The Changing Footprint of Water Use in the Columbia Valley

by Tuck Russell

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Friends, Fish Heads, Water Wonks, lend me your flows;
I come to bury Senior Rights, not to praise them.

Well, those of you with the slightest understanding of water law – and that would be most of you – are probably thinking I'm nuts, because burying senior rights is about as likely as Caesar shaking hands with Sasquatch. And you're right: we're not throwing the doctrine of prior appropriation out the window any time soon. As other speakers will note, the most we can realistically try is to encourage senior water rights holders to lend their water when they don't need it and others do, and that is a pivotal strategy in allocating our increasingly scarce supplies in the Columbia Valley. We are taking steps in that direction with the creation of water trusts and banks, but currently they have little effect on the changing footprint of water use there.

What got me thinking about that changing footprint was the Columbia River Basin 2011 Long Term Water Supply and Demand Forecast, a monumental document which was almost as hard to produce as it is to say the title three times fast. Considerable mental effort and resources were expended in its production, and this edition takes climate change into account. How many of you have cracked the electronic cover on this great work? Show of hands. I'll admit that I haven't read it end to end, myself – after all, it's a big sucker, hundreds of pages long – but one of the significant findings regarding supply got my journalistic attention: it forecast surface supply increasing 3% by 2030. Meanwhile, irrigation demand – which dwarfs all other demands in the basin -- was forecast to rise 2% over the same period. This chart portrays that for the entire basin, and it shows plenty of room between supply and demand at all times. Well, no worries, then, right? Wrong. Silly journalist. Indeed, the very first caveat is that timing changes will shift water away from times of highest demand. In a nutshell, by 2030, flows will increase about 17% during the winter and decrease 14% during the summer. This is great news for that huge segment of our population that is kayakers who are also members of the Polar Bear Club. It's not such good news for farmers in the basin, particularly those farmers holding junior water rights.

How much worse is that? The second caveat is that first chart doesn't include municipal demand, hydropower demand, instream flows, or conveyance losses. Even though agricultural use dominates others, when you add those in – as the forecast does at the watershed level – the picture doesn't look nearly as pretty. An example is the forecast for the Upper and Lower Yakima and Naches Water Resource Inventory Areas, showing that even in wetter years, supply will be short during much of the growing season. This forecast further notes that curtailment of pro-ratable irrigation water rights occurred in 45% of years between 1977 and 2005. The forecast of future curtailment for the middle climate scenario suggests that it will occur in 90% of the upcoming years.

The question I wanted to answer is what are those farmers holding junior water rights going to do about it? They may remember 2001 as a pretty tough year, but that may look like a walk in the park compared to what's coming. Are they exploring shifting their crop mix to something less water intensive? To my surprise, the answer seems to be "no" for the most part. At least, not yet. It is difficult to match up existing data to arrive at this answer quantitatively. I took an amateurish stab at it, became frustrated, and then found the great minds behind the forecast also had similar problems. It would be interesting to see a poll on this, but I'm a journalist, not a professional pollster. So I did what journalists do: I interviewed a few farmers and agricultural researchers. As such, my results are

anecdotal, but the common thread was that when it came to making planting decisions, market forces trump projected water availability three ways from Sunday.

This is obviously oversimplified. For one, farmers of annual crops, such as corn, can respond relatively quickly to medium term trends in water availability. To illustrate with an extreme example, a corn farmer seeing a low snowpack in the beginning of the season, and extrapolating that he'd only receive half his needed water, could plant half the corn. Facing the same scenario, a tree fruit farmer would likely have to forget about a crop at all, and water just to save his trees.

Second, the magnitude of the curtailment matters. While curtailments have been frequent, those bad enough to cause significant threats to crops have been sparse.

Third, there are crop management practices that can deal with the shortfall. The downside is that these practices usually involve some loss of crop, risks to the quality of the crop, and more labor. I'll use apples as an illustration. Apple growers facing a small shortfall in water supply can buzz cut their cover crop. It will likely bounce back the following year – assuming water availability returns to normal – and will take less water from the trees. Less water means more risk of sunburn, which spots fruit and reduces its quality, a problem that can be combatted by painting the trees with white latex paint. For more serious shortfalls, more drastic tactics are required. These range from thinning the crop to pulling out older, less productive trees, to very heavy pruning. All of those involve sacrificing crop -- including next year's, in the case of the last two measures.

Fourth, timing of curtailments matters. Each crop has a few critical periods in its life cycle, during which stress due to lack of water is a very bad thing. Where we are on that learning curve in determining the best watering protocols varies. For some crops, these periods are well understood, for others, not so much. For tree fruit, the most critical periods are during spring flowering and final fruit swell, while flowering plus four weeks and fall dormancy are of secondary importance. This has been known for some time. For hops and hay crops, on the other hand, these periods are still being researched. A hay farmer might get all of four of his accustomed cuttings, but if he lacks water at the end of the season, next year's yield goes down substantially, and he would be better advised to sacrifice a cutting and use the last of his allocation for the end of the season. This is relatively new information.

Fifth, soil profile matters, especially for tree fruit and grapes. Such crops planted in shallow or sandy soil are not going to weather a drought as well.

Note that these responses to curtailment often assume a normal year follows. Historically, this has been a reasonable assumption, but the forecast above suggests the odds of that happening are going to be halved. It's pretty tough for a farmer to survive two bad years in row.

Nevertheless, Columbia Basin farmers will likely go on planting as they have been, figuring they can manage the risks surrounding water availability. Farmers are inherently gamblers, and honestly, market conditions are the bigger gamble for most of them. This does not mean they have their heads in the sand about water scarcity. Farmers are slowly swallowing the capital intensive, but more efficient methods of water application such as microsprayers and drip. This is a reaction to the fact that water may be cheap, but isn't free, that pumping cost continues to go up, and of course, that scarcity looms. This trend is being helped along inadvertently by a couple of other factors. Thanks to soaring metal prices, metal fittings on center pivot systems have been subject to rapidly rising theft rates in the last decade, a vulnerability not shared by drip irrigation. Another factor is the implementation of Good Agricultural Practices, which mandates high quality standards on water that touches produce and fruit,

and here again, that is not a problem for drip irrigation.

These factors probably influence water conservation more than recent and potential policy changes pertaining to water rights, but every little bit helps. Actions that remove the incentive to use an entire water right – such as defining conservation as a beneficial use exempt from relinquishment – will subject use to economic forces and promote efficiency, and should be pursued.

Policy regarding drought relief has also changed in recent years. For the past couple of years, water from Lake Roosevelt has become available for drought years, and is expected to add 10% to supplies available to holders of interruptible rights, at the expense of instream flows. The odds of a large scale surface storage project in the Yakima Basin have also improved in the last couple of years. Both of these developments encourage farmers to plant as they have.

What then, are the market forces driving change in the water footprint? The biggest one is the rapid global expansion of middle class consumers, even as our own middle class shows signs of shrinking. This creates demand for higher value foodstuffs and their inputs – which include a few low value crops. Combine this with a weak dollar, and our opportunities for export look pretty promising. There is rising global demand for dairy, meat, fresh fruit, and wine. In certain countries, there are structural impediments to meeting this demand, and those countries must import to meet it.

Japan, for example, has decent water infrastructure, but a shortage of arable land. China and India have lots of arable land, but are a bit short on water infrastructure. The Columbia Valley is blessed with both.

Let's look at Washington's top ag products, and then at the forces that are driving some of them.

This table is organized by value. I'd love to be able to put a percentage of irrigation water use next to each one, but the data isn't quite there to do that very reliably. Maybe next time. The best I can do is give an approximation of how many feet of water per acre each requires.

I'll start with hay, which includes monoculture of alfalfa, timothy, and other grasses, as well as irrigated pasture. Washington's hay production has trended fairly steadily upwards in the last 30 years, but in the last ten, an increasing portion of that, now in the neighborhood of 20% of production, is floating to Asian markets to feed their livestock. It is a fairly water intensive crop, using upwards of 3.5 feet per acre per year. Even hay producers are looking at drip irrigation, but few have made that leap. As noted above, water shortages can reduce the number of cuttings per season and thus reduce yield, but it's a fairly low-risk crop, and the odds of getting wiped out are remote. Data on hay acreage in the Columbia Valley is hard to come by, but the statewide total is over 700,000 acres.

Irrigated wheat covers about 250,000 acres and requires about 1.5 feet per year. Dryland wheat accounts for 2 million acres! Approximately 85% is exported, and a substantial portion is used for feed, especially in years when forage crops aren't doing as well. Acreage has wobbled between 2.7 and 2.2 million acres for the past 30 years. Irrigated wheat yields 5 times more than dryland wheat. If wheat farmers could get the water rights, they'd grow a lot more irrigated wheat. Wheat is generally planted in the fall, and harvested in July. It tolerates water deficits better than many other crops, and is obviously not subject to late season shortages.

At this point, I'd like to try a trivia question with you folks. What do you think is Washington's highest value commodity in dollars per pound? Anyone? The answer is: Pot. In 2005 it came in at $270

million. Which beat out cherries in that year for the number #8 spot. Officials noted that this was the 7th consecutive record year for seizures, and 2007's haul doubled 2005's at almost $600 million. I gather seizures peaked in 2009 and have since come down. The DEA would like us to believe this indicates the tide is turning in this particular battle in the war on drugs, as they say they are putting in the same amount of time looking. Who knows? This is one of the few commodities in which King County can compete with Eastern Washington, as pot is such a high value crop that creating insolation where there is none is actually economically feasible for the sun-challenged grower. Data on planted acreage and water use is basically non-existent, but we can expect that data to improve somewhat in coming years. In any case, Chelan County was the leader, with Grant County second, King third, and Yakima and Franklin Counties rounding out the top 5. Certain farmers in Okanogan County hope to change that ranking. Mind you, this figure is based only on the number of plants the authorities were able to seize. If you figure they get one third of what is actually out there, pot is our numero uno crop. The DEA ranks Washington as the nation's number 2 producer. Even so, we have to assume planted acreage, and thus the water footprint, is relatively small, though one might speculate that increased water demand from end users could impact municipal use.

Dairy is our 2nd largest agricultural commodity by value, and about half is exported. A significant amount of water is used by dairy, but it's hard to do a cows to apples comparison. One source calculates that a 2000 head, 160 acre farm would use roughly 123 acre feet per year, or .75 acre feet per acre. This does not include the water used to grow their feed, but neither is much water used in further processing, in contrast to non-table grapes and processed potatoes.

Speaking of grapes, wine grape production in the state has simply exploded, from 62,000 tons in 1997 to 200,000 this year. Wine grapes are almost entirely drip irrigated, and require roughly 1 foot per acre. Juice grapes, by contrast, have declined in acreage. Planted acreage for both is a mere 50,000 acres. As such, the overall water footprint of the wine and grape industry is relatively small. It should be noted, however, that converting grapes into wine and juice takes substantially more water.

The apple industry presents a more volatile case involving secondary trends. Acreage trended steadily upwards until the early 2000s, but at that time China's push into the juice apple industry made that segment tougher for Washington orchardists. Acreage actually declined somewhat, troughing in the middle of the decade. Some former apple orchards are now planted with cherries and wine grapes. But recently, apples have gained back some ground, riding a wave of demand for new fresh varieties such as Jonagolds and Honeycrisps. Apples and other tree fruit are fairly water intensive, requiring roughly 3 feet per year.

The trend in planted acreage of potatoes has mirrored that of apples over the past decade. I suspect that is merely coincidence. Potatoes cover roughly 160,000 acres. Potatoes for processing dominate fresh potatoes, and about half are exported. They need from 1.5 to 2 acre feet of water. Potatoes are relatively sensitive to water deficits compared to other crops such as wheat, particularly when their tubers are growing in midsummer.

Cherries are a higher risk fruit than apples, more susceptible to frost and rain damage, but acreage dedicated to them has grown swiftly in the last decade, as apple growers sought better margins than they were getting on apples. They require a bit less water, and because their growing season ends much earlier, they are less likely to be affected by late summer shortages. Acreage has roughly doubled from 25,000 in 2006 to 50,000 in 2011.

Though it doesn't make the top 10 list by value, corn has a noticeable footprint. It is useful in rotation

strategies. There are several categories. Field corn for grain and silage covers 200,000 acres. Sweet corn for eating covers about 82,000 acres. Corn requires about 2 acre feet of water.

Climate change affects crops in more direct ways than water shortfalls. Warmer nights nights during the growing season mess up acid balance in grapes and many tree fruits. Warmer winters cause those crops to ripen sooner than normal, to the detriment of quality. Apples get less crisp and tart. Harvest times get protracted, which increases labor costs. Hay seems to like increased heat, and yields actually go up. If cows have noticed a decline in quality, they haven't told us. Wheat and potatoes are a mixed bag: increased atmospheric carbon dioxide will help yields, and reduce transpiration, but higher heat can offset those effects and increase the incidence of disease. Corn yields go down when temperatures vault the 90 degree threshold, and the number of days that threshold is exceeded is projected to double in the next two decades. In general, more extreme weather – such as more, deeper freezes and frosts as well as heat waves, are going to be bad for most crops. Even cows are affected, with high heat causing lower production of milk. My point here is that the changing temperature patterns resulting from climate change may affect crop mix and location decisions more than lower water availability resulting from climate change. And that will in turn affect water use.

One big piece of the water use pie that I have only mentioned in passing really deserves more attention: conveyance losses. Let's return to that watershed level supply and demand chart we looked at earlier. See those big chunks of fluorescent green? Those are conveyance losses. Compare those to the smaller blue chunks, which are instream flow targets. That little yellow line is municipal use. It's that small in virtually all of the Valley, and that's why I will continue to ignore it. The conveyance losses are more than both of those combined. If we could reduce them to near zero, that would almost take care of the curtailment problem by itself. I am aware that conveyance losses due to leakage may add a bit to return flows, but it's my understanding that they mostly raise the water table without being recoverable. Evaporative losses may never come back at all. Upgrading all that infrastructure is an expensive proposition, but so are new reservoirs. Why couldn't we at least cover open canals with solar panels? You're probably thinking “that's crazier than fish with feet,” but they are doing just that in India.

This is a doable challenge for water managers. Another one is to collaborate with policy makers, agricultural researchers, and farmers to time delivery at the critical stages of crop life cycles, even when junior status would formerly not have allowed it.

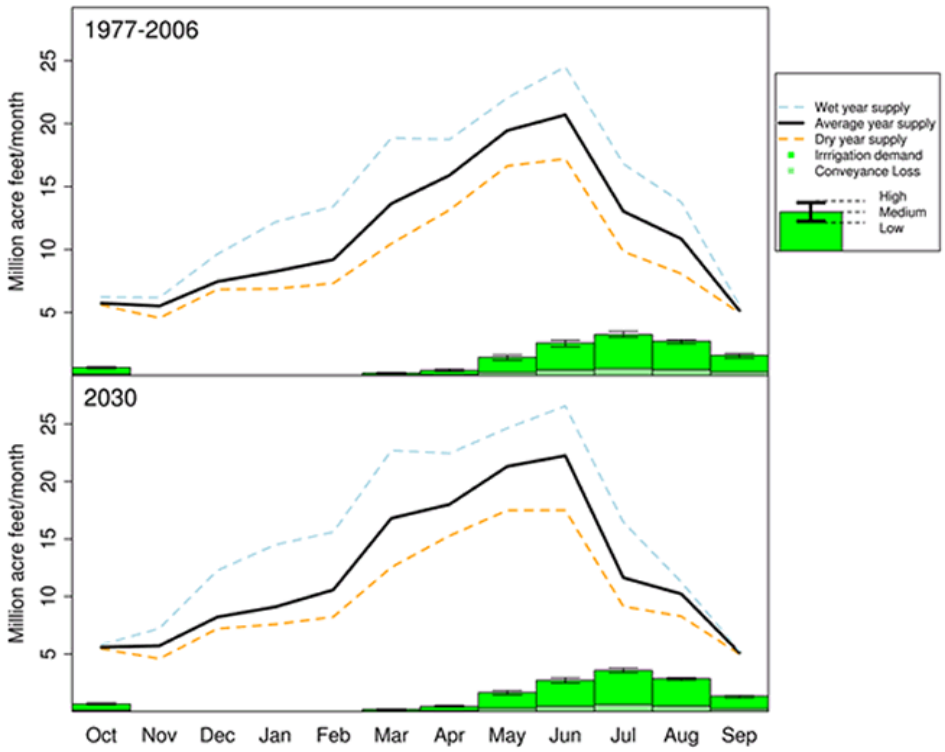
It is time to sum up. In spite of dire forecasts of water shortages, most farmers in Columbia Valley, even the more vulnerable ones holding interruptible junior rights, will continue to plant as they have. They will trust water managers to get water to them most of the time, and they will trust their ability to manage shortfalls. Their decisions on crop mix and location will be driven far more by market demands – and perhaps to a lesser extent by changing temperature patterns – than by water supplies. It would probably take two consecutive drought years to change that.

At that point, maybe we'll see Columbia Valley farmers start buying mountain properties and planting citrus trees.

Thank you, and enjoy dessert!

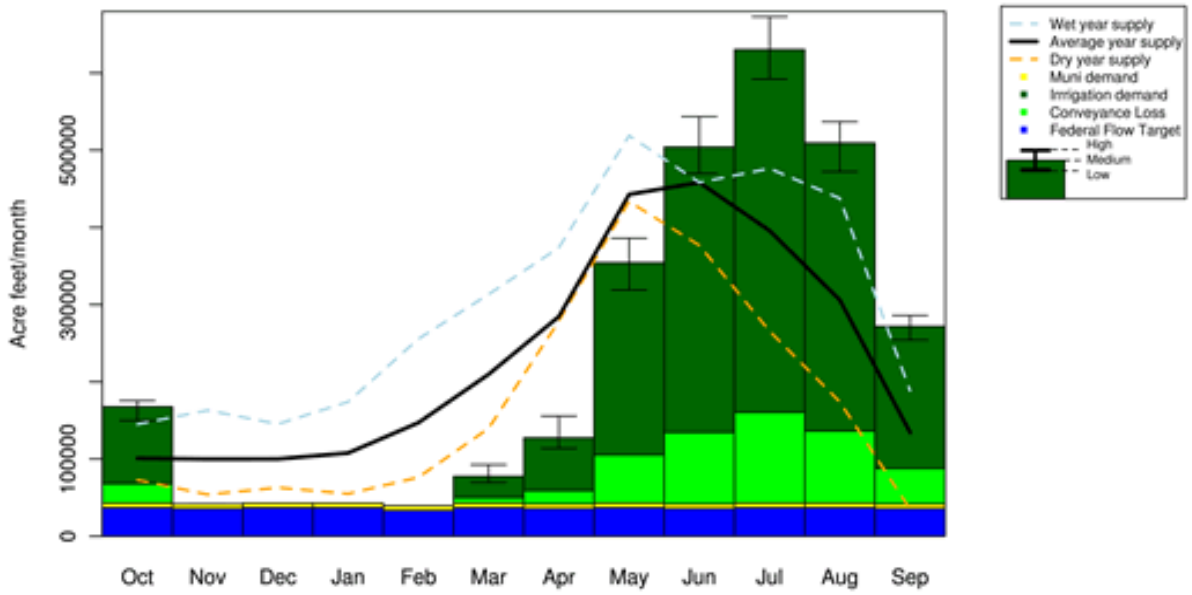
Tuck is a freelance writer who moved to Yakima from San Diego in 2006 to take advantage of the sunshine. wine, climbing, and hiking -- and inexpensive real estate. Tuck worked for several years for a small Prosser winery, mainly in the cellar and laboratory, and a bit in the tasting room and vineyard. Tuck writes about the wine industry and environmental issues, and sometimes both at once. Past stories have covered the challenges of restoring Pacific Lamprey in the Columbia Basin, and the movement of the Washington wine industry towards “sustainability.” He is currently researching the topic of artificial aquifer recharge. Tuck serves on the Citizens' Committee of the Yakima Basin Fish and Wildlife Recovery Board.

Water supplies and irrigation demands for the Columbia River Basin



- Comparison of regulated surface water supply and surface water irrigation demands for the historical (top) and 2030 forecast (bottom) periods under the medium-growth, medium-trade economic scenario across the entire Columbia River Basin, including portions of the basin outside of Washington State. Wet (80th percentile), dry (20th percentile), and average (50th percentile) flow conditions are shown for both supply and demand.

WRIAs 37, 38 & 39
(Lower Yakima, Naches & Upper Yakima)
Supply & Demand



- Comparison of surface water supply, surface water irrigation demands, and municipal demand for 2030, using the baseline economic scenario, and the middle value of the range of climate change scenarios considered. Wet (80th percentile), average, and dry (20th percentile) flow conditions are shown for supply. The 80th, 50th, and 20th percentile conditions are also shown for irrigation demand using error bars. Demands and supplies are defined as above. Water curtailment is not considered.

Washington's Top Crops for 2011

Top Ten Commodity	2011 Value of Production
Apples *	$1.83 (billion)
Milk	$1.28 (billion)
Wheat	$1.14 (billion)
Potatoes	$771 (million)
Hay	$714 (million)
Cattle/Calves	$592 (million)
Cherries	$534 (million)
Nursery/Greenhouses	$306 (million)
Grapes	$189 (million)
Pears *	$186 (million)

* = First in U.S. Production