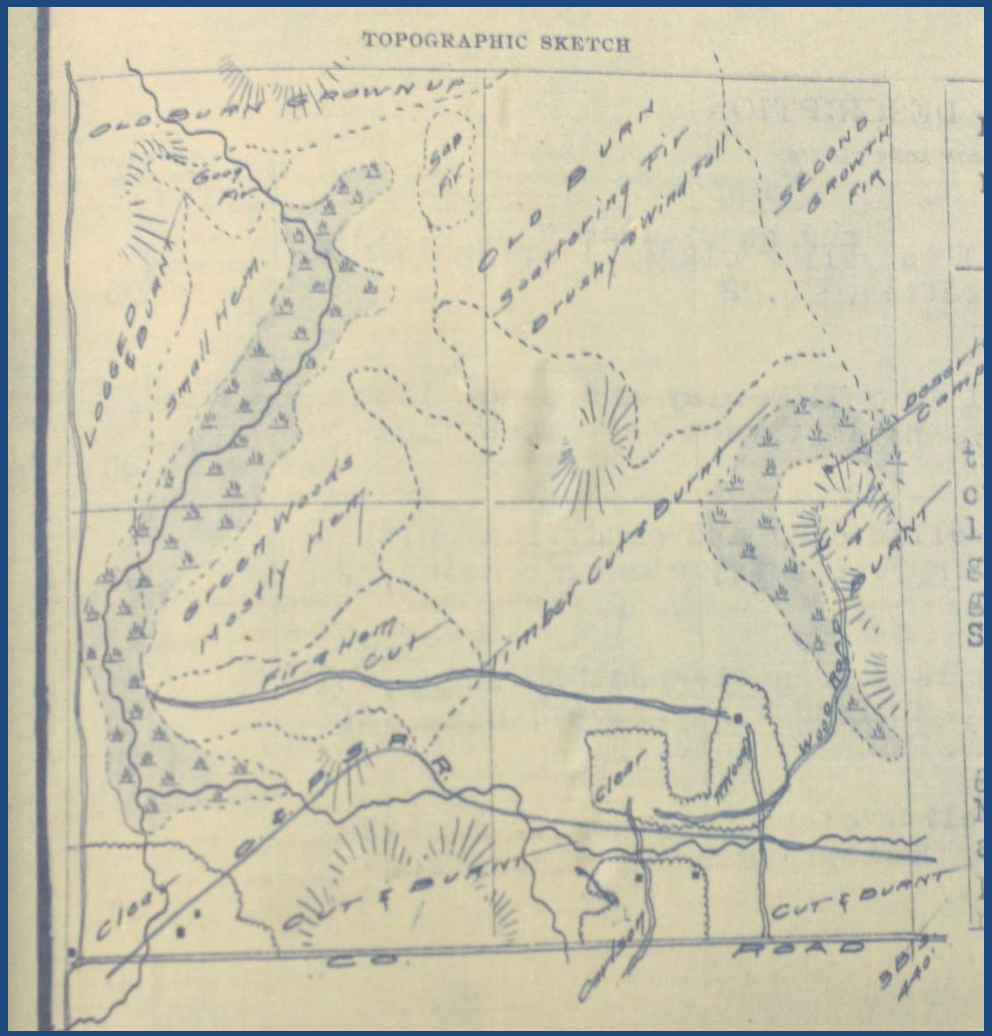
Land Cover 1907-1911

Timber Cruise (by 40 acre 1/16ths)

Soil Survey Map (1:125,000)

Timber Cruise 1907-8

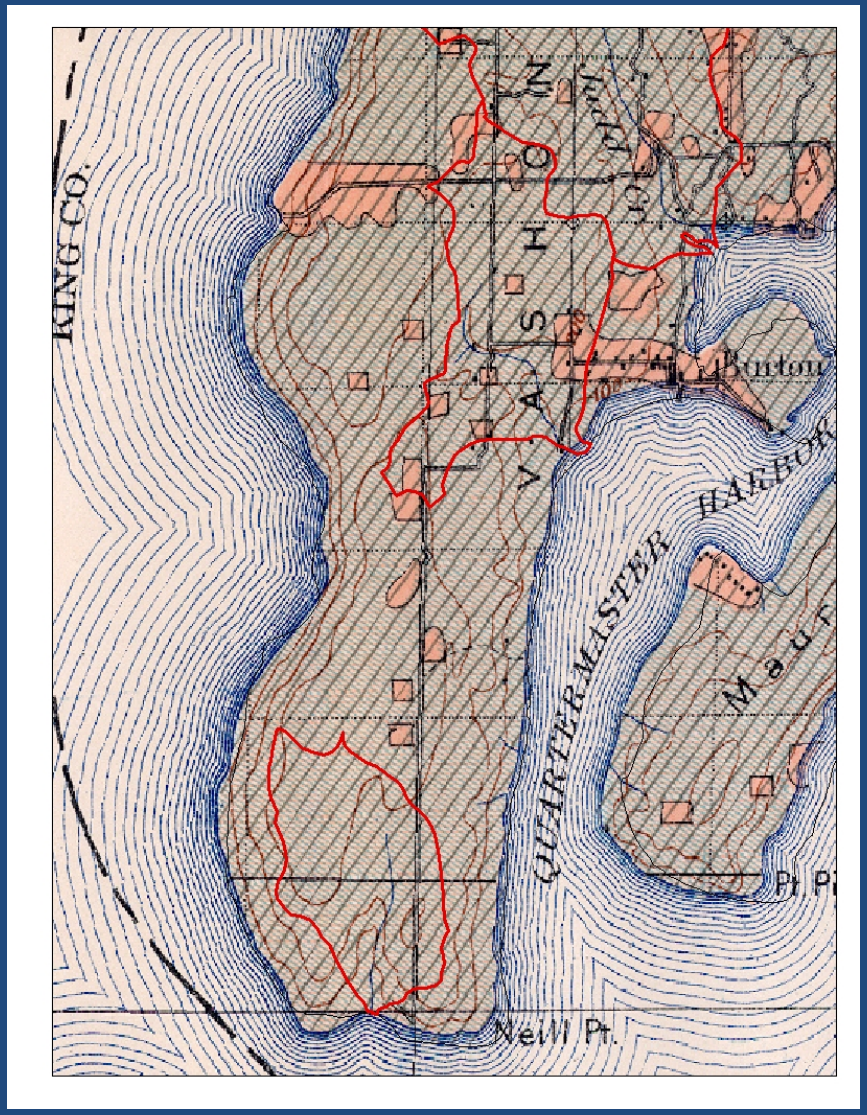
TN22 RN06 Sec 2 - Taylor

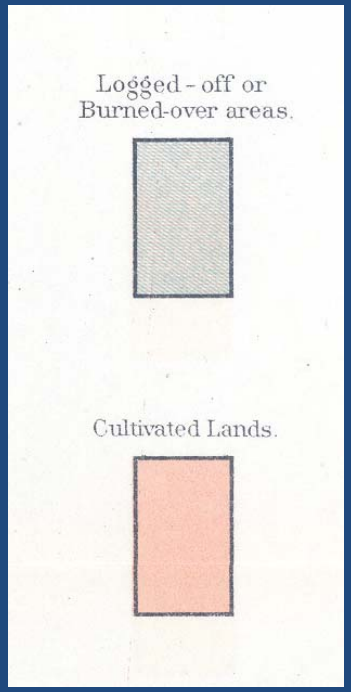


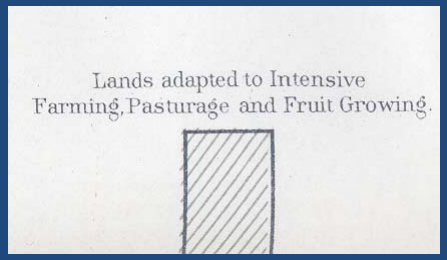
	IMPROVE VALUE $
E½ SE¼ owned by Robert Witty, rents for $5 per month; house 18 x 28 1½ story (green) poorly built inside,	600
Barn 16 x 40 (poor)	25
SW¼ SW¼ owner, Howard, of Seattle, leased by Ed Hudson; house 1 story white 18 x 24 (old)	150
Barn 24 x 40	250
Orchard of 25 poor trees; 16 acres cleared; good land	25
SW¼ SW¼ near the corner built on wrong land by mistake; 1½ story, drab, 18x24; ell, 12x16,	300

1911 Soil Survey

1:125,000







Land Cover Classes

1907-1911

Data Source	Original Text from Map	Cover – Level 1	Cover – Level 2
Timber Cruise Maps 1907-08 (Eastern Basins)	Old Growth	Old Growth	Forest
	Fir (conky, good, fair, live, scattering, thick growth), Cedar (live, swell butt, D.), Hemlock	Conifer	
	Alder, maple, vine maple, cottonwood	Deciduous	
	Alder and Fir, Alder and Hemlock	Mixed	
	"Grown up" hemlock, hemlock thicket, second growth, green woods, small hemlock, undergrowth of fir	2nd Growth	
	Logged, cut over	Logged	Vegetation Removed
	Logged and Burned	Logged and Burned	
	Burn	Burn	
	Old Burn	Old Burn	
	Cleared (confirmed in notes), Slashed, Part Cleared, Slash	Cleared	
	Pasture, Field	Pasture	Cultivated
	Bottom Land	Bottom	Wetland/ Bottomland
	Wetland, Swamp, Slough	Wetland	
	Lake, Sound	Open Water	Open Water
Soil Survey (Vashon Basins)	Logged or burned + adapted to intensive farming, pasture, or fruit growing	Intensive Ag	Cultivated
	Cultivated	Cultivated	

Aerial Photo Interpretation

1936

1948

1965

1995

2007

Land-Cover Categories

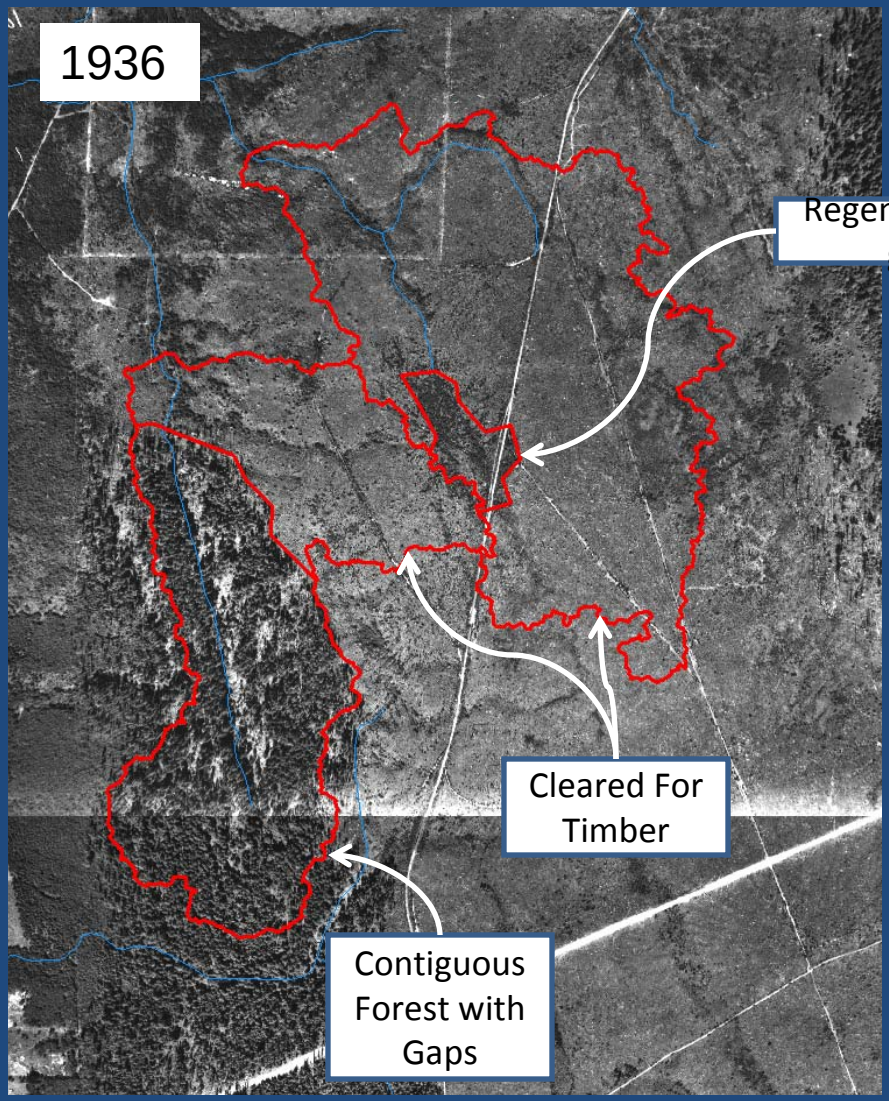
1936 and 1948

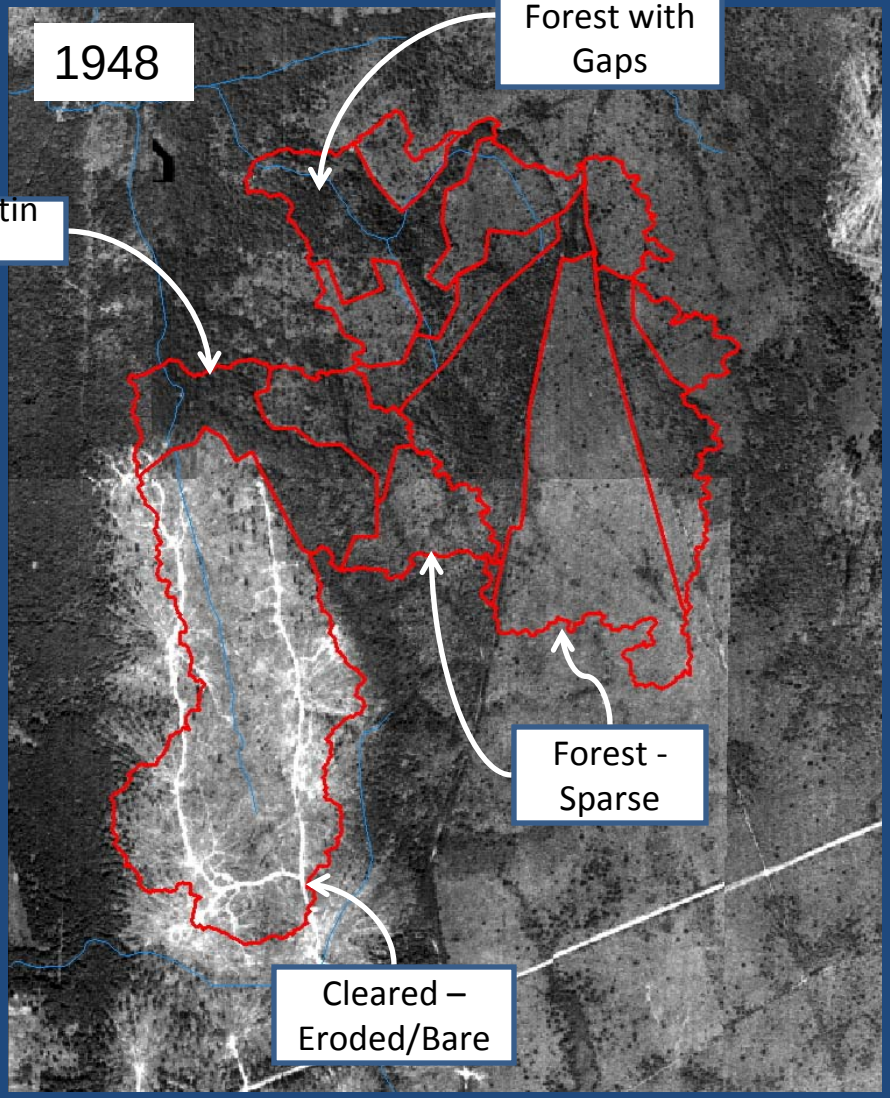
Scale =1:10,000; minimum size = 1 hectare

Description	Cover – Level 1	Cover Level - 2
Medium Light – not forest not as dark as regenerating forest, not as light as agriculture or bare ground	Grass	Grass
Sparse (Dots of individual trees distinguishable across more than 50% of the polygon) individual trees covering 10-40% of polygon	Forest – Sparse	
Extremely Sparse – dotted trees cover <10% of polygon	Forest – Extremely Sparse	
Clumped (Individual trees form clumps and blocks but overall the polygon is between 40 and 60% forested)	Forest-Clumped	Forest
Gaps occasionally visible but otherwise contiguous (>60% forested)	Forest-Contiguous w/ gaps	
Spaces are not visible between trees	Forest – Contiguous	
Medium darkness between grass and forest – covering at least 70% of the polygon – smooth, dense texture	Shrub/ Regenerating forest	Regenerating
Open treeless areas often in regular (straight line) shapes or with sharp edges, near roads or buildings, not clearly attributable to a particular purpose.	Cleared - unknown	Cleared
Star-like shapes associated with logging roads	Cleared – Eroded/bare	
Visible downed timber, in forestry area with little development or agriculture. Logging roads visible.	Cleared for Timber	
Regularly spaced trees	Orchard	Agriculture
Multiple small patches of ag (orchard, row crop, buildings, unknown purpose)	Mixed Agriculture	
Impervious Surface dominant (parking lots, rooftops), high(er) density regularly spaced housing not associated with agriculture.	Developed	Developed
Lakes, large rivers, wetlands	Open Water	Water

Land Cover Polygons

South and East Seidel

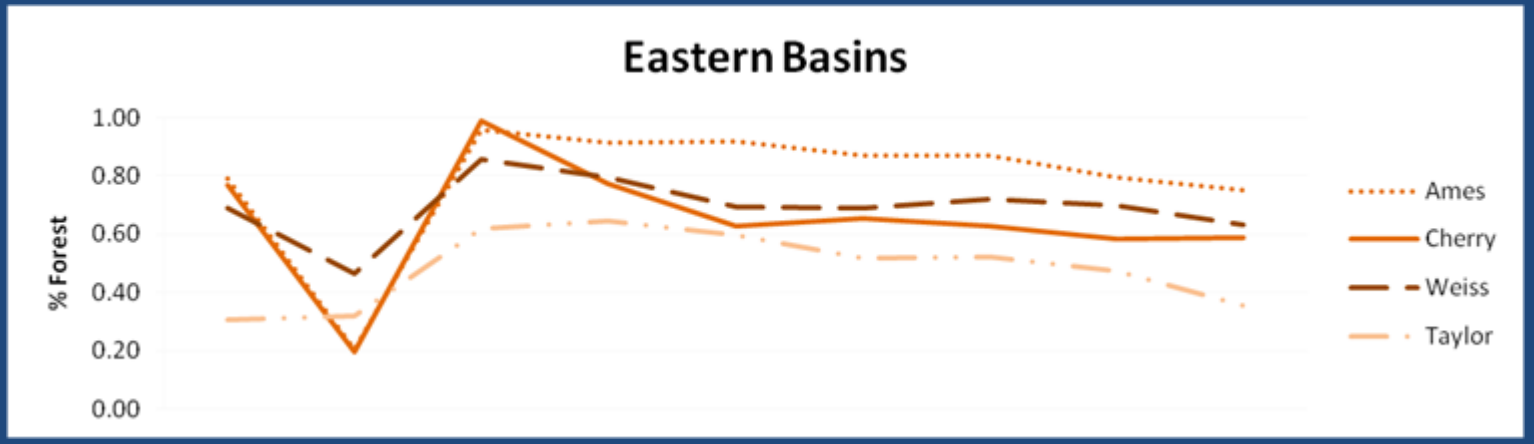


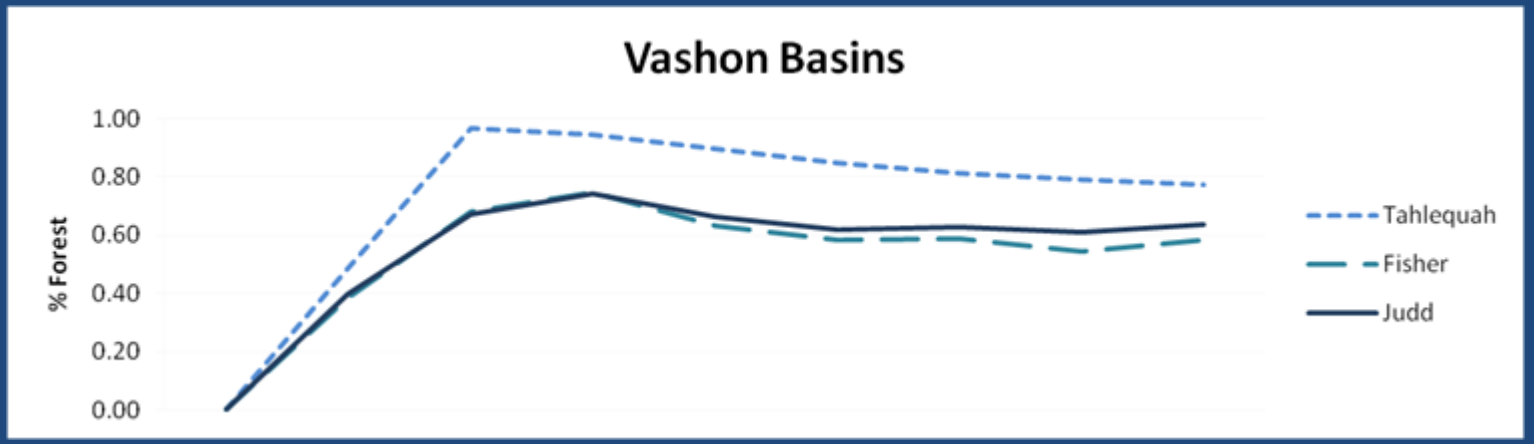


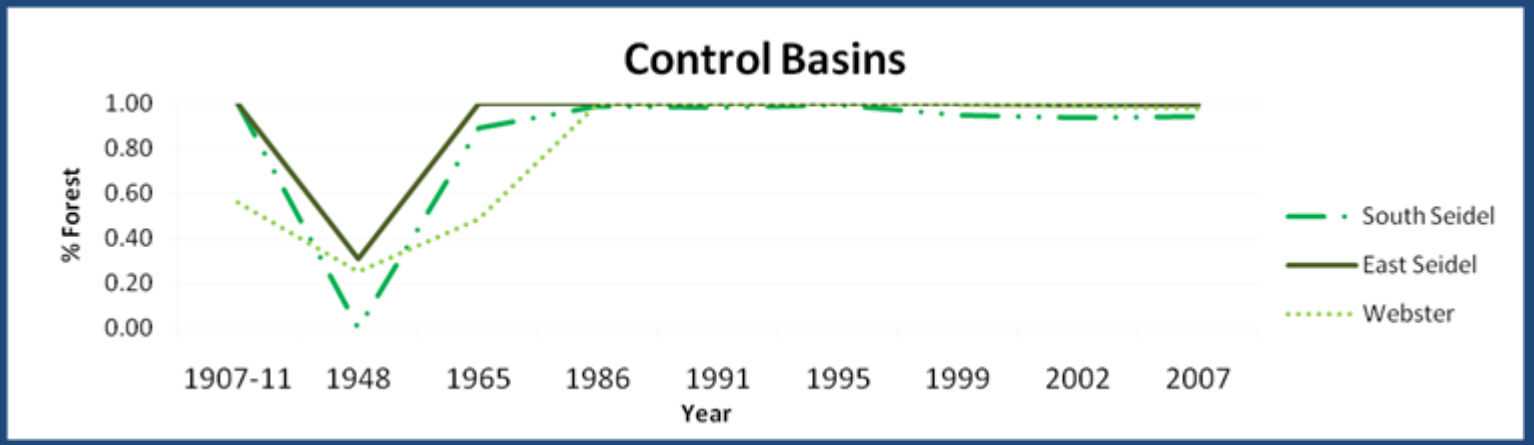
Preliminary Results

Forest Cover

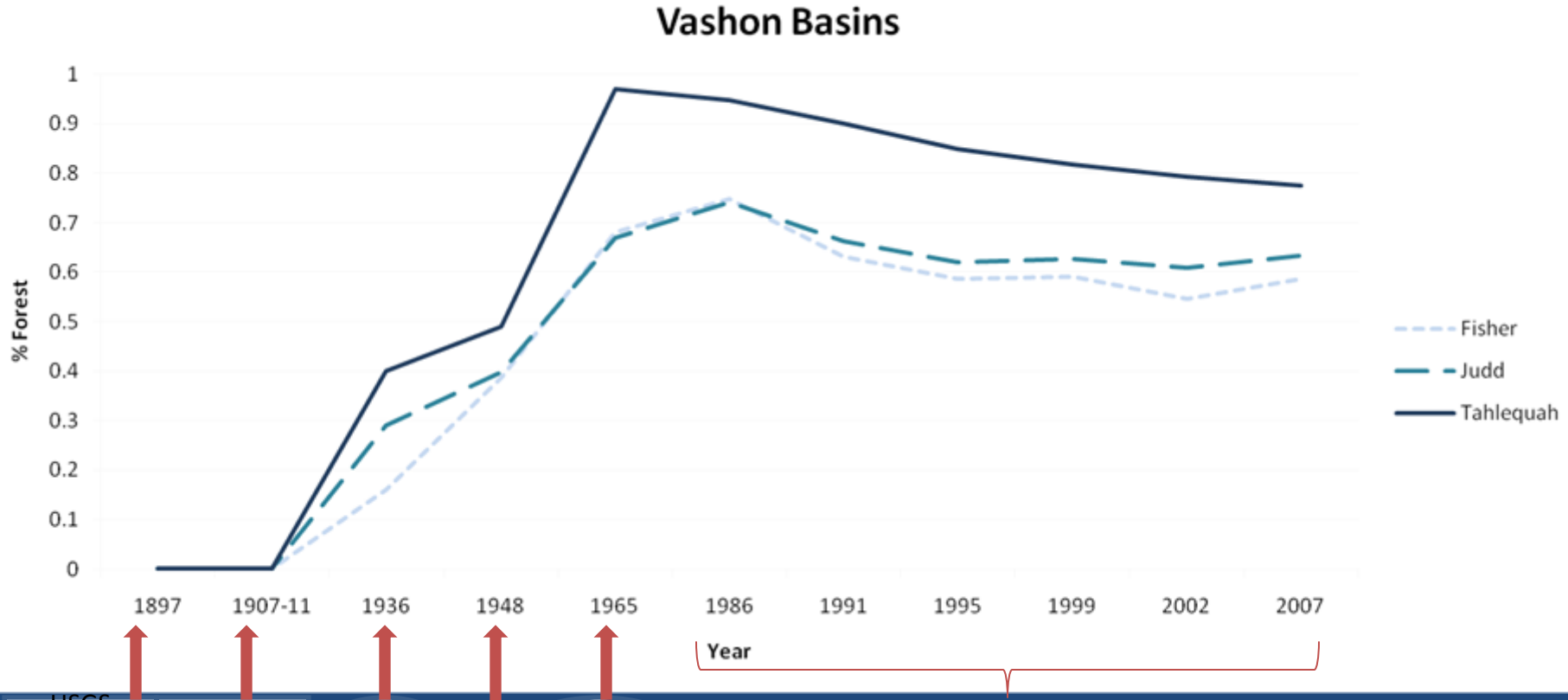
Change in % Forest Cover - 1907-11 to 2007







Forest Cover - Vashon



USGS Land Class 1:250,000

USGS Soil Survey 1:125,000

Aerial 1:800

Aerial 1:20,000

Aerial 1:60,000

Landsat 30 m resolution

User's Accuracy (%):

	1986	1991	1995	1999	2002	2007
Conifer	65	89	90	92	76	98
Mixed	63	79	89	87	81	94

Data Sources and Acknowledgements

- Staff - UW Map Library and Special Collections Archive
- Janette Gomes - King County Archive
- Phil Stairs - Washington State Archive – Puget Sound Branch
- Paul McCombs - King County Department of Development and Environmental Services
- Dr. Tom Minichillo - King County Road Services
- Rob Ryan - Natural Resources Conservation Service
- CAO team - King County Natural Resources
- Urban Ecology Research Lab