Climate Change on Columbia Basin Treaty-Tribal Lands

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Portland, Oregon

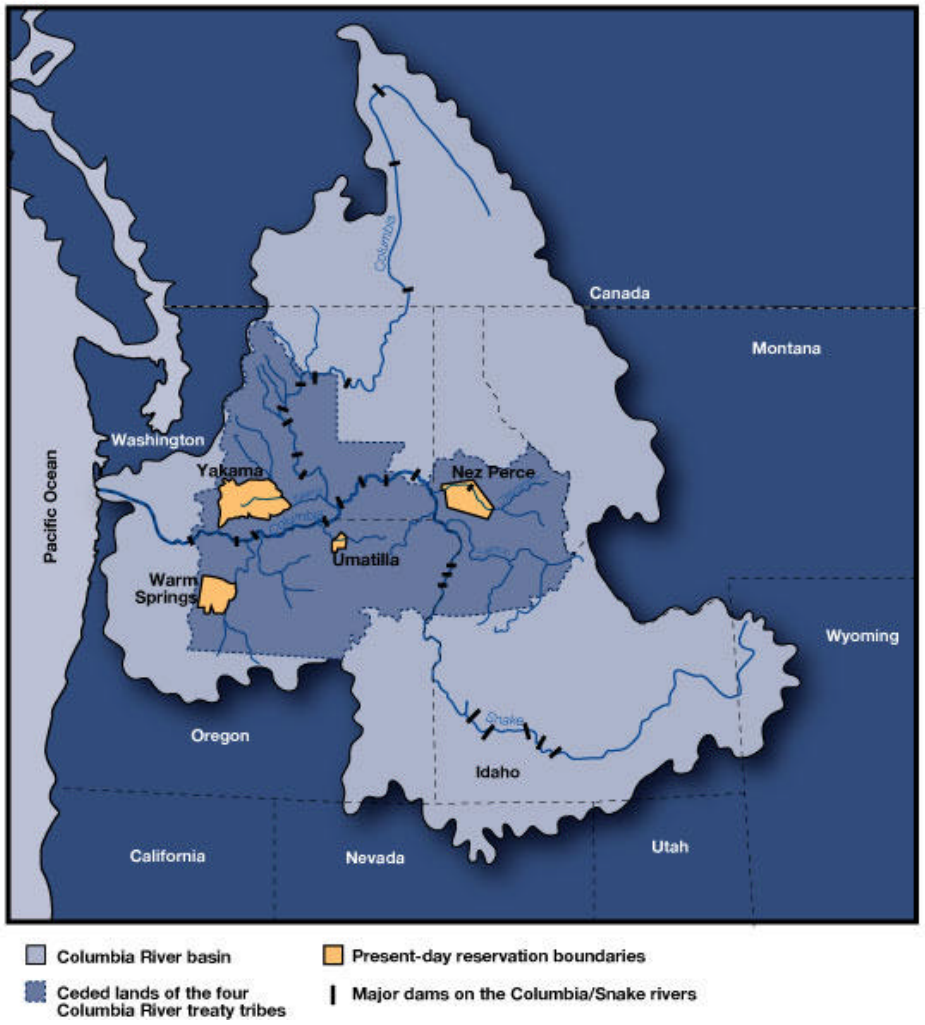
Study Goals

- Outline the current climate characteristics for treaty-tribal reservation and ceded lands.
- Compare how the climate has changed over the last 100 years (through 2004) for treaty-tribal lands and ceded lands.
- Assess climate impact to tribal water resources.
- Native Peoples Climate Change Workshop
  http://www.usgcrp.gov/usgcrp/Library/nationalassessment/native.pdf

Methods

- PRISM Climate data (OSU). (http://gis.esri.com/library/userconf/proc98/PROCEED/TO600/PAP577/P577.HTM)
- Key parameters: Maximum air temperature, minimum air temperature, and precipitation.
- Tributary Flow analysis: USGS historical observed daily stream flow data used to assess shift in sub-basin flow timing and seasonal flow volumes.
- Columbia Flow analysis: BPA modified-adjusted monthly stream flow data (compensates for evaporation effects and reservoir operations).
- Assess climate change risk—land below elevation 4000 feet? UW-CIG criteria (www.cses.washington.edu/cig)

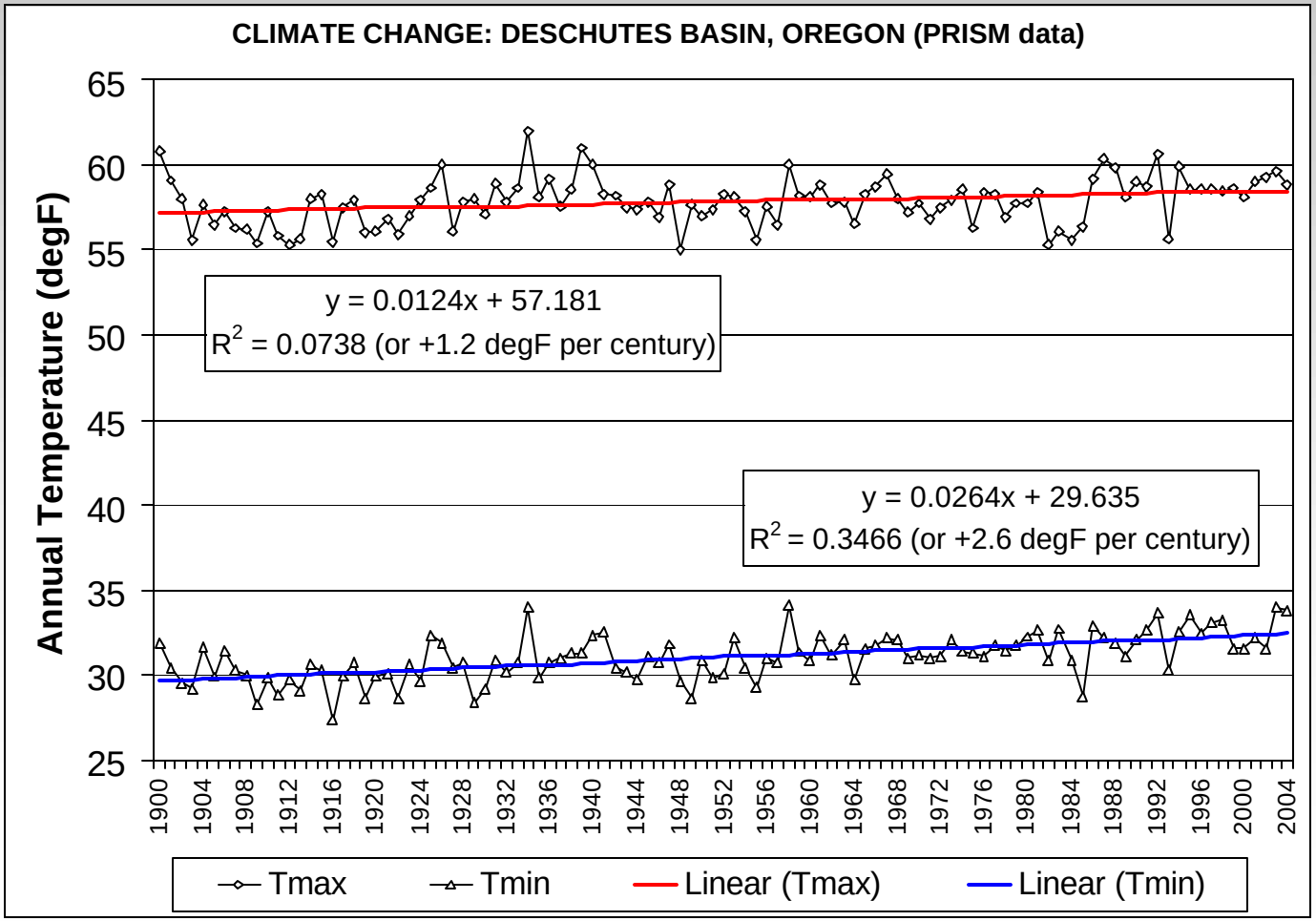
Location Map



Watersheds

- Confederated Tribes of the Warm Springs:
- --Deschutes, John Day, Hood River, and Fifteen Mile Creek.
- Confederated Tribes of the Umatilla:
- --John Day, Umatilla, Grand Ronde, and Imnaha (Oregon).
- --Walla Walla and Tucannon (Washington).
- Nez Perce Tribe:
- --Clearwater and Salmon (Idaho).
- --Grand Ronde, Imnaha, Walla Walla and Tucannon.
- Confederated Tribes of the Yakama Nation:
- --Yakima, Klickitat, Wind, Wenatchee, Entiat, Methow, and Okanogan.

Climate Change: Deschutes Basin



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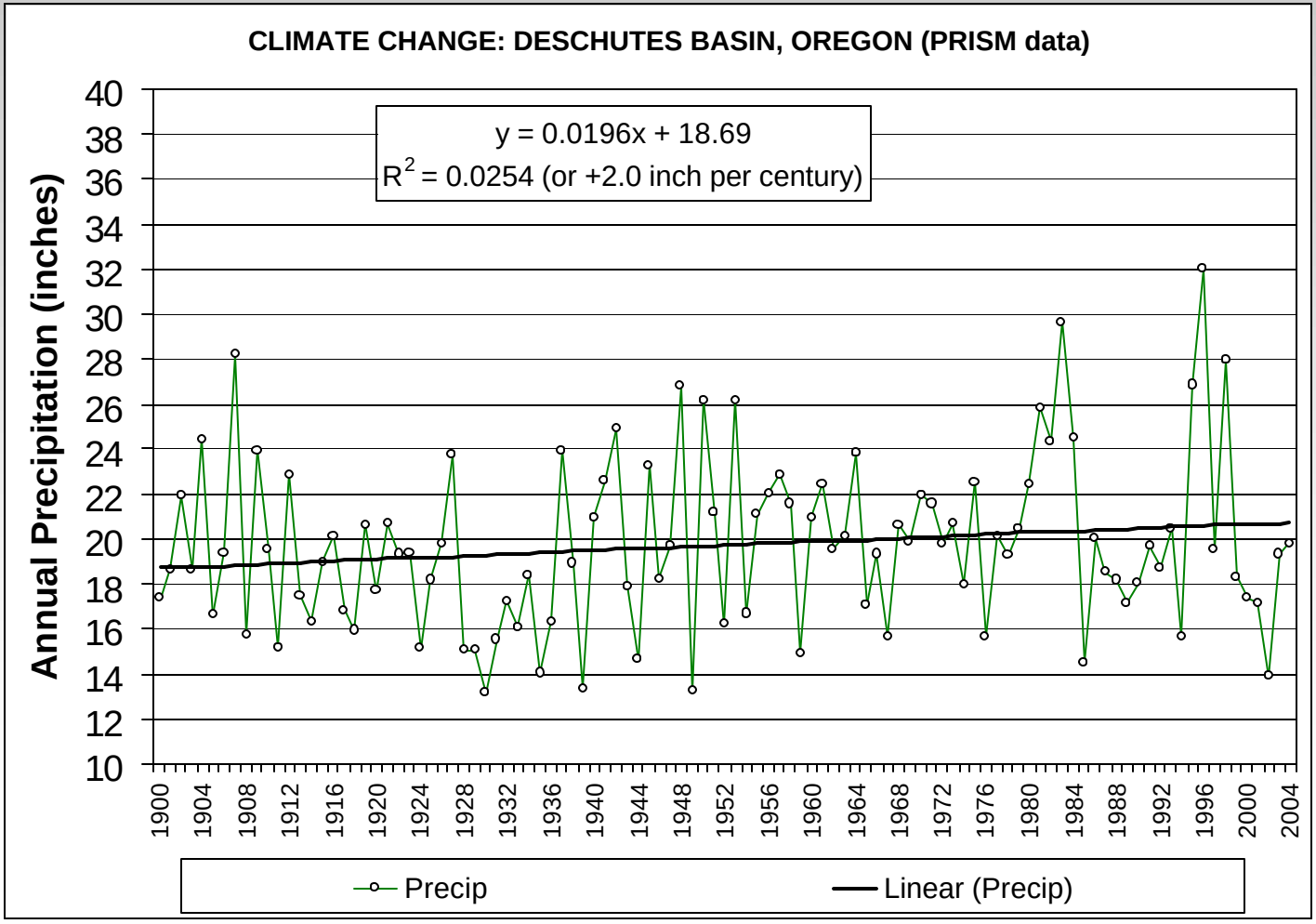
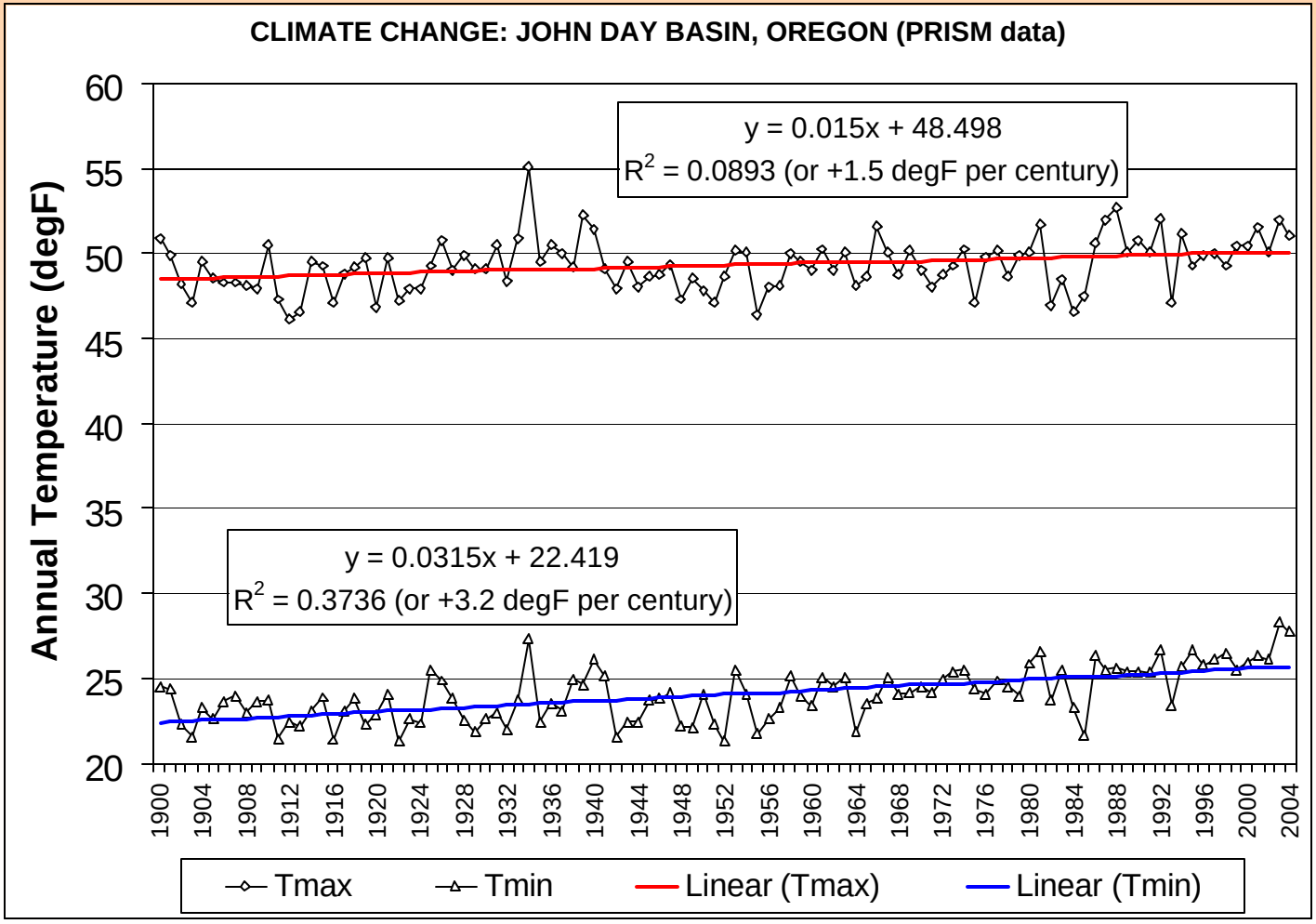


Climate Change:
John Day Basin



Climate Change:
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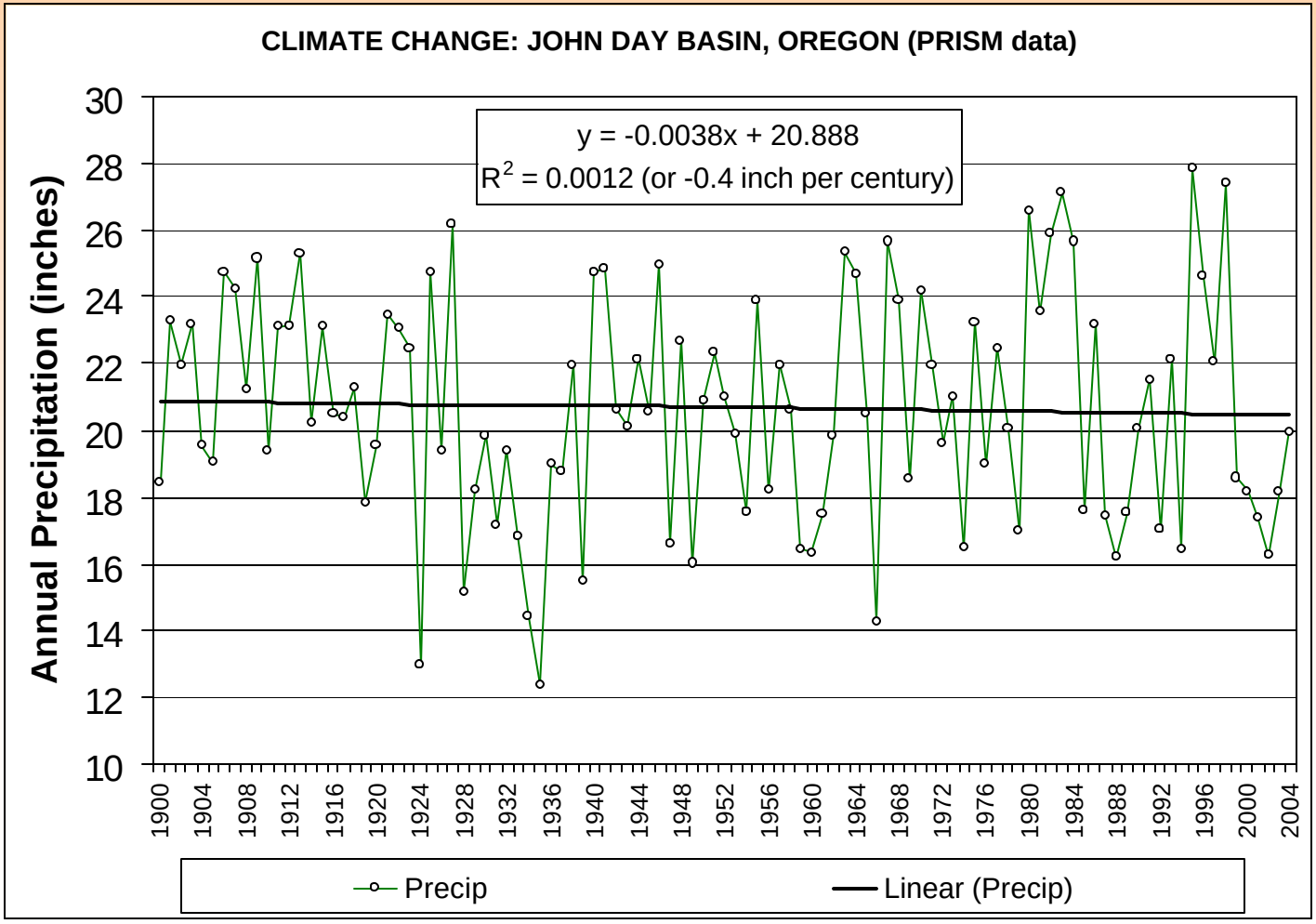
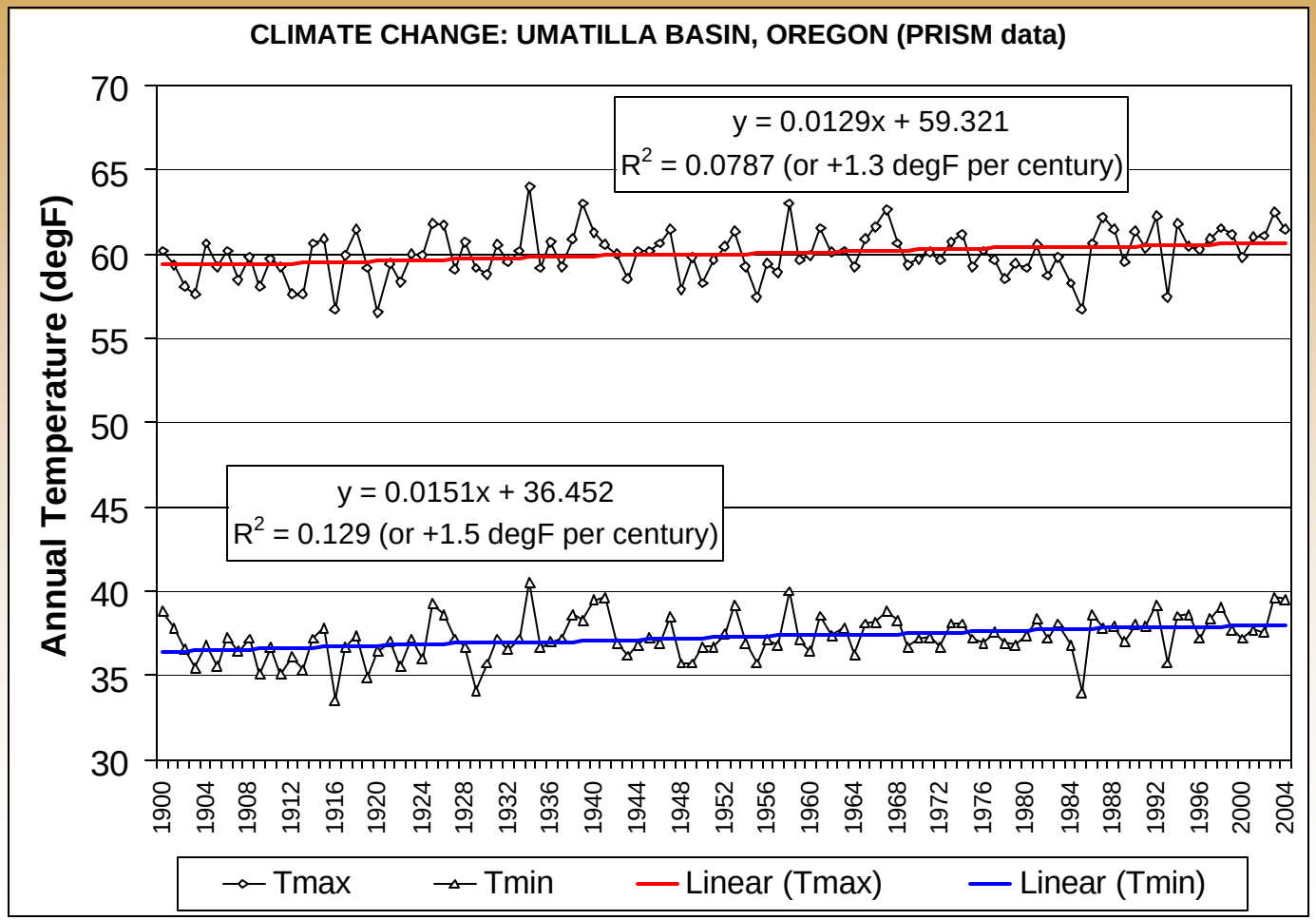
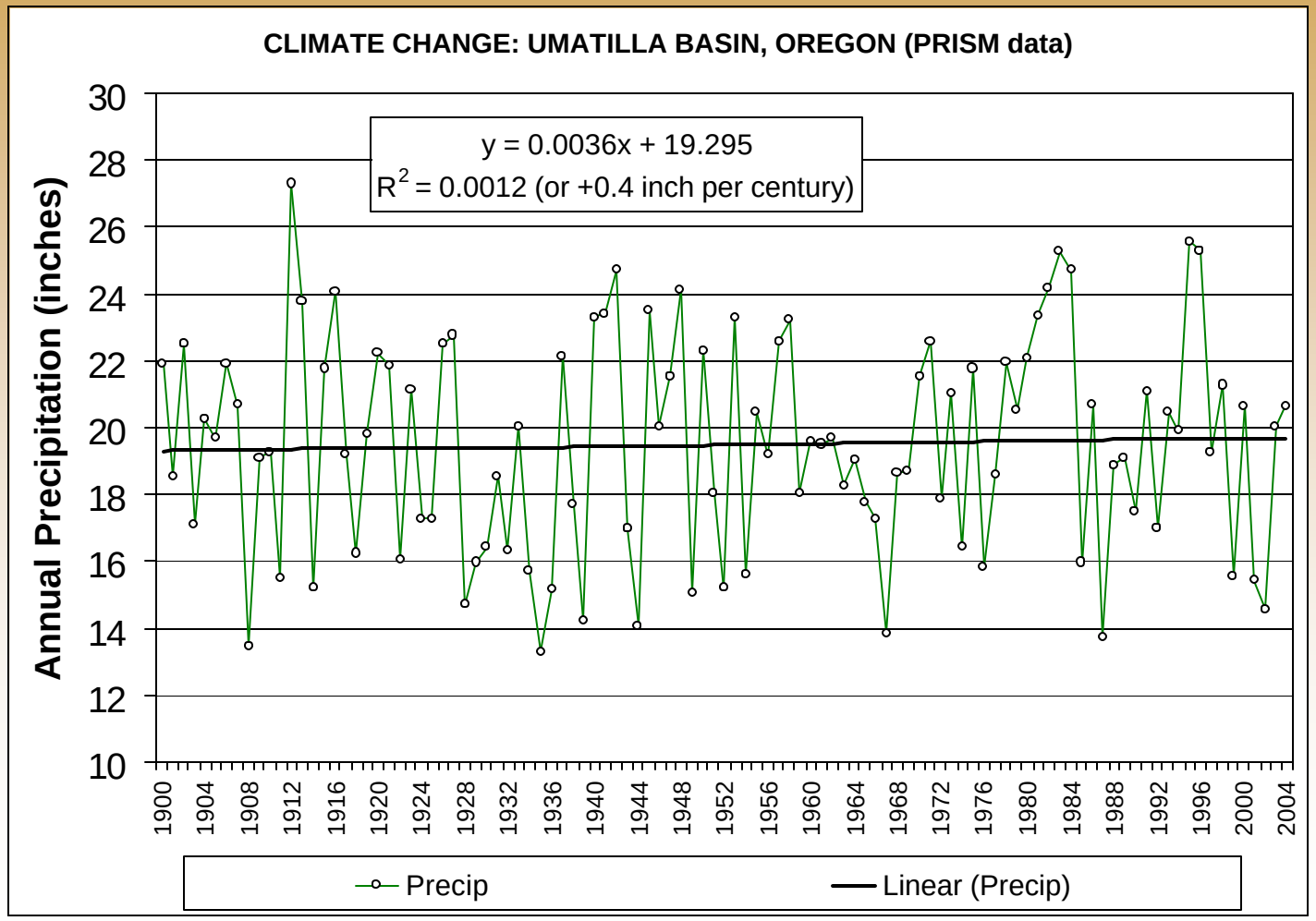


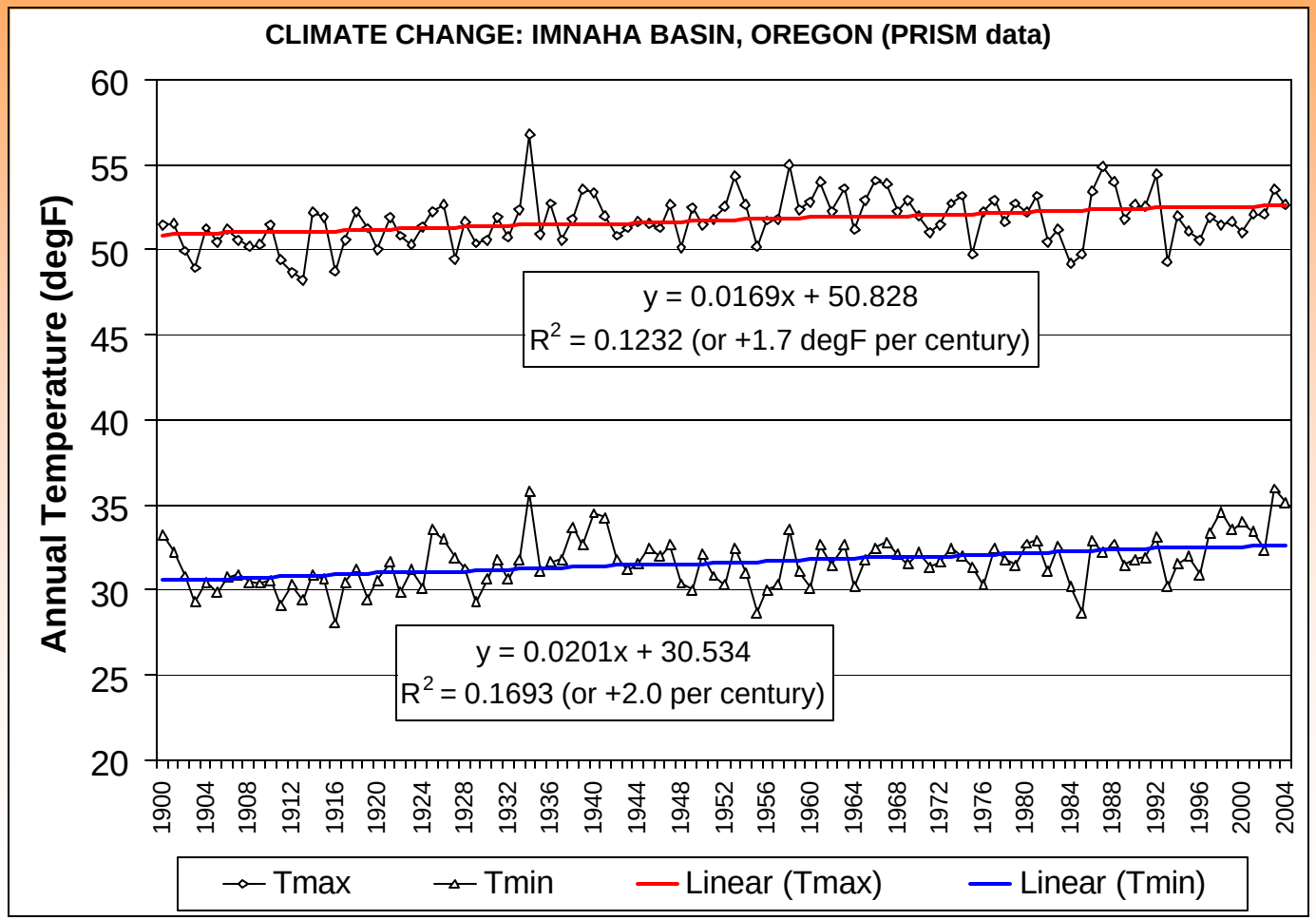
Climate Change: Umatilla Basin



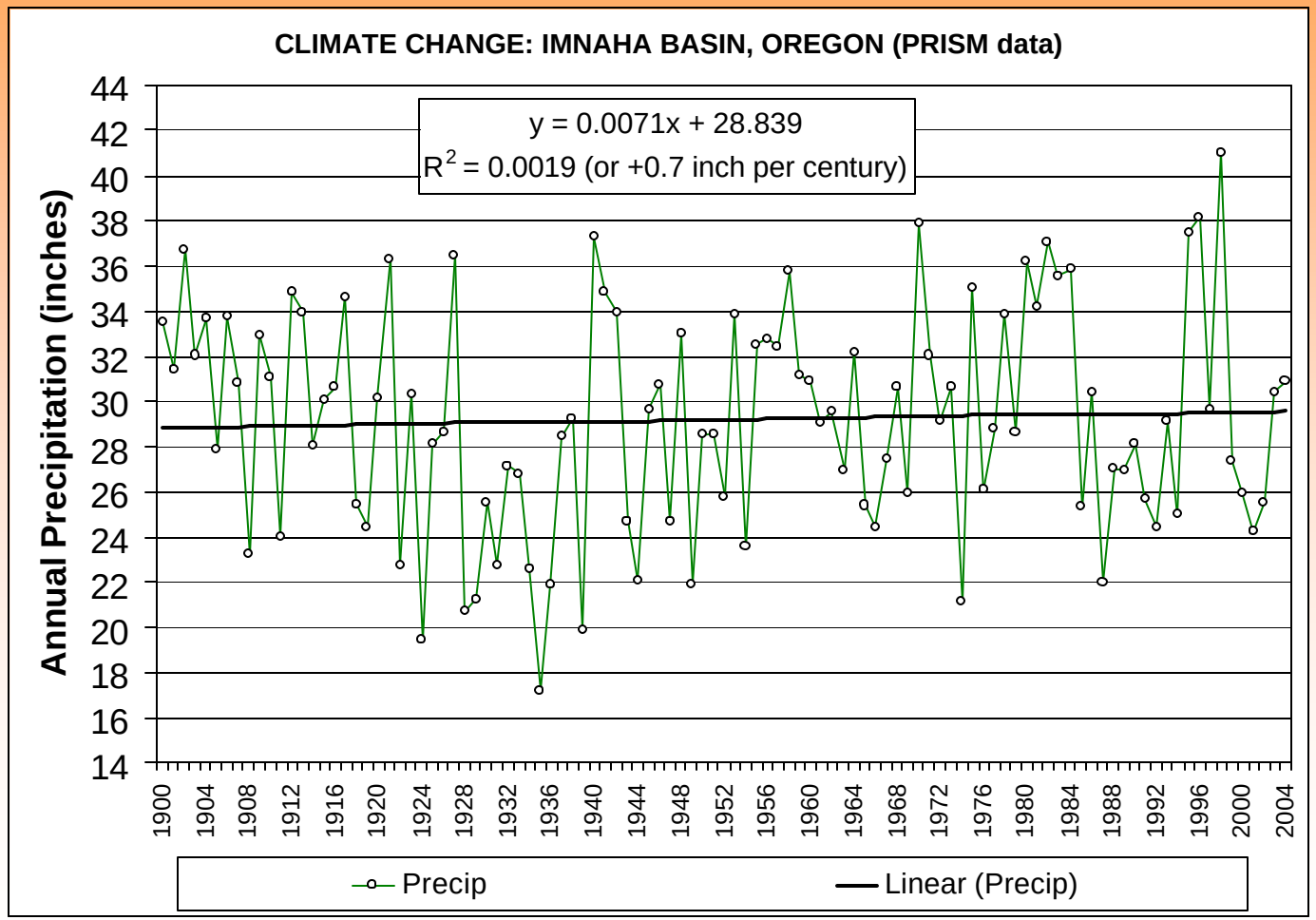
Climate Change: Umatilla Basin



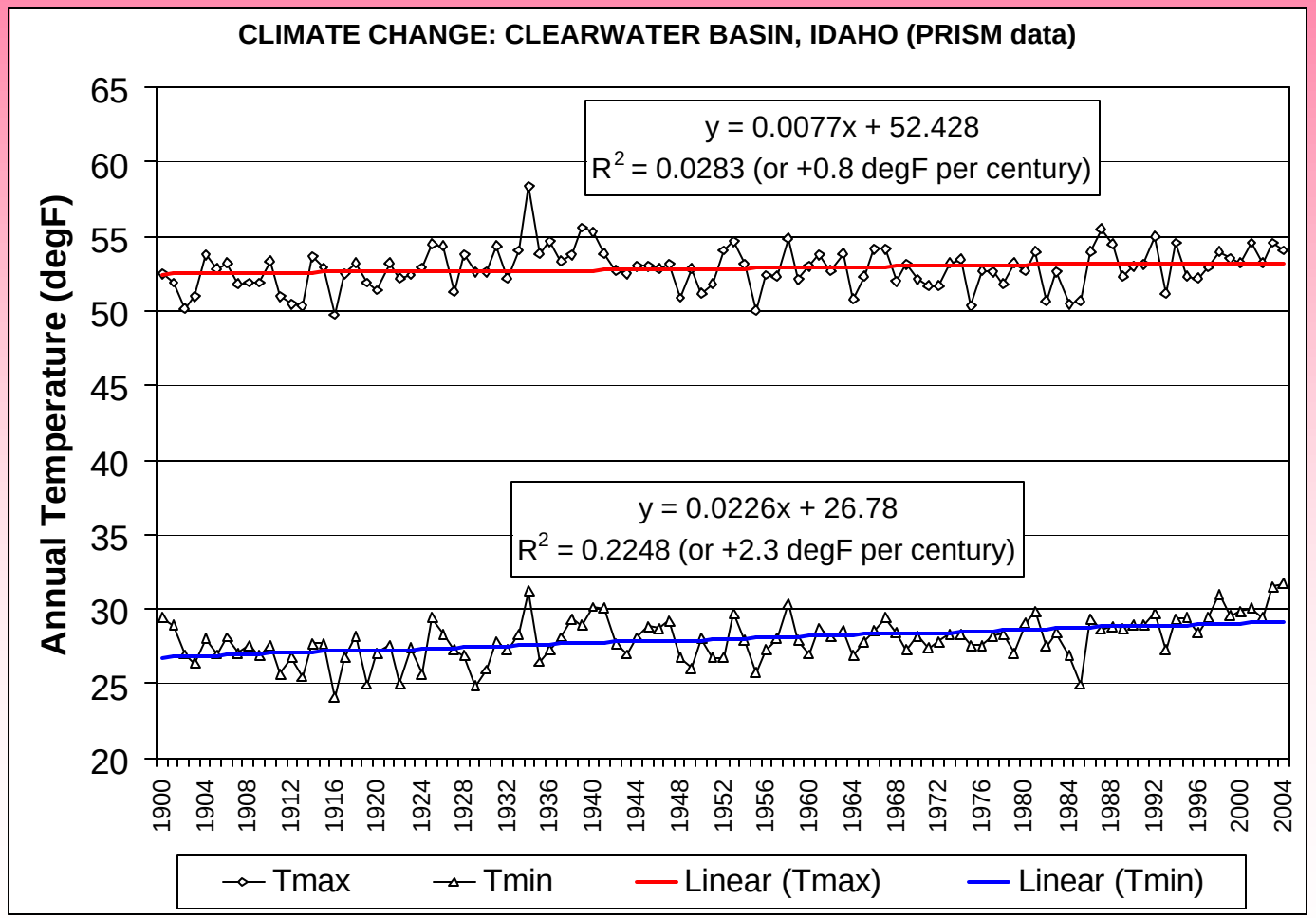
Climate Change:
Imnaha Basin



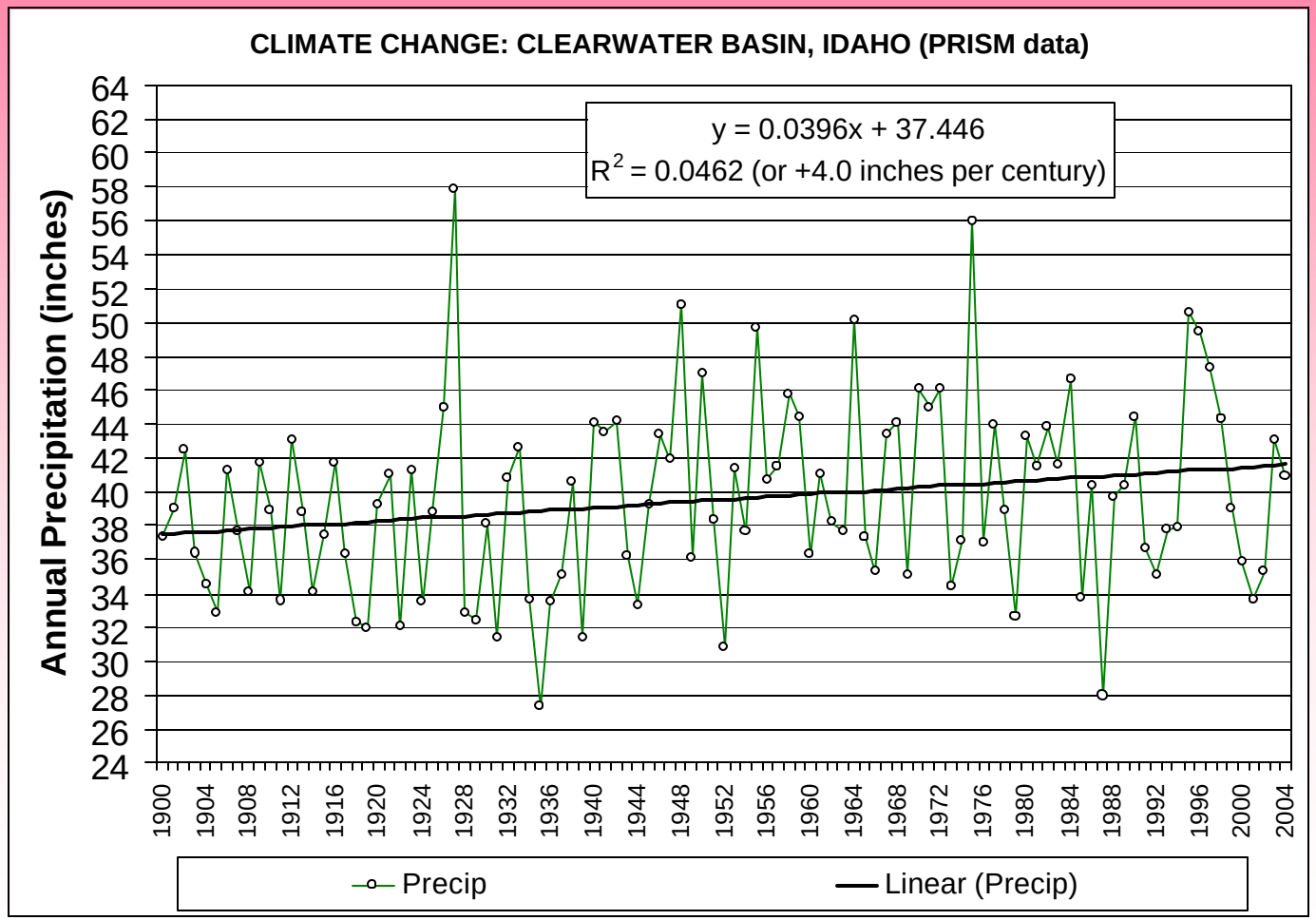
Climate Change:
Imnaha Basin



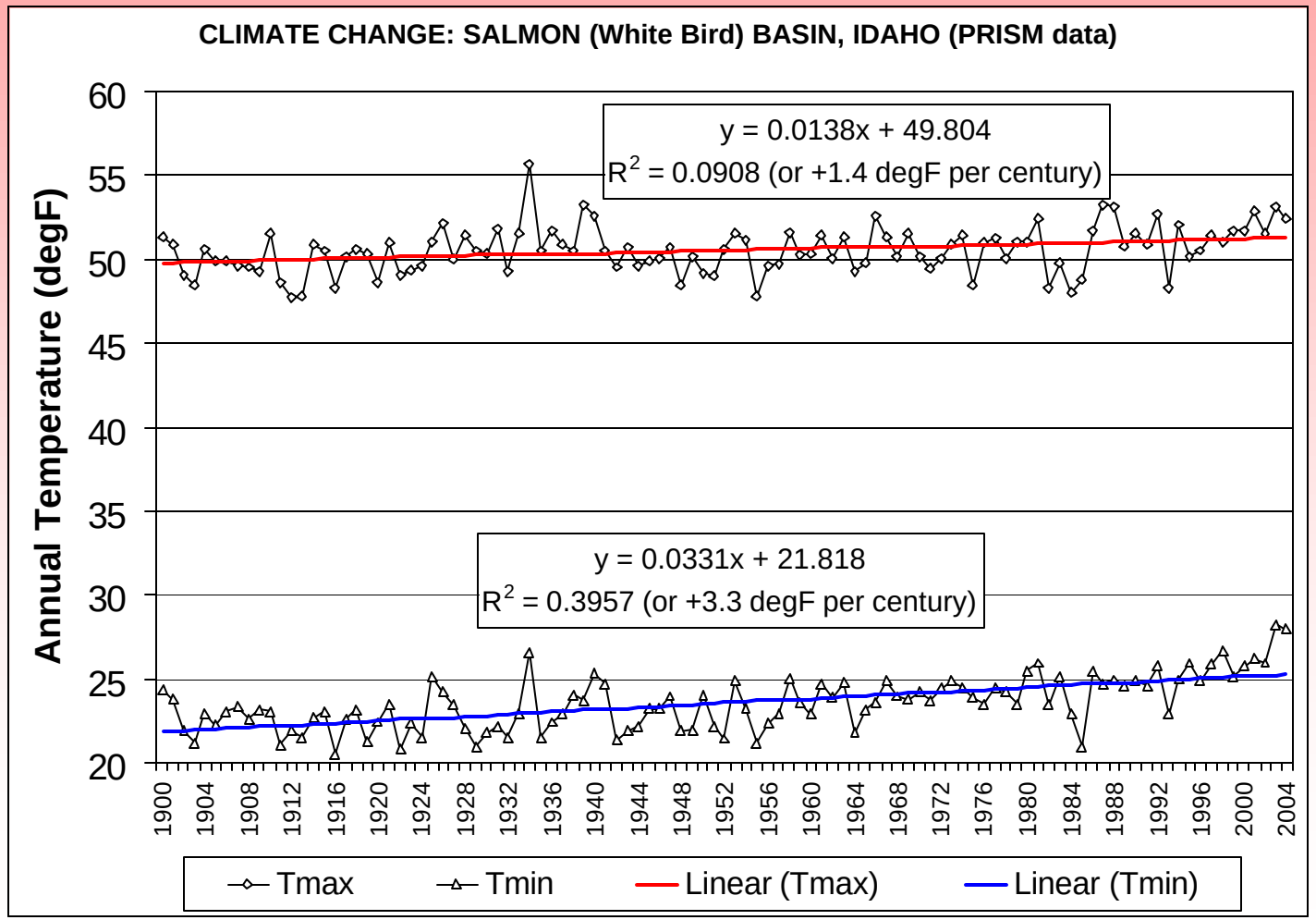
Climate Change: Clearwater Basin



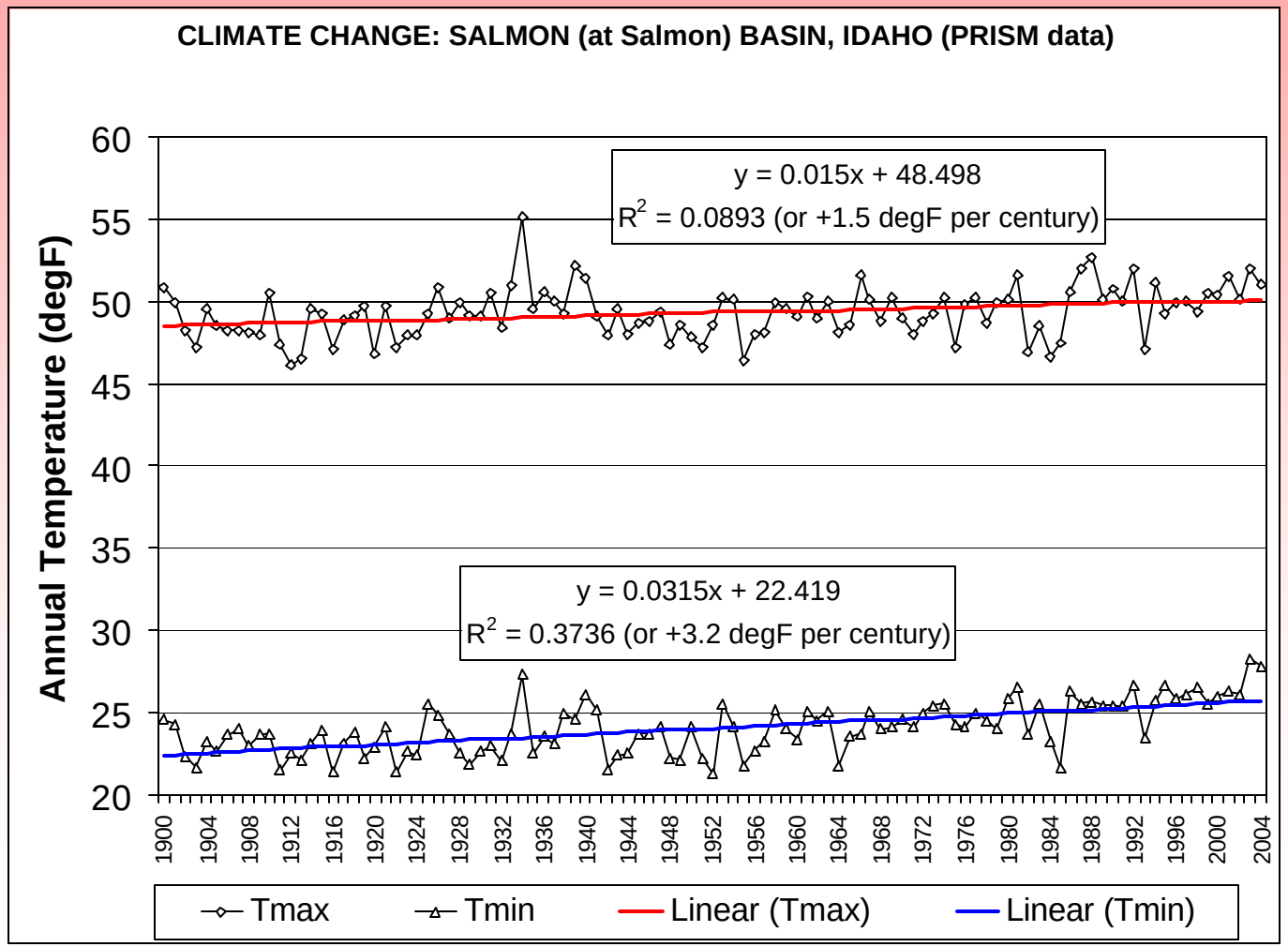
Climate Change: Clearwater Basin



Climate Change: Salmon Basin



Climate Change: Upper Salmon Basin



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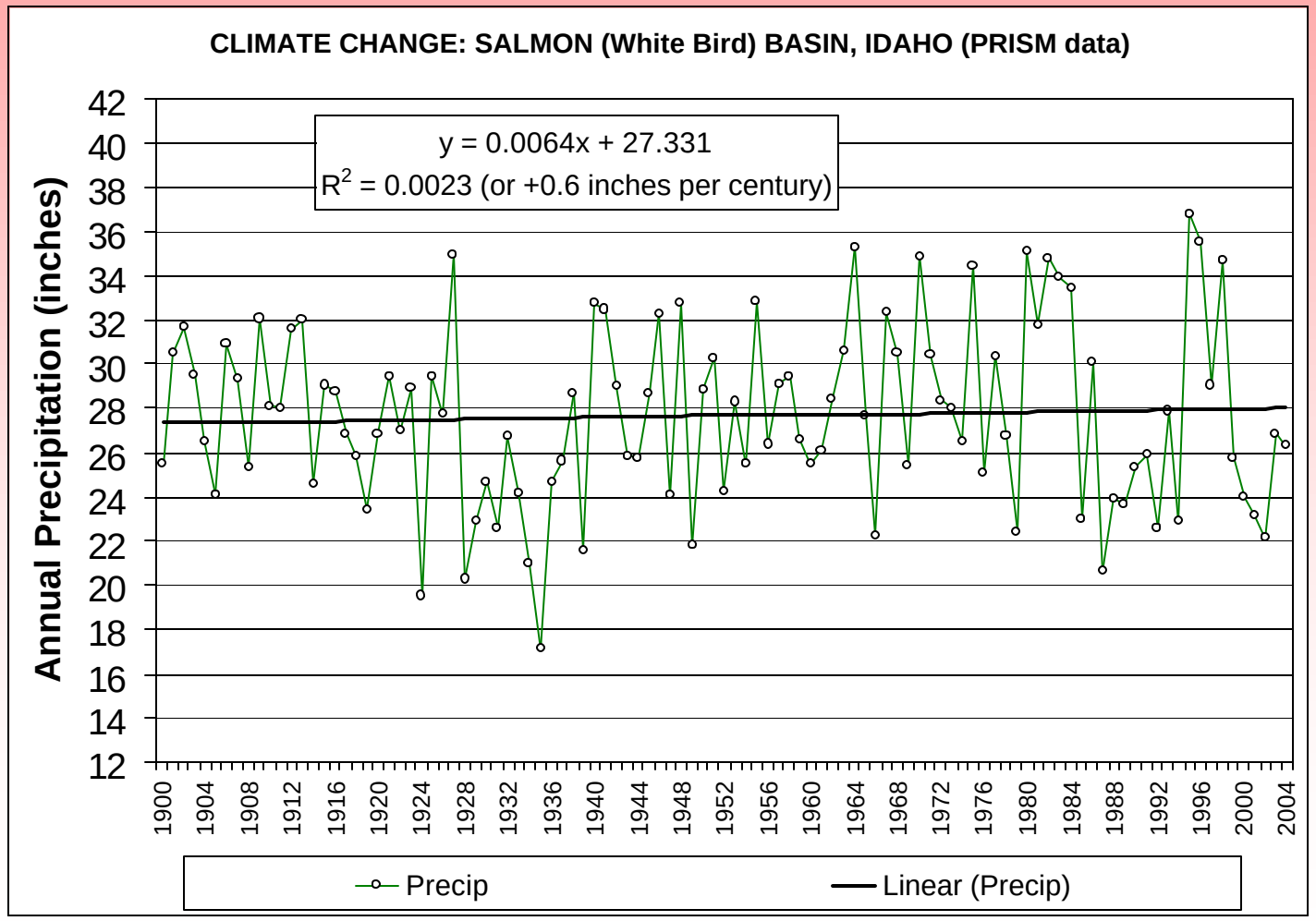

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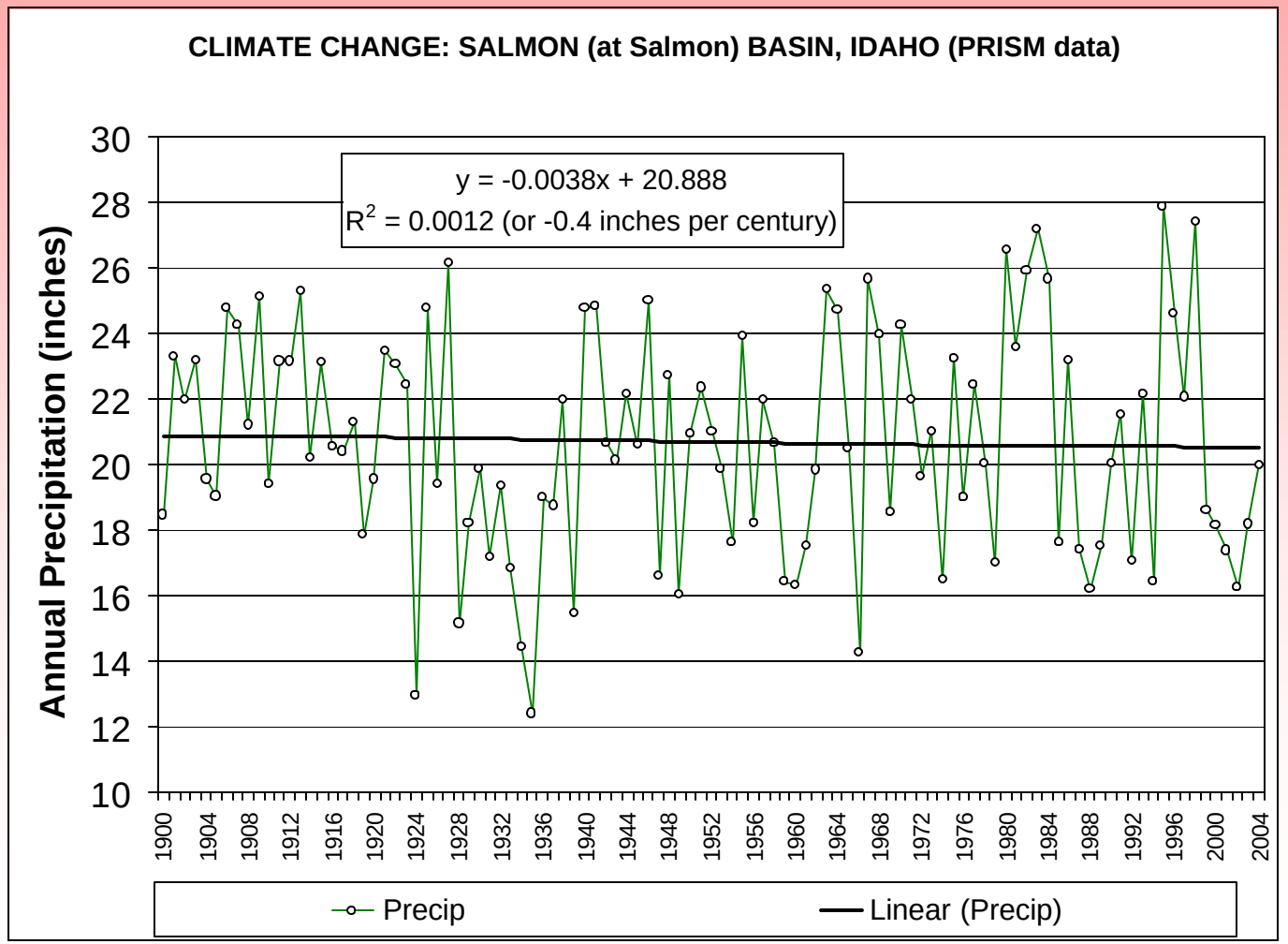
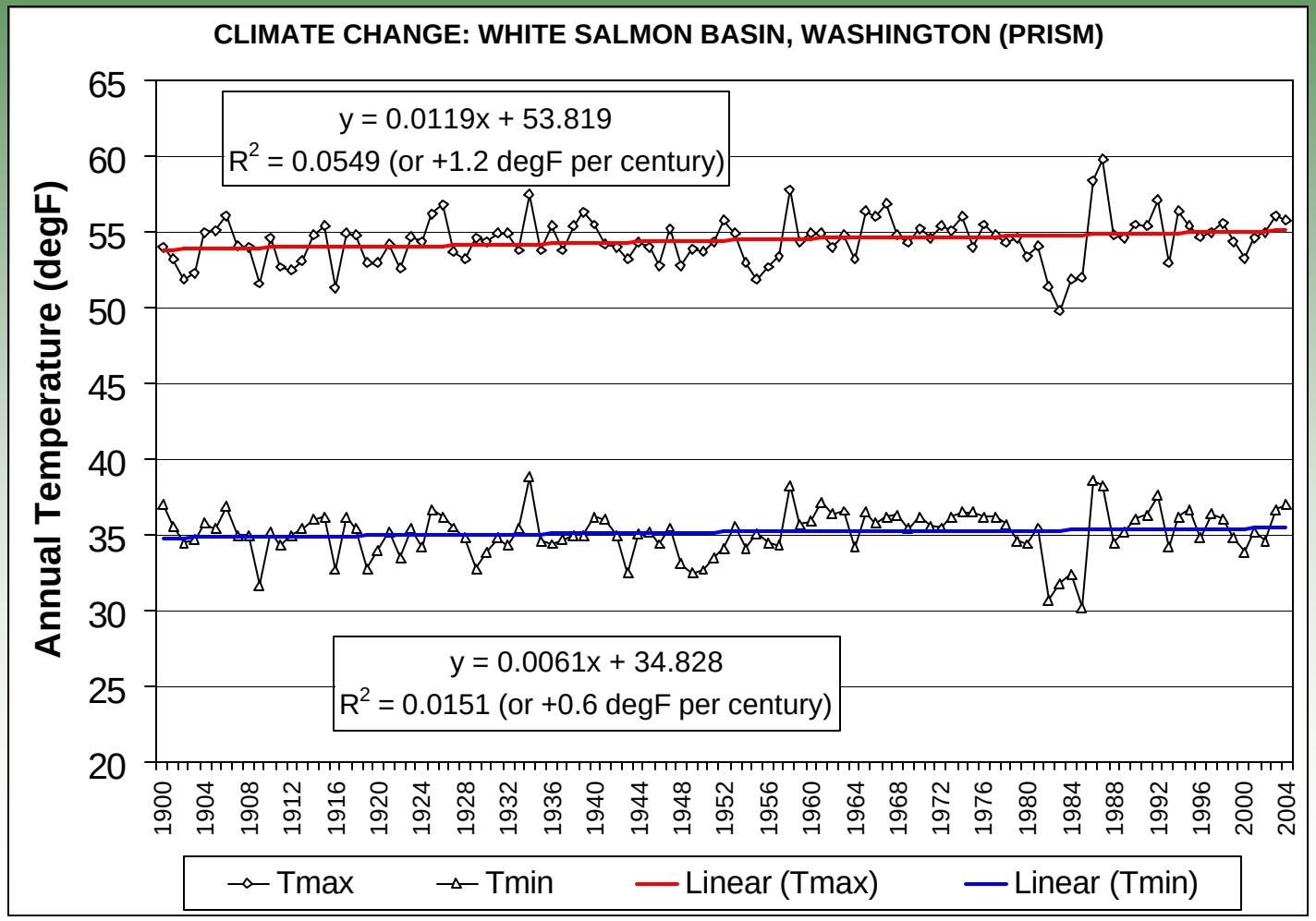


Climate Change: White Salmon Basin



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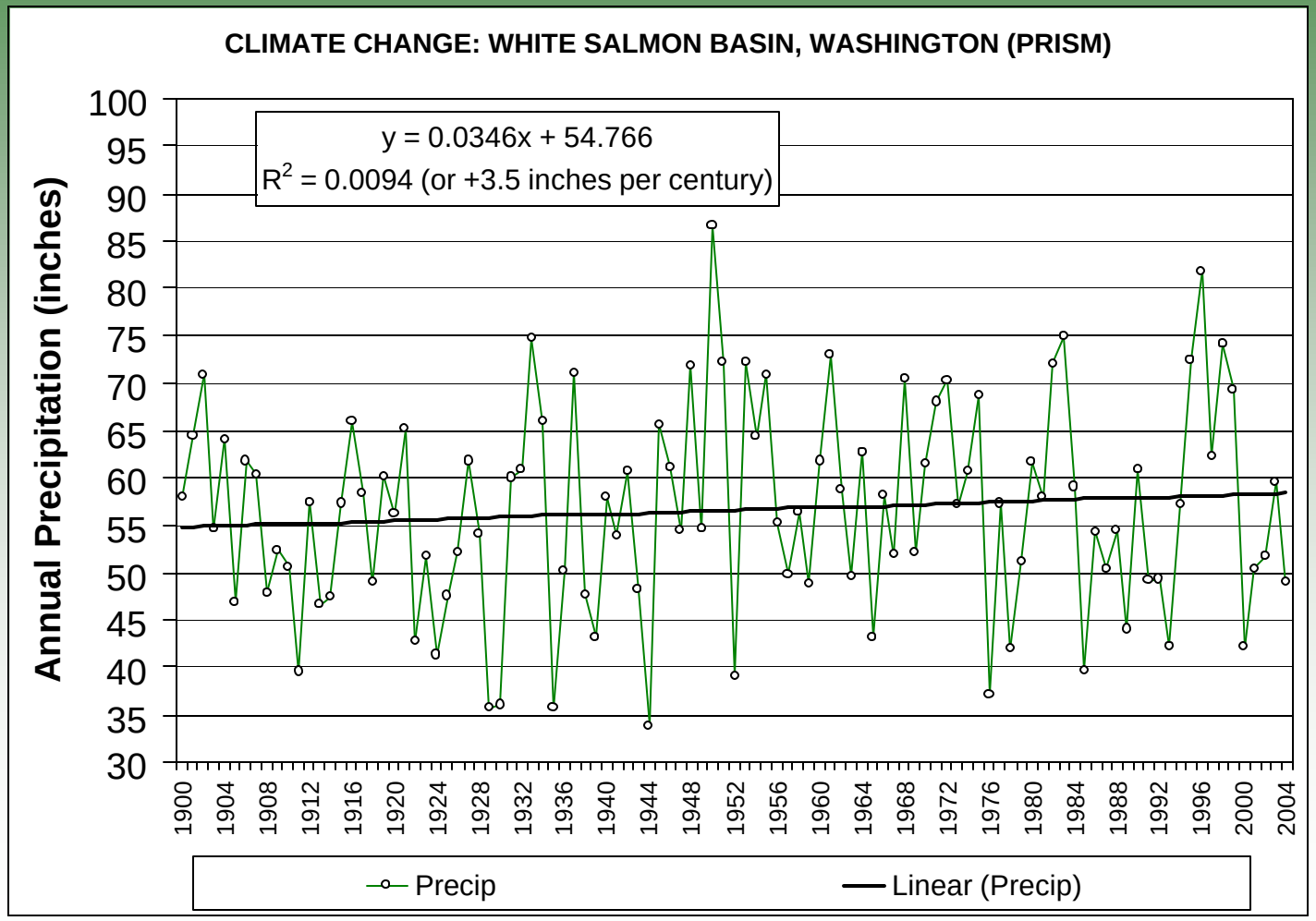
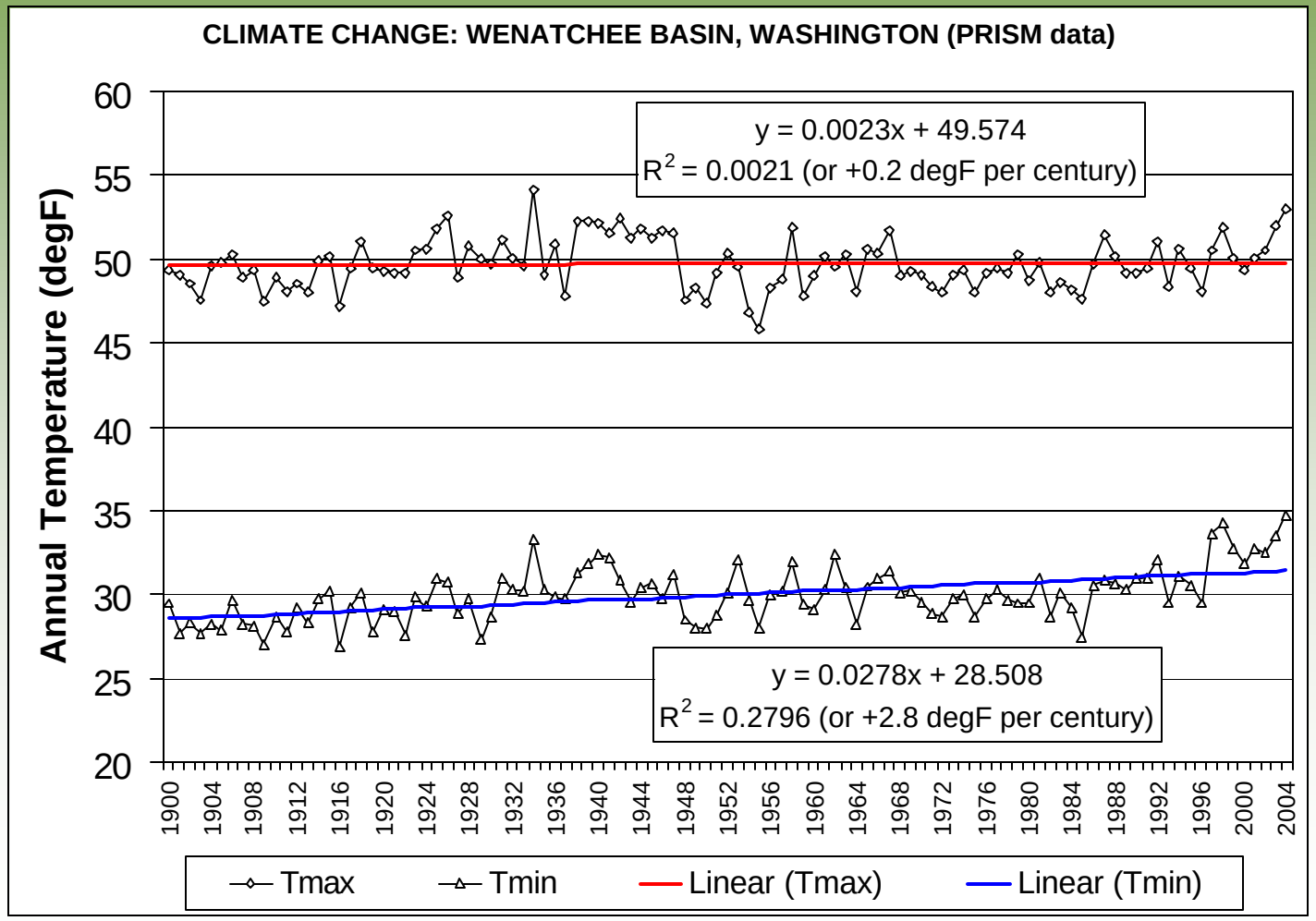


Climate Change: Wenatchee Basin



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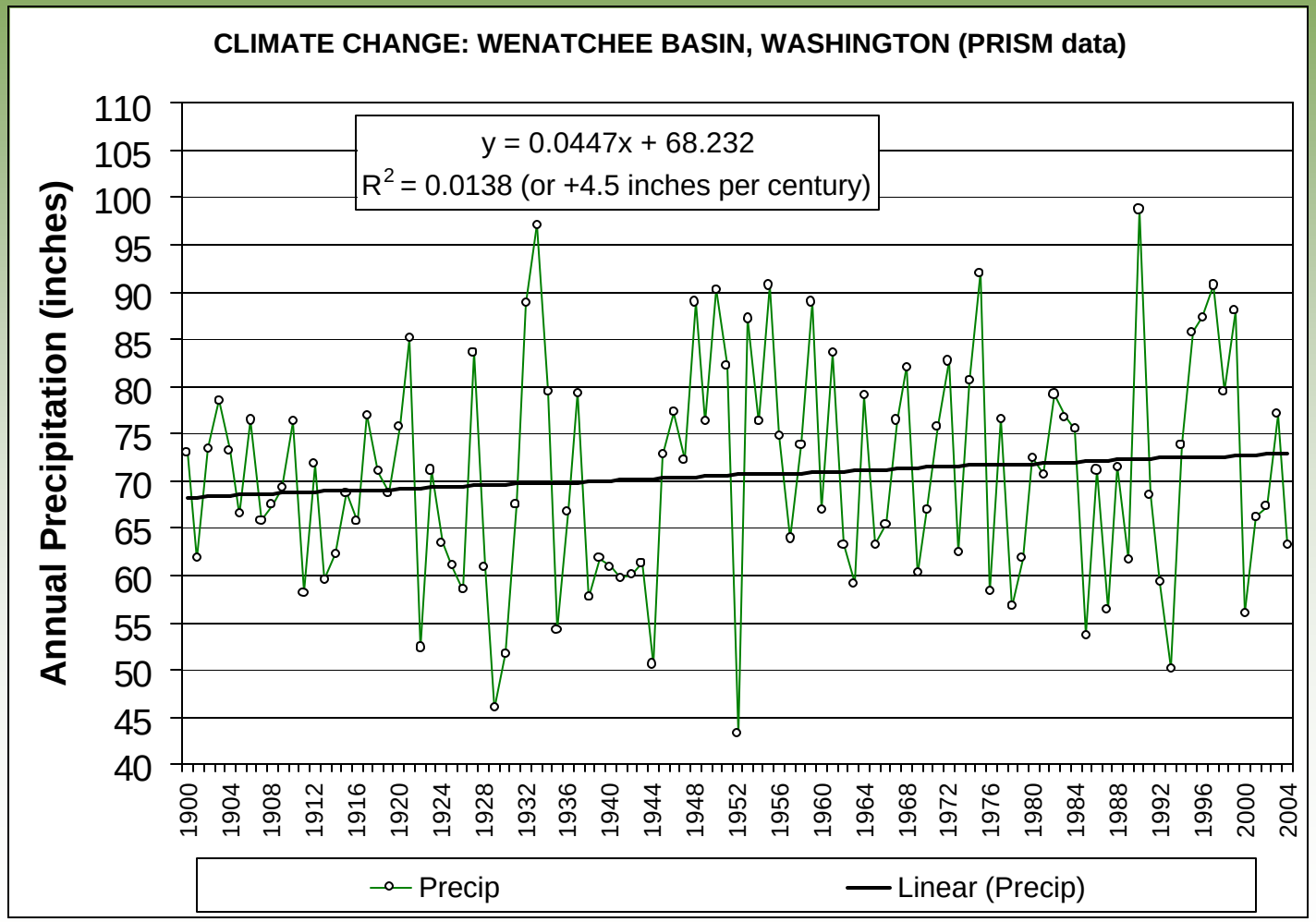
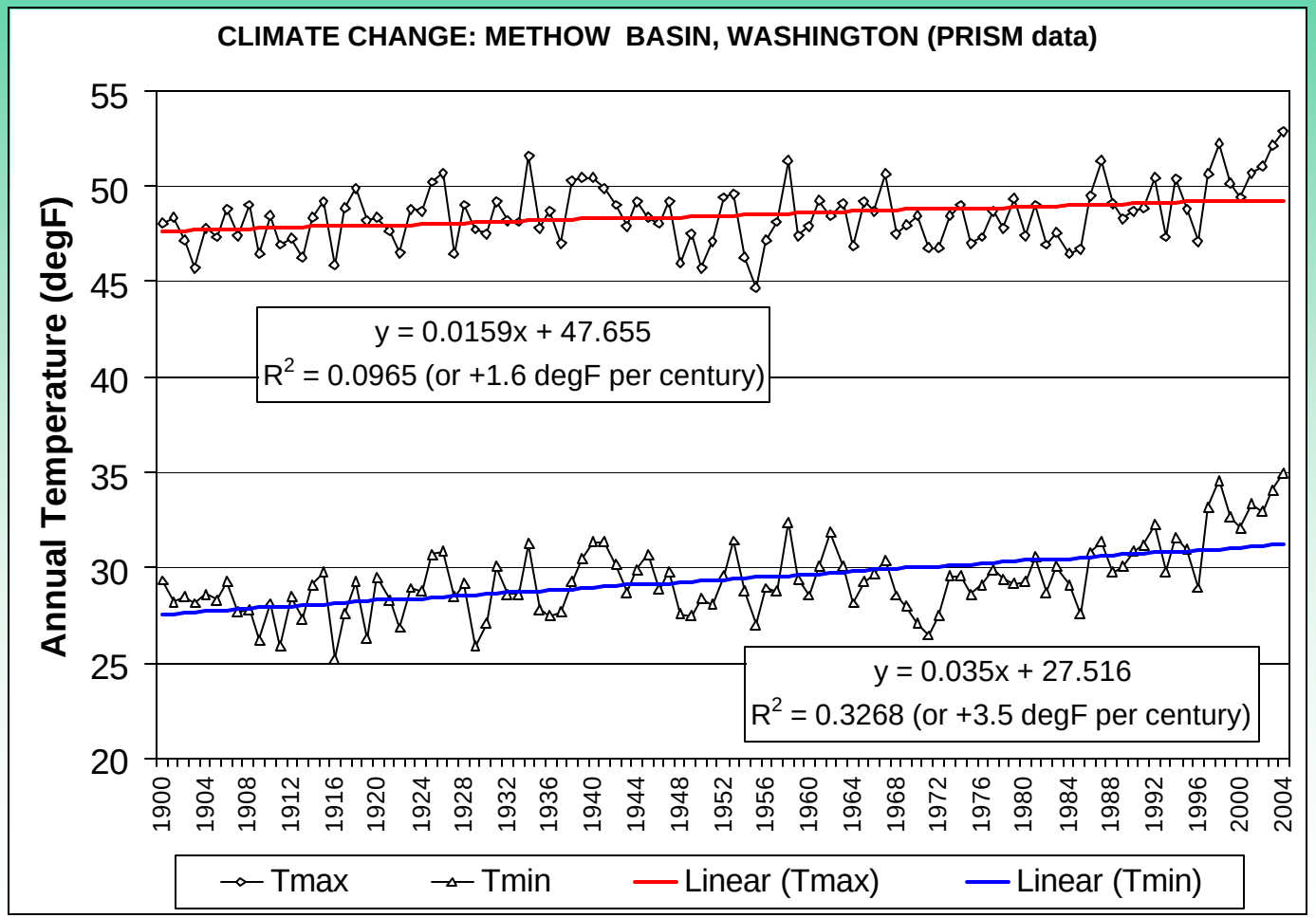
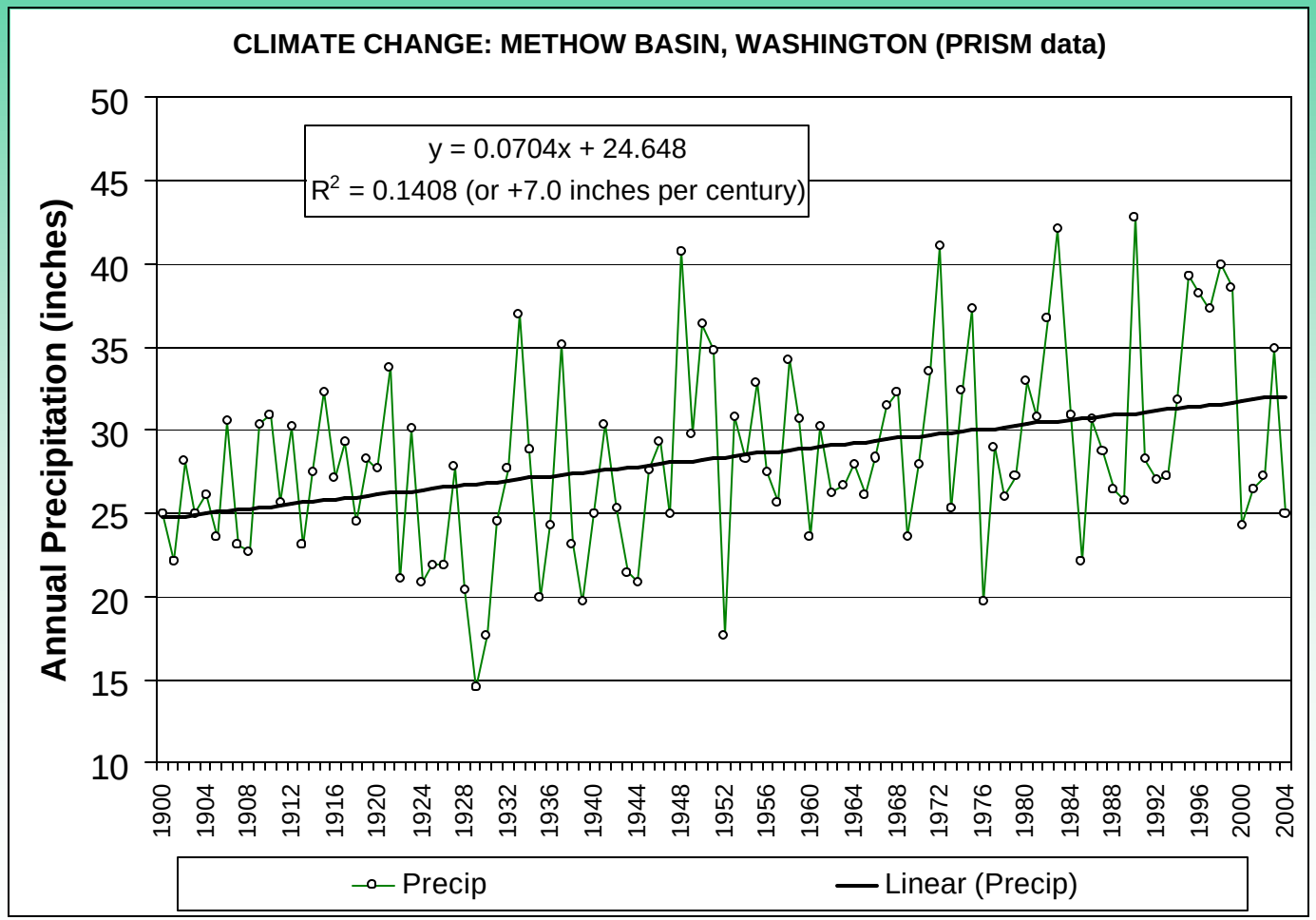


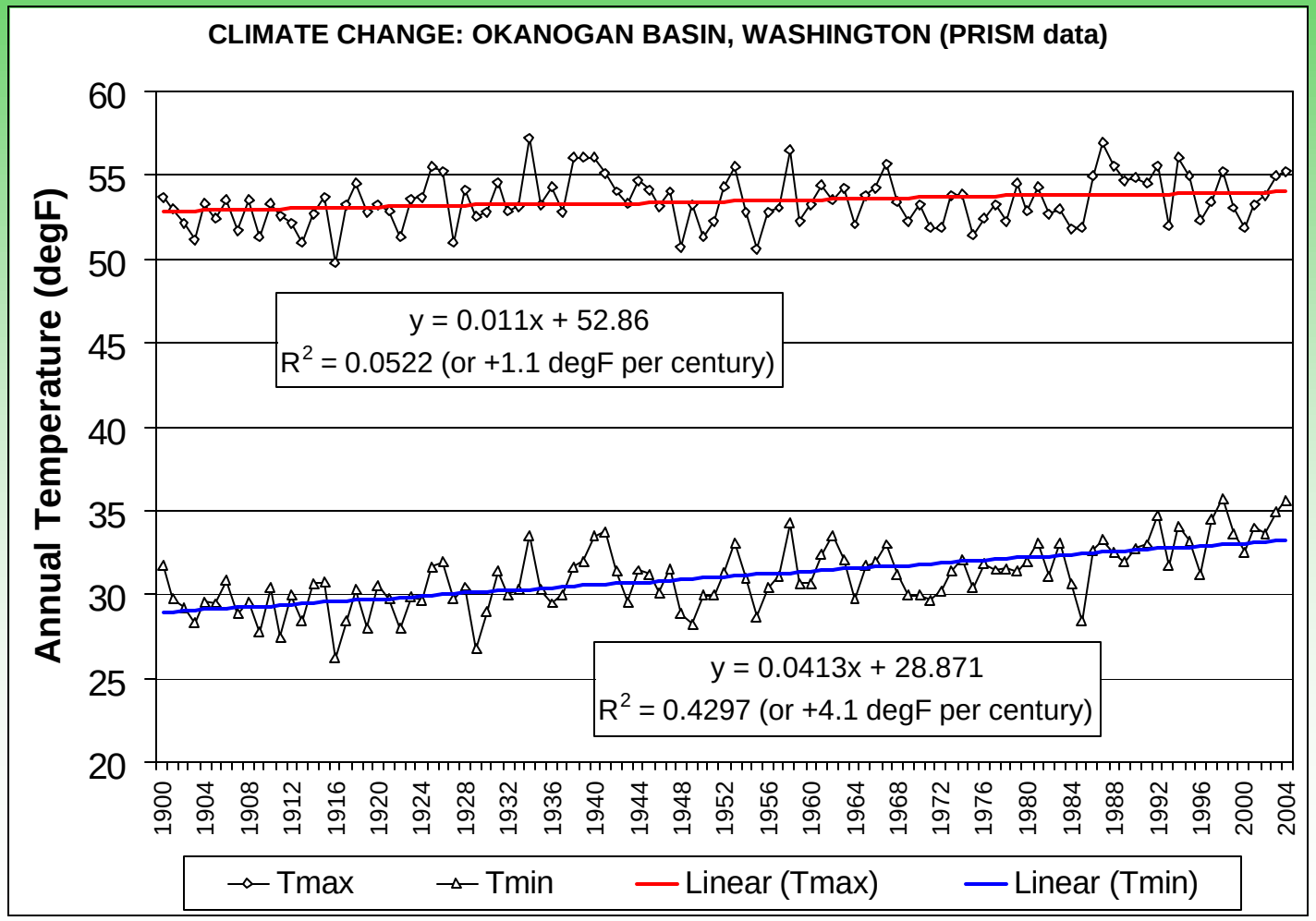
Climate Change: Methow Basin



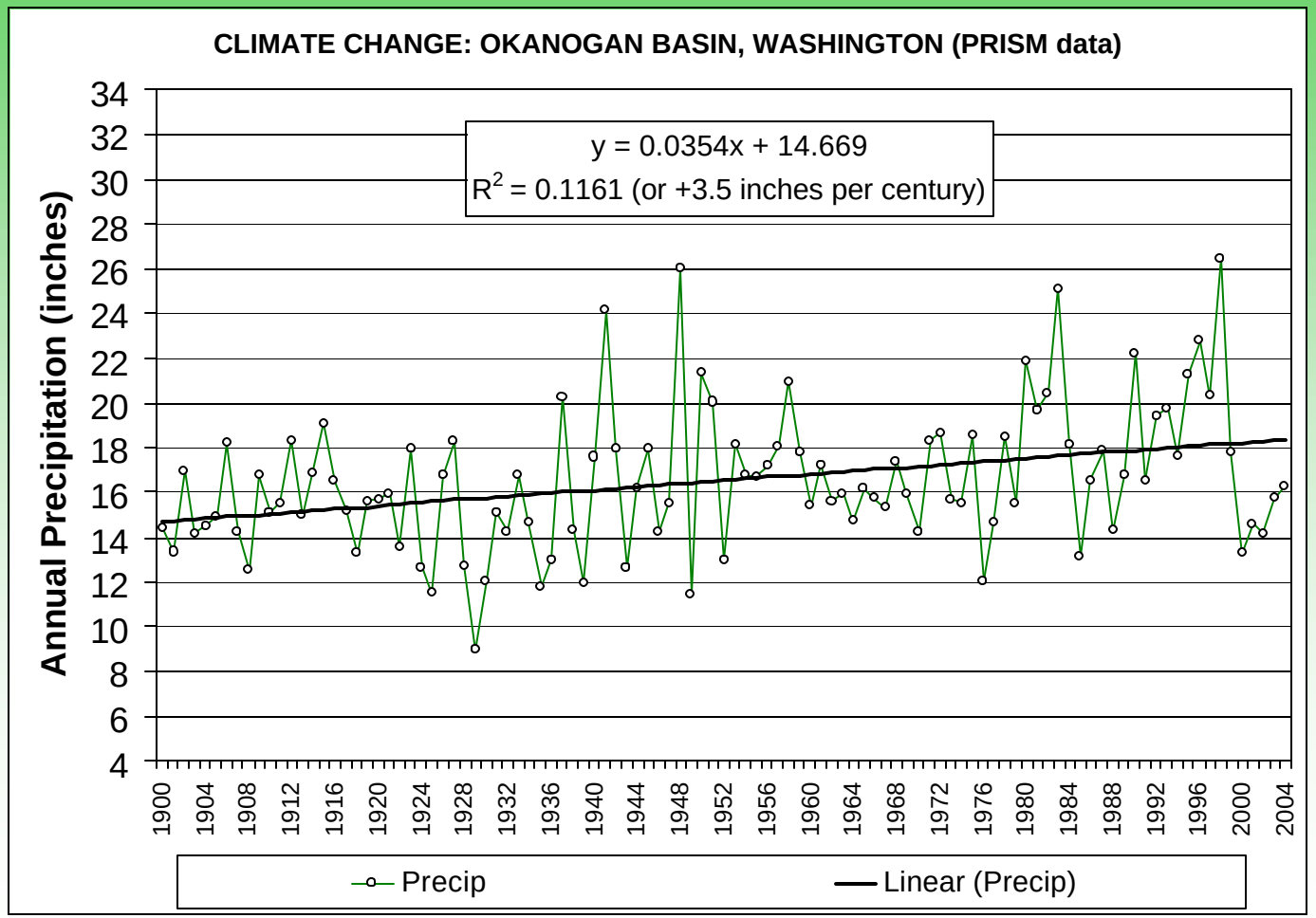
Climate Change: Methow Basin



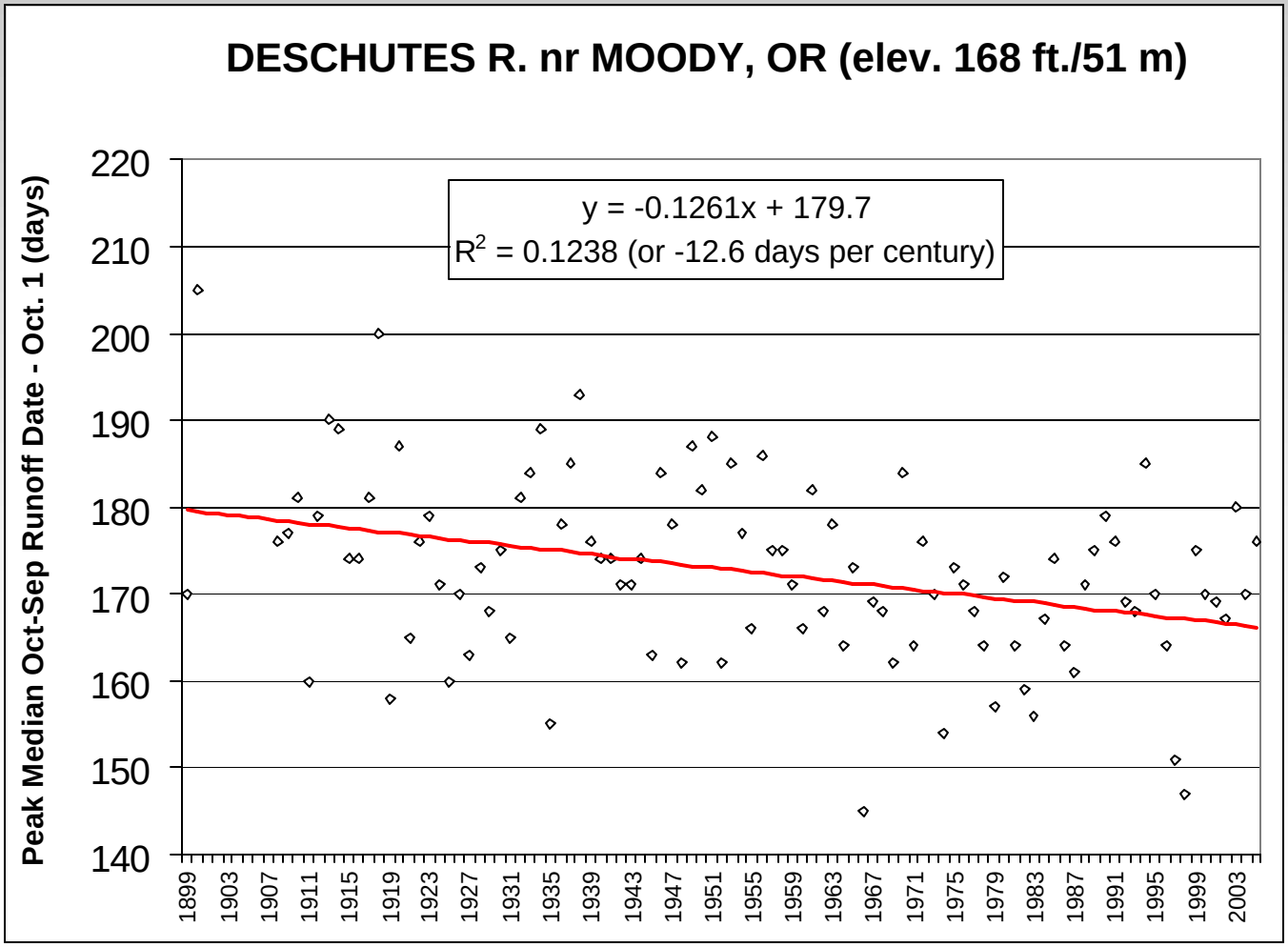
Climate Change: Okanogan Basin



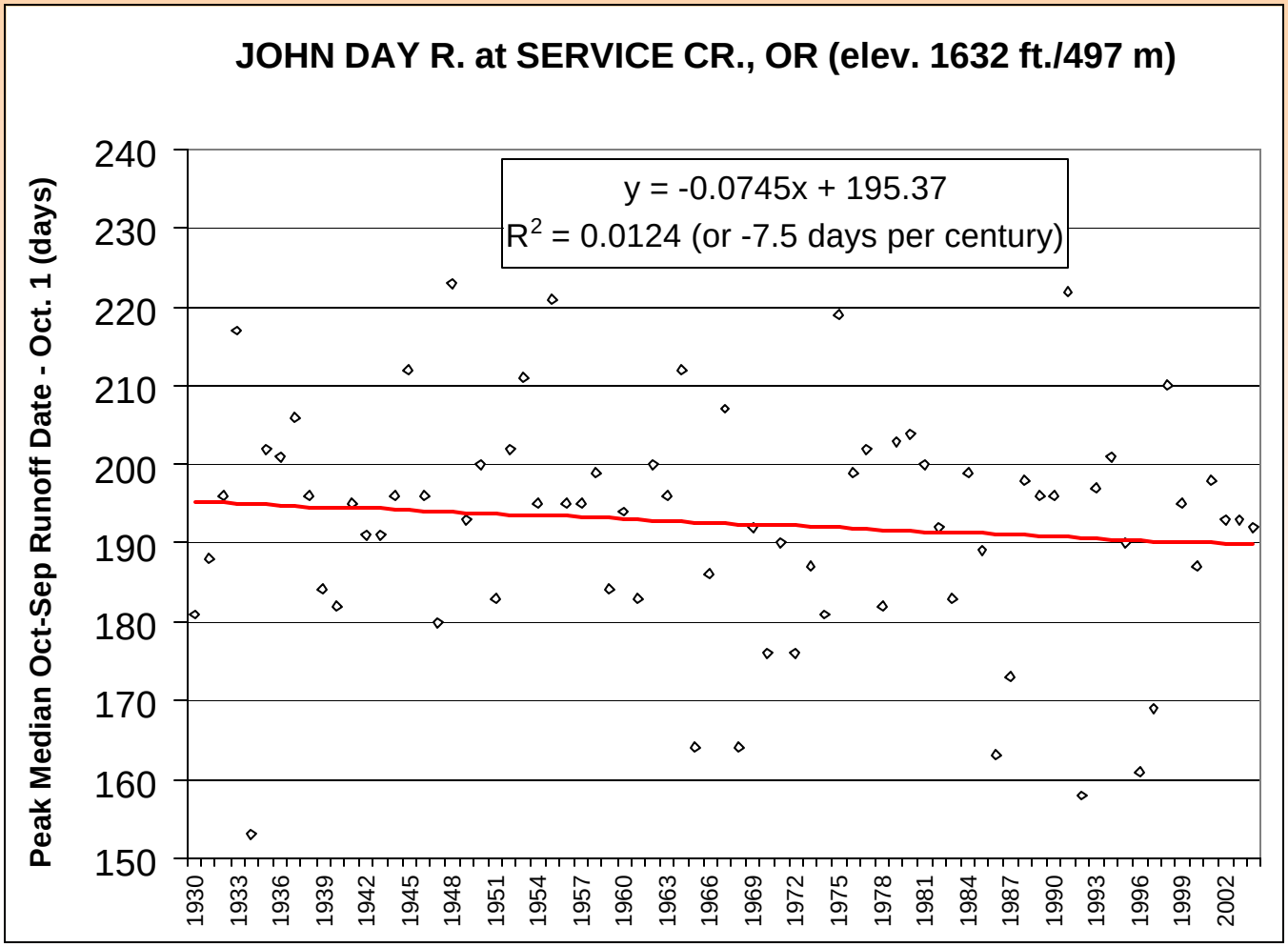
Climate Change: Okanogan Basin



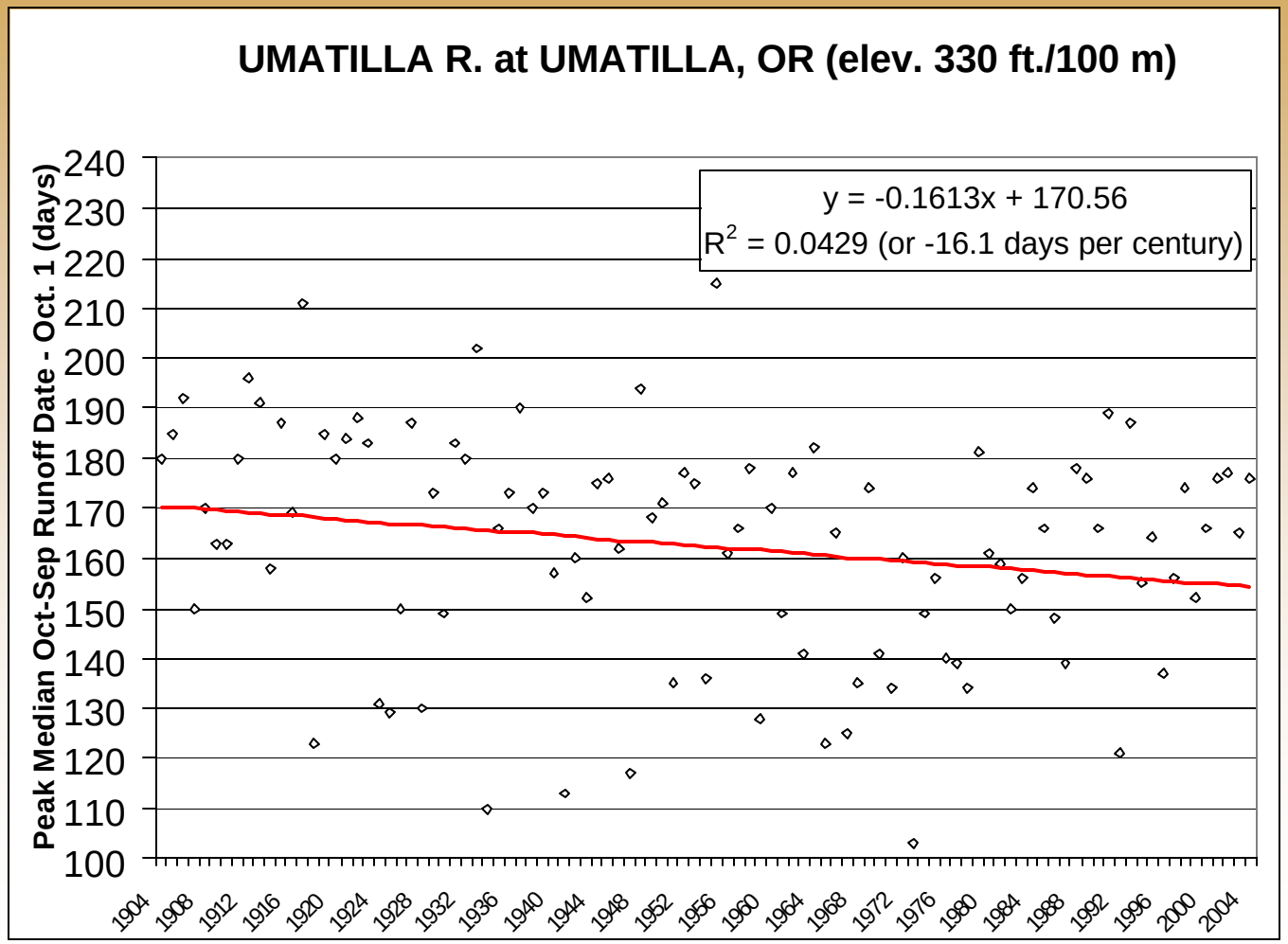
Freshet timing: Deschutes Basin



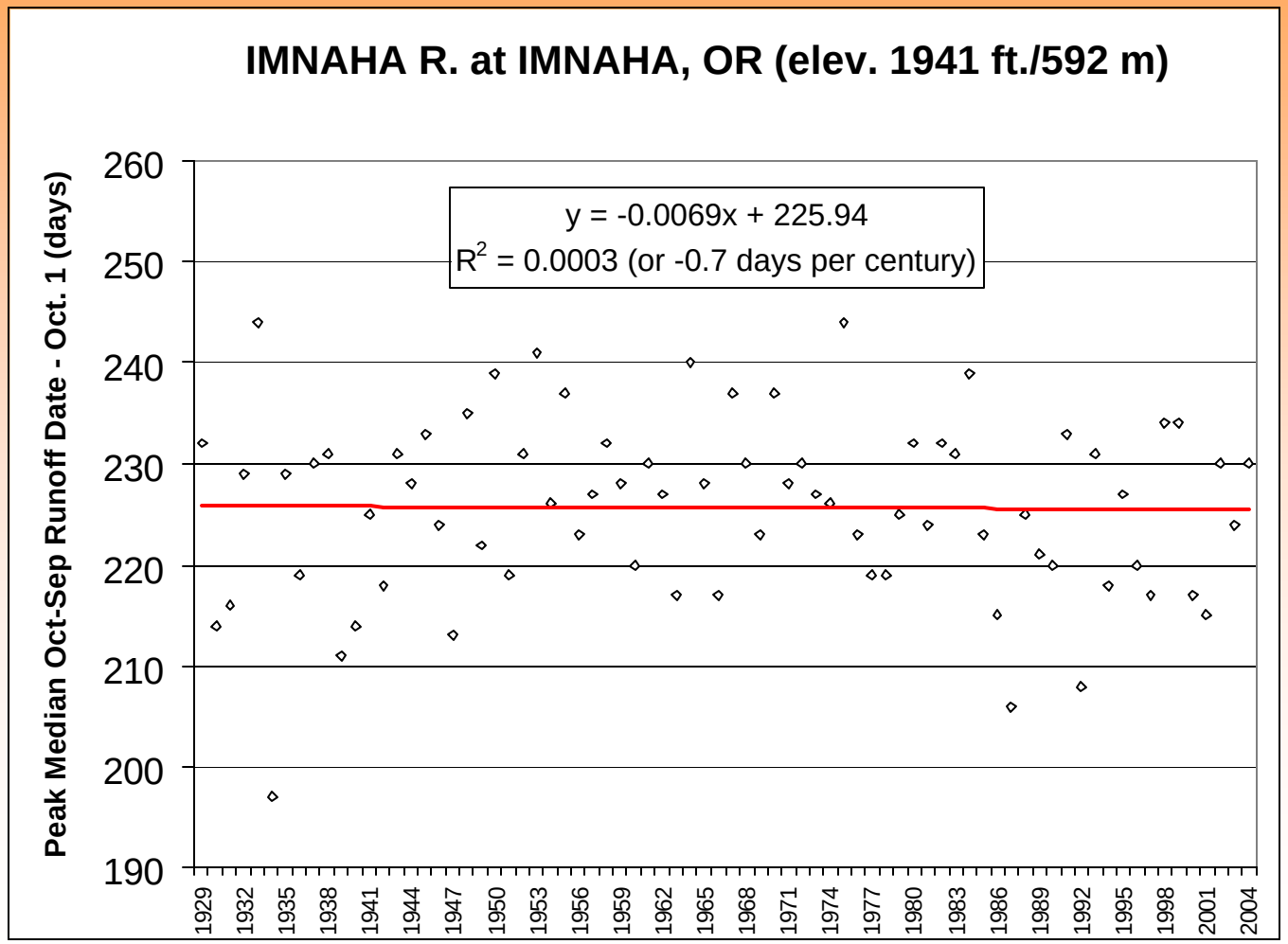
Freshet timing: John Day Basin



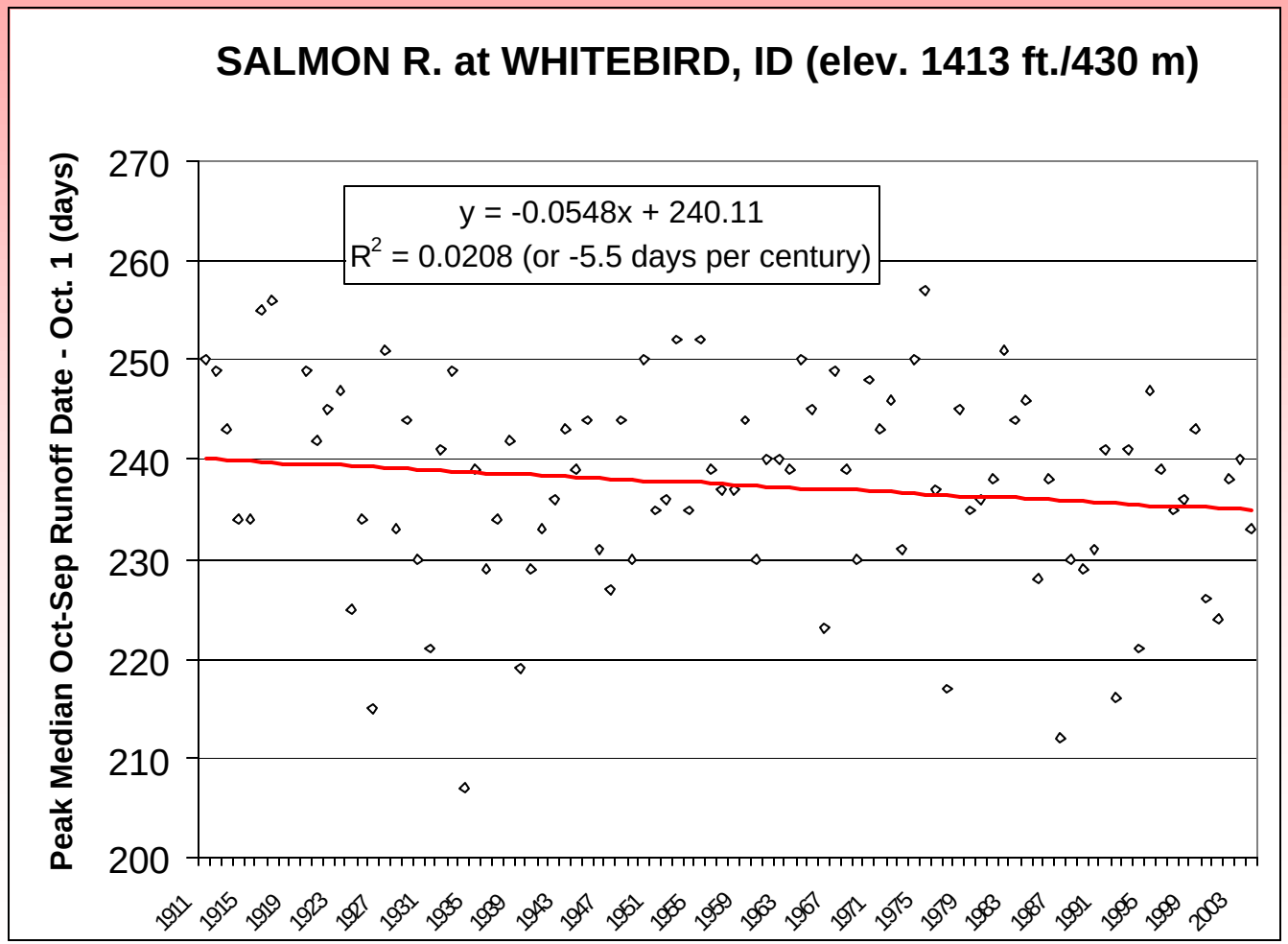
Freshet Timing:
Umatilla Basin



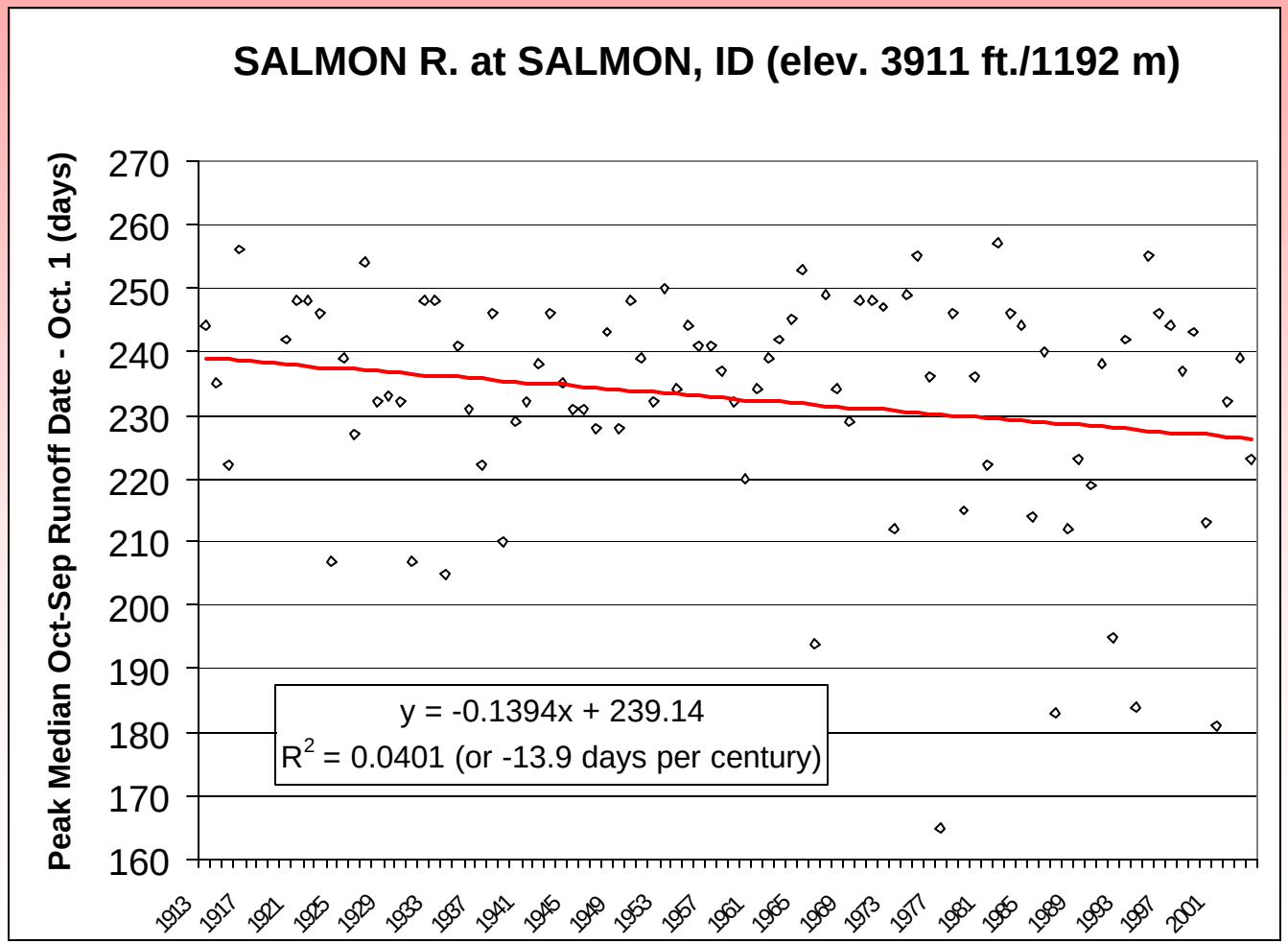
Freshet Timing:
Imnaha Basin



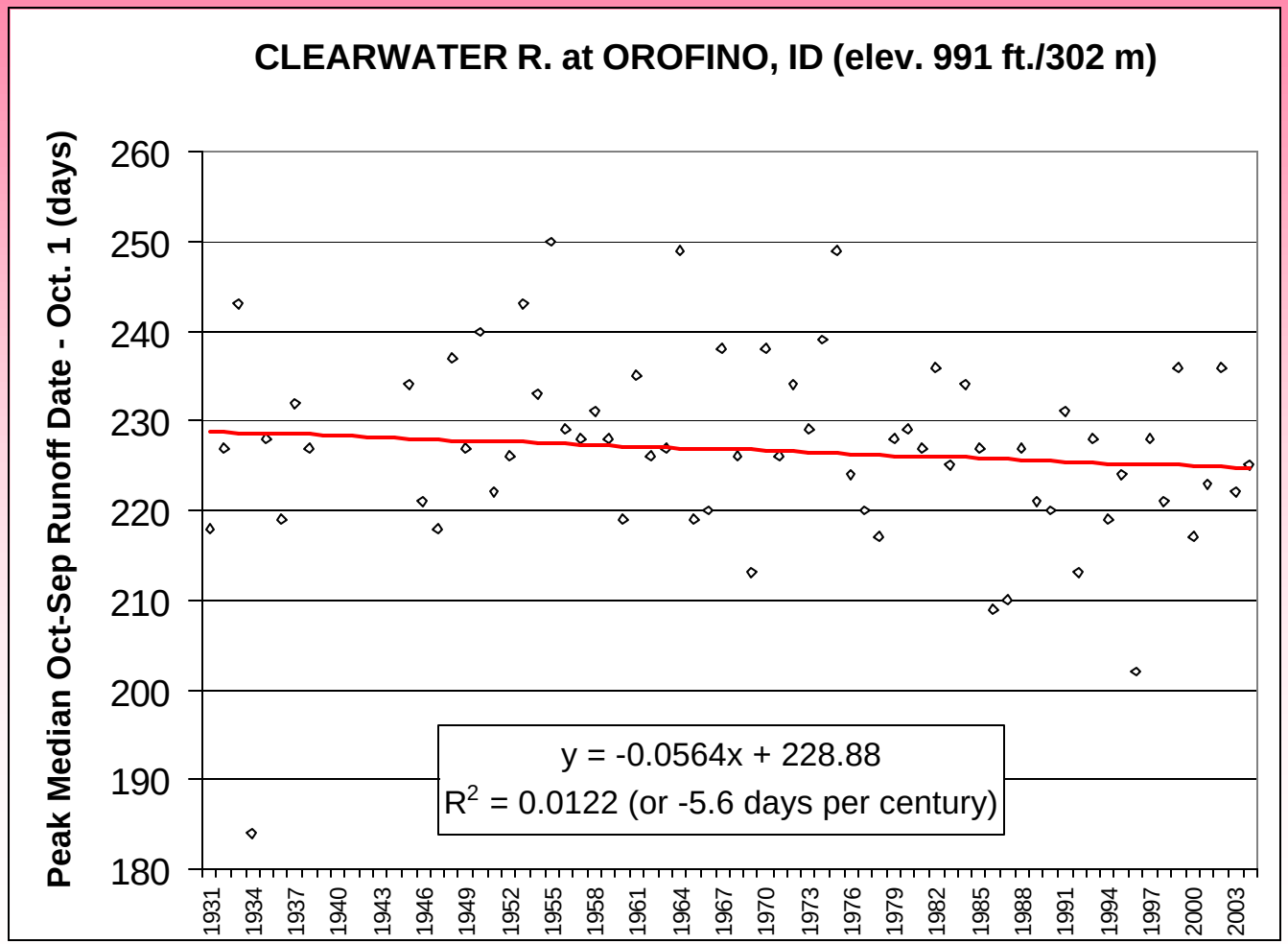
Freshet timing: Salmon Basin



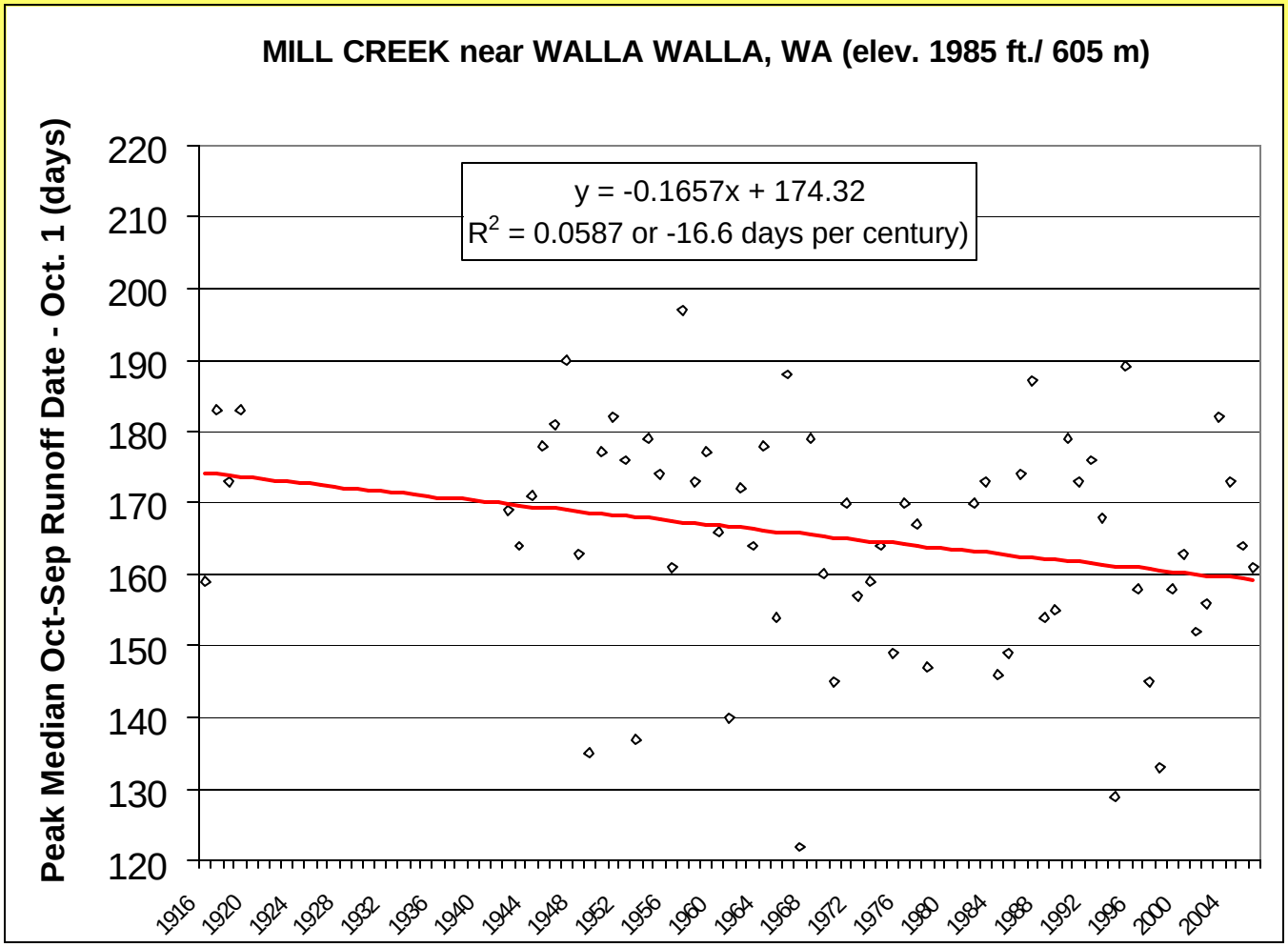
Freshet timing: Upper Salmon Basin



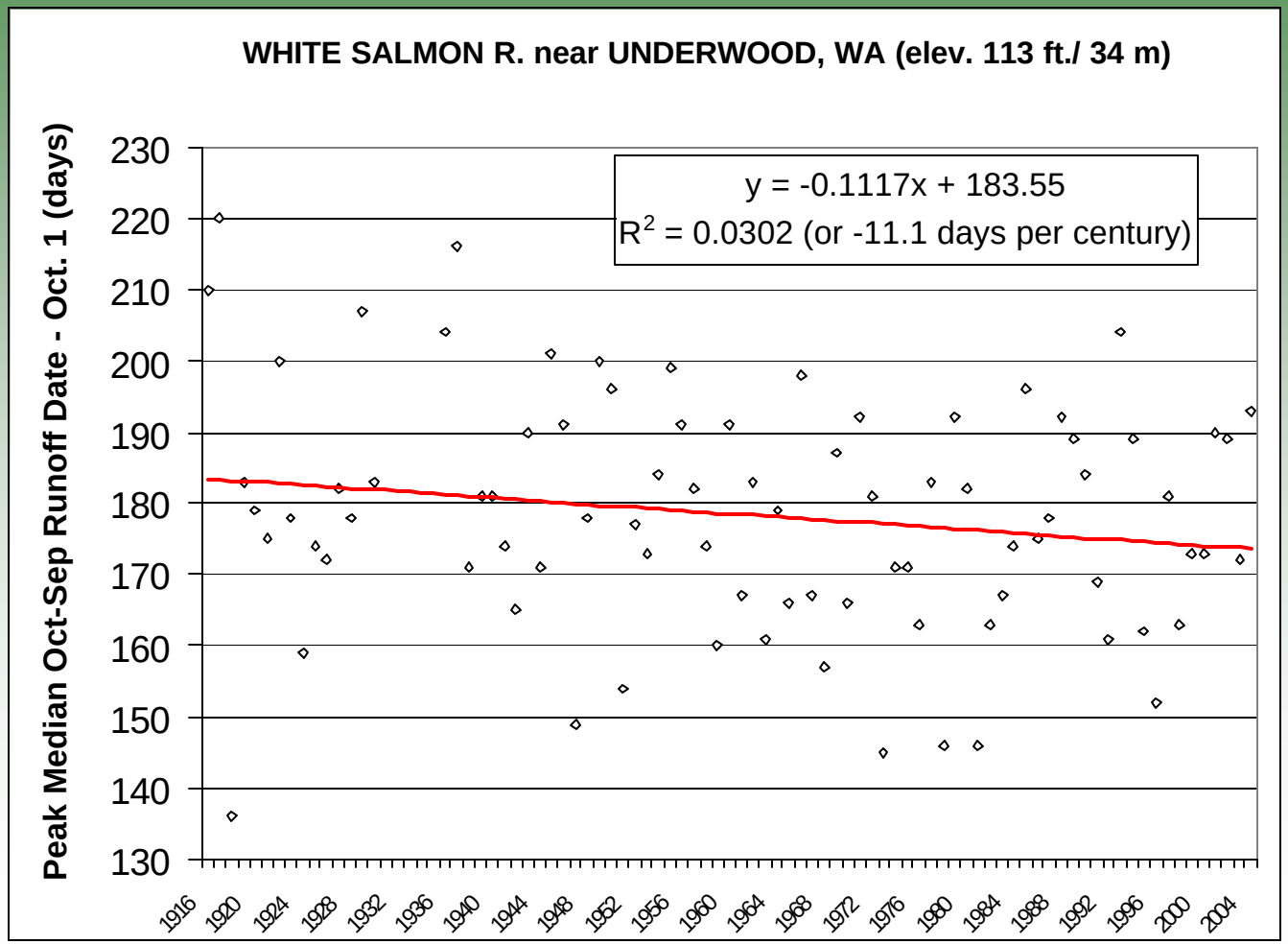
Freshet timing: Clearwater Basin



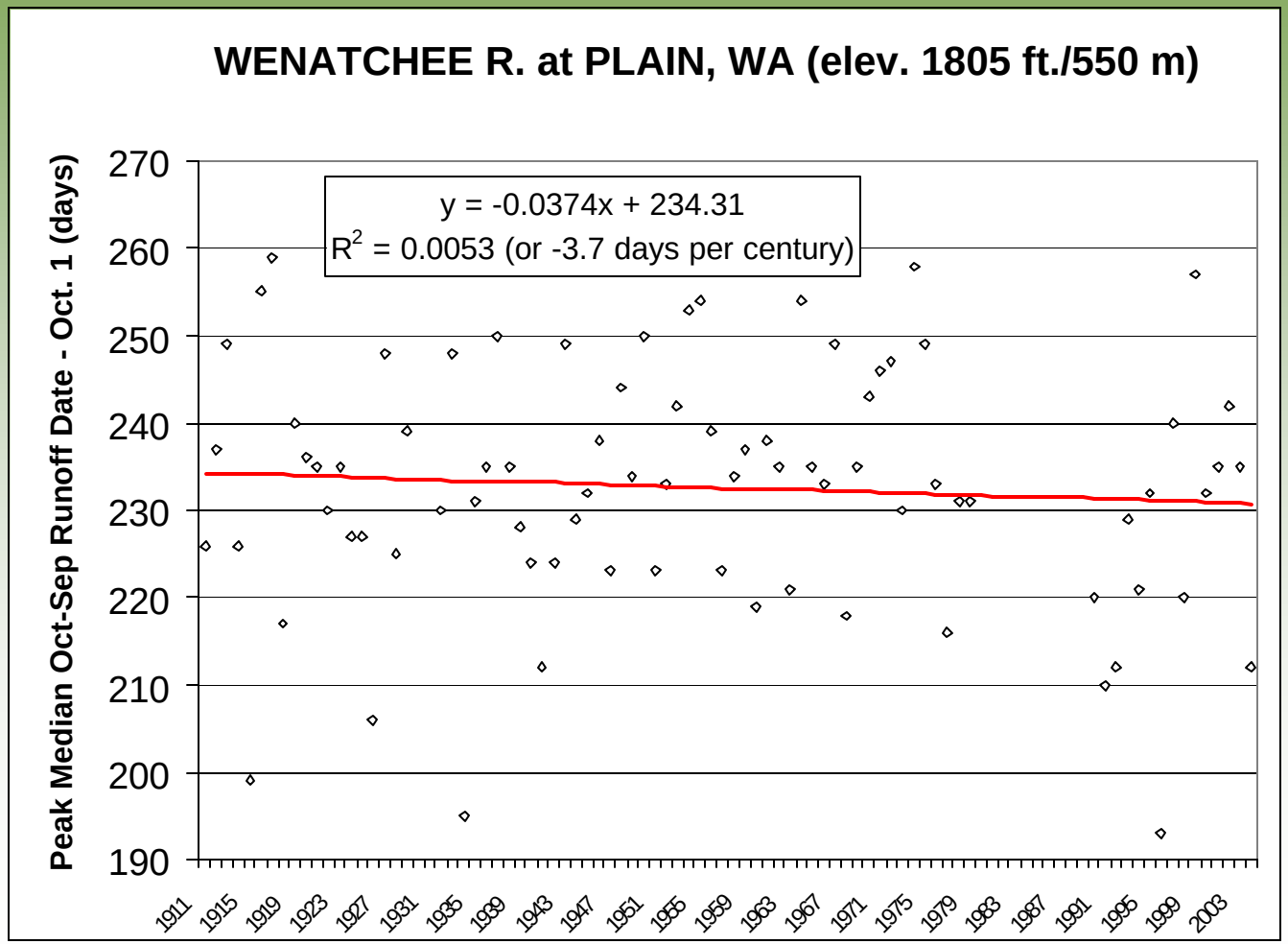
Freshet Timing:
Walla Walla Basin



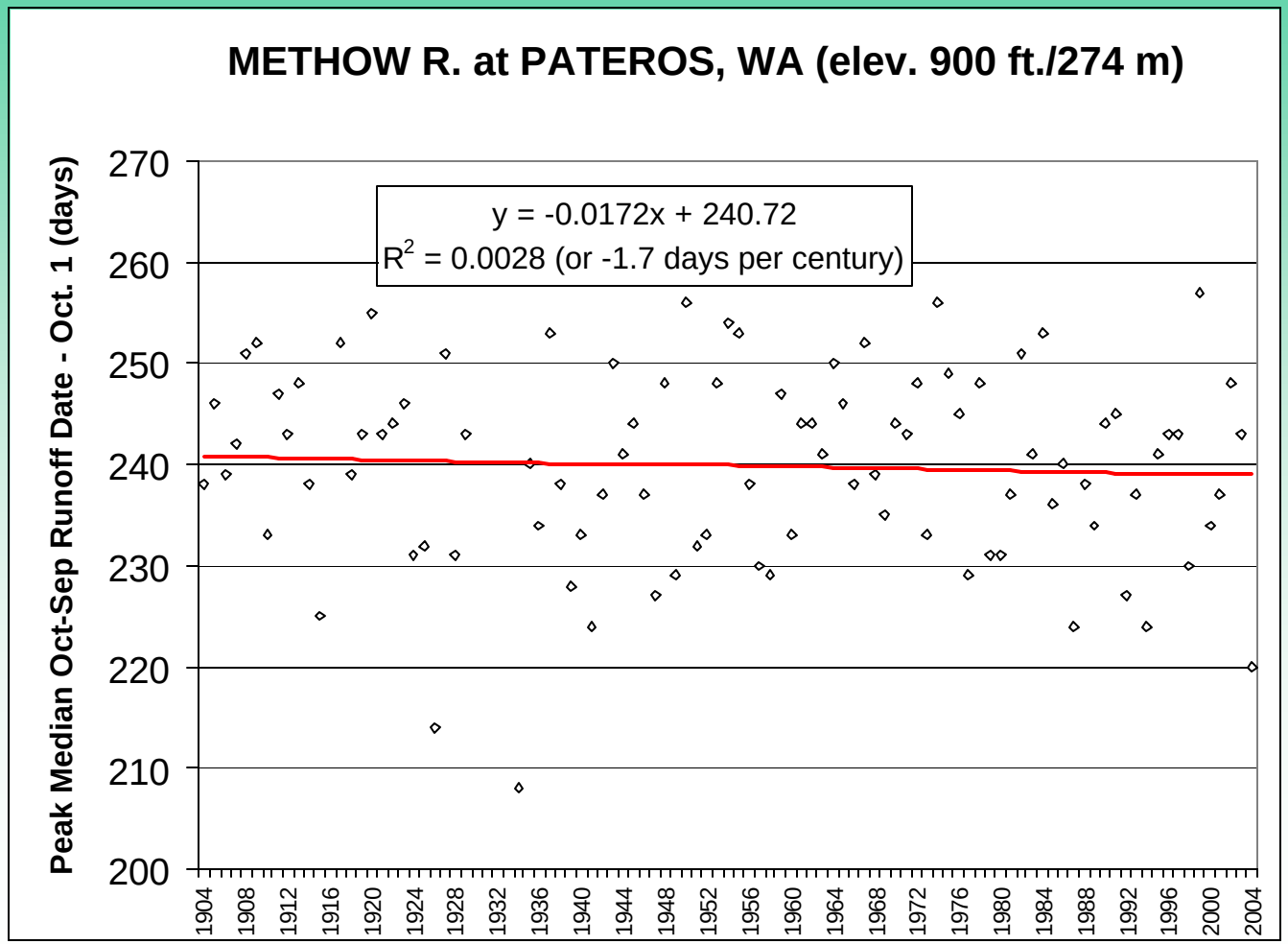
Freshet timing:
White Salmon Basin



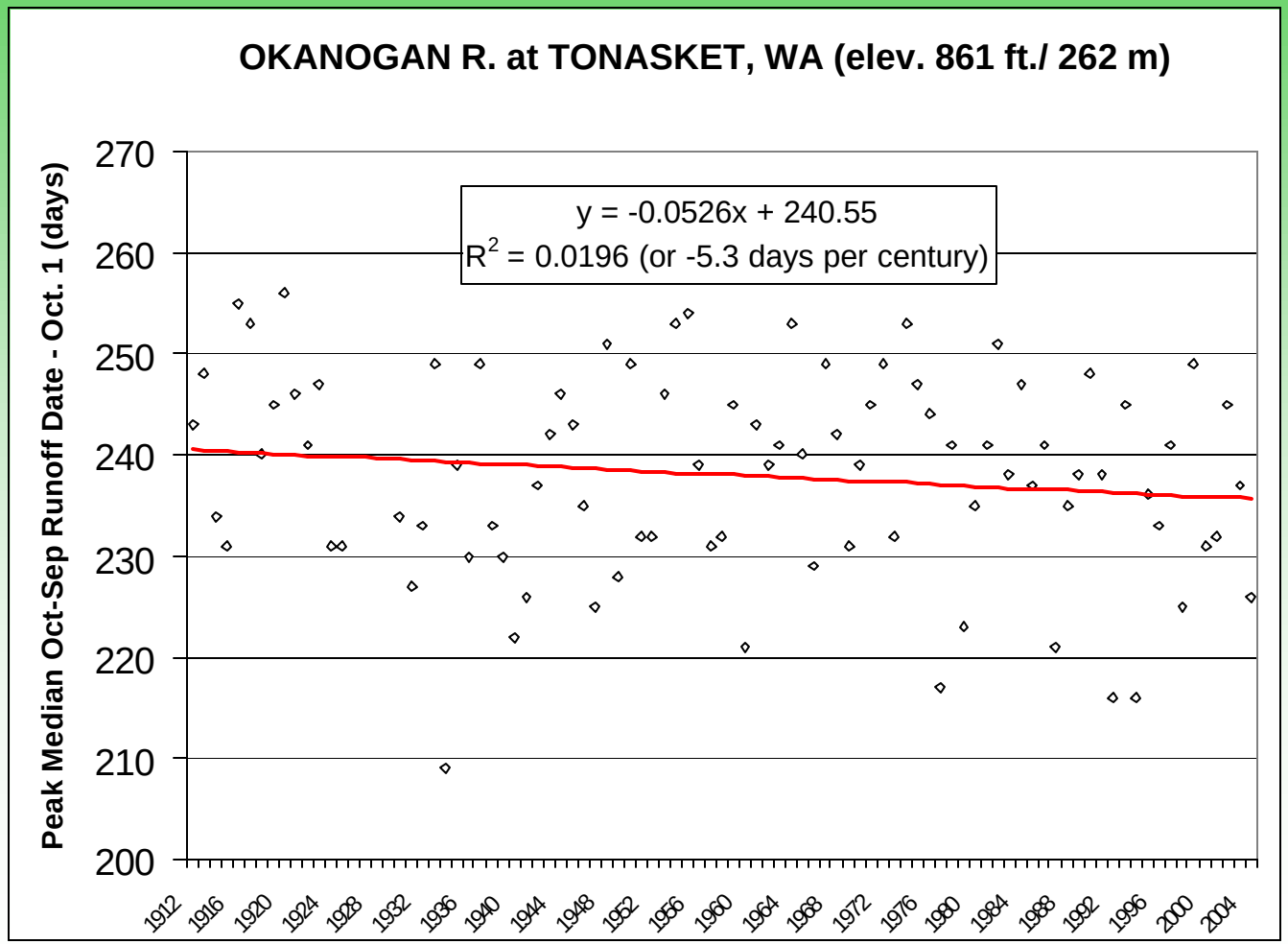
Freshet timing:
Wenatchee Basin



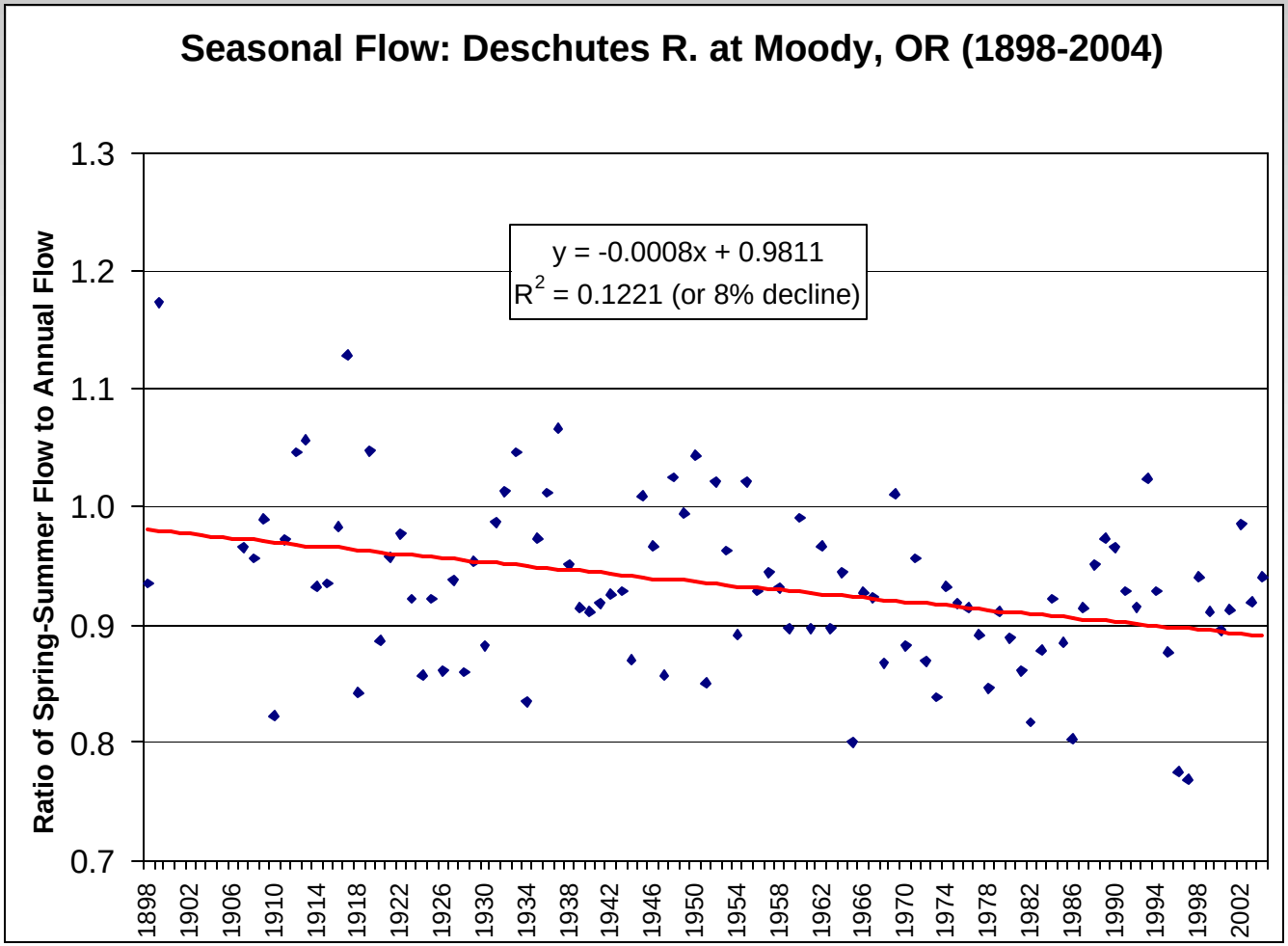
Freshet timing:
Methow Basin



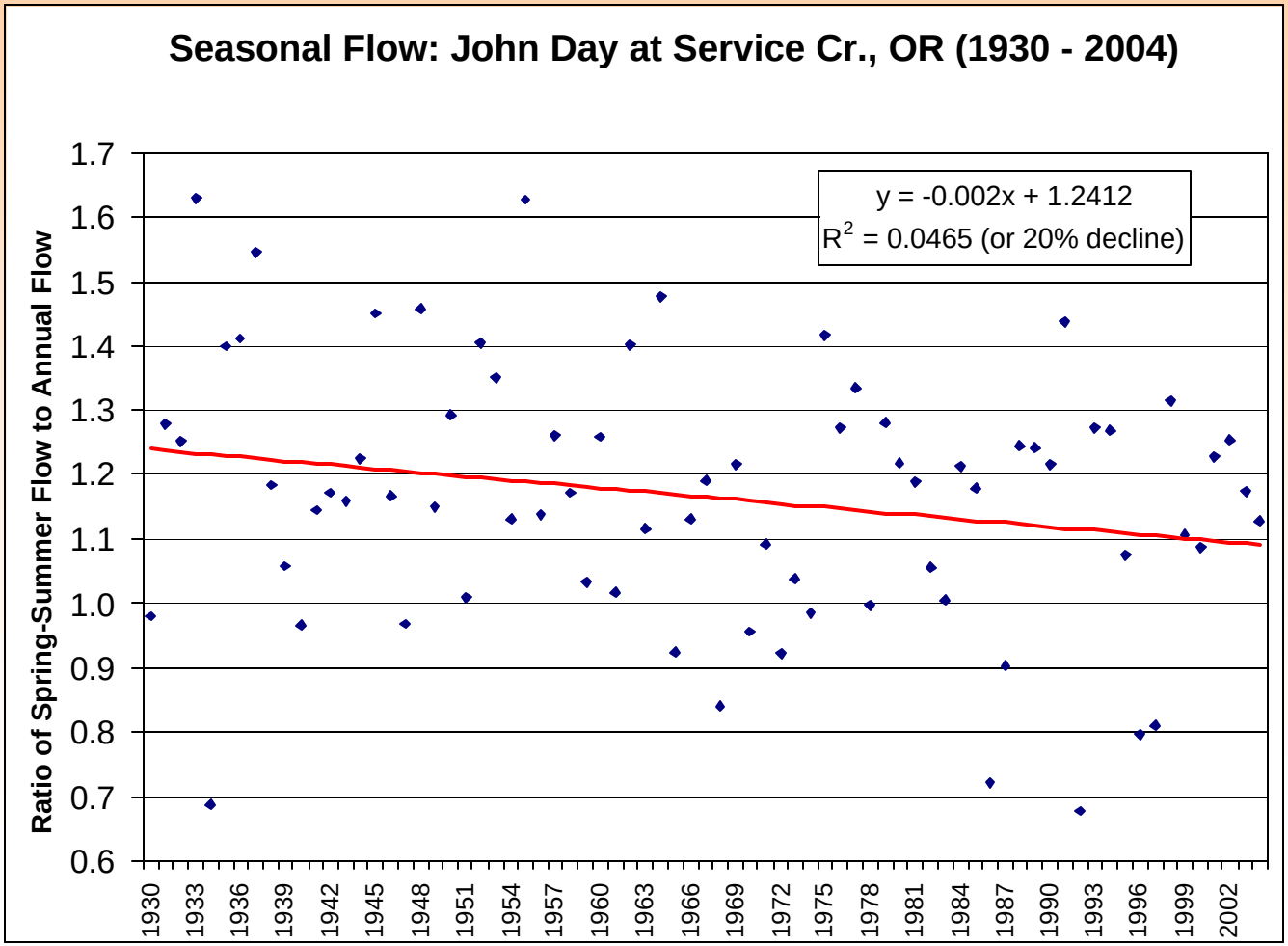
Freshet timing:
Okanogan Basin



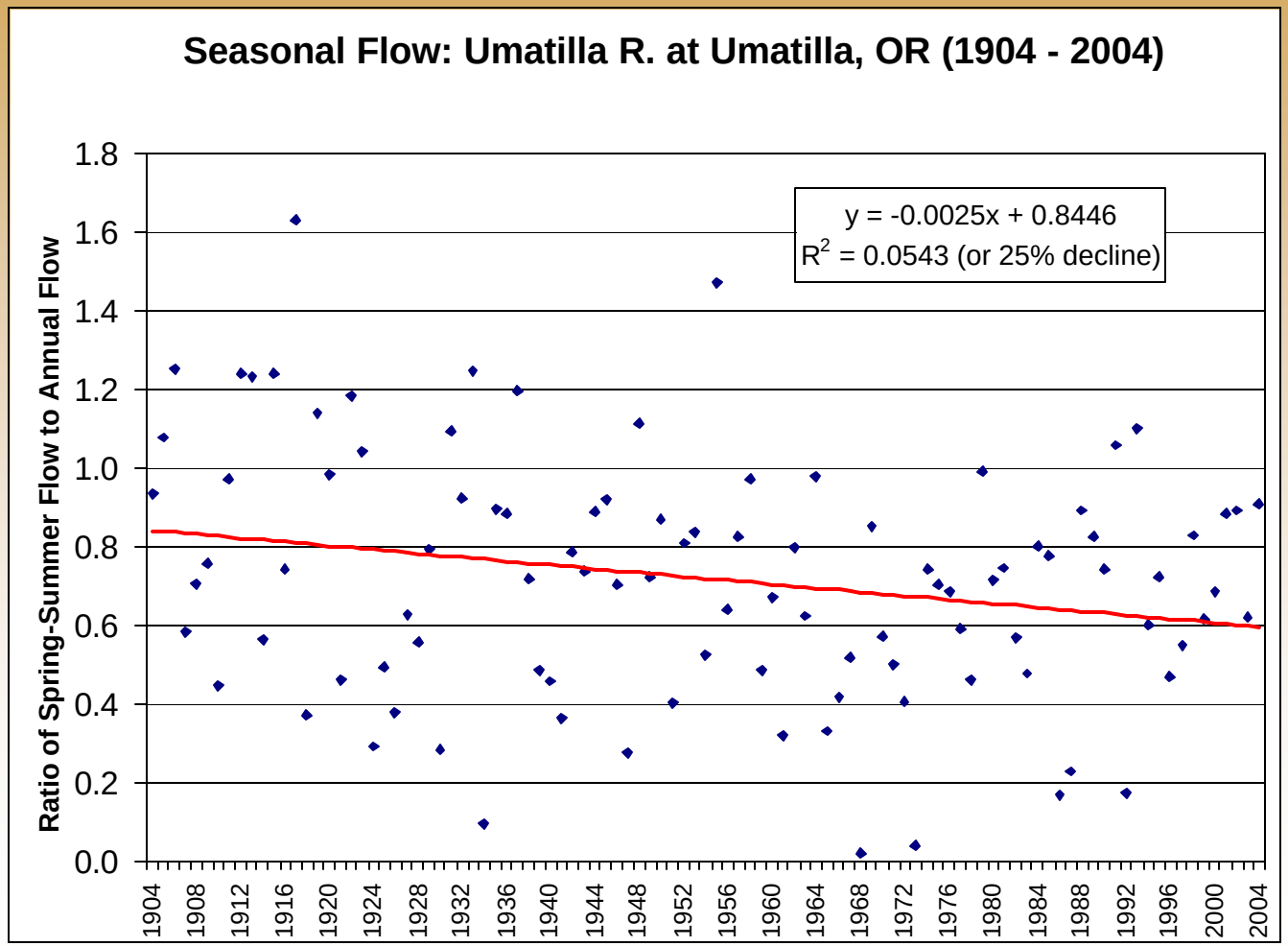
Flow Volume: Deschutes Basin



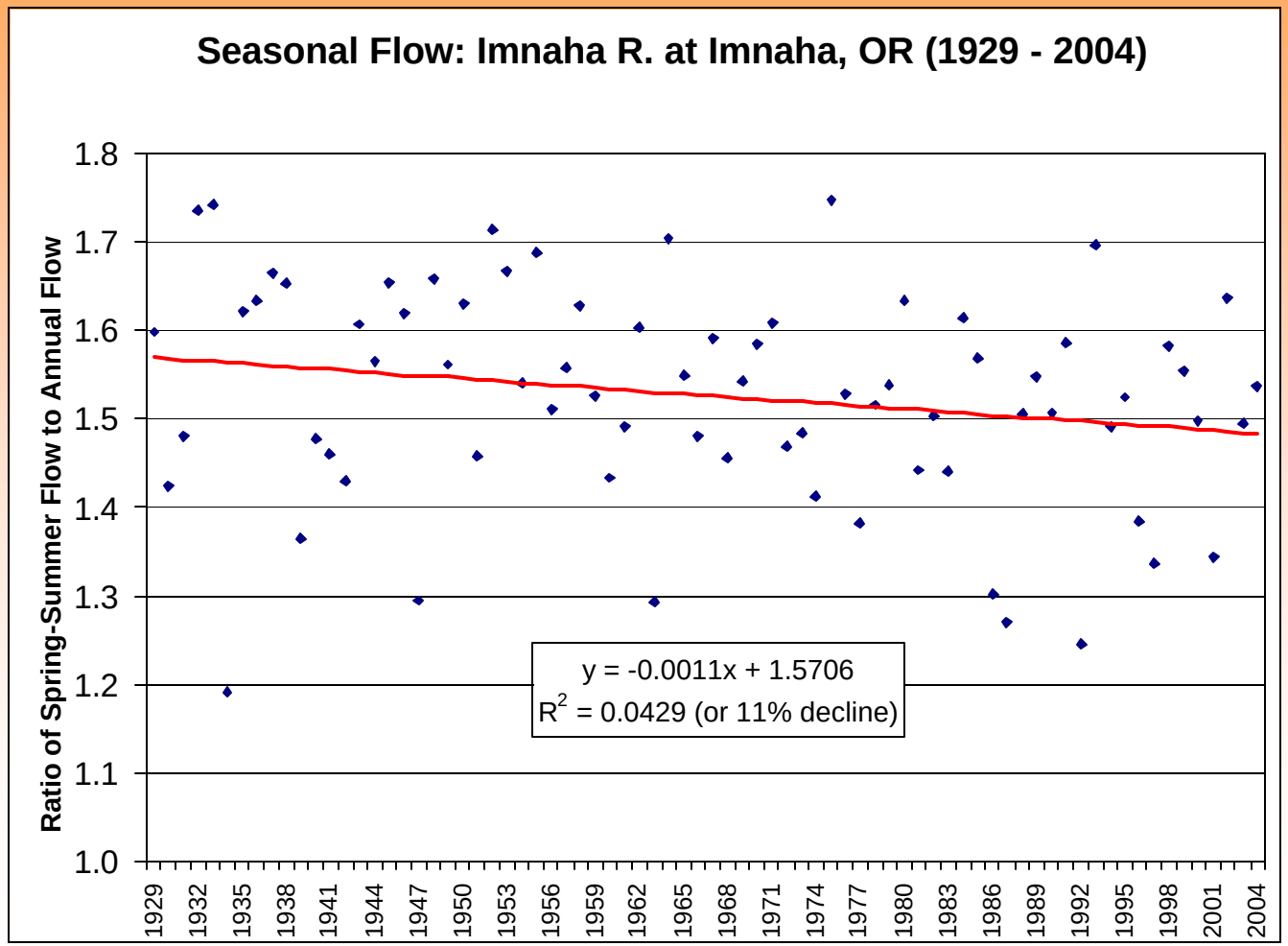
Flow Volume:
John Day Basin



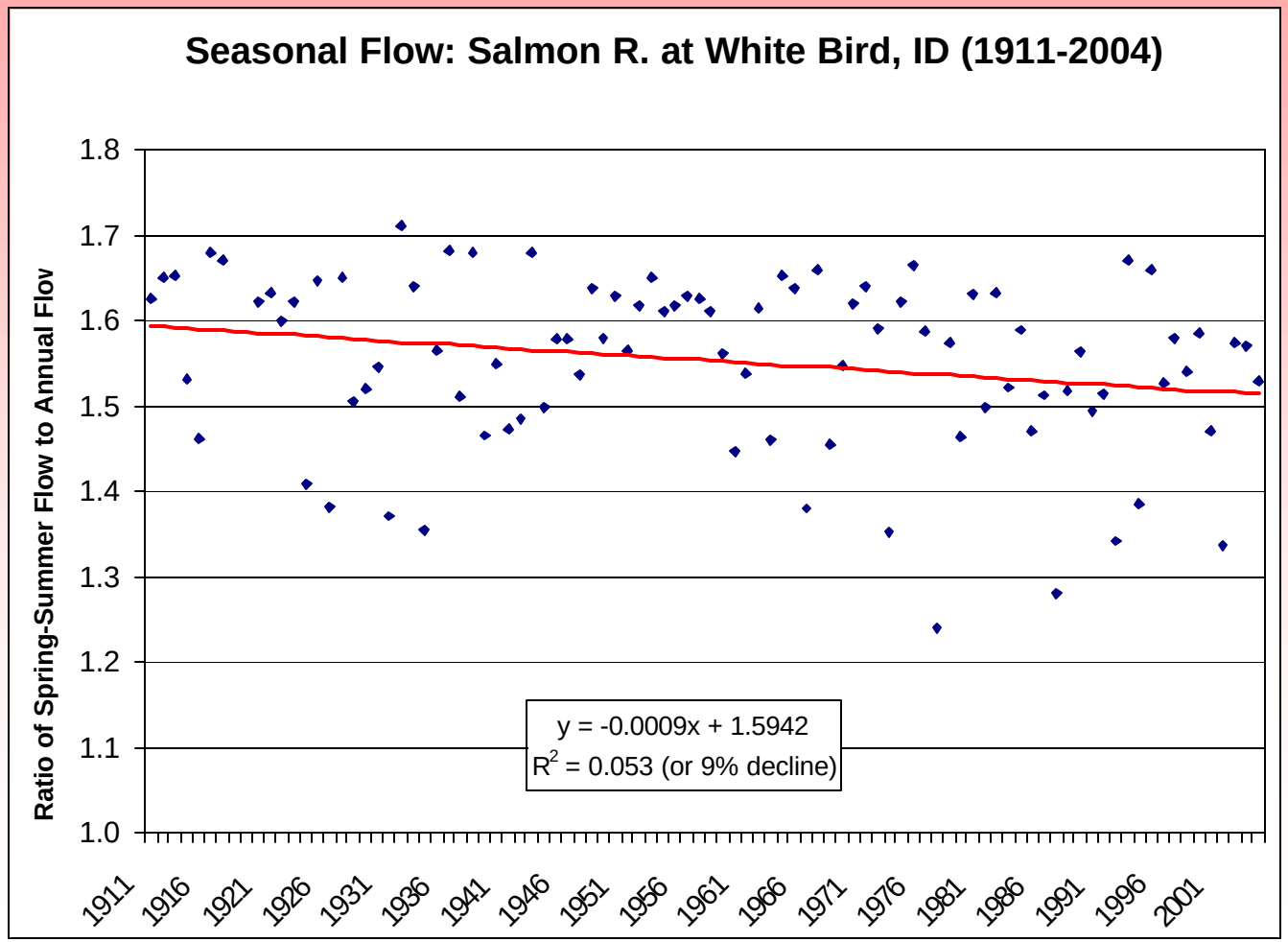
Flow Volume:
Umatilla Basin



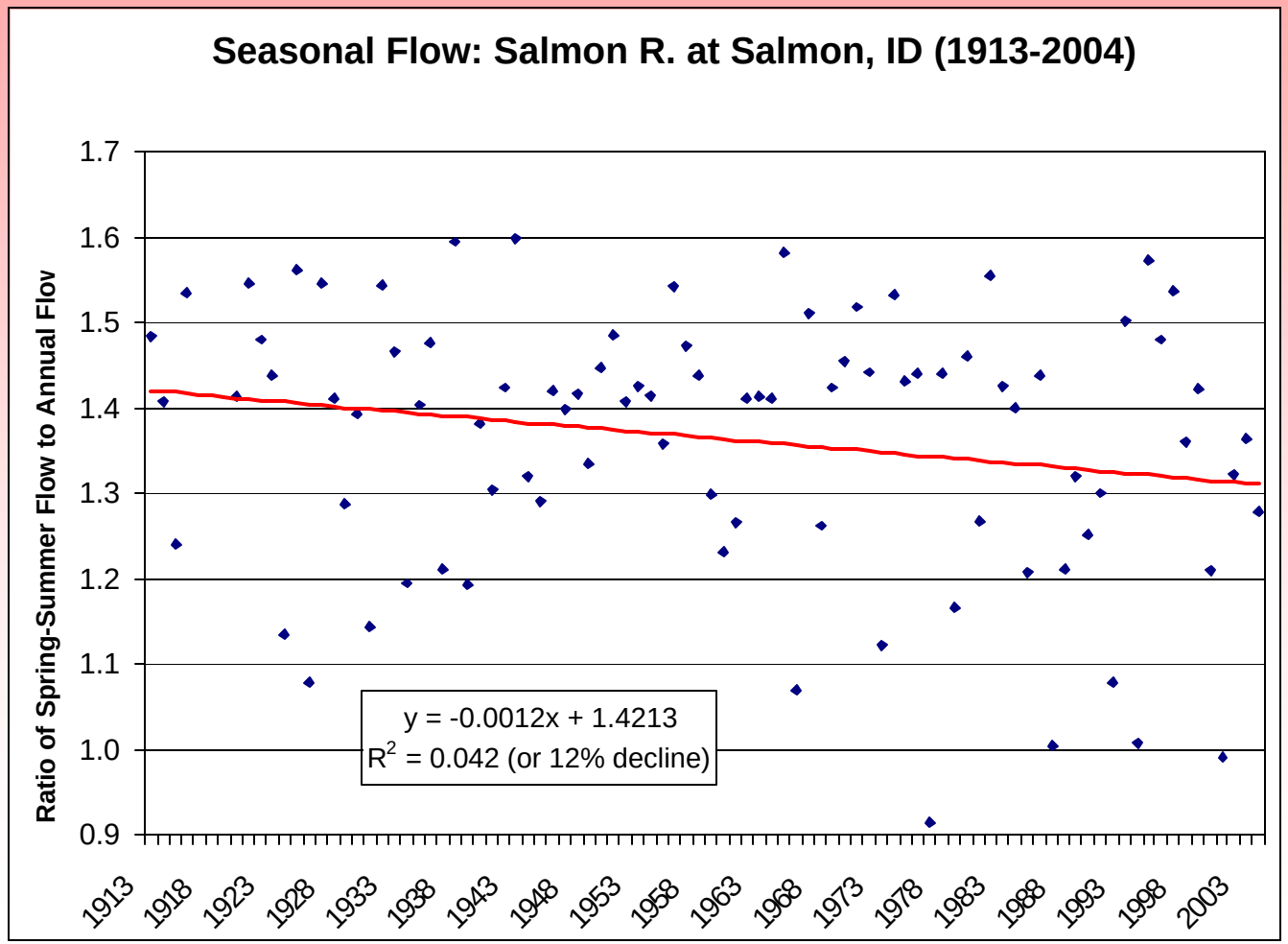
Flow Volume:
Imnaha Basin



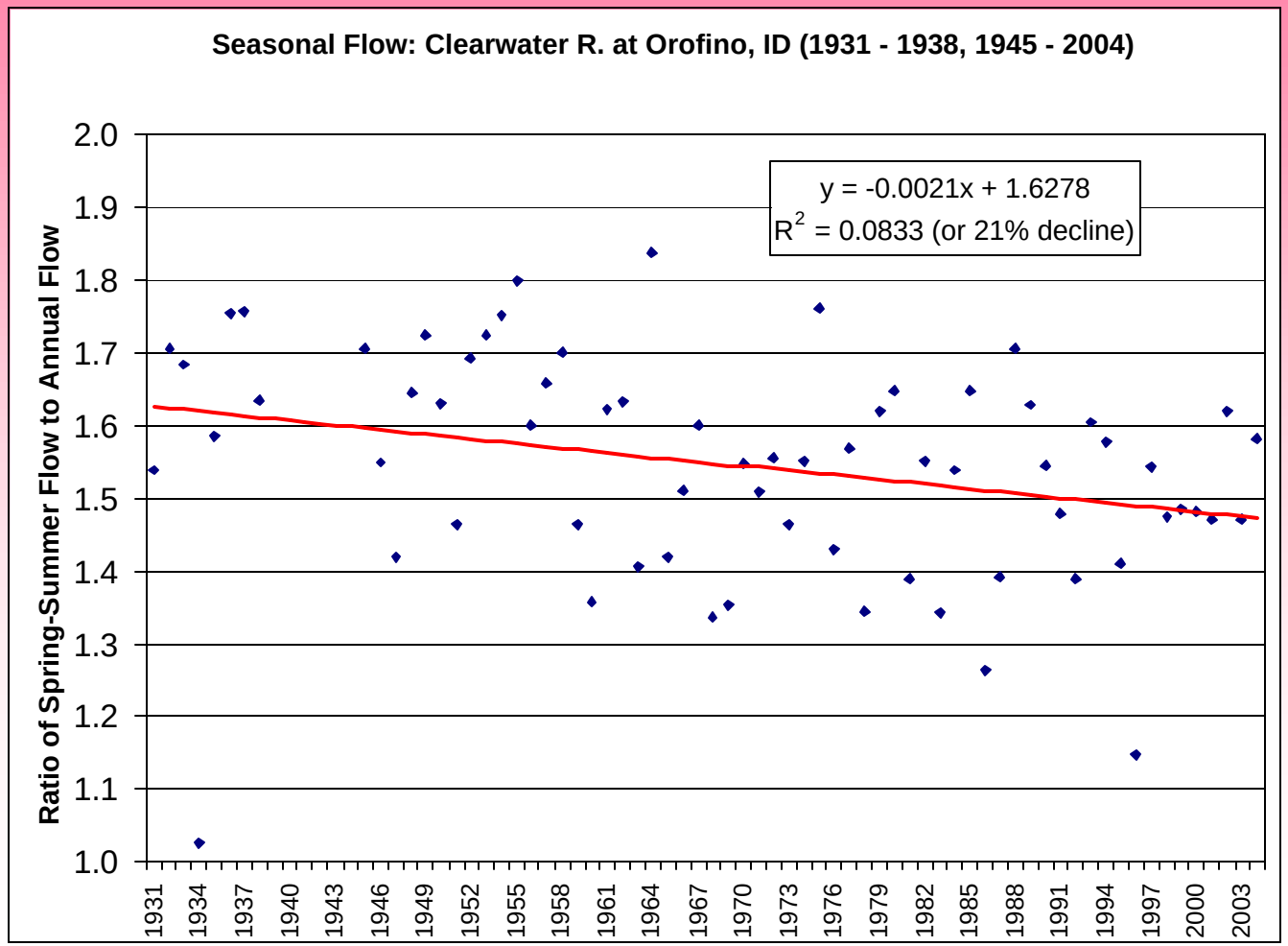
Flow Volume:
Salmon Basin



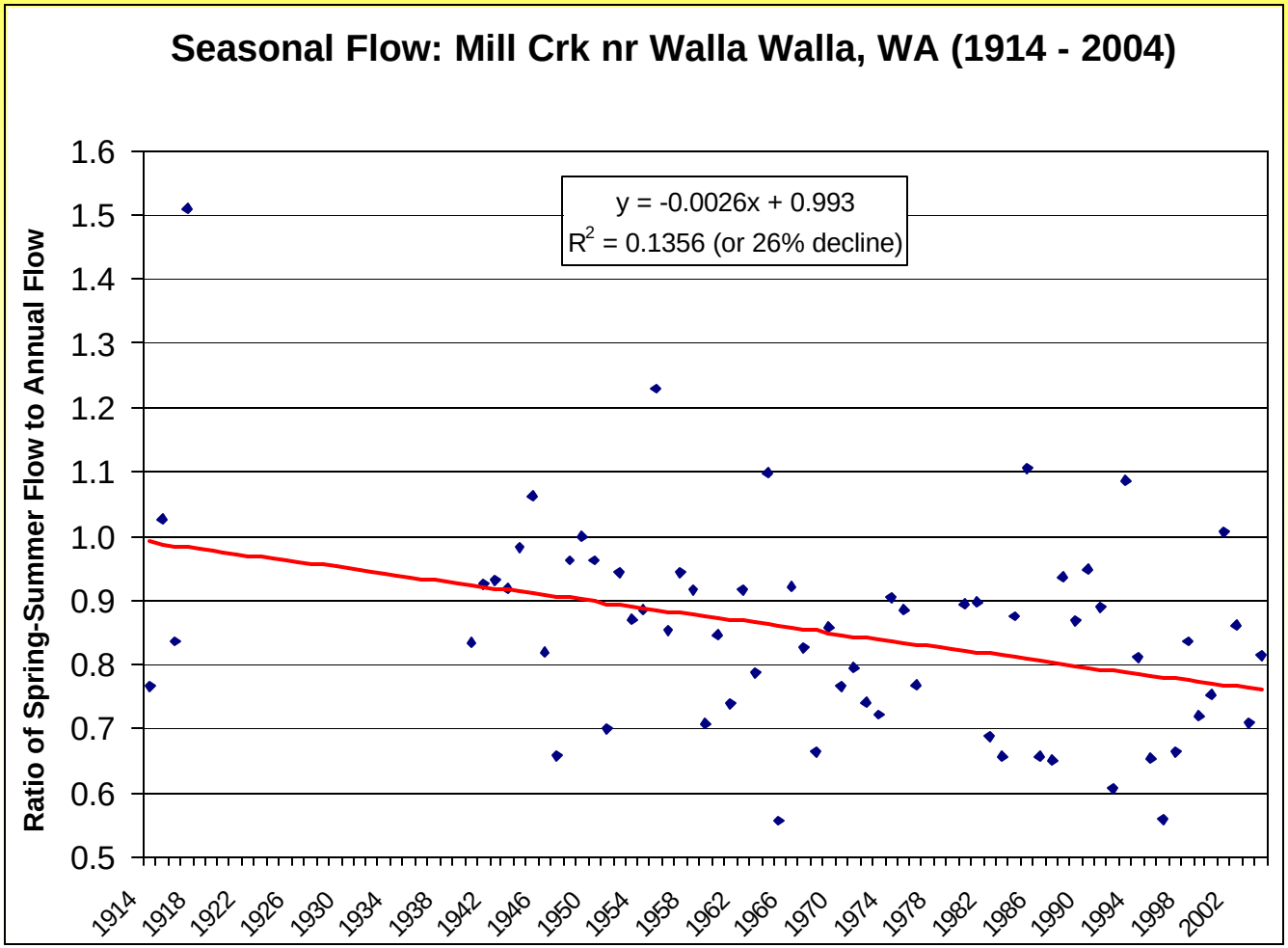
Flow Volume:
Upper Salmon Basin



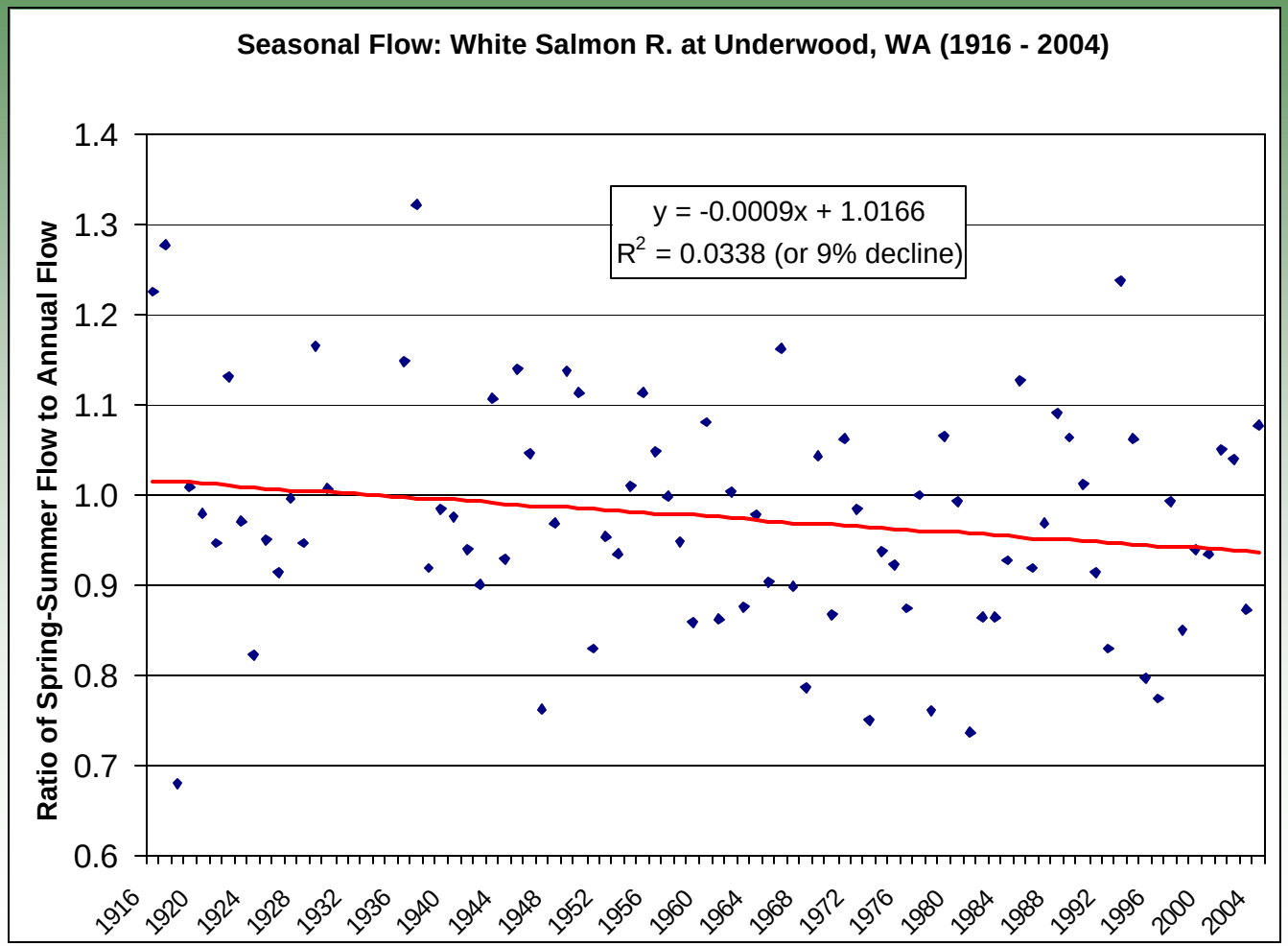
Flow Volume: Clearwater Basin



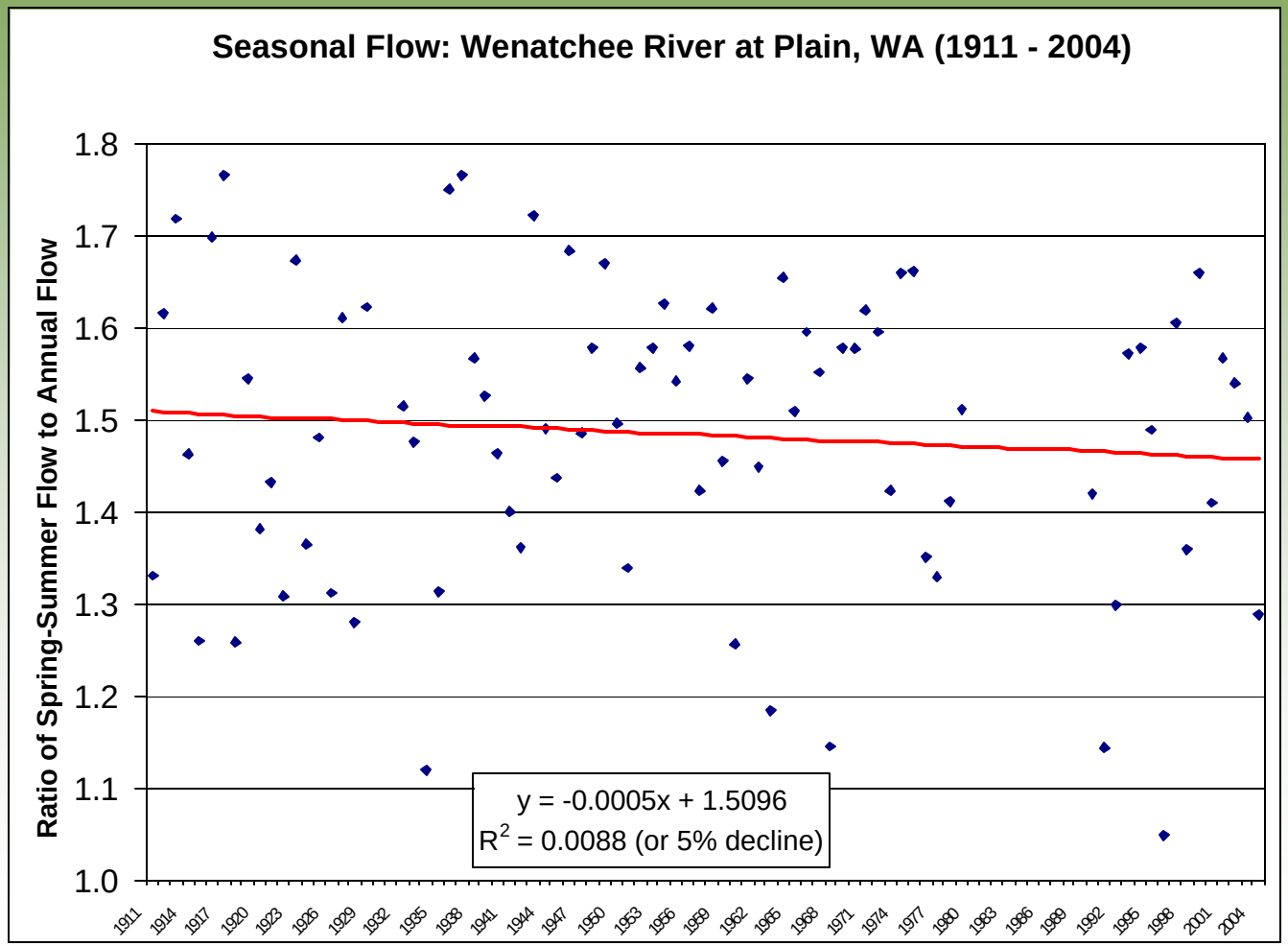
Flow Volume:
Walla Walla Basin



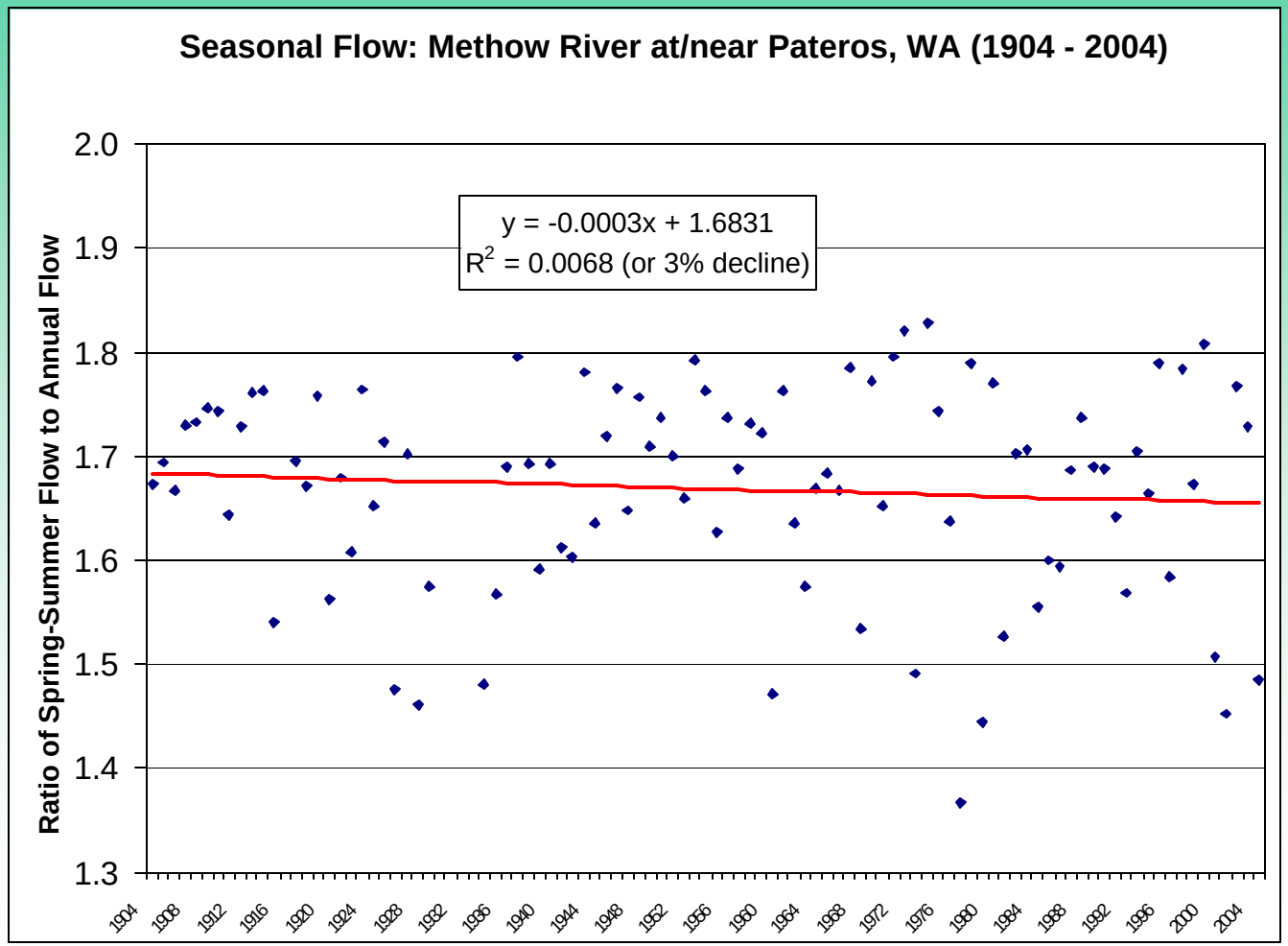
Flow Volume:
White Salmon Basin



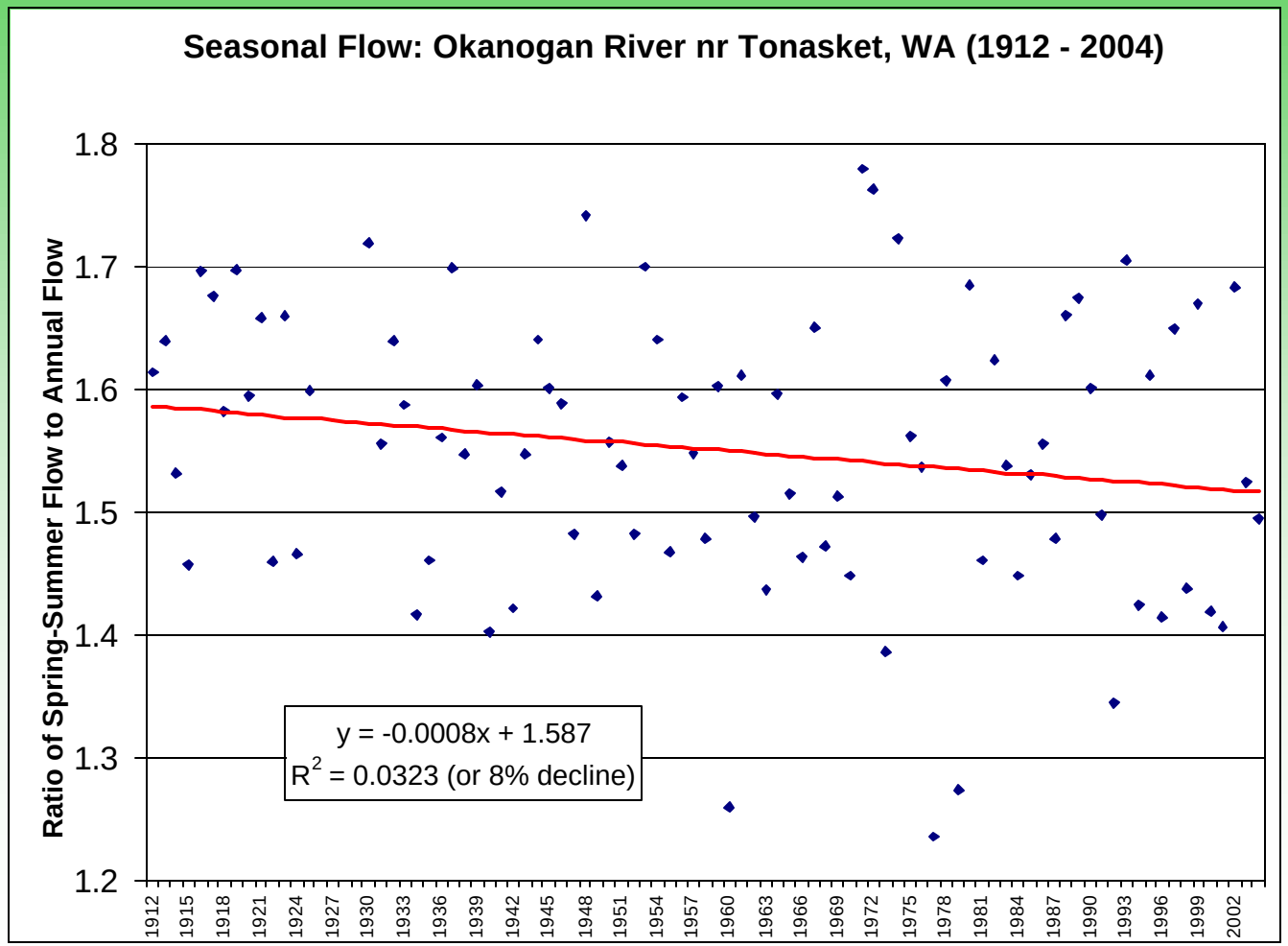
Flow Volume:
Wenatchee Basin



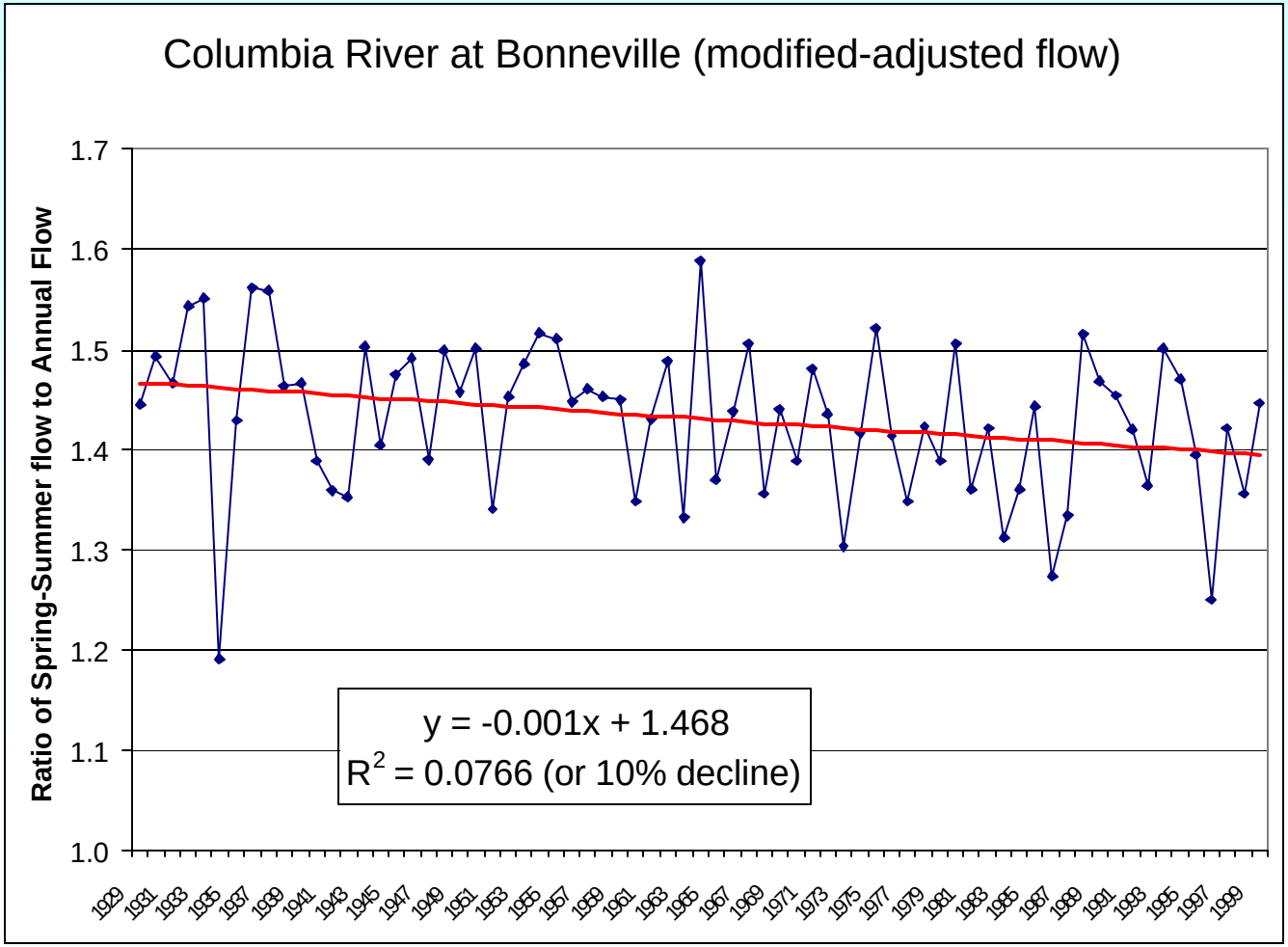
Flow Volume: Methow Basin



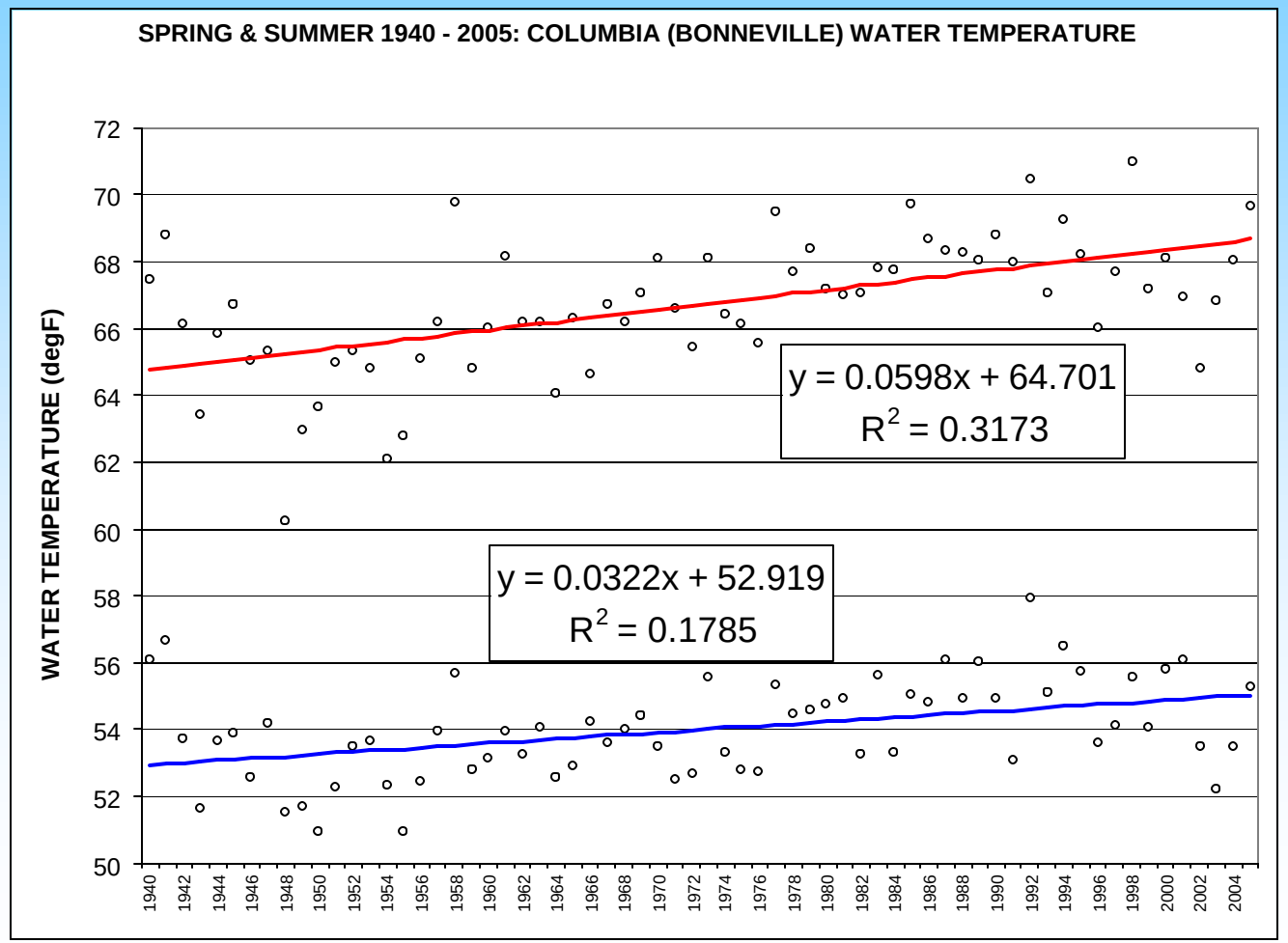
Flow Volume:
Okanogan Basin



Flow Volume:
Columbia Basin



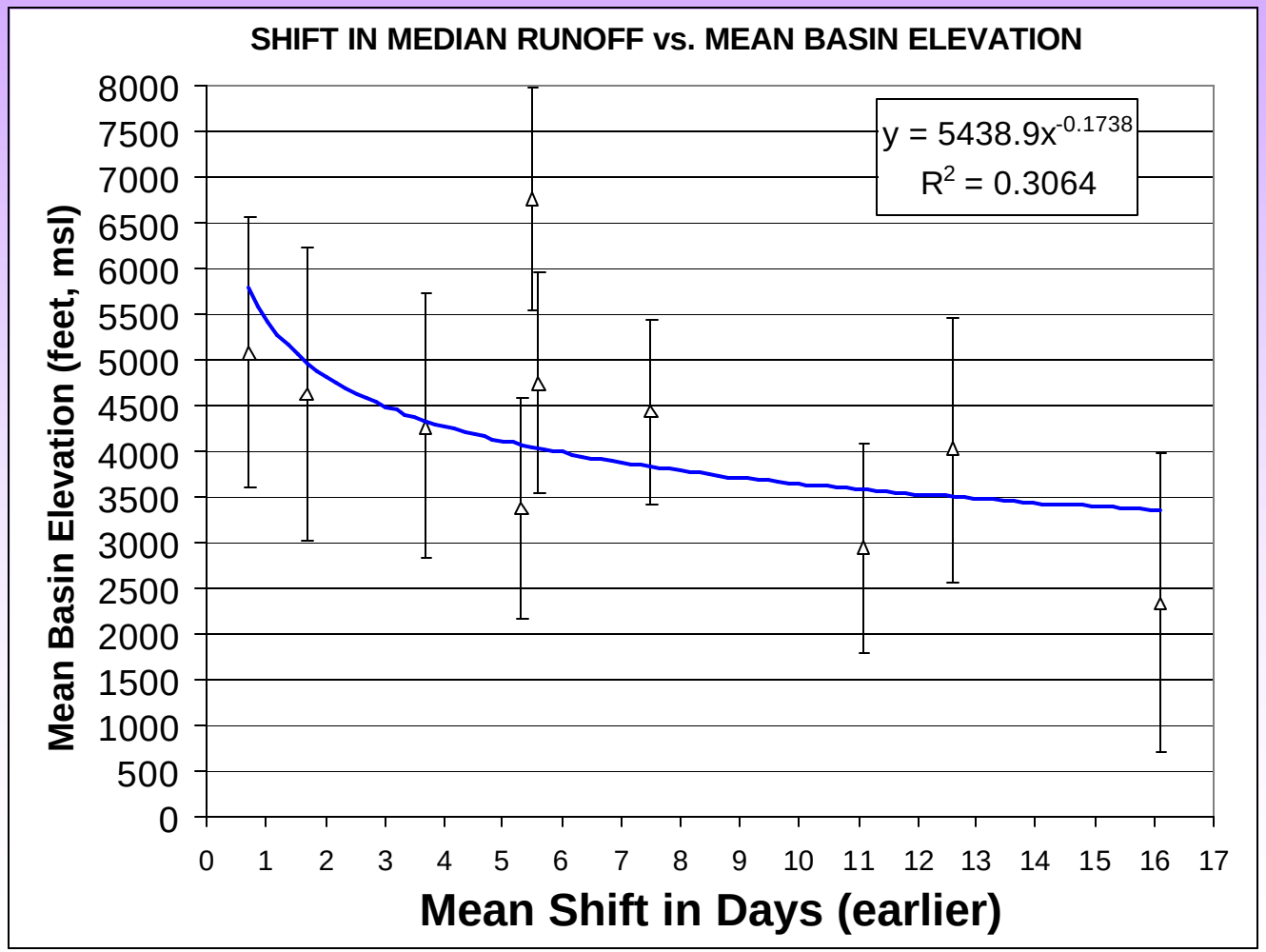
Water Temperature: Columbia Basin



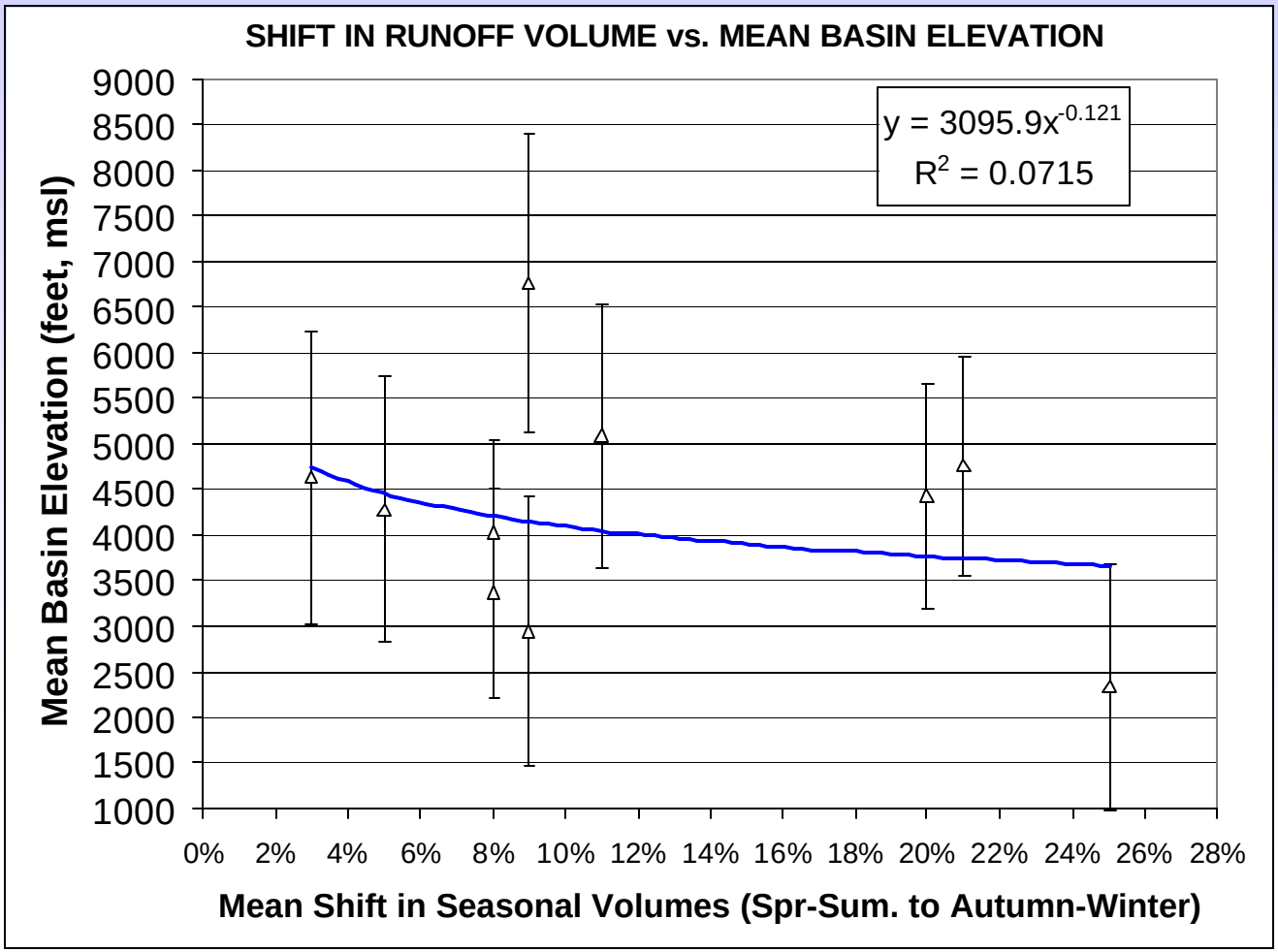
Snow-pack decline: 4000 ft. threshold

WARM SPRINGS	Area (sq.mi.) >4000 ft.	Area (sq.mi.) <4000 ft.	% >4000 ft.	% <4000 ft.	Percent Total of
Deschutes	6064	4695	56%	44%	all Sub-basins
John Day	3747	4186	47%	53%	above 4000 ft.:
Hood River	80	260	24%	76%	**31%**
Fifteen Mile Creek	20	564	3%	97%	
UMATILLA	Area (sq.mi.) >4000 ft.	Area (sq.mi.) <4000 ft.	% >4000 ft.	% <4000 ft.	Percent Total of
John Day	3747	4186	47%	53%	all Sub-basins
Umatilla	300	2218	12%	88%	above 4000 ft.:
Grand Ronde	2417	1692	59%	41%	**16%**
Imnaha	648	203	76%	24%	
Walla Walla	161	1601	9%	91%	
Tucannon	108	1352	7%	93%	
NEZ PERCE	Area (sq.mi.) >4000 ft.	Area (sq.mi.) <4000 ft.	% >4000 ft.	% <4000 ft.	Percent Total of
Clearwater	235	2096	10%	90%	all Sub-basins
Salmon	6402	740	90%	10%	above 4000 ft.:
Grand Ronde	2417	1692	59%	41%	**54%**
Imnaha	648	203	76%	24%	
Walla Walla	161	1601	9%	91%	
Tucannon	108	1352	7%	93%	
YAKAMA	Area (sq.mi.) >4000 ft.	Area (sq.mi.) <4000 ft.	% >4000 ft.	% <4000 ft.	Percent Total of
Yakima	1307	4849	21%	79%	all Sub-basins
Klickitat	314	1038	23%	77%	above 4000 ft.:
Wind	7	217	3%	97%	**14%**
Wenatchee	623	710	47%	53%	
Entiat	232	187	55%	45%	
Lake Chelan	566	369	61%	39%	
Methow	1144	689	62%	38%	
Okanogan	252	1394	15%	85%	

Shift in Runoff Timing vs. Basin Elevation



Shift in Seasonal Volume vs. Basin Elevation



Conclusions

- Yakama Nation and Umatilla Tribe: highest risk for climate change, based on lowest amount (14-16%) of land above 4000 feet.
- Nez Perce Tribe has the low-moderate risk for climate change, based on highest amount (54%) of land above 4000 feet.
- Warm Springs Tribe has a moderate-high risk for climate change, based on low-modest amount (31%) of land above 4000 feet.
- Deschutes basin century climate change: +1.2 degF day temperature, +2.6 degF night temperature, +2.0 inch (11%) more precipitation. Flow peaks 12.6 days sooner. Spring-summer flow drops by 8%.
- John Day basin century climate change: +1.5 degF day temperature, +3.2 degF night temperature, -0.4 inch (2%) less precipitation. Flow peaks 7.5 days sooner. Spring-summer flow drops by 20%.
- Umatilla basin century climate change: +1.3 day temperature, +1.5 degF night temperature, +0.4 inch (2%) more precipitation. Flow peaks 16.1 days sooner. Spring-summer flow drops by 25%.

Conclusions (cont.)

- Imnaha basin century climate change: +1.7 day temperature, +2.0 degF night temperature, +0.7 inch (2%) more precipitation. Flow peaks 0.7 days sooner. Spring-summer flow drops by 11%.
- Salmon basin century climate change: +1.4 degF day temperature, +3.3 degF night temperature, +0.6 inch (2%) more precipitation. Flow peaks 5.5 days sooner. Spring-summer flow drops by 9%.
- White Salmon basin century climate change: +1.2 degF day temperature, +0.6 degF night temperature, +3.5 inch (6%) more precipitation. Flow peaks 11.1 days sooner. Spring-summer flow drops by 9%.
- Clearwater basin century climate change: +0.8 degF day temperature, +2.3 degF night temperature, +4.0 inch (11%) more precipitation. Flow peaks 5.6 days sooner. Spring-summer flow drops by 21%.
- Walla Walla basin century climate change: Flow peaks 16.6 days sooner. Spring-summer flow drops by 26%.

Conclusions (cont.)

- Wenatchee basin century climate change: +0.2 degF day temperature, +2.8 degF night temperature, +4.5 inch (6.5%) more precipitation. Flow peaks 3.7 days sooner. Spring-summer flow drops by 5%.
- Methow basin century climate change: +1.6 degF day temperature, +3.5 degF night temperature, +7.0 inch (28%) more precipitation. Flow peaks 1.7 days sooner. Spring-summer flow drops by 3%.
- Okanogan basin century climate change: +1.1 degF day temperature, +4.1 degF night temperature, +3.5 inch (24%) more precipitation. Flow peaks 5.3 days sooner. Spring-summer flow drops by 8%.
- Columbia River at Bonneville: spring-summer flow drops by 10%.
- Salmon impacts—mixed bag for spawning, emergence, and passage.
- Next steps: analyze more (and higher elevation) sub-basins.
- Thanks to David Graves & Jenny Lloyd, CRITFC's GIS specialists.