



Boise Front Recharge

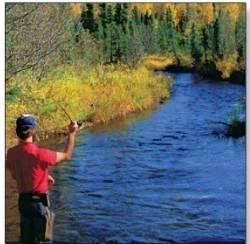
Presented by Allan Wylie, IDWR

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Outline

- Tributary aquifer recharge is difficult to determine
- Carter and Driscoll (2006) relationship between yield efficiency and elevation
- Aishlin (2006) calculated groundwater recharge for the Dry Creek Experimental Watershed
- Use Aishlin data and Carter and Driscoll technique and expand to whole Boise Front
- Look at other estimates
- Proposal



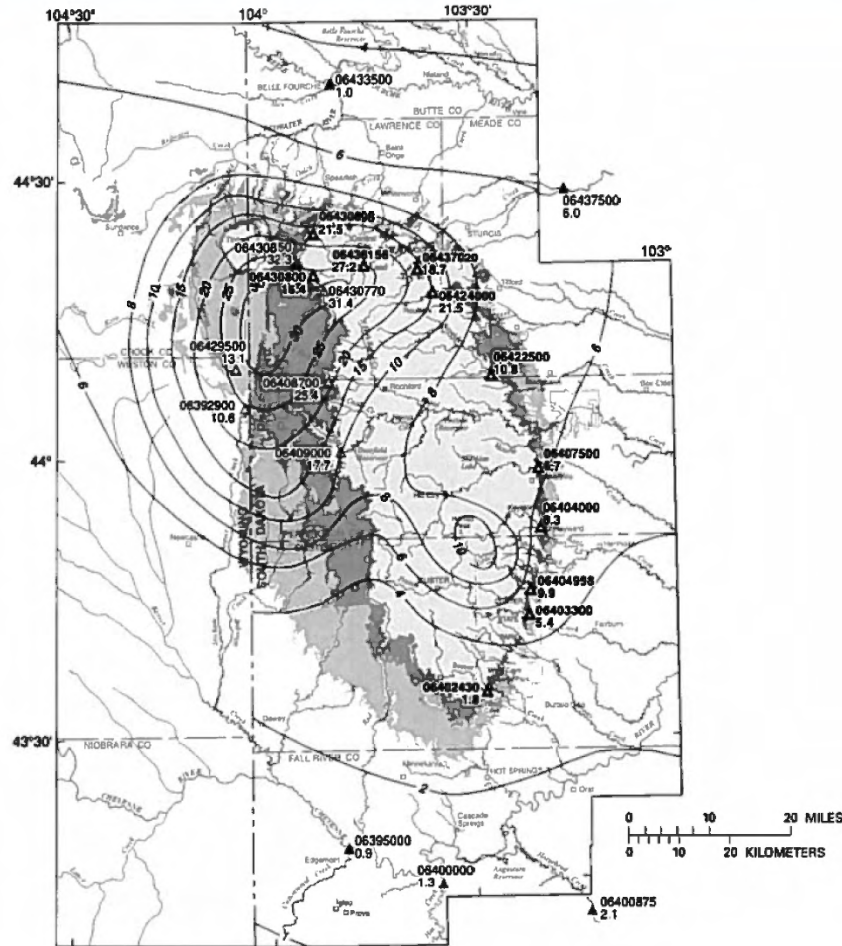
Tributary aquifer recharge is difficult to determine

- Can't see it
- Attempts to quantify tributary aquifer recharge require lots of detailed measurements and are hence expensive
 - Still a calculated value, not a measurement
- How big a component of the water budget is tributary aquifer recharge

Carter and Driscoll

- Carter, J.M., Driscoll, D.G., 2006, Estimating recharge using relations between precipitation and yield in a mountainous area with large variability in precipitation: Journal of Hydrology V 316, pp 71-83.
- Black Hills of South Dakota
- Part of Black Hills underlain by crystalline core
 - Igneous and metamorphic rock
 - Mount Rushmore
 - Assumed no recharge when watershed was on crystalline core
 - Monitored precipitation and surface water runoff
- Developed relationship between watershed yield efficiency and elevation
- Calculated recharge for area of Black Hills underlain by limestone
 - Knowing elevation and hence yield efficiency

J.M. Carter, D.G. Driscoll / Journal of Hydrology 316 (2006) 71–83



Base modified from U.S. Geological Survey digital data, 1:100,000 and City Engineer's map, Rapid City, 1991

- Outcrop of the Madison Limestone
- Outcrop of the Minnelusa Formation
- Predominantly igneous and metamorphic rocks; classified as "crystalline core" setting (from Driscoll and Carter, 2001)
- 15— Line of equal average annual yield efficiency—Interval 1, 2, or 3 percent

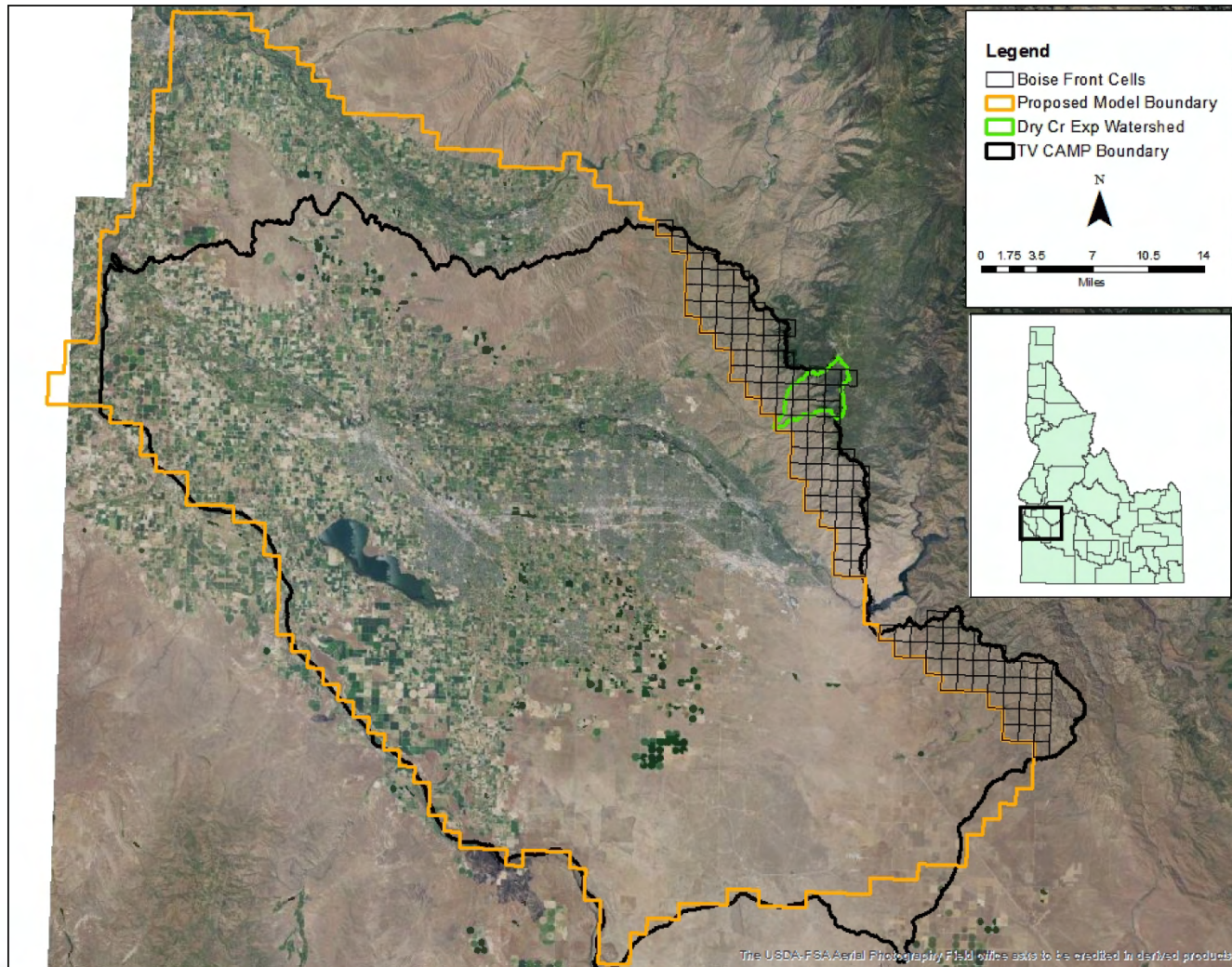
EXPLANATION

- ▲ Streamflow-gaging station—Numbers indicate site number and estimated yield efficiency, in percent, for water years 1950–1998
 - ▲ Substantial influence from ground-water discharge in Limestone Plateau area
 - ▲ Representative of "crystalline core" setting
 - ▲ Outside "crystalline core" setting
- | | |
|--------------------|---------------------|
| ▲ 06430850
32.3 | ▲ 06437829
31.87 |
| ▲ 06402250
10.8 | ▲ 06424860
21.5 |
| ▲ 06433500
1.0 | ▲ 06407500
2.7 |
| | ▲ 06404000
2.3 |
| | ▲ 06404998
2.9.8 |
| | ▲ 06403300
5.4 |
| | ▲ 06402430
1.8 |
| | ▲ 06400875
2.1 |
| | ▲ 06400000
1.3 |
| | ▲ 06395000
0.9 |
| | ▲ 06408700
25.9 |
| | ▲ 06409000
19.7 |
| | ▲ 06429500
13.1 |
| | ▲ 06392900
10.8 |
| | ▲ 06438900
18.34 |
| | ▲ 06430770
31.4 |
| | ▲ 06430698
21.5 |
| | ▲ 06430850
32.3 |
| | ▲ 06431984
27.2 |

Aishlin

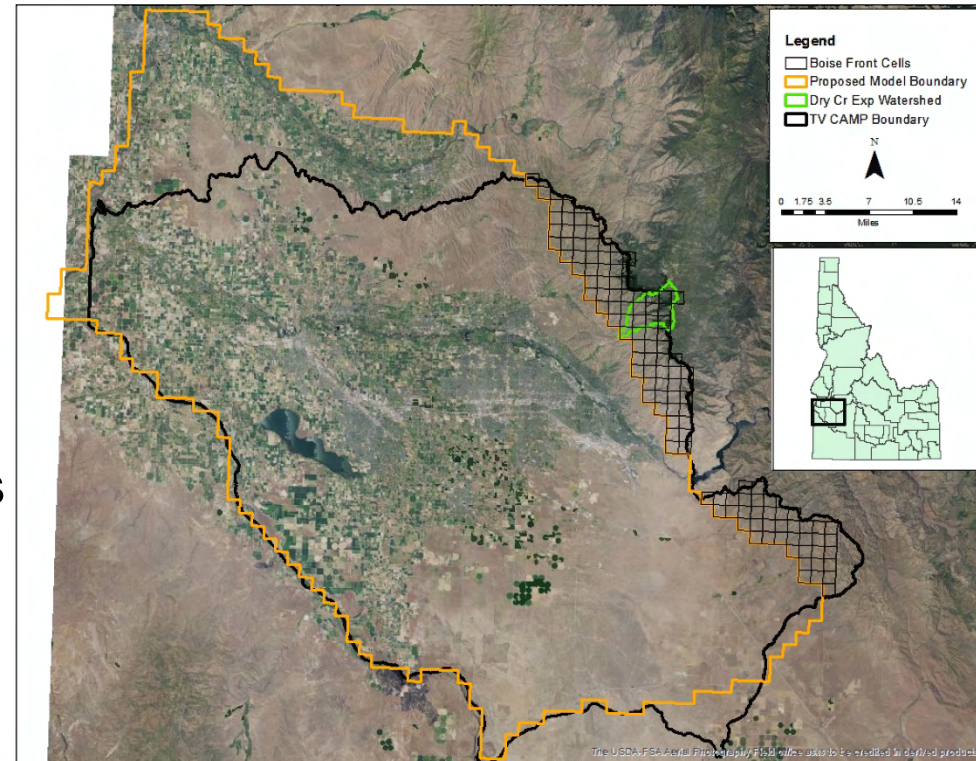
- Aishlin, P.S., 2006, Groundwater recharge estimation using chloride mass balance, Dry Creek Experimental Watershed: Unpublished master's thesis, Boise State University, Boise, Idaho.
- Use a chloride mass balance to calculate recharge
- Calculated ~5.5% of precipitation went to recharge
 - Was able to demonstrate that higher percentage of precipitation went to recharge at higher elevations
- Kormos, P.R., McNamara, J.P., Seyfried, M.S., Marshall, H.P., Marks, D., Flores, A.N., 2015, Bedrock Infiltration estimates from a catchment water storage-based modeling approach in the rain snow transition zone: Journal of Hydrology V 525, pp 231-248.
 - Came up with a similar recharge estimate on one of Aishlin's catchments.

Aishlin



Method

- Obtain centroids for Boise Front cells
- Project centroids onto 10M DEM to get elevations
- Apply recharge fraction by elevation from Aishlin to the entire Boise Front
- Project recharge fraction points onto annual PRISM precipitation raster to obtain annual recharge through the Boise Front



Source	Mountain Front Recharge (AF)
This analysis	515
Petrich and Urban (2004)	905
Urban (2004)	4,300
Newton (1991)	Small
Welhan (2012)	9,000
SPF (2007a)	3,900
SPF (2007b)	5,580

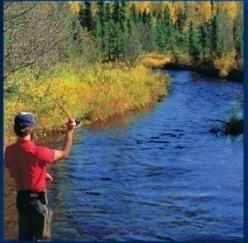
- Total recharge from Urban (2004) for year 1996 = 1,020,300 AF
- Total recharge from Petrich and Urban (2004) = 1,035,000 AF

Recommendation

- Boise Front Recharge probably will not contribute significantly to model predictive uncertainty
 - Option A: Fix Boise Front Recharge at zero
 - Option B: Make Boise Front Recharge an adjustable parameter and use the various estimates to establish an acceptable range
 - 0 – 9000 AF

Some References

- Newton, G.D., 1991, Geohydrology of the regional aquifer system, western Snake River Plain, southwestern Idaho: U.S. Geological Survey Professional Paper 1408-G, 52 p., 1 plate in pocket. [Also available at <https://pubs.er.usgs.gov/publication/pp1408G>]
- Petrich, C.R., and Urban, S., 2004, Characterization of ground water flow in the lower Boise River basin: Moscow, University of Idaho Water Resources Research Institute, Research Report IWRRI-2004-01, 148 p. [Also available at <https://idwr.idaho.gov/files/projects/treasure-valley/TVHP-Characterization.pdf>]
- SPF Water Engineering, 2007a, Ground-water supply evaluation for the Mayfield town site property; November 1, 30 pp. plus appendices. Also available at <https://idwr.idaho.gov/water-data/projects/east-ada-county/references.html>]
- SPF Water Engineering, 2007b, Ground-water supply evaluation for Elk Creek Village, Application for Permit No, 61-12090; December 17, 17 pp. plus appendices. [Also available at <https://idwr.idaho.gov/water-data/projects/east-ada-county/references.html>]
- Urban, S.M., 2004, Water budget for the Treasure Valley aquifer system for the years 1996 and 2000: Moscow, University of Idaho Water Resources Research Institute, Research Report unnumbered, variously paged. [Also available at <https://idwr.idaho.gov/files/projects/treasure-valley/TVHP-Water-Budget-1996-2000.pdf>]
- Welhan, J.A., 2012, Preliminary hydrogeologic Analysis of the Mayfield Area, Ada and Elmore Counties, Idaho: Idaho Geological Survey Staff Report [Also available at <https://idwr.idaho.gov/water-data/projects/east-ada-county/references.html>]



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