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Natural Resources of Yakima, Washington

Yakima, Washington is an area rich in natural resources. The unique atmospheric and hydrologic conditions created by the presence of the Cascade Mountains prove to set up a thriving biosphere capable of producing a number of valuable goods.

Atmospheric Resources:

Yakima, Washington's atmospheric resources play a crucial role in developing other key natural resources, most notably those found in the biosphere. These natural resources prove to fuel the economy of Yakima. Without the climate, air quality and access to water that Yakima possesses, natural resources such as fertile soil, forestry and agriculture would not exist.

Climate-

Yakima experiences four distinct seasons and has a climate that can be described as mild and dry. Yakima's average temperature over twelve month's is fairly mild with a temperature of 48.9 degrees (Table 1.). Highs of winter/summer range from 37-87 degrees and lows range from 20-50 degrees (Table 1). Throughout the year, a window of five months (May-September) provides Yakima with an ideal growing season with temperatures between fifty and sixty degrees (Table 1.). Yakima leads the nation in the production of apples and hops and is among the leaders in production of sweet cherries, mint, plums, pears and peaches.

Rainfall levels in Yakima are relatively low compared to the rest of Washington, as they are sheltered by the Cascade Mountains. Yakima’s average annual rainfall total is 8.26 inches (Table 1.) compared to an average of 38.8 inches in Seattle. This does not cause problems with agriculture as the area is well irrigated.

Yakima is often praised for the number of sunny/blue sky days per year, with over 270 often being the norm. Because of this, there are a number of residential solar energy companies in the area. Solar energy is very popular among residential consumers. However, it is still in the developing stages of becoming a viable natural resource capable of providing for the economy.

Table 1. Average Temperature and Precipitation in Yakima, Washington (30 year interval)

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep.	Oct.	Nov	Dec	Avg/Total
Average Temp (Degrees)	29.1	35.2	42.5	48.7	56.2	62.9	69.1	68.3	60.0	48.6	37.0	28.8	48.9
Average Precipitation (Inches)	1.17	0.80	0.70	0.53	0.51	0.62	0.22	0.36	0.39	0.53	1.05	1.38	8.26
Average Min Temps	20.5	24.7	28.9	33.2	40.0	46.2	50.9	50.1	42.3	32.9	26.3	20.5	34.7
Average Max Temps	37.7	45.6	56.0	64.1	72.4	79.6	87.2	86.5	77.6	64.3	47.7	37.1	63.0

Air Quality-

The air quality of Yakima is generally good with 243 days considered “good quality” in 2012 by the EPA (Table 2). However Yakima does struggle with particulate matter 2.5. In 2006 the Clean Air Act raised the standard for allowable amount of PM 2.5 in the air. Yakima is on the verge of exceeding this number and being labeled as a non-attainment area. The

consequences of being labeled a non-attainment area would not be good for Yakima as they would be required to enforce restrictions that would slow down the economy e.g. agricultural burning bans and also enforce restrictions on households such as winter burning bans and requiring wood stove upgrades/replacements if they are not satisfactory. It would cost money to hire people to enforce all of these restrictions which would be a strain on Yakima's economy.

Particulate matter consists of any solid or liquid particle suspended in the Earth's atmosphere. PM 2.5 refers to the size of the particles - a diameter of 2.5 micrometres or less. The other categorization of particulate matter, particulate matter 10, refers to anything with a diameter of 10 micrometres or less. Generally speaking PM 2.5 is more dangerous as the finer particles have the ability to penetrate the lungs and cause damage to the other organs throughout the body. The primary constituents of Yakima's particulate matter include dust (unpaved/paved roads), miscellaneous (waste disposal), residential fuel combustion and mobile (non-road/road). Poor air quality can impact a number of things including human health, agriculture, economy and ecosystems.

Table 2. Air Quality in Yakima, Washington as defined by EPA.

# Days Good	# Days Moderate	# Days USG	# Days UH	# Days VUH	# Days CO	# Days NO2	# Days O3	# Days SO	# Days PM 2.5	# Days PM 10
243	115	3	0	0	0	0	0	0	366	0

Of all Yakima's atmospheric resources, two have the ability to be problematic, the lack of rainfall and presence of particulate matter 2.5. Fortunately, the town of Yakima was built around old, well irrigated farm land. Irrigation systems were already in place and have since been

improved and updated. However, if these irrigation systems were to fail, Yakima would have trouble providing enough water to sustain agriculture which would undoubtedly hurt their economy. Particulate matter 2.5 can cause human health problems and also hurt agriculture. If measures of PM 2.5 are not kept within reason, Yakima could begin to experience the adverse effects of having too much PM 2.5 in the atmosphere. A number of groups in the area are well aware of the PM 2.5 levels and have been advocating the importance of making an effort to lower PM 2.5 levels.

Even considering Yakima's potential atmospheric flaws, Yakima is still rich in atmospheric resources. The temperature, amount of sunlight and water, translate into an ideal growing season for a number of crops which form the backbone of their economy. Their water resources, while not natural, are plentiful as they use complex irrigation systems. Particulate matter 2.5 is recognized as an issue and actively being reduced.

Hydrologic Resources:

Yakima, Washington's hydrologic resources are naturally limited due to low annual precipitation levels caused by the influence of the Cascade Mountains. Complex irrigation systems have been developed to take advantage of Yakima's fertile soil by providing Yakima with enough water to sustain profitable agriculture.

Freshwater Supplies-

Surface water:

The majority of surface water in Yakima stems from a tributary of the Columbia River, the Yakima River. The Yakima River originates from the Keechelus Lake which is located about

200 miles northwest of Yakima in Kittitas County. The river flows down from Kittitas through Yakima at an average rate of 2434.166 ft³/s (Figure 1) and then empties into the Columbia River near Richland. Note that Yakima’s river discharge has been very constant over the last century and rarely drops below 2000 ft³/s (Figure 1) as humans have developed dams and reservoirs for irrigation that disrupt natural discharge rates.

The Yakima River provides crucial irrigation for Yakima’s naturally dry soil. Because rainfall levels are low, Yakima has come to rely on the Yakima River for its fresh water needs. Extensive irrigation systems have been built along the Yakima River for the sole purpose of obtaining freshwater for agriculture. Yakima’s peak growing season correlates with the average river discharge which peaks from April through August (Figure 1). Agricultural demand is responsible for the majority of consumptive use of water from the Yakima River.

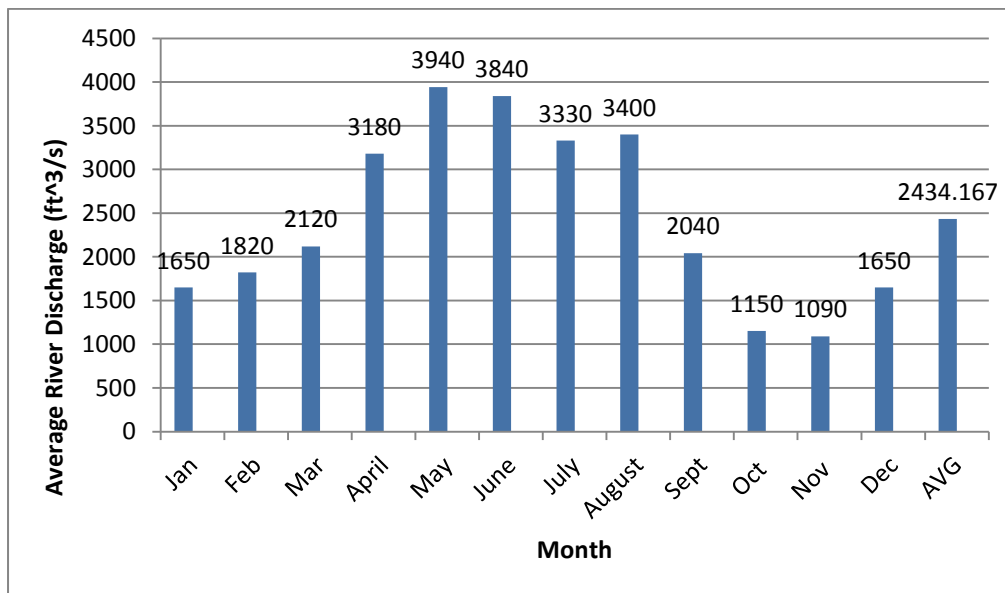


Figure 1. Yakima River – Average Monthly Discharge (1933-2012).

Groundwater-

The majority of Yakima's freshwater demands are fulfilled by surface supplies, namely the Yakima River. However, aquifers supplement the agricultural demand for water, making agricultural withdrawals the number one use of available ground water. Despite that fact, Groundwater is the main source of drinking water for those in Yakima County, serving about 200,000 people or roughly 80% of the population in the county.¹

Water Use

Agriculture:

With a mild climate and rich soils, agriculture has become the backbone of Yakima's economy. Yakima is among leaders of the nation in production of a number of crops including hops, apples and wine. Agricultural water use dominates the total water withdrawals of Yakima (Table 3). Yakima, on average withdrawals 658.32 million gallons per day, out of those 658.32 million gallons, 606.17 million gallons are used for irrigation for agriculture.

However, it was not always this way. Before complex irrigation systems were built, Yakima was a dry area unable to support profitable crop growth. In the early 1900's, The Bureau of Reclamation who are tasked with overseeing water resource management, created the Yakima Project, with the objective of supplying freshwater to Yakima Valley mainly by means of irrigation. With the mild climate, rich soils and number of sunny days per year, people saw the potential for economic growth via agriculture if sufficient water was made available. During this era many dams and canals were built and they remain in use today. As they age, concerns about

¹ <http://www.usbr.gov/pn/programs/yrbwep/reports/DPEIS/DPEIS.pdf>

the structural integrity are brought up. A number of the original dams have been modified in the last 30 years to address these concerns.

County	Total water withdrawals Mgal/d	Total irrigation Mgal/d	Total public Mgal/d	Total livestock	Total “other” withdrawals	
Yakima	658.32	606.17	32.39	7.15	12.61	

Table 3. Average sources of water withdrawal in Yakima county, Washington from 1985-2000.

Hydropower:

Washington State is the largest producer of hydropower in United States. A great portion of the United States relies on Washington’s hydropower production for electricity². However, in Yakima, the majority of power produced is used for irrigation pumping systems. Power plants located on the Yakima River include the Chandler power plant and the Roza power plant, each responsible for the production of about 12,000 kilowatts.

Recreation:

The Yakima River is used recreationally for rafting, boating, kayaking, fishing and a number of other activities normally found around rivers. The Yakima Valley's “Flip Flop” is an event where a dam on the Tieton River, (a tributary of the Yakima River) is released annually to respond to demands for water each fall season. Because of the dam release, the river flow almost doubles, providing desirable white-water rafting conditions during a time of the year where river

² <http://wdfw.wa.gov/conservation/habitat/planning/energy/hydro.html>

flow levels are normally low. This attracts a lot of white-water rafters because it is one of the only rivers in the area during that time of the year that can create such type of rapids.

Water Quality-

Water quality of the lower portion of the Yakima River has shown to contain toxic chemicals, namely DDT and other pesticides, thermal pollution and suspended solids (sediment pollution). Levels of pollutants are close to violating standards set by the EPA for the state of Washington. Thermal pollution of the river has been traced to power stations. Non-point sources have been linked to fertilizer runoff and soil erosion (soil containing banned pesticides still eroding).

Lithospheric Resources:

By geographic nature, Yakima Washington does not produce/rely on a lot of resources derived from the lithosphere. Surrounding counties and the state of Washington as a whole on the other hand have ample amounts of coal and other minerals that have in the past been used to benefit economically. In the future the use of coal is planned to be significantly reduced.

Coal:

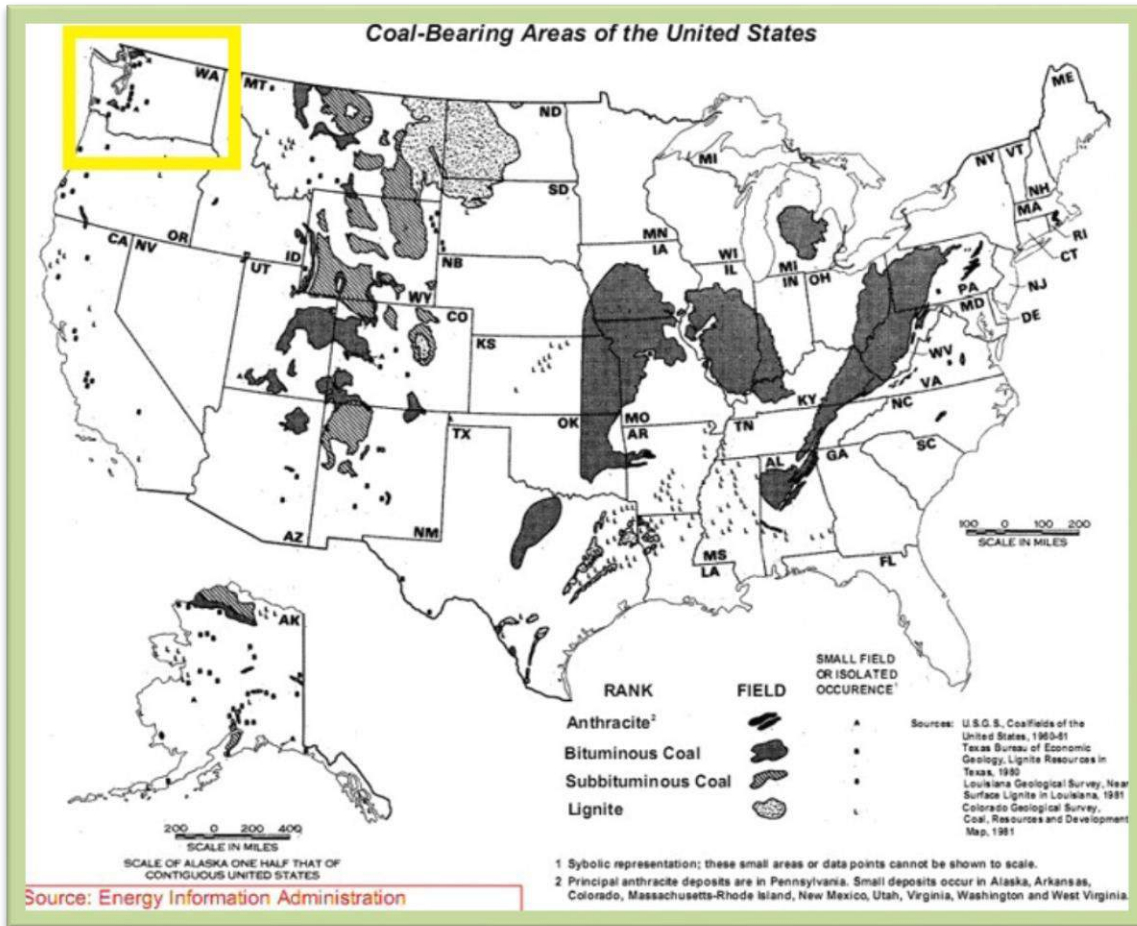
Of the mineral resources present in Washington, coal is one of the most important due to its potential economic value. Of the fossil fuels, coal is the most abundant, but also the dirtiest and contains the lowest carbon content. The coal industry as a whole has been on the decline as different, cleaner burning forms of fuel become the preferred source of energy. However, it is becoming apparent that these forms of fuel (oil/natural gas) are not an infinite resource and will

continue to rise in price as the United States becomes dependent on other nations for their energy needs. 40 percent of the United States total energy consumption is oil. Efforts are being made to change this statistic so the United States doesn't rely so heavily on foreign nations. There is plenty of coal in the United States and there has been a revival of interest in using coal as a primary source of energy. It is a question of whether or not it would be economically viable to invest in the development of cleaner methods of burning coal and better extraction methods (figure out how to get more energy from lower grade coal, Lignite, Bituminous).

There has also been significant resistance to the idea of burning/mining coal in Washington in the future despite the economic benefits. One of the largest coal fired power plants not just in Washington but the entire country, the TransAlta Centralia Mine is scheduled to phase out the use of coal and slowly implement cleaner forms of energy like wind and solar by 2025. This will reduce air pollution along with eliminating all of the other negative impacts of mining and burning coal.

The use of coal in the future in Washington is a subject of debate. While Washington could use there abundance of coal as a natural resource to benefit economically, it looks like they are making extensive efforts to head away from coal and towards cleaner, renewable energy.

Figure Two. Coal-Bearing Areas of the United States



Gold:

Gold mining in Washington today is treated as more of a recreational activity than an industry. Placer deposits (gold found in streambeds) are able to be extracted via panning, one of the simplest and oldest ways to mine. This attracts people of all sorts interested in gold. Lode deposits on the other hand require blasting since the gold is still embedded in rock. As erosion occurs, rock disintegrates and allows gold to be carried away where it eventually ends up in a streambed. Still Gold can be treated as a profitable natural resource because of the economic value it brings by attracting people for recreation.

Other Minerals:

The non-fuel mineral industry in Washington is worth about \$689 million per year according to the USGS. These minerals include sand and gravel, crushed stone, industrial minerals (diatomite, clay, olivine, silica) and metals. Of these commodities, the most valuable in Washington are sand and gravel which are used to make construction aggregates used for common construction materials like concrete, drainage stone and material under foundations. In 2011, over 21 percent of the United States sand and gravel production came from the Pacific North West (Table 4).

Table 4. Construction sand and gravel sold or used by producers in the United States.

Region/division	2010				2011			
	Quantity (thousand metric tons)	Percentage of total	Value (thousands)	Percentage of total	Quantity (thousand metric tons)	Percentage of total	Value (thousands)	Percentage of total
Northeast:								
New England	36,500 ^f	4.5	\$302,000 ^f	5.1	36,100	4.5	\$316,000	5.2
Middle Atlantic	54,300 ^f	6.8	474,000 ^f	8.1	54,700	6.8	478,000	8.0
Midwest:								
East North Central	128,000	15.9 ^f	801,000 ^f	13.6 ^f	124,000	15.4	773,000	12.8
West North Central	109,000 ^f	13.5	565,000 ^f	9.6	117,000	14.5	633,000	10.5
South:								
South Atlantic	51,700 ^f	6.4	398,000 ^f	6.8 ^f	48,400	6.0	389,000	6.5
East South Central	34,100 ^f	4.2 ^f	227,000 ^f	3.9 ^f	33,400	4.1	225,000	3.7
West South Central	112,000 ^f	14.0 ^f	878,000 ^f	15.0 ^f	116,000	14.3	912,000	15.2
West:								
Mountain	157,000 ^f	19.5	1,070,000 ^f	18.1	149,000	18.4	1,020,000	17.0
Pacific	121,000	15.1 ^f	1,160,000	19.8 ^f	131,000	16.2	1,270,000	21.1
Total	805,000 ^f	100	5,870,000 ^f	100	810,000	100	6,020,000	100

^fRevised.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

The state of Washington seems to be moving away from the use of coal, one of its most abundant and profitable natural resources that comes from the lithosphere. This is surely a good

thing from an environmental standpoint as the mining/burning of coal (with current techniques) is devastating to the environment. Methods like strip mining produce a lot of waste, which becomes especially vulnerable to runoff and also damage the aesthetics of the area. The benefits of switching over to cleaner energy production methods may not be realized for decades to come and many will argue in favor of keeping coal a profitable natural resource. Historically, the natural resources of the lithosphere have not been the backbone of Washington's economy and probably will not be in the future either. Washington has come to rely on resources from other areas in particular the biosphere and hydrosphere.

Biosphere Resources

Most of Yakima's natural resources are found in the biosphere. The favorable climatic conditions that exist provide Yakima with a biosphere able to support diverse types of agriculture among other natural resources. This makes Yakima County one of the most productive and fertile growing regions in the United States.

Agriculture:

Agriculture is a large component of Washington's economy, the majority coming from Yakima County. However, Washington's hydrologic resources are naturally limited due to low annual precipitation levels caused by the influence of the Cascade Mountains. Complex irrigation systems have been developed to take advantage of Yakima's fertile soil by providing Yakima with enough water to sustain profitable agriculture. Figure 3 illustrates the rain shadow caused by the Cascade Mountains. It is easy to see the heavily irrigated areas of Washington on the dry eastern side of the Cascade Mountains. Yakima is among the irrigated areas.

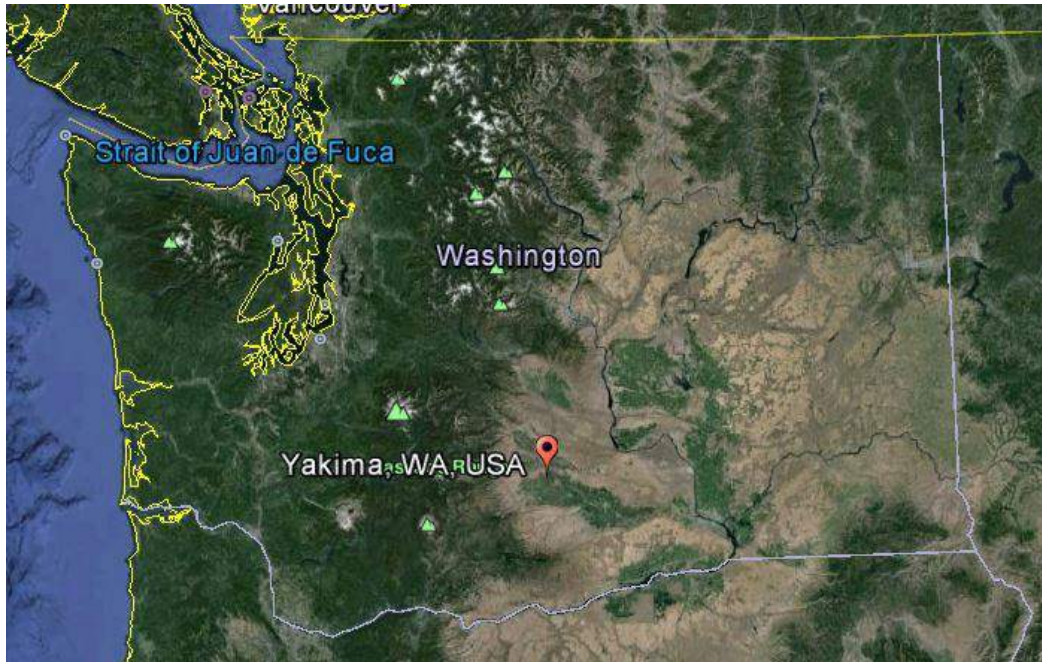


Figure 3. Google Earth image illustrating rain shadow effect of the Cascade Mountains. *Note the areas of heavy irrigation on the eastern side of the mountain.

Yakima’s geographic properties make for a climate that favors agriculture. Throughout the year, a window of five months (May-September) provides Yakima with an ideal growing season with temperatures hovering between fifty and sixty degrees (Table 1.). Yakima produces a number of fruits including apples, peaches, grapes, sweet cherries, plums, melons, and pears. According to the 2007 Census of Agriculture, Yakima was ranked fourth in the United States for total production of “other crops and hay” (Figure 4). Within the “other crops” category are flowers known as hops. Hops are an ingredient used to flavor and preserve beer. Yakima is one of only a few areas in the world where hops can be planted in the spring and harvested in the fall. About 75% of the United States total hop production comes from Yakima County, two-thirds of which are exported to other countries³. The hops of the Pacific Northwest are renowned around the world making the production of hops an important part of Yakima’s agricultural portfolio. Yakima County was also ranked fifth for total fruit, tree nut and berry production as well as first

³ http://www.usahops.org/index.cfm?fuseaction=hop_farming&pageID=13

for total apple production (Figure 4). complex, environmentally friendly, irrigation methods, along with ideal growing conditions allow Yakima to consistently produce quality fruit and other agricultural products that prove to play a major role in Washington's economy.

Forestry:

According to the 2012 Washington Timber Harvest Report, total volume of trees harvested east of the Cascade Mountains was 393,980 (Table 5). Major counties contributing to the total include Stevens, Klickitat and Pend Oreille. Compare that to the western side total of 2,345,692 (Table 6). Major counties contributing include Lewis, Grays Harbor and Cowlitz. It is evident that the majority of timber harvest comes from the western, windward side of the Cascade Mountains (not where Yakima is located). In both cases, the majority of land where timber was harvested was privately owned and also in both cases the majority of tree species harvested was coniferous. Timber harvesters most often practice clear-cutting methods to minimize competition for sunlight when the trees grow back.

Since Yakima is located in the rain shadow of the Cascade Mountains, trees and vegetation usually do not grow in excess unless irrigated. All of the agriculture talked about earlier relies heavily on irrigation systems. Refer to figure 3 to see the effect of the rain shadow. Because of this, timber harvesting is not a big industry in Yakima since there are not many areas where enough trees exist naturally that they can be cut down for profit. However, the western side of the Cascade Mountains is a different story. Timber harvesting in Washington as a whole ranks among the top ten as of 1997.

National Parks/Forests

The state of Washington possesses a biosphere that contains a lot of natural beauty and potential tourist attractions including National Parks like Mount Rainier which contains the Gifford Pinchot National Forest in which Mt. St. Helens is located and other national parks like Olympic and Northern Cascades.

2007 CENSUS OF AGRICULTURE

County Profile

Yakima County – Washington

Ranked items among the 39 state counties and 3,079 U.S. counties, 2007

Item	Quantity	State Rank	Universe ¹	U.S. Rank	Universe ¹
MARKET VALUE OF AGRICULTURAL PRODUCTS SOLD (\$1,000)					
Total value of agricultural products sold	1,203,806	1	39	12	3,076
Value of crops including nursery and greenhouse	787,459	2	39	13	3,072
Value of livestock, poultry, and their products	416,347	1	39	41	3,069
VALUE OF SALES BY COMMODITY GROUP (\$1,000)					
Grains, oilseeds, dry beans, and dry peas	38,571	10	36	708	2,933
Tobacco	-	-	-	-	437
Cotton and cottonseed	-	-	-	-	626
Vegetables, melons, potatoes, and sweet potatoes	(D)	7	37	80	2,796
Fruits, tree nuts, and berries	577,526	1	39	6	2,659
Nursery, greenhouse, floriculture, and sod	(D)	11	38	(D)	2,703
Cut Christmas trees and short rotation woody crops	(D)	(D)	33	(D)	1,710
Other crops and hay	129,987	2	39	4	3,054
Poultry and eggs	(D)	12	39	(D)	3,020
Cattle and calves	81,962	2	39	129	3,054
Milk and other dairy products from cows	324,685	1	34	11	2,493
Hogs and pigs	545	3	37	1,026	2,922
Sheep, goats, and their products	1,508	1	39	73	2,998
Horses, ponies, mules, burros, and donkeys	1,334	6	39	148	3,024
Aquaculture	39	31	34	818	1,498
Other animals and other animal products	(D)	6	39	(D)	2,875
TOP CROP ITEMS (acres)					
Apples	54,676	1	38	1	2,144
Forage - land used for all hay and haylage, grass silage, and greenchop	52,295	4	39	256	3,060
Corn for silage	25,047	1	25	28	2,263
Wheat for grain, all	20,427	14	30	499	2,481
Grapes	18,671	2	35	13	2,040
TOP LIVESTOCK INVENTORY ITEMS (number)					
Layers	(D)	8	39	(D)	3,024
Cattle and calves	212,762	1	39	37	3,060
Colonies of bees	19,674	1	38	18	2,640
Sheep and lambs	9,971	1	39	111	2,891
Horses and ponies	6,893	2	39	27	3,066

Figure 4. 2007 Census of Agriculture – Yakima County, Washington. *Note U.S. Rank of apple production, “Other crops and hay” and Fruits, tree nuts and berries.

County	PRIVATE LANDS	STATE LANDS	FEDERAL LANDS	OTHER PUBLIC	TOTAL VOLUME
Asotin	61	0	0	0	61
Chelan	10,255	172	4,395	0	14,822
Columbia	262	0	348	0	610
Ferry	25,223	9,042	3	0	34,268
Garfield	0	0	1,784	0	1,784
Kittitas	6,378	712	6,881	34	14,005
Klickitat	76,252	4,434	29	17	80,732
Lincoln	533	1,821	0	0	2,354
Okanogan	4,585	19,611	8,035	0	32,231
Pend Oreille	30,720	5,530	11,313	1,857	49,420
Spokane	16,998	6,015	0	1,122	24,135
Stevens	88,625	25,420	9,251	372	123,668
Whitman	56	0	0	0	56
Yakima	1,905	9,068	4,861	0	15,834
Eastside totals	261,853	81,825	46,900	3,402	393,980

Table 5. Eastside breakdown of timber harvest in Washington State.

County	PRIVATE LANDS	STATE LANDS	FEDERAL LANDS	OTHER PUBLIC	TOTAL VOLUME
Clallam	140,927	39,450	1,743	0	182,120
Clark	26,140	41,319	0	1,075	68,534
Cowlitz	206,735	24,345	701	21	231,802
Grays Harbor	265,229	25,329	10,723	18,928	320,209
Island	5,335	0	0	0	5,335
Jefferson	78,637	16,081	2,149	0	96,867
King	103,937	6,381	1,592	1,468	113,378
Kitsap	18,148	5,016	0	2,946	26,110
Lewis	326,248	37,009	2,158	52	365,467
Mason	83,738	22,595	0	1,765	108,098
Pacific	208,289	3,901	182	0	212,372
Pierce	109,004	5,661	3,956	1,432	120,053
San Juan	344	333	0	0	677
Skagit	69,258	34,454	357	1,394	105,463
Skamania	66,528	5,930	3,735	0	76,193
Snohomish	53,622	33,202	3,409	643	90,876
Thurston	52,693	14,373	4,479	119	71,664
Wahkiakum	58,854	21,478	0	0	80,332
Whatcom	46,640	23,487	0	15	70,142
Westside Totals	1,920,306	360,344	35,184	29,858	2,345,692
East / West Totals	2,182,159	442,169	82,084	33,260	2,739,672

Table 6. Westside breakdown of timber harvest in Washington State. *Note the westside timber harvest is about two million times greater than that of the eastside.

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