Department of Natural Resources

Economic & Revenue Forecast

Fiscal Year 2022, First Quarter
September 2021

Forecast Summary

Coronavirus pandemic Although the COVID-19 pandemic not longer completely overshadows all of the normal constituent parts of the forecast, it is still an important consideration for the world economy and still poses significant risks.

Since the previous forecast, vaccination rates have slowed dramatically, falling from an average of more than 3 million doses per day in mid-April to a low of just more than 500,000 per day in mid-July. As more people get vaccinated and the country got closer to a fully vaccinated population, a drop-off in the rate of vaccination was expected. But that is not what has happened in the U.S. Instead, a large portion of the population is hesitant or completely against getting vaccinated, such that only 53 percent of the population has been fully vaccinated.

In the previous forecast we were optimistic that the U.S. would be approaching herd immunity by now and the pandemic would largely be a problem external to the U.S., though it would still have implications and risks for the U.S. economy. Herd immunity now seems very unlikely in the foreseeable future. Additionally, the more contagious Delta variant of COVID-19 has created another spike in cases across the US, but has been particularly large in some regions.

Having said that, it seems unlikely that current or future outbreaks of COVID will entirely shut down the economy like in early 2020. Instead, it seems more likely that the ongoing pandemic will have more insidious impacts that are more difficulty to quantify. These could include things like:

- Reduced demand for services or fluctuations in demand for different types of goods because many people are still wary of public spaces.

- Disruptions to shipping, both international and domestic, because of overrun ports and outbreaks in port cities, as happened at the Ningbo-Zhoushan, the worlds third largest container port, in mid-August [1].

- Reduced economic output across the economy due to outbreaks among labor in other sectors.

- Reduced labor availability due to school closures or availability.

- Impaired productivity growth due to long COVID (ongoing symptoms that can severely affect normal life after the illness) affecting a meaningful portion of the workforce — current estimates are that around 11 million people in the U.S., or around 30 percent of those infected, are affected by long COVID [2].

This means that the path of the economic recovery and how long it will take is inordinately unclear. The massive multiple fiscal stimulus packages and monetary policy response of the U.S. appears to have been enough to mitigate the worst of the damage and even driven a strong rebound, at least as far as GDP is concerned. Importantly, personal income and savings *increased* in 2020. This means that U.S. consumers, as a whole, were flush with cash to spend at the end of 2020 and early 2021 (though this is a very uneven situation, with a significant portion of the population worse off).

However, the effects of the direct fiscal stimulus programs have likely already moved through the economy and the additional economic programs have ended or are ending soon. For instance, the expanded and extended unemployment benefits ended in early September, the Federal Housing Authority moratorium on single-family evictions for foreclosed borrowers will end on September 30, and the moratorium on rental property evictions has expired.

Additionally, the combination of a re-opening economy and relatively high savings have sharply increased demand while supply chain issues and labor constraints across the world are limiting the supply response, causing large price spikes from everything from cars to lumber to aluminum. Some of these price spikes have resolved, like lumber, while

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[1] https://www.ft.com/content/e1263950-1173-4832-a011-ada04df1e93c

[2] https://pascdashboard.aapmr.org/

others are appearing, like aluminum. Over time the supply chains and labor constraints will likely resolve and the high prices will suppress demand in the interim, but it seems likely that it will take some time to reach new price equilibria.

Although the recovery may be rocky, most of the major indicators currently suggest that it will be strong. Overall, the outlook of this forecast is less optimistic than the previous.

Lumber and Log Prices. Lumber prices have plummeted to $408/mbf in August, after peaking at around $1,600/mbf in May (West Coast standard or better 2x4, Douglas-fir/Hemlock). This is roughly what the price was in December 2019 as prices were picking up due to housing construction demand, before COVID-19 threw everything into disarray.

The high lumber prices pulled up log prices, with the price of a "typical" DNR log rising from a low of $498/mbf in April 2020 to peak at $718/mbf in April 2021. These are very high historically, but interestingly, still below the highs of early 2018. Since April, log prices have softened, falling to $636/mbf in August. This is, notably, still higher than the prices of early 2020.

Early in the pandemic, we, and others, expected the pandemic to undermine house prices and demand, and, consequently, the demand for lumber. This widely shared expectation, as well as actual COVID-19 outbreaks and restrictions, resulted in slower production at mills, furloughs, layoffs, and some mill closures. However, it appears that extremely low interest rates spurred housing demand and starts, and remodeling and renovation demand spiked during stay-at-home orders. The result was a sharp drop in supply while strong demand remained, making lumber prices rocket up and pushing up log prices. These high prices continued into the summer as wood manufacturers weren't able to sufficiently expand output due to supply chain and labor supply difficulties.

Lumber prices were expected to remain high through the third quarter of 2021, but have fallen much further and faster than expected. Prices are already recovering from their recent lows are ex-

pected to reach and remain on the higher end of their historical range through 2022.

Timber Sales Volume. FY 21 sales volume was 541 mmbf, with few offered contracts unsold.

DNR now plans to offer around 580 mmbf for sale in FY 22. Although stumpage prices thus far still seem relatively high, stumpage demand appears to have softened, with four DNR timber sales having already passed-in with no bids in the first two auctions.

Given the recent plummeting lumber prices, softening timber prices and apparent weakness in stumpage demand, the sales volume forecasts are unchanged.

Timber Sales Prices. Sales prices through FY 21 were been consistently high, with every sale being above the five-year average of $340/mbf, and many of them well above. In June the sales price forecast for FY 21 was increased to $395/mbf — well above our initial FY 21 forecast of $300/mbf in June 2020 — and this was very close to the final FY 20 average price of $396/mbf.

Again, given the recent drop in lumber prices, softening timber prices and weakness in stumpage demand, the sales price forecasts are unchanged. This may be too conservative, lumber prices are already climbing again, but it seems a reasonable balance of the risks to both the upside and downsides at this point.

Timber Removal Volume and Prices. The removal volume in FY 21 was decreased by 10 mmbf to 490 mmbf in the June 2021 forecast. This decrease was based on harvests through April and was after another reduction in the February forecast. The decrease in June was also were based on an understanding that there were still meaningful constraints on harvest labor and hauling services, much of which were taken up in fire salvage operations in Oregon.

The FY 21 harvest volume forecast was remarkably off. The final harvest was 528 mmbf, above even our forecast volume just before the start of the fiscal year in June 2020 of 520 mmbf.

It is unclear why our forecast was so wrong. Part of

it is likely that DNR tracking of harvest volume is done through the internal financial system, and harvest volume is generally recognized only when revenue is recognized. For many contracts, this means that there is a, sometimes substantial, amount of harvest volume that isn't tracked until the contract is fully closed out. This is why June is typically the month with the largest harvest volume — because many of the completed contracts must be closed out before the end of the fiscal year.

The removal volume forecast is unchanged in outlying years.

The forecast average removal price for FY 21 was increased in June by $6/mbf to $337/mbf due to the continued high average price of removals to date and the high value of remaining inventory. The final average removal price for FY 21 was $341/mbf.

Removal prices in outlying years are all slightly decreased. This is due to the much-higher-than-expected harvests essentially shifting the harvest of high-value timber into FY 21.

Timber Revenue. Timber revenue in FY 21 was 528 mmbf, substantially higher than forecast due primarily to the much higher harvest volume. Revenue in FYs 22 and 23 are decreased by $7 million and $9 million to $179 million and $176 million, respectively. These and decreases in outlying years are due to lower expected average harvest prices.

Timber revenues for the 2019-21 biennium are $363 million — around 9 percent higher ($15 million) than previously forecast. Forecast revenues for the 2021-23 biennium are decreased by $9 million to $355 million.

Non-Timber Revenues. In addition to revenue from timber removals on state-managed lands, DNR also generates sizable revenues from managing leases on uplands and aquatic lands.

The non-timber uplands revenue forecasts were $4 million higher than forecast in FY 21 at $50 million. This was due to higher than expected revenue in a number of areas, including orchard/vineyard, dryland, commercial, and communications.

Forecast revenue for both FYs 22 and 23 are increased by $2 million to $47 million. This is due to improved expectations for orchard/vineyard and communications leases in all years, as well as a one-time increase in irrigated agriculture revenue.

The aquatic lease revenue for FY 21 was around 4 percent lower (less than $1 million) than forecast in June due much lower revenue in non-water-dependent rents offsetting higher revenue in other sources. In FY 22 and outlying years, the aquatic lease revenue forecast is decreased by around one percent, driven by lower expectations in other revenue.

Geoduck revenue in FY 21 was around five percent higher than expected, ending the year at $13 million. The forecast revenue for FY 22 is increased slightly to $17 million based on updated sales volume information.

In June, the forecast geoduck revenue was increased meaningfully for all forecast years due to better-than-expected prices in recent auctions. Typically, we are wary of increasing outlying years' price forecast based on recent prices, but the recent prices suggest that there is something of a mean reversion of geoduck prices. Prices dropped significantly in mid-2019 as tariffs between the U.S. and China began affect demand. Then, in early 2020, they fell sharply as the Chinese economy was essentially shut down. As China has gained a level of control over the pandemic, demand has increased and it looks like there's a new equilibrium of between $7-9/lb. The new June forecast reflects the lower side of this range.

The most recent geoduck auction results in August, at $11.32/lb, support a higher price forecast and suggest that our current range may be too low. However, significant risks to geoduck prices still exist at this point. Aside from the COVID-19 pandemic, there remains a trade war between the U.S. and China, with high tariffs on geoduck. These are expected to continue indefinitely, limiting Chinese consumption and continuing to push Chinese consumers toward other luxury seafood. And as always in the geoduck fisheries, paralytic shellfish poison closures create uncertainty around harvest volumes

as well.

Total Revenues. Revenues for the 2019-21 biennium (FYs 20 and 21) were $503 million — $19 million higher than previously forecast. The forecast revenue for the 2021-23 biennium are decreased by $5 million to $506 million.

Other notes to the Forecast. In addition the ongoing a COVID-19 resurgence, a number of sources of uncertainty may affect DNR revenue specifically, and the overall economic activity more broadly. These include: legal challenges to the sustainable harvest volume and marbled murrelet conservation strategy; uncertainty about the type and quality of stumpage DNR is able to bring to market more than six months out; the ongoing trade war and political tension with China directly affecting timber and agricultural exports and prices; uncertainty about the stability of the current high housing starts level; supply chain issues across the world economy threatening to undermine economic growth more broadly as well as affecting timber-specific industries, such as a lack of glue impairing plywood manufacturing; and now, as of this writing, the threat of an imminent default by one of China's largest real estate developers that is threatening to become a "contagion" and cause a cascading wave of defaults across the country. Additionally, while the timber sales volume estimates are based on the best available internal planning data, they are subject to adjustments due to ongoing operational and policy issues.

From the beginning of 2018 until just before the COVID-19 pandemic, the U.S. and China engaged in an escalating trade dispute. Prior to the pandemic, the tariffs on geoduck were 25 percent and were a significant driver of the drop in geoduck prices in late 2019. The log tariffs and a slowdown in housing starts were the major contributors to the lower domestic price of logs through late 2019. With the pandemic, tariffs were reduced to 5 percent tariff on geoduck, wheat, and softwood logs. There's no indication that tariffs between the countries will be reduced further or removed soon.

In addition to the coronavirus and the trade tensions discussed above, other things could undermine Chinese demand for wood, such as the continued loss of Pacific Northwest market share to international and Southeastern U.S. competitors.

Another issue on the horizon that should be mentioned in relation to timber markets, is that it appears that Russia is moving forward with legislation banning the export of timber from the beginning of 2022. Given that Russia supplies around 12 percent of world log exports, the ban will have a significant impact on log supply across the world. In the short term, this will likely push up log prices across the world, and will mainly affect China, which gets a significant amount of logs from Russia. This will also likely push up lumber and wood product prices. This has not been built into the forecast prices, but will likely be when the legislation is finalized.

Finally, climate change has emerged as a more meaningful immediate risk as opposed to an amorphous risk in the far future, as previously rare extreme weather events become more common. The drought this year appears to have decreased wheat production on DNR lands by about 40 percent. Droughts and high temperatures are also increasing wildfires. While these do not appear to have seriously affected revenue from DNR timber lands since 2015, they pose a significant risk to both our short-term timber revenue forecast, potentially destroying standing timber under contract, as well as long-term revenue by destroying younger stands that would be harvested in future decades. Recent research suggests that the massive fires in Oregon around Labor Day 2020 caused not only immediate damage, but will reduce future Oregon harvests by *115 to 365 mmbf per year for the next 40 years.* That, with the more immediate damage of the fires, suggests an overall economic impact of $5.9 billion[3].

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[3]2020 Labor Day Fires: Economic Impacts to Oregon's Forest Sector, Oregon Forest Resources Institute ''https://oregonforests.org/sites/default/files/2021-09/OFRI-LaborDayFiresEconomicReport_Final 2021.pdf''

Table 1: September 2021 Forecast by Source (millions of dollars)

Timber Sales		FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25
Volume (mmbf)		496	488	534	542	500	500	500	500
	Change				2	-	-	-	-
	% Change				0%	0%	0%	0%	0%
Price ($/mbf)		458	325	291	395	340	340	340	340
	Change				$ 1	$ -	$ -	$ -	$ -
	% Change				0%	0%	0%	0%	0%
Value of Timber Sales		**227.1**	**158.8**	**155.3**	**214.2**	**170.0**	**170.0**	**170.0**	**170.0**
	Change				$ 1.0	$ -	$ -	$ -	$ -
	% Change				0%	0%	0%	0%	0%
Timber Removals									
Volume (mmbf)		528	508	529	528	520	520	510	500
	Change				38	(0)	0	(0)	-
	% Change				8%	0%	0%	0%	0%
Price ($/mbf)		338	382	345	341	344	339	340	340
	Change				4.3	(7.1)	(9.4)	(2.9)	-
	% Change				1%	-2%	-3%	-1%	0%
Timber Revenue		**178.6**	**194.3**	**182.5**	**180.2**	**178.9**	**176.1**	**173.1**	**170.0**
	Change				15.0	(3.8)	(4.8)	(1.5)	-
	% Change				9%	-2%	-3%	-1%	0%
Upland Leases									
Irrigated Agriculture		10.4	8.9	9.0	8.8	9.4	9.0	9.0	9.0
	Change				0.0	0.4	-	-	-
	% Change				0%	4%	0%	0%	0%
Orchard/Vineyard		8.5	9.0	8.8	9.4	9.0	9.0	9.0	9.0
	Change				1.2	0.8	0.8	0.8	0.8
	% Change				15%	10%	10%	10%	10%
Dryland Ag/Grazing		6.6	6.6	6.2	6.8	6.0	6.0	6.0	6.0
	Change				1.1	-	-	-	-
	% Change				19%	0%	0%	0%	0%
Commercial		10.9	10.2	10.3	11.3	10.8	10.8	10.8	10.8
	Change				0.5	-	-	-	-
	% Change				4%	0%	0%	0%	0%
Other Leases		9.8	10.0	10.0	13.7	11.8	11.9	12.0	12.1
	Change				1.4	1.1	1.0	1.0	0.9
	% Change				11%	10%	9%	9%	8%
Total Upland Leases		**46.1**	**44.6**	**44.3**	**50.0**	**47.0**	**46.7**	**46.8**	**46.9**
	Change				4.2	2.3	1.8	1.8	1.7
	% Change				9%	5%	4%	4%	4%
Aquatic Lands									
Aquatic Leases		12.0	13.5	12.7	9.7	12.4	12.4	12.4	12.4
	Change				(0.4)	(0.2)	(0.2)	(0.2)	(0.2)
	% Change				-4%	-1%	-1%	-1%	-1%
Geoduck		26.4	23.6	10.6	13.0	16.9	15.2	15.2	15.2
	Change				0.6	0.3	-	-	-
	% Change				5%	2%	0%	0%	0%
Aquatic Lands Revenue		**38.4**	**37.1**	**23.4**	**22.6**	**29.3**	**27.6**	**27.6**	**27.6**
	Change				0.1	0.1	(0.2)	(0.2)	(0.2)
	% Change				1%	1%	-1%	-1%	-1%
Total All Sources		**263.1**	**276.0**	**250.1**	**252.9**	**255.2**	**250.3**	**247.4**	**244.5**
	Change				19.3	(1.4)	(3.2)	0.1	1.5
	% Change				8%	-1%	-1%	0%	1%

Table 2: September 2021 Forecast by Fund (millions of dollars)

Key DNR Operating Funds		FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25
041	RMCA - Uplands	40.6	39.9	33.5	33.5	41.4	39.8	39.8	39.6
	Change				1.7	3.2	(0.6)	(0.2)	0.2
	% Change				5%	8%	-1%	-1%	1%
041	RMCA - Aquatic Lands	17.6	16.7	9.9	10.2	12.8	11.9	11.9	11.9
	Change				0.5	0.1	(0.1)	(0.1)	(0.1)
	% Change				5%	1%	0%	0%	0%
014	FDA	22.1	25.6	28.3	27.2	20.4	21.3	21.3	21.1
	Change				3.0	(2.0)	(1.0)	(0.2)	0.2
	% Change				13%	-9%	-4%	-1%	1%
21Q	Forest Health Revolving	4.4	7.5	8.7	13.5	13.7	12.7	9.9	8.2
					1.0	(2.3)	3.5	2.3	0.5
					8%	-15%	38%	30%	7%
Total DNR Key Operating Funds		**84.7**	**89.7**	**80.5**	**84.4**	**88.3**	**85.7**	**82.9**	**80.8**
	Change		1.0		6.2	(1.0)	1.9	1.8	0.9
	% Change				8%	-1%	2%	2%	1%
Current Funds									
113	Common School Construction	62.6	64.2	59.5	53.2	67.2	65.5	65.9	65.6
	Change				1.0	6.0	(0.6)	(0.2)	0.4
	% Change				2%	10%	-1%	0%	1%
999	Forest Board Counties	59.6	69.5	68.7	69.5	47.8	51.4	52.0	51.8
	Change				9.7	(6.3)	(3.1)	(0.8)	0.4
	% Change				16%	-12%	-6%	-1%	1%
001	General Fund	2.1	1.9	4.7	4.4	4.0	3.6	3.4	3.4
	Change				(0.1)	0.1	(0.0)	(0.0)	0.0
	% Change				-2%	1%	0%	0%	1%
348	University Bond Retirement	3.2	1.3	0.6	1.6	2.5	2.0	1.9	1.9
	Change				(0.1)	0.4	(0.0)	(0.1)	(0.1)
	% Change				-4%	22%	-1%	-4%	-3%
347	WSU Bond Retirement	1.6	1.4	1.9	2.6	1.5	1.5	1.6	1.6
	Change				0.8	(0.2)	(0.2)	(0.2)	(0.2)
	% Change				44%	-11%	-13%	-13%	-13%
042	CEP&RI	5.3	2.7	3.6	2.2	4.0	4.0	4.3	4.3
	Change				0.2	1.1	0.1	0.2	0.2
	% Change				10%	39%	3%	4%	6%
036	Capitol Building Construction	6.2	9.8	4.4	7.7	6.8	7.2	7.4	7.4
	Change				0.9	(1.0)	(0.7)	(0.2)	0.1
	% Change				14%	-13%	-8%	-2%	1%
061/3/5/6	Normal (CWU, EWU, WWU, TESC) School	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
	Change				(0.1)	(0.0)	(0.0)	(0.0)	(0.0)
	% Change				-51%	-9%	-10%	-10%	-10%
Other Funds		1.1	1.2	1.1	0.6	0.8	0.4	0.2	0.1
	Change				(0.1)	(0.3)	(0.1)	(0.0)	0.0
	% Change				-10%	-26%	-14%	-3%	1%
Total Current Funds		**141.7**	**152.1**	**144.7**	**141.9**	**134.9**	**135.9**	**136.8**	**136.3**
	Change				12.3	(0.2)	(4.5)	(1.3)	0.9
	% Change				10%	0%	-3%	-1%	1%

(Continued)

Table 3: September 2021 Forecast by Fund (millions of dollars), cont'd

Aquatic Lands Enhancement Account			FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25
02R			20.8	20.4	13.5	12.4	16.5	15.6	15.6	15.6
		Change				(0.4)	0.1	(0.1)	(0.1)	(0.1)
		% Change				-3%	0%	-1%	-1%	-1%
Permanent Funds										
	601	Agricultural College Permanent	4.2	4.1	5.4	5.7	4.6	4.1	3.9	3.8
		Change				0.5	(1.0)	(0.5)	(0.2)	(0.1)
		% Change				9%	-18%	-10%	-5%	-2%
	604	Normal School Permanent	4.1	2.9	2.6	2.8	2.7	2.7	2.6	2.6
		Change				0.1	(0.1)	(0.1)	(0.1)	(0.0)
		% Change				5%	-3%	-4%	-3%	-1%
	605	Common School Permanent	0.8	0.2	0.2	0.4	0.3	0.3	0.3	0.3
		Change				0.1	-	-	-	-
		% Change				32%	0%	0%	0%	0%
	606	Scientific Permanent	7.0	5.4	3.1	4.9	7.4	5.5	4.8	4.6
		Change				0.6	0.8	0.1	(0.0)	0.0
		% Change				13%	13%	2%	0%	0%
	607	University Permanent	0.3	0.7	0.1	0.3	0.5	0.5	0.5	0.5
		Change				(0.1)	0.0	(0.0)	(0.0)	0.0
		% Change				-35%	5%	-5%	-1%	1%
Total Permanent Funds			**16.5**	**13.3**	**11.4**	**14.2**	**15.6**	**13.1**	**12.1**	**11.8**
		Change				1.1	(0.2)	(0.5)	(0.3)	(0.1)
		% Change				9%	-2%	-3%	-2%	-1%
Total All Funds			**263.7**	**275.4**	**250.1**	**252.9**	**255.2**	**250.3**	**247.4**	**244.5**
		Change				19.3	(1.4)	(3.2)	0.1	1.5
		% Change				8%	-1%	-1%	0%	1%

Figure 1: Timber Forecast Charts
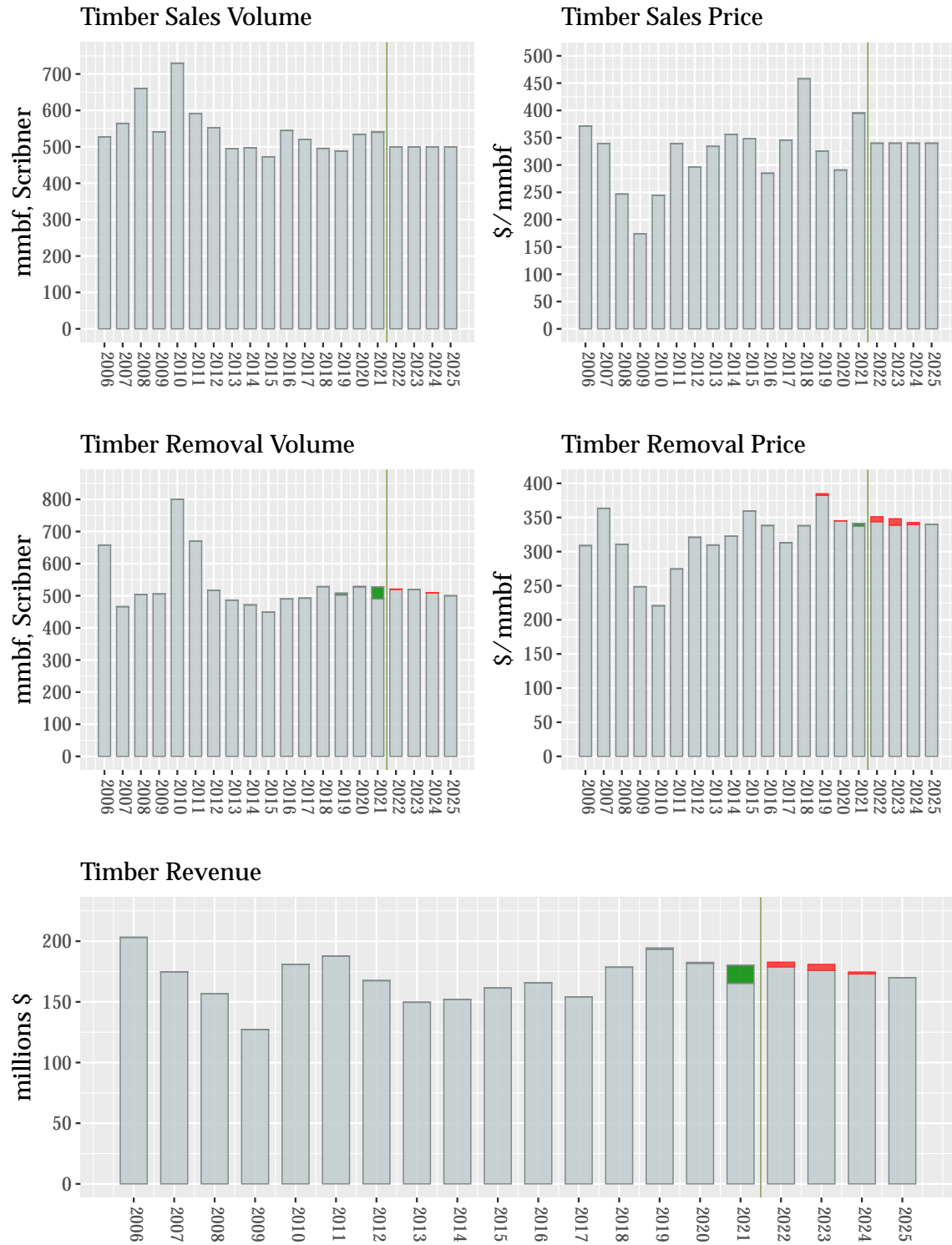
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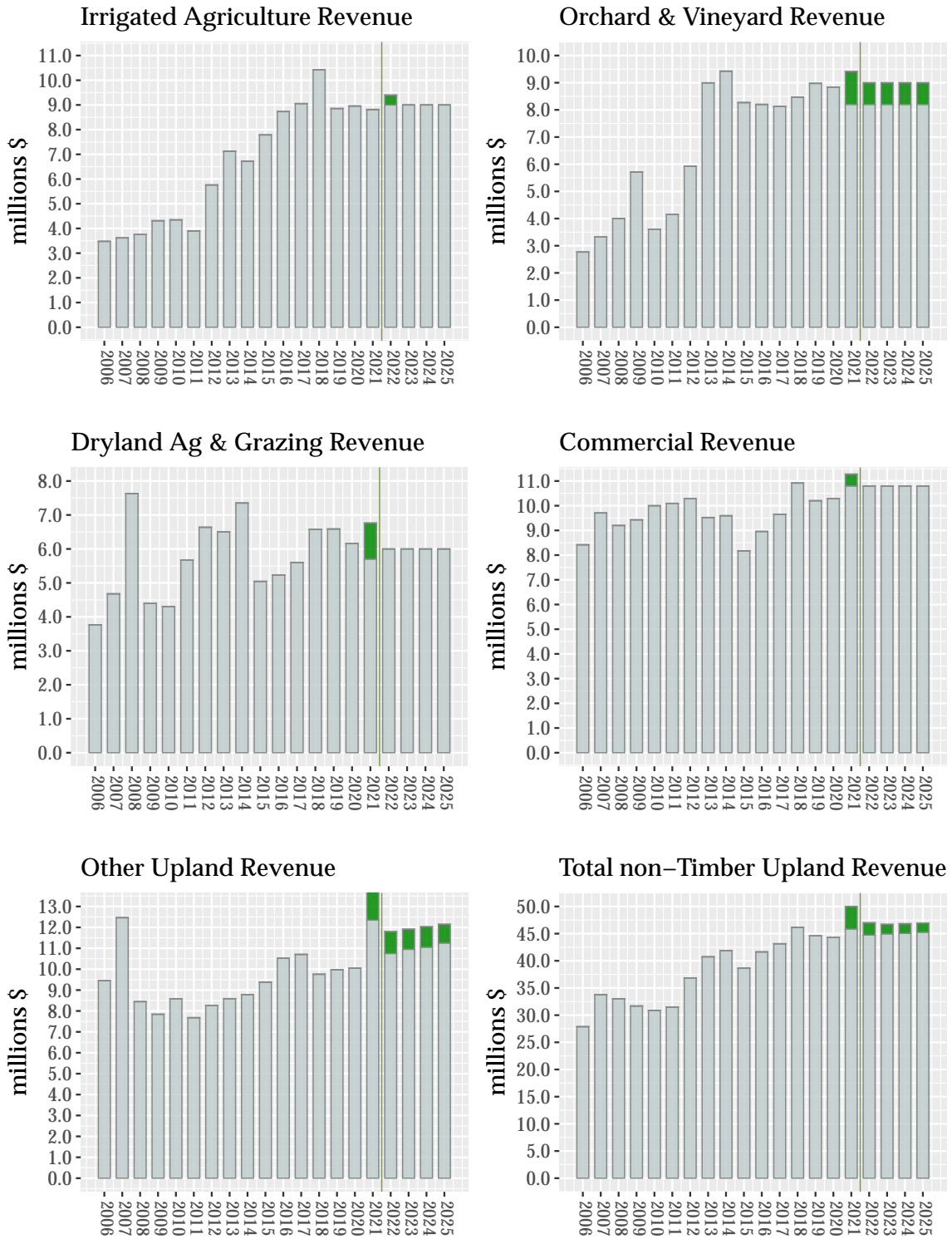
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Acronyms and Abbreviations

bbf   Billion board feet
BLS   U.S. Bureau of Labor Statistics
CAD   Canadian dollar
CNY   Chinese yuan (renminbi)
CPI   Consumer Price Index
CY   Calendar Year

DNR   Washington State Department of Natural Resources
ECB   European Central Bank
ERFC   Washington State Economic and Revenue Forecast Council
FDA   Forest Development Account
FEA   Forest Economic Advisors
Fed   U.S. Federal Reserve Board

FOMC   Federal Open Market Committee
FY   Fiscal Year
GDP   Gross domestic product
HMI   National Association of Home Builders/Wells Fargo Housing Market Index
IMF   International Monetary Fund
ITC   U.S. International Trade Commission

mbf   Thousand board feet
mmbf   Million board feet
PSP   Paralytic shellfish poisoning
PPI   Producer Price Index
Q1   First quarter of year (similarly, Q2, Q3, and Q4)
QE   Quantitative easing

RCW   Revised Code of Washington
RMCA   Resource Management Cost Account
SA   Seasonally adjusted
SAAR   Seasonally adjusted annual rate
SLA   Softwood Lumber Agreement

TAC   Total allowable catch
USD   U.S. dollar
WDFW   Washington Department of Fish and Wildlife
WWPA   Western Wood Products Association
WTO   World Trade Organization

Preface

This *Economic and Revenue Forecast* projects revenues from Washington state lands managed by the Washington State Department of Natural Resources (DNR). These revenues are distributed to management funds and beneficiary accounts as directed by statute.

DNR revises its Forecast quarterly to provide updated information for trust beneficiaries and state and department budgeting purposes. Each DNR Forecast builds on the previous one, emphasizing ongoing changes. Forecasts re-evaluate world and national macroeconomic conditions, and the demand and supply for forest products and other goods. Finally, each Forecast assesses the impact of these economic conditions on projected revenues from DNR-managed lands.

DNR Forecasts provide information used in the *Washington Economic and Revenue Forecast* issued by the Washington State Economic and Revenue Forecast Council. The release dates for DNR Forecasts are influenced by the state's forecast schedule as prescribed by RCW 82.33.020. The table below shows the anticipated schedule for future *Economic and Revenue Forecasts*.

This Forecast covers fiscal years 2022 through 2025. Fiscal years for Washington State government begin July 1 and end June 30. For example, the current fiscal year, Fiscal Year 2022, runs from July 1, 2021, through June 30, 2022.

The baseline date (the point that designates the transition from "actuals" to predictions) for DNR revenues in this Forecast is August 1, 2021. The forecast numbers beyond that date are predicted from the most up-to-date DNR sales and revenue data available, including DNR's timber sales results through June 2021. Macroeconomic and market outlook data and trends are the most up-to-date available as the Forecast document is being written.

Unless otherwise indicated, values are expressed in nominal terms without adjustment for inflation or seasonality. Therefore, interpreting trends in the Forecast requires attention to inflationary changes in the value of money over time, separate from changes attributable to other economic influences.

Economic Forecast Calendar

Forecast	Baseline Date	Final Data and Publication Date (approximate)
November 2021	October 1, 2021	November 15, 2021
February 2022	January 1, 2022	February 15, 2022
June 2022	May 1, 2022	June 15, 2022
September 2022	August 1, 2022	September 15, 2022

Acknowledgements

Macroeconomic Conditions

This section briefly reviews macroeconomic conditions in the United States and world economies because they influence DNR revenue — most notably through the bid prices for DNR timber and geoduck auctions and lease revenues from managed lands.

COVID-19 Pandemic

Although COVID-19 pandemic no longer completely overshadows all of the normal constituent parts of the forecast, it is still an important consideration for the world economy and still poses significant risks.

Since the previous forecast, vaccination rates have slowed dramatically, falling from an average of more than 3 million doses per day in mid-April to a low of more than 500,000 per day in mid-July. As more people get vaccinated and the country got closer to a fully vaccinated population, a drop-off in the rate of vaccination was expected. But that is not what has happened in the U.S. Instead, a large portion of the population is hesitant or completely against getting vaccinated, such that only 53 percent of the population has been fully vaccinated.

In the previous forecast we were optimistic that the U.S. would be approaching herd immunity by now and the pandemic would largely be a problem external to the U.S., though it would still have implications and risks for the U.S. economy. Herd immunity now seems very unlikely in the foreseeable future. Additionally, the more contagious Delta variant of COVID-19 has created another spike in cases across the US, but has been particularly large in some regions.

Having said that, it seems unlikely that current or future outbreaks of COVID will entirely shut down the economy like in early 2020. Instead, it seems more likely that the ongoing pandemic will have more insidious impacts that are more difficulty to quantify. These could include things such as:

- Reduced demand for services or fluctuations in demand for different types goods because many people are still wary of public spaces.

- Disruptions to shipping, both international and domestic, because of over-run ports and outbreaks in port cities, as happened at the Ningbo-Zhoushan, the worlds third largest container port, in mid-August [4].

- Reduced economic output across the economy due to outbreaks among labor in other sectors.

- Reduced labor availability due to school closures or availability.

- Impaired productivity growth due to long-COVID (ongoing symptoms that can severely affect normal life after the illness) affecting a meaningful portion of the workforce - current estimates are that around 11 million people in the U.S., or around 30 percent of those infected, are affected by long-COVID [5].

In addition to the real health and economic problems caused by the pandemic, the upheaval of the economic systems and the above ongoing pandemic impacts have dramatically increased the difficulty of economic modeling. Broadly, economic models rely on historical data to try to forecast or understand how the future will look. And most economic data that feed into these models is delayed by at least a month, and often longer. The suddenness and severity of the coronavirus impacts mean that economic models are operating well outside of their historical bounds. This causes "out of sample" or "generalization" errors — the current data is just so far outside of the normal bounds that the models become ever more inaccurate. Even some of the models that use more frequent data are having difficulty — for instance the New York Fed's Nowcast model's publication was suspended on September 3, 2021 due to uncertainty and volatility caused by the pandemic[6].

Altogether, this means that the path of the economic recovery and how long it will take is inordi-

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[4] https://www.ft.com/content/e1263950-1173-4832-a011-ada04df1e93c

[5] https://pascdashboard.aapmr.org/

[6] https://www.newyorkfed.org/research/policy/nowcast

nately unclear. The massive multiple fiscal stimulus packages and monetary policy response of the U.S. appear to have been enough to mitigate the worst of the damage and even driven a strong rebound, at least as far as GDP is concerned. Importantly, personal income and savings *increased* in 2020. This means that U.S. consumers, as a whole, were flush with cash to spend at the end of 2020 and early 2021 (though this is a very uneven situation, with a significant portion of the population worse off).

However, the effects of the direct fiscal stimulus programs have likely already moved through the economy and the additional economic programs have ended or are ending soon. For instance, the expanded and extended unemployment benefits ended in early September, the FHA moratorium on single-family evictions for foreclosed borrowers will end on September 30, and the moratorium on rental property evictions has expired.

Additionally, the combination of a re-opening economy and relatively high savings have sharply increased demand while supply chain issues and labor constraints across the world are limiting the supply response, causing large price spikes from everything from cars to lumber to aluminum. Some of these price spikes have resolved, like lumber, while others are appearing, like aluminum. Over time the supply chains and labor constraints will likely resolve and the high prices will suppress demand in the interim, but it seems likely that it will take some time to reach new price equilibria.

Although the recovery may be rocky, most of the major indicators currently suggest that it will strong. Overall, the outlook this forecast is less optimistic than the previous.

## U.S. Economy

Gross Domestic Product

Typically, GDP is a useful indicator of how the U.S. economy is growing overall. When GDP is growing well, then generally there will be an increase in jobs, spending, and overall economic welfare. This often includes growth in housing spending and construction, which influences timber prices and DNR's

income from timber. It is a useful indicator of how other, more directly relevant indicators, may move in the future.

Figure 4: U.S. Gross Domestic Product
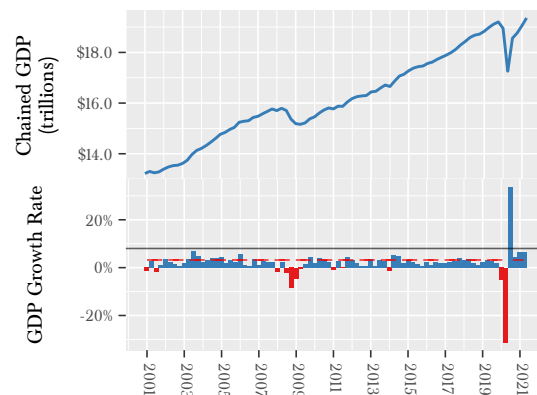
The onset of the COVID-19 pandemic caused the sharpest quarterly GDP decline in history, first -0.86 percent in Q1 and then a staggering -9.62 percent in Q2 (-31.4 percent SAAR). However, it rebounded with growth of 33.4 (SAAR) percent in Q3 and 4.0 percent (SAAR) in Q4. This meant that the average annualized GDP was -3.5 percent for 2020, and left chained GDP at roughly what it was in Q3 2018 (Figure 4).

Typically, GDP growth rebounds after a recession, spiking to well above the historical average. This didn't happen with the Great Recession in 2008-09, but with the fiscal stimulus packages, ongoing monetary stimulus and the drop in COVID-19 cases, near-term economic growth is likely to be quite strong. Continuing to see the 2020 Q3 rebound growth rate of 30+ percent is unrealistic, but seeing the 2020 Q4 growth of around 4 percent is not. The first two quarters of 2021 have actually outpaced the fourth quarter of 2020 with real growth rates of 6.3 percent and 6.6 percent growth, respectively.

The strong growth rates of the first two quarters are broadly expected to continue. In their June forecast, the FOMC projected that GDP would grow by between 6.8 and 7.3 percent in 2021, with a

median estimate of 7.0 percent. Other forecasters have pinned their expectations closer to 6 percent. This would be higher than any annual growth since 1983.

Figure 5: Unemployment Rate and Monthly Change in Jobs
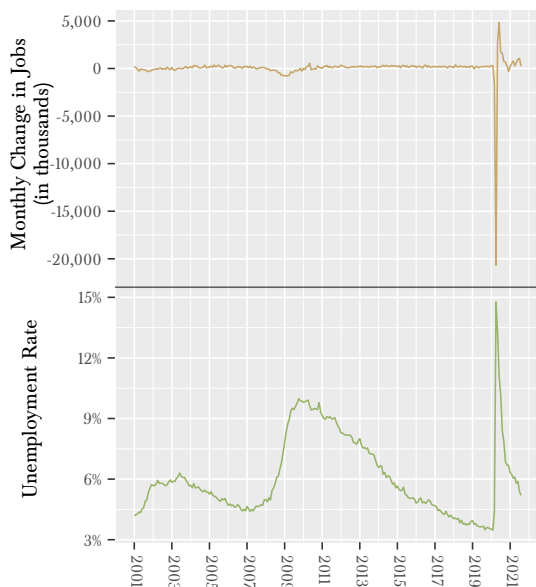
The Atlanta Fed's GDPNow, a high-frequency forecast, now predicts Q3 2021 GDP growth of about 3.7 percent (SAAR). As noted in the summary section, the New York Fed's Nowcast, the other major high-frequency forecast we typically look at, suspended publication on September 3, 2021 because of uncertainty and volatility caused by the pandemic.

There is still a lot of uncertainty around all of these forecasts because, as noted in the summary, economic models are typically based on historical relationships - which the pandemic has upended. The global economy isn't operating anything like how it normally would be.

Employment and Wages

The labor market is the driving force behind consumption, which typically constitutes about 70 per-

cent of GDP and naturally extends to the demand for housing, the major driver of U.S. timber demand. The U.S. headline unemployment rate measures the number of people looking for work as a percentage of the number of people in the labor force. It had been trending downward since peaking at 10 percent in 2010 and was 3.5 percent in February 2020, one of its lowest points since 1969 (Figure 5).

With the shutdown of the economy, the unemployment rate shot up to 14.7 percent in April 2020, the highest it has been since the Great Depression. At the same time, the labor force participation rate — that is, the percentage of the working age population that is in the labor force — decreased substantially from 63.4 percent in February to 60.2 percent in April 2020. The decrease in the labor force participation rate meant that the increase in the unemployment rate was a meaningful underestimate of the actual rate of unemployed people who would have preferred employment.

Since mid-2020, both have improved, with the unemployment rate decreasing to 5.2 percent in August 2021 and the labor force participation rate increasing to 61.7 percent.

Overall, despite the rebound, there are around 5 million fewer jobs in August 2021 than in February 2020 and about 3 million fewer people in the labor force (that is, employed or looking for work).

Figure 6: Employment and Unemployment

skilled areas. This is likely due in part to everything opening up all at once, spiking demand while supply catches up. It will likely take some time before labor markets reach a new equilibrium.

The June FOMC forecast is for the 2021 unemployment rate to be between 4.2-5.0 percent, down from the December forecast range of 4.7-5.4 percent.

Another way to get insight into the unemployment situation is to look at how many people have been unemployed for a long period of time. The number of long-term unemployed (27 weeks or longer) ballooned from a low of 939,000 in April 2020 to 4.0 million in January. The number of long-term unemployed continued to rise through early 2021, even as the unemployment rate has fallen. Only in April 2021 did it start to fall, dropping from slightly above 4.2 million in March to 3.2 million in August.

The speed of job re-growth slowed considerably in late 2020 — dropping from a high of 4.8 million new (or re-created) jobs in June 2020 to a *306,000 job loss* in December. Job creation has picked up after that, averaging 451,000 jobs/month in January through April 2021, and has accelerated even more with an average of 716,000 jobs/month from May through August. At this rate, the economy will have recovered all of the jobs lost to the pandemic around mid-2022.

However, it is unclear what job growth will look like, even in the near future. It is likely that it will continue to be characterized by fits and starts, for instance, July had more than 1 million jobs added, while August had only 235,000. Although job growth has been strong in some areas — services and, the leisure and hospitality sectors accounted for almost all of the job growth in April — there has been little change, or even a decline, in employment in other sectors. Additionally, there are numerous reports of employers having difficulty filling roles. These are largely in lower-skill and lower-wage areas (which aren't necessarily always the same); however, they are also in some higher-

Another metric used to understand long-term unemployment is continued unemployment claims — a measure of the number of people who have continued to file unemployment insurance claims after their initial claim. During the Great Recession, continued claims peaked at 6.6 million in 2009. The most recent week's estimate on September 16, 2021, is continued claims of 2.7 million. This is well below the recent peak of 24.9 million in May 2020, and about what the same number of claims as in late 2013. Having said that, it's possible that this metric has been distorted by the end of extended federal unemployment insurance.

Finally, the U-6 is an alternative measure of unemployment that includes involuntarily part-time employment (underemployment) and marginally attached workers, who are not included in the headline unemployment rate but who, nevertheless, are likely to be looking for work and would benefit from better job prospects. The U-6 also ballooned, increasing from 7.0 percent in February 2020 to 22.8 percent in April 2020. Since then, it has fallen to 8.8 percent in August 2021 (Figure 6).

Figure 7: Labor Market Indicators
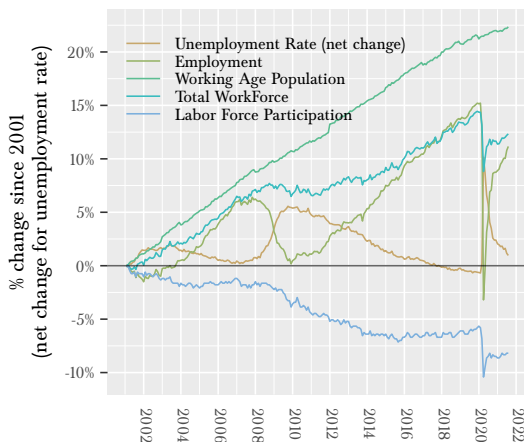
Inflation

Aside from a short period in 2012, core inflation has been below the FOMC's target since the recession in 2008. Similarly to GDP forecasts, inflation forecasts have been consistently too high, with each year predicted to break the cycle of weak inflation, only to disappoint as the year progresses (Figure 8).

For policy purposes, the FOMC uses the core Personal Consumption Expenditures (PCE) index as the measure of inflation, which removes the more volatile fuel and food prices. Except for short periods in 2012 and 2018, this measure shows inflation at or below the 2.0 percent target since September 2008. Core PCE growth averaged between 1.4 and 1.7 percent from 2015-2017, rose to average 1.9 percent in 2018 and fell back to average 1.5 percent in 2019.

In a fairly striking policy change, the FOMC announced in September 2020 that it would "aim to achieve inflation moderately above 2 percent for some time so that inflation averages 2 percent over time and longer-term inflation expectations remain well anchored at 2 percent." This is a marked departure from policy in the last 10 years, when there were a number of (sometimes-contentious) interest rate increases, even though inflation was well below 2 percent.

Inflation in 2020 remained low at 1.5 percent. Only in April 2021 did core PCE break above the 2 percent target. Since then, inflation has been above 3.0 percent and inflation expectations for 2021 have jumped. The FOMC now expects core inflation between 3.1 and 3.5 percent, up dramatically from 2.2 to 2.4 percent in March. This is well above the expectations in its December forecast range of 1.7-1.8 percent.

The fiscal stimulus packages, expansionary monetary policy, and recent jump in inflation have precipitated a lot of discussion and worry about potential runaway inflation. However, as many economists have noted, employment is still low, and short-term jumps in the inflation rate are to be expected as economies open up and issues with ramping up production are worked through.

It is unlikely that inflation will prove to be a problem through 2022, but if it stays high, the Fed has a number of tools at its disposal to ensure that inflation doesn't get out of control. However, the current supply chain issues, particularly caused by shipping backups, are concerning. There's no indication that they are resolving and, in fact, seem to be getting worse. If they continue to constrain supply, or get worse, then it's entirely possible that prices will continue to be pushed up.

Figure 8: U.S. Inflation Indices
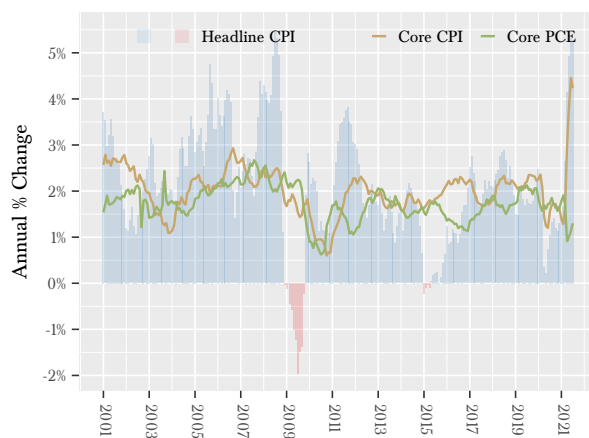
Interest Rates

Interest rates are a powerful tool used by the Federal Reserve Bank to influence the U.S. economy. An increase in interest rates will generally slow down economic growth — business investment slows down because borrowing money becomes more expensive, so job and wage growth slow down (constraining consumption). Similarly, it becomes more expensive for consumers to borrow, impeding demand in the housing and auto markets. In normal times, a decrease in interest rates will expand investment, employment, wages, and consumer credit. The opposite of all of this is also true — decreasing or low interest rates can help drive economic expansion.

From December 2008 to December 2015, the Federal Reserve held the federal funds rate in the 0.0-0.25 percent range. To keep rates that low for that long was unprecedented and reflected the immense damage done by the Great Recession. During that time, the Fed pledged to keep the rates near zero until it judged that there had been sufficient progress toward its dual mandate of maximum employment and around 2.0 percent inflation.

Beginning in December 2015, the FOMC gradually raised interest rates from 0.0-0.25 percent range to 2.25-2.5 percent range by the end of 2018. Its notable that these increases were made based on progress in the recovery of employment and inflation, and a strong economic growth outlook, rather than employment or inflation that had reached any threshold. Given this history, it is a significant change that the FOMC has backed away from this policy, promising to keep rates very low until the *average* inflation is around 2 percent.

In response to the economic threat of the novel coronavirus pandemic, the FOMC held a special meeting in March and dropped the federal funds rate to 0.1 percent. In addition to the new policy, the FOMC outlook released on September 16 was extraordinary, showing that its median projections are for a 0.1 percent federal funds rate until *2022* at least. Its projections were unchanged in December, but updated to a range of 0.1-0.6 in March, where they remained in June.

The U.S. Dollar and Foreign Trade

The trade-weighted U.S. dollar index climbed dramatically from 2014 through late 2016. Through 2015 and 2016, this was largely due to the relative strength of the U.S. economy, which, although fairly weak, was growing faster than most other advanced countries. Although the value of the U.S. dollar was below its 2015 peak for most of 2016, the results of the U.S. presidential election pushed the exchange rate well above its previous high. From mid-2017 to May 2018, the dollar dropped back, but then increased above its earlier 2016 high. Between February and April 2020, the U.S. dollar trade-weighted index jumped almost 6 percent, largely due to a "flight to safety" from the uncertainty caused by the pandemic (Figure 9). Since April 2020, it has fallen back significantly, and is about where it was in mid-2019.

The lower dollar means that timber and lumber from the Pacific Northwest has become less expensive for international buyers and, conversely, timber and lumber imported into the U.S. becomes more expensive. This will tend to support local prices and DNR's timber and agricultural revenues. Wildstock geoduck revenue will also be positively affected because geoduck is primarily marketed abroad.

Figure 9: Trade-Weighted U.S. Dollar Index
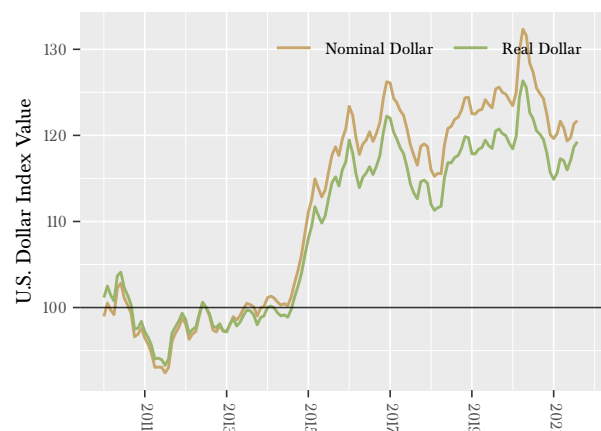
Foreign trade and access to export markets is normally important for DNR revenues. Chinese de-

mand for timber and lumber was a major support for lumber prices after 2010, even though DNR timber cannot be exported directly. Additionally, much of the soft white wheat produced in Washington is exported to Asia and the vast majority of the Pacific Northwest geoduck harvest is exported to China.

Prior to the COVID-19 pandemic, there were ongoing trade tensions between the U.S. and China with both countries implementing tariffs. Although a "Phase One" trade deal had been signed before the pandemic to deescalate the trade war, there weren't actually any apparent changes to tariffs. Of the products relevant to DNR revenue, softwood logs are subject to a 5 percent tariff. Geoduck, wheat, and many orchard/vineyard agricultural products (such as apples) are also subject to a 5 percent tariff, apparently due to the pandemic. Prior to the pandemic, they were taxed with a 25 percent tariff.

It appears that the new U.S. administration is focused on matters other than resolving the trade war, so we don't expect any easing of tariffs anytime soon. For timber, this is likely to be immaterial. Domestic lumber, and timber, demand is largely driven by the housing market, which is booming. This will likely support prices, regardless of the export markets.

Petroleum

Crude oil and its derivatives strongly affect production, transportation, and consumption in the world and U.S. domestic economies. Broadly, a drop in oil prices acts like a tax cut for consumers and can encourage consumption. Additionally, all other things being equal, lower petroleum prices will decrease diesel fuel prices and will make transportation-sensitive industries — such as Pacific Northwest logging and agriculture — more competitive in international markets.

As with everything else, the coronavirus pandemic has had a major impact on oil prices, even sending the spot prices negative for a short time (Figure 10). However, since then, prices have recovered to around $60/barrel in real terms — near the 2019 average price. These are fairly low prices historically, so they are unlikely to put much of a drag on economic growth.

Figure 10: Crude Oil Prices
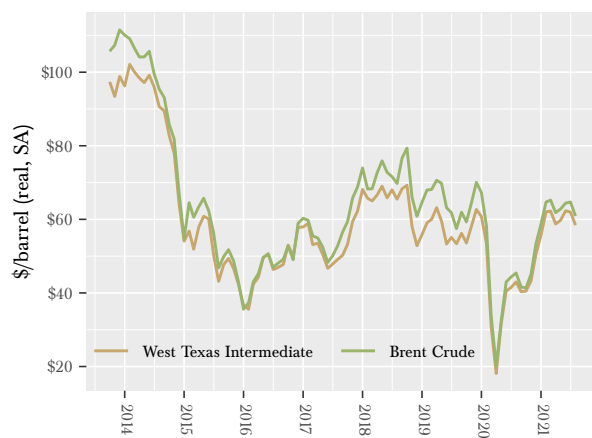
Wood Markets

Timber stumpage revenue constitutes about 70 percent of total DNR revenues on average. Therefore, DNR is vitally concerned with understanding stumpage prices, log prices, lumber prices, and the related supply-and-demand dynamics underlying all three. This section focuses on specific market factors that affect timber stumpage prices and overall timber sales revenue generated by DNR.
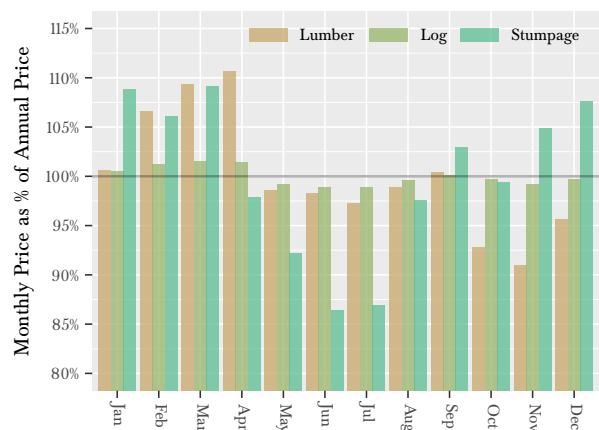
Figure 11: Lumber, Log, and Stumpage Prices in Washington
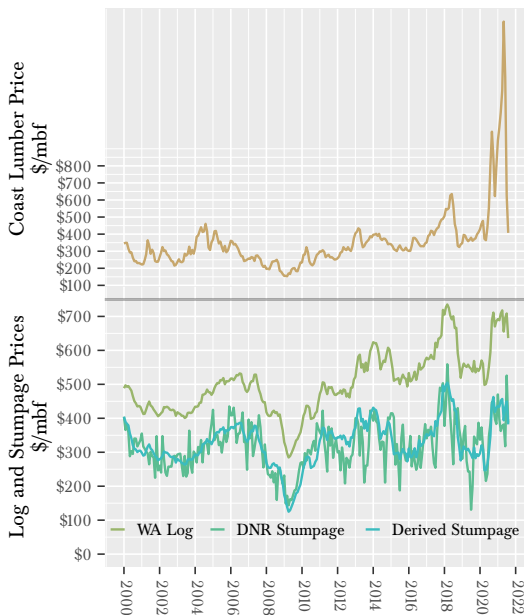
In general, timber stumpage prices reflect demand for lumber and other wood products, timber supply, and regional lumber mill capacity. There is a consistent, positive relationship between log prices and DNR's stumpage prices, despite notable volatility in stumpage prices (Figure 11). High log prices make access to logs more valuable, increasing purchasers' willingness to pay for stumpage (the right to harvest). Volatility in stumpage prices arise not only from log prices, but also from the volume of lumber and logs held in mills' inventories and from DNR-specific issues, such as the quality and type of the stumpage mix offered at auction, the region,

and the road-building requirements of a particular sale.

The relationship between lumber and log prices is less consistent. Lumber prices are significantly more volatile, and both the direction and size of price movements can differ from log prices. This is due to both demand and supply-side factors. On the demand side, mills will often have an inventory of logs in their yards, as well as an inventory of "standing logs," so they do not always need to bid up log or stumpage prices to take advantage of high lumber prices. From the supply side, landowners often do not need to sell their timber, so when prices fall too far, they can withhold supply and allow their trees to grow and increase in quality.

Figure 12: Lumber, Log, and DNR Stumpage Price Seasonality

There are differences in price seasonality between lumber, logs, and stumpage, as illustrated in Figure 12. These prices are affected by a degree of seasonality that is largely the result of when each of these commodities will be used. For instance, lumber prices tend to be higher starting in February, when housing construction starts to pick up, and decline through fall as demand wanes, while stumpage prices tend to be highest in December-March, when harvesters are lining up harvestable stock for the summer. DNR stumpage price volatility is also affected by the firefighting season and the

quality of the stumpage mix, which varies throughout the year but tends to be lower from July through September.
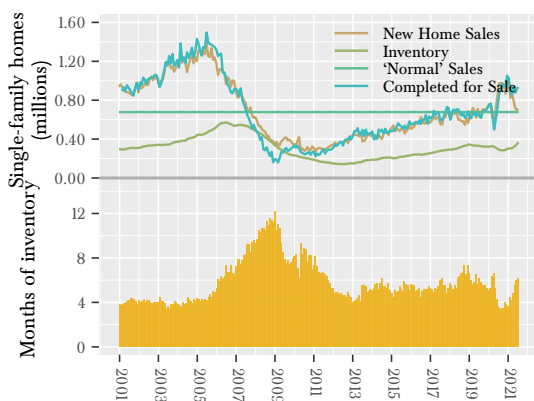
U.S. Housing Market

This section continues with a discussion of the U.S. housing market because it is particularly important to overall timber demand in the U.S.

New residential construction (housing starts) and residential improvements are major components of the total demand for timber in the U.S. From 2000-18, these sectors have averaged 69 percent of softwood consumption — 37 percent going to housing starts and 32 percent to improvements — with the remainder going to industrial production and other applications.

The 2007 crash in the housing market and the following recession drastically reduced demand for new housing, which undermined the total demand for lumber. Since the 2009-11 trough, an increase in housing starts has driven an increase in lumber demand, though not to nearly the extent of the peak.

Figure 13: New Single-Family Home Sales

As with almost every other part of the economy, the coronavirus pandemic created a lot of uncertainty in the housing market. Since the initial collapse in activity, both starts and new home sales have risen significantly — largely driven by strong

household balance sheets and record-low mortgage rates.

New Home Sales

Unsurprisingly, new home sales plummeted during the 2008-09 recession, reaching a record low of 306,000 (SAAR) in 2011 before beginning a slow rise (Figure 13). New home sales increased from 440,000 (SAAR) in 2014 to an average of 616,000 in 2017, still well below the long-term (1963-2010) "normal" rate of 678,000 (SAAR) sales per year. In 2018, new home sales averaged 651,000 (SAAR) through May, before dropping meaningfully to average 593,000 for June-December. From November 2019 through January 2020, new home sales rose steeply to peak at 756,000, the highest it had been since the recession.

From January through April 2020, new single-family home sales fell back to 570,000 (SAAR) as the initial effects of the pandemic took hold. However, April was the bottom. From then, new home sales quickly grew well beyond their January 2020 highs to a peak of 977,000 (SAAR) in August, averaging 934,000 in the latter half of the year. In January 2021, 993,000 (SAAR) new homes were sold, and have averaged 907,000 (SAAR) per month — 24 percent more than highest peak month between 2008-2020. Since then, through July, sales have fallen to around 708,000 (SAAR).

Based on the consistent high number of sales, extremely low interest rates for the foreseeable future, solid household balance sheets, and strong demand, new home sales are expected to remain high for some time, although they may be offset by more existing housing coming on to the market.
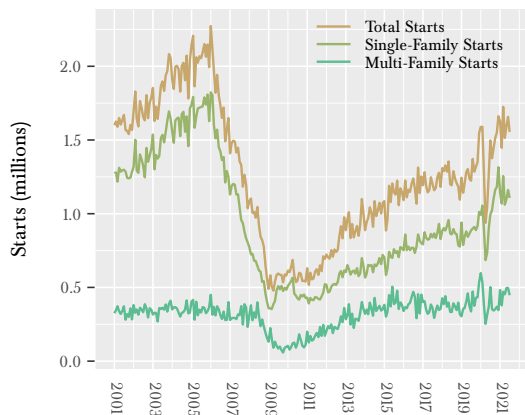
Housing Starts

In April 2009, U.S. housing starts fell to the lowest point since the Census Bureau began tracking these data in 1959. U.S. housing starts picked up in 2011 and continued to rise, largely because of increases in multi-family starts. Single-family starts were more or less flat after the recession through 2012, but rose slowly through most of 2019 (Figure 14).

Starts picked up meaningfully in the last quarter of 2019 to average 1.3 million (note that all of the housing starts figures are SAAR), above the 1.25 million average for 2018. Although this was well above the 2012 average of 0.78 million, it is still well below the pre-recession long-term average of 1.6 million.

Starts hit 1.6 million in January and February 2020 before dropping sharply in April to 0.9 million. Again, as with sales, April 2020 was the nadir, and starts climbed back quickly increased to more than 1.5 million in October through January. Through August 2021, starts have averaged 1.6 million.

House prices started rising again only in 2012 as economic and employment indicators continued to improve. Figure 15 charts the seasonally adjusted S&P/Case-Shiller Home Price Index for the 20-city composite, which estimates national existing home price trends, as well as the Index for Seattle.

Nationally, after increasing in most months since bottoming out in January 2012, the Case-Shiller 20-city composite price index growth slowed significantly from May 2018 to late 2019. Seattle house prices had been growing much faster than national prices, doubling from its low in February 2012 to July 2018, while nationally house prices increased by 62 percent. From late 2019, the index started growing strongly again.

Figure 14: Housing Starts

Figure 15: Case-Shiller Existing Home Price Index

Like sales, expectations for starts for the foreseeable future are high based on the current rebound, low interest rates, and underlying demand.

It's notable that the share of single-family starts has increased markedly in the past year. In January 2020, around 62 percent of the new starts were single family. In January 2021 this share had grown to 70 percent. Single-family housing uses more lumber than multi-family housing, so the increase in starts should have a proportionally larger effect on lumber demand than early 2020.
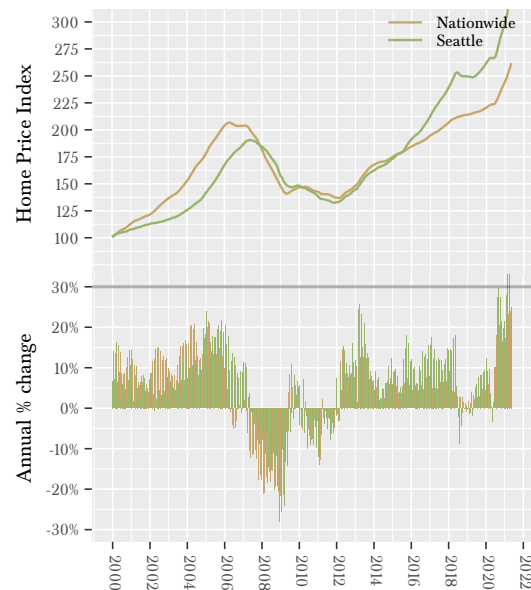
Housing Prices

U.S. housing experienced six unprecedented years of falling or flat prices following the recession.
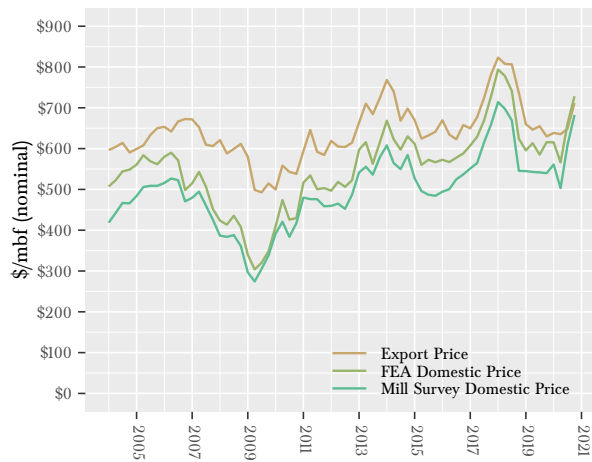
Although the pandemic initially stalled national price growth, the national Case-Shiller ended the year with 9.7 percent year-over-year price growth in December. Locally, the Seattle Case-Shiller Index actually fell from a high of 267.1 in March to a low of 265.9 in June, but prices grew rapidly in the latter half of 2020. In December, the year-over-year price growth was 12.5 percent.

This rapid price growth is the result of both strong demand — largely due to low interest rates but also possibly due to demand from tele-workers looking for homes outside of cities — and *very* limited supply. The inventory of homes for sale fell as fewer people put their homes up for sale, likely not wanting to have potential buyers walking through. Since around mid-2020, the inventory of new single-family homes has steadily increased, but is still quite low compared to the demand for homes.

Export Markets

Although federal law prohibits export of logs from public lands west of the 108th meridian, log exports can still have a meaningful impact on DNR stumpage prices. Exports compete with domestic purchases for privately sourced logs and strong export competition pulls more of the supply from the domestic market, thereby raising all domestic prices. However, changes in export prices do not necessarily influence domestic prices in a one-to-one relationship.

Figure 16: Log Export Prices

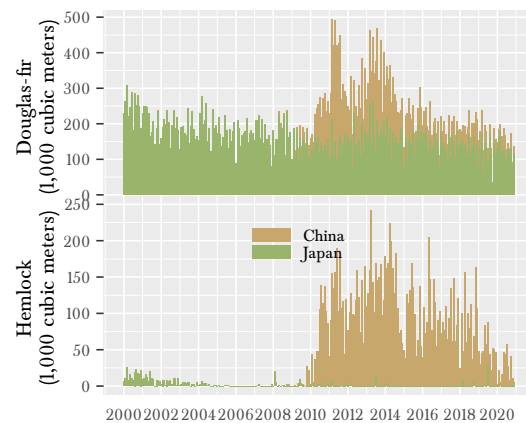term contracts, and high transaction costs.

Note that the export prices shown in Figure 16 are weighted by DNR's typical species mix, not the species mix of actual export volumes.

The primary markets for logs and lumber from Washington are China and Japan. Japan primarily imports Douglas-fir and has been relatively consistent, averaging 1.8 million m^3 per year since 2009. China primarily imports hemlock, but has been much more variable in its demand.

After entering the market meaningfully in 2010, demand from China was a major support for log and lumber prices in Washington (Figure 17). That started waning in late 2014 as China's economic health wavered, the U.S. dollar appreciated while the value of the euro and ruble dropped (making U.S. timber comparatively more costly), and a 25 percent Russian tariff on log exports was reduced.

Surprisingly, exports to Japan in 2020 actually increased by about 7 percent. However, exports to China continue to fall, and were down 41 percent in 2020 compared to 2019.

Figure 17: Log Export Volume

Export prices are almost always higher than domestic prices, a difference which is referred to as the "export premium" (Figure 16). The export premium is primarily due to the characteristics of the export markets, which can include a demand for higher-quality wood, a high value placed on long-

There is currently legislation in Russia that would ban log exports. This could strongly affect China, where many mills were built near the Russian border to take advantage of cheap logs. The Russian

export ban is designed to support local mill operations. In the longer term, it may mean that China still has access to cheap lumber, as they will likely be the main export market. In the short term, it may increase Chinese dependence on other log exporters, including the Pacific Northwest.

Current Lumber Prices

Lumber prices skyrocketed in late 2020, with Hemlock-Douglas-fir 2x4 prices rising from around $450/mbf in June 2020 to $1,000/mbf in September 2020. After weakening a little from September through November, prices again shot up and passed $1,318/mbf in June 2021. In the two months since June, prices have plummeted, back to around $400/mbf.

Broadly, there are at least four key things that have made lumber prices explode:

- housing starts and home improvements;

- the loss of supply from British Columbia;

- lead time and inventory management for projects; and

- the production capacity of mills and their caution about expanding.

The high prices have been across the board in wood-based building materials (all building materials, really). But the story for lumber is representative of most other wood products as well.

First, as mentioned above, housing starts are the dominant driver of lumber demand in the U.S., making up almost 70 percent of demand historically.

Single-family housing starts collapsed from February 2020 at 1.1 million units (SAAR) to 0.7 million in April 2020. At the same time mills drastically slowed down, either actually completely stopping production or seriously reducing it – putting people out of work or furloughing them. Some of those people went to other lines of work, making it harder to ramp up production later. Notably, this is generally the time when mills are ramping up production, building up their inventory in preparation for

higher demand for the housing construction season.

However, April was the nadir. From there, starts increased dramatically every month; by August they were higher than any month from 2008-19. Single-family starts peaked at 1.3 million (SAAR) in December, shooting up demand for lumber, and have remained above the December 2019 peak. Mills started increasing production again in July 2020, but took a while to ramp back up. While production was still catching up, orders were piling up and *piling up for the future.* Since December, starts have averaged 1.1 million (SAAR) – every month has had more starts than any month in the past 13 years.

Remodeling and renovation started climbing earlier and peaked much earlier, but were also much higher than previous years. In 2019, home improvement consumption peaked at 1.78 billion board feet (bbf) in September. In 2020, June had just under that at 1.73 bbf and then every month from July to November had more lumber consumption than the peak in 2019.

The huge increase in residential improvements started this wave in demand. That demand took up much more lumber than previous years, started to bid up prices, and took up supply that would have been inventory to fill orders for home building.

Second, this all happened with the backdrop of British Columbia's supply falling off a cliff from 2018. The beetle kill harvest there, which increased harvest volume from 2000, is basically done and mills have started closing, shutting down a key lumber import supply. With that decreased supply and the closing mills, there's less flexibility in supply – it just can't be ramped up as easily. This likely decreased the elasticity of supply, so that even small increases in (unexpected) demand resulted in sharp increases in price.

Third comes from the orders piling up for the future. The snowball of lumber orders started rolling in mid-year 2020 with the surprising home improvement demand. It kept getting bigger because everyone wanted wood, but the new supply was

still taxed and mills hadn't built up their inventories.

When home-building started picking up, builders also needed lumber. Typically, home builders buy their lumber in advance, tying up production into the future. But they don't always get it right, so some need wood as soon as possible. However, nobody had lumber available because all of the mills' output had already been bought months in advance. Those who needed wood immediately had two choices: buy on the cash market at exorbitant prices and/or buy up unsold stuff in the future. And it's not just buy it up, but *bid it up* to make sure they have the supply they need.

The home-building demand is, of course, linked to house prices. Builders are willing to pay higher prices for lumber because the houses they are building have high prices. Housing demand right now is such that many home-builders are selling the homes far in advance of building them – so they are guaranteed to sell at current high prices, and the company can preorder the lumber at the high price of lumber, knowing that their profit is locked in.

Fourth, the Great Recession devestated mills. For instance, the number of lumber mills in Washington decreased from 68 mills in 2006 to 37 in 2016 (according to the Washington Mill Survey). The remaining mills survived because they are cautious about expanding capital, taking on debt or hiring too many people. They're part of a cyclical commodity market, so they know it has booms and busts. Lumber is fairly cyclical, so if a company takes on a lot of debt and expands during a boom, then the bust will bankrupt them.

Mills saw the high prices in July and August 2020 and likely thought that it was a nice bonus, but unlikely to last – as the recent spike in 2018 didn't. Mills did expand production some, but slowly, while selling off their future production. West Coast lumber production increased from mid-2020, but by the end of the year was only up to what it was in peak 2019. Only in the past couple of months have mills increased output to close to peak output in 2018 (when West Coast lumber prices spiked to $635/mbf).

Additionally, even though it seems like mills are trying to expand output now, they are apparently having difficulty finding the labor for it.

Like the reduced production from British Columbia, having fewer mills in Washington state likely limited the flexibility in the lumber supply, further reducing the elasticity of supply.

In addition to the major drivers above, there are also supply chain issues – particularly glue for oriented strand board and plywood, and transport issues for everyone. For instance, companies were apparently offering bonuses of $1,500/day for log truck drivers in Oregon to haul fire salvage because they were having difficulty finding drivers.

There is also likely some financial speculation going on as well. Lumber is traded on futures markets and futures are financial contracts that can be traded by anyone. So when the price increases sharply, some people are likely purchasing contracts to speculate on it, which increases the volatility of prices, at least in the short term.

Price Outlook

Lumber Prices

As shown in Figure 11, lumber prices started increasing rapidly in late 2017. In June 2018, prices hit $635/mbf, higher in real terms than any since 2000. However, from June 2018, prices dropped dramatically to a low of $324/mbf in November 2018 — a 47 percent drop. Prices through October 2019 made a modest recovery to average $371/mbf before jumping to $411/mbf in December 2019.

As discussed above, lumber prices skyrocketed in late 2020, but have since fallen just as dramatically. A pull-back from the extraordinarily high price was expected, but they weren't expected to fall as much as they have. The outlook for lumber prices is still broadly positive — interest rates seem like they'll be low for some time, which will continue to support home buying, there is a large population of people entering prime-home-buying age, employment and wages are improving, etc.

Prices into 2022 are expected to continue to be on

the high end of the more normal range, averaging around $500/mbf.

Log Prices

Figure 18 presents prices for Douglas-fir, hemlock, and DNR's composite log. The latter is calculated from prices for logs delivered to regional mills, weighted by the average geographic location, species, and grade composition of timber typically sold by DNR. In other words, it is the price a mill would pay for delivery of the typical log harvested from DNR-managed lands. The dark green line for the DNR composite log price on Figure 18 is the same as the light green line on Figure 11.

Log prices appear to have also bottomed in April 2020 and had recovered by August, but they have obviously not reached the same extremes as lumber prices. Timber harvesters and mills often have an inventory of standing timber to draw from, so they don't always need to bid up new logs. Since September 2020, log prices appear to have reached a plateau, vacillating between $630/mbf and $720/mbf. They are expected to be roughly flat through the end of 2021, before starting to slowly increase in 2022.
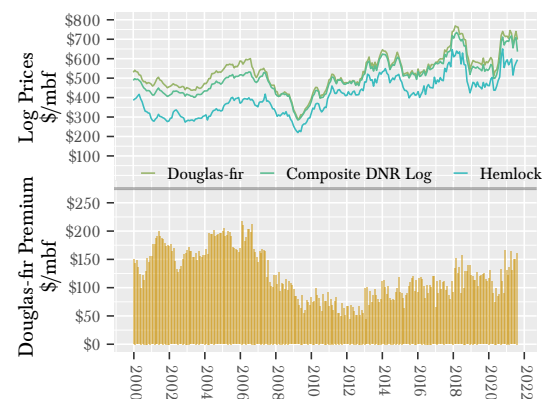
Stumpage Prices

Timber stumpage prices are the prices that successful bidders pay for the right to harvest timber from DNR-managed lands (Figure 19). At any time, the difference between the delivered log price and DNR's stumpage price is equivalent to the sum of logging costs, hauling costs, and harvest profit (Figure 11). Subtracting the average of these costs from the log price line gives us a derived DNR stumpage price.

When actual DNR stumpage prices differ significantly from the derived stumpage prices, a correction is likely to occur. Currently, stumpage prices are a bit lower than we'd expect, given log prices — having diverged in recent months as stumpage prices have fallen. Although log and lumber prices bottomed out in April 2020, DNR stumpage prices fell through May 2020, to a low average auction price of $215/mbf. However, they rebounded ear-

lier than expected, jumping to $347/mbf in July, which typically has the lowest auction prices of a year. DNR timber auctions have had very strong prices through the end of the year, so that the average stumpage for FY 21 was $396/mbf. The average price for stumpage through the first two auctions of FY 22 was $463/mbf. This is so high largely because the July auction was full of particularly valuable timber, and had an average price of $526/mbf.

As always, these prices also depend heavily upon the characteristics of the sales, particularly the type and quality of the wood, the type of logging, and the costs associated with road-building and maintenance. Right now, sales prices may also be more heavily influenced by the ready availability of the sales – that is, whether purchasers can begin harvesting soon or whether they have to do a lot of preparatory work.

Figure 18: DNR Composite Log Prices

DNR Stumpage Price Outlook

DNR currently contracts with a forest economics consulting firm that provides log and timber stumpage price forecasts, as well as valuable insights into the housing, lumber, and timber markets. By modeling DNR's historical data on its price forecasts, we arrive at a stumpage price outlook (Figure 19, note that the FEA "forecast" series reflects the species and class characteristics of typical

DNR timber; the original series were West Coast averages, and are not shown).

It is important to note that these are nominal price expectations.

Figure 19: DNR Timber Stumpage Price
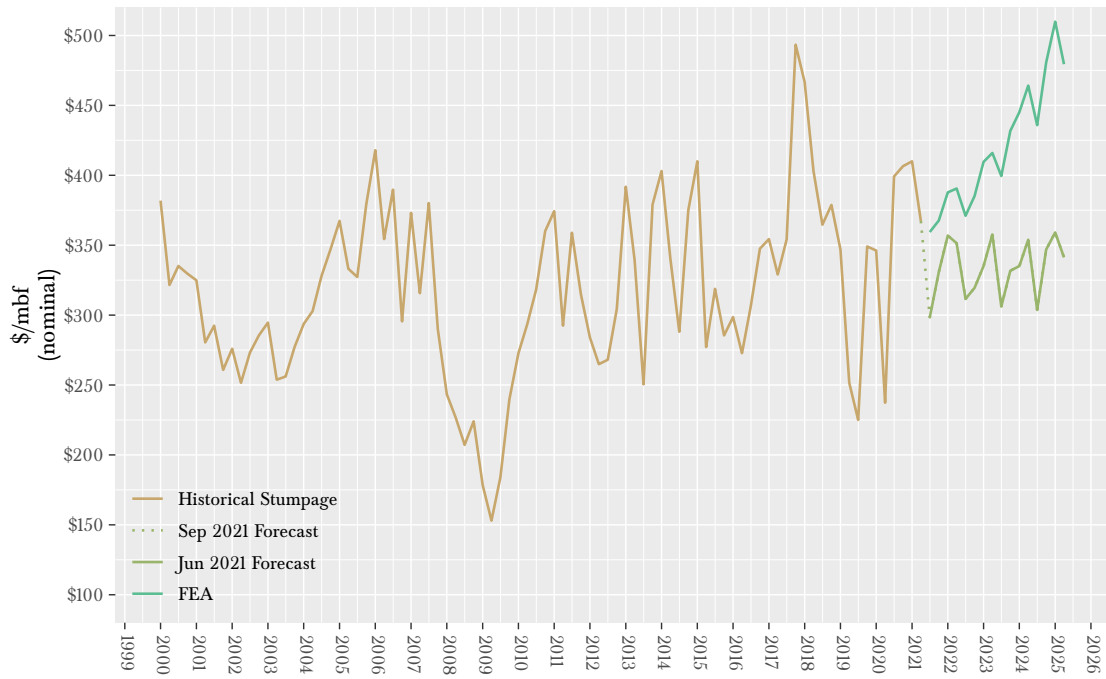
DNR Revenue Forecast

This Revenue Forecast includes revenue generated from timber sales on trust uplands, leases on trust uplands, and leases on aquatic lands. It also forecasts revenues to individual funds, including DNR management funds, beneficiary current funds, and beneficiary permanent funds. Caveats about the uncertainty of forecasting DNR-managed revenues are summarized near the end of this section.

Timber Revenue

DNR sells timber through auctioned contracts that vary in duration. For instance, contracts for DNR timber sales sold in FY 2019 needed to be harvested between three months and three years from the date of sale, with most being around two years. The purchaser determines the actual timing of harvest within the terms of the contract, which is likely based on perceptions of market conditions. As a result, timber revenues to beneficiaries and DNR management funds lag behind sales.

For the purposes of this chapter, timber that is sold but not yet harvested is referred to as "inventory" or "under contract." Timber volume is added to the inventory when it is sold and placed under contract, and it is removed from the inventory when the timber is harvested.

Timber Sales Volume

The sales volume forecast for FY 21 was increased to 540 mmbf in June, close to the actual 541 mmbf. (Figure 20). The sales volume forecast for FY 22 and outlying years is unchanged at 500 mmbf, though the current plan is for DNR to offer around 580 mmbf for auction. Although demand still appears to be relatively high, the first two auctions of the year had numerous no-bids. Either demand isn't as strong as it was earlier in the year or the timber DNR is bringing to sale is not desirable enough, or both. Either way, the no-bids suggest at least some caution.

FY 15 was the first year of the new sustainable harvest decade (FY 15 through FY 24) for Western Washington, though the new Sustainable Harvest Calculation wasn't officially adopted until December 2019. However, multiple lawsuits have been filed that put the status of the new sustainable harvest estimates into question. Without certainty on the sustainable harvest limit, annual Westside sales volumes forecasts are unchanged at 450 mmbf for future years. Together with projected Eastside timber sales of 50 mmbf for each of the next several years, we arrive at a projected annual timber sales volume of about 500 mmbf for FYs 22-25.
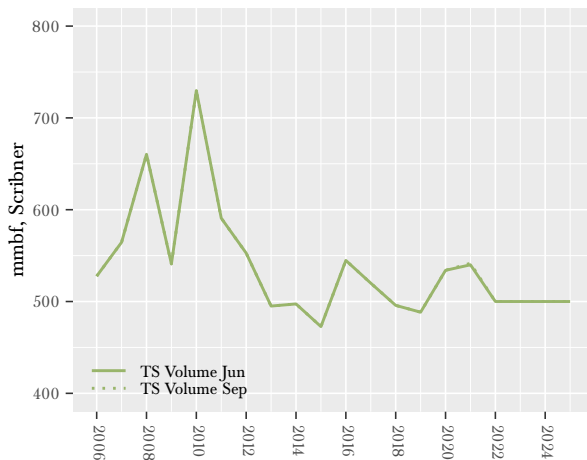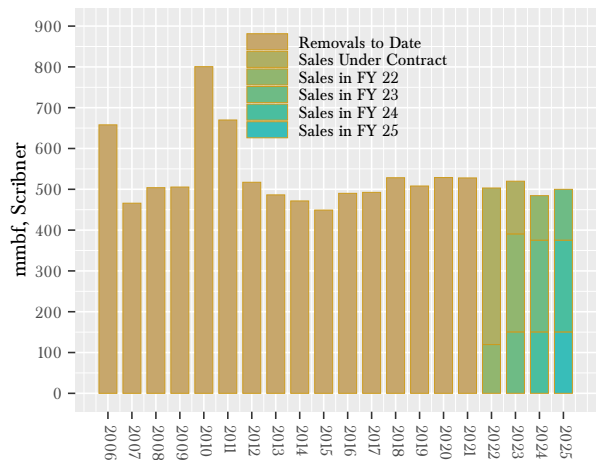

Figure 20: Forecast Timber Sales Volume

Figure 21: Forecast Timber Removal Volume

Timber Removal Volume

The FY 20 removal volume was 527 mmbf (Figure 21). The FY 21 volume harvest forecast was reduced in June by 10 mmbf to 490 mmbf due to continued slow harvest activity. However, the final two months of the fiscal year had harvests well above what was expected.

While it's unclear exactly why our forecast was so wrong, part of the explanation is likely that DNR tracking of harvest volume is done through the internal financial system, and harvest volume is generally recognized only when revenue is recognized. For many contracts, this means that there is a sometimes-substantial amount of harvest volume that isn't tracked until the contract is fully closed out. This is why June is typically the month with the largest harvest volume — because many of the completed contracts must be closed out before the end of the fiscal year.

The removal volume forecast is also unchanged in outlying years.
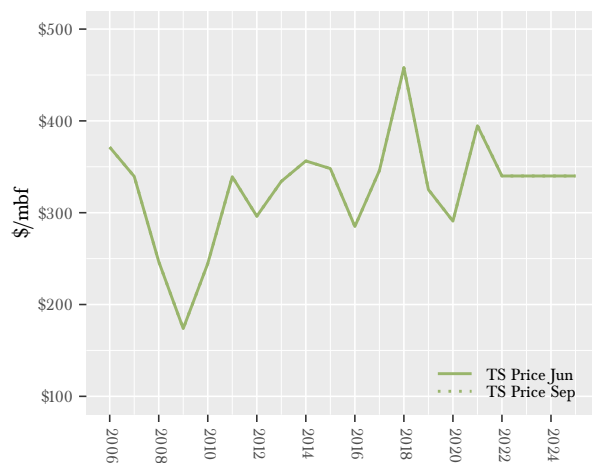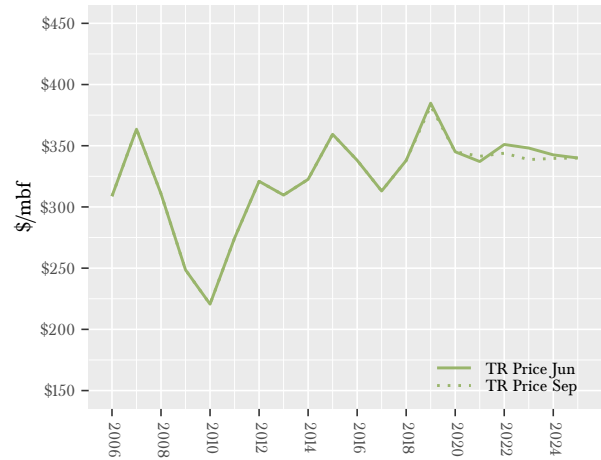
Figure 22: Forecast Timber Sales Price

Timber Sales Prices

The price results of monthly DNR timber sales are quite volatile (Figure 11). As discussed in the stumpage price outlook, the DNR sales price (stumpage) forecast is informed by West Coast log and stumpage price estimates from a forest economics consulting firm.

Sales prices through FY 21 were been consistently high, with every sale being above the five-year average of $340/mbf, and many of them well above. In June the sales price forecast for FY 21 was increased to $395/mbf — well above our initial FY 21 forecast of $300/mbf in the June 2020 — and this was very close to the final FY 20 average price of $396/mbf.

Again, given the recent drop in lumber prices, softening timber prices and weakness in stumpage demand, the sales price forecasts are unchanged. This may be too conservative, because lumber prices are already climbing again, but at this point it seems a reasonable balance of the risks to both the upside and downsides.

Timber Removal Prices

Timber removal prices are determined by sales prices, volumes, and harvest timing. They can be thought of as a moving average of previous timber sales prices, weighted by the volume of auc-

Figure 23: Forecast Timber Removal Price

tioned timber removed in each time period. (Figure 23).

Removal prices in outlying years are all slightly decreased. This is due to the much higher than expected harvests essentially shifting the harvest of high value timber into FY 21.
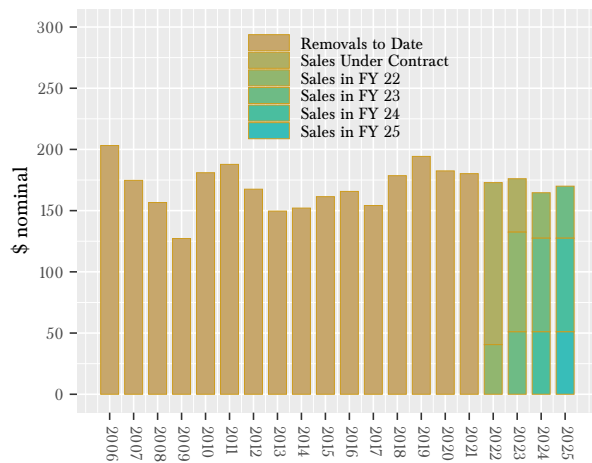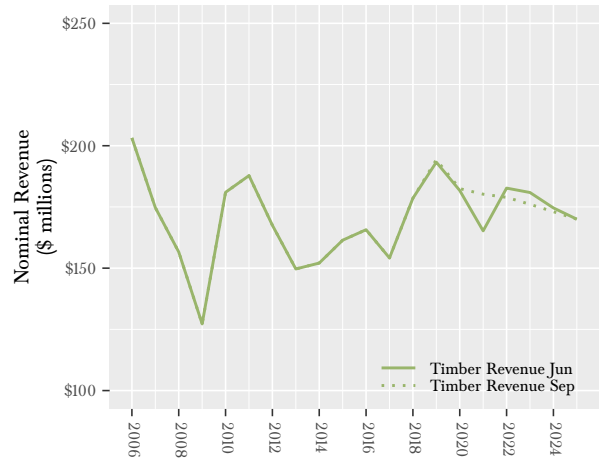
Figure 25: Forecast Timber Removal Revenue

Figure 24: Forecast Timber Removal Value

Timber Removal Revenue

Figure 24 shows projected annual timber removal revenues, broken down by the fiscal year in which the timber was sold. Revenue estimates reflect all of the changes described above.

Forecast revenues for the 2021-23 biennium are decreased to $355 million (-$8 million).

Upland Lease Revenues

Upland lease revenues are generated primarily from leases and the sale of valuable materials other than timber, on state trust lands (Figure 26).

Upland lease revenues were increased meaningfully in June for FY 21 by $1.3 million due to higher-than-expected revenue from a number of different sources. This ended up being a meaningful underestimate, with revenue coming in $4.2 million above even this increased forecast, ending the year at $50.0 million.

This was due to higher revenue from several sources and has spurred an increase in the forecast for a couple of sources. Irrigated revenue is increased by $0.4 million in FY 22 due to remaining cash-on-account that should be accrued to revenue this fiscal year. The high orchard/vineyard revenue in FY 21 should be indicative of what's likely to be seen in the coming years, so this this source is increased by $0.8 million in all years.

Communication lease revenue forecast is increased again this forecast, by $0.3 million in all outlying years. High revenue in FY 21 was due to lease renewals that required payment of back rent and increases in the base rent, which has also increased the forecast in outlying years. Other lease revenues are increased by $0.5 million in all forecast years, due to increased revenue from the rights-of-way program, which has been improving its processes to bring revenue closer to market value, and special uses revenue.

Figure 26: Forecast Upland Lease Revenue
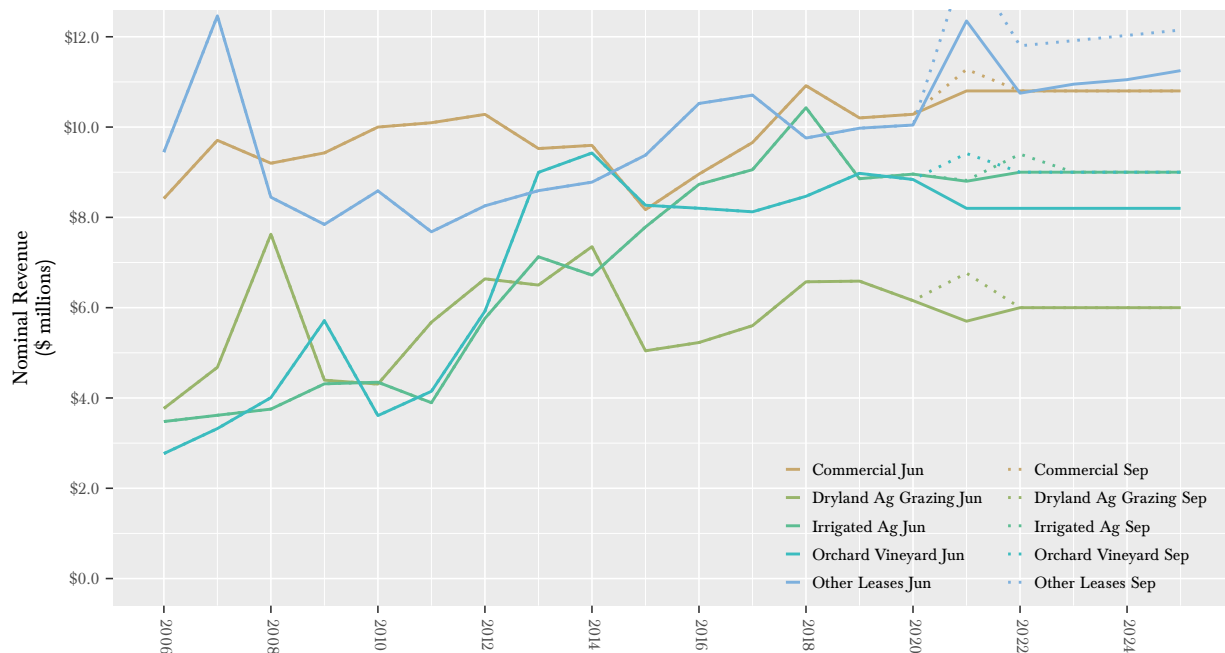
Aquatic Lands Revenues

Aquatic lands revenues are generated from leases on aquatic lands and from sales of geoduck. In the past, on average, leases have accounted for one-third of the revenue and geoduck sales accounted for the remainder. However, prices for geoduck plummeted in the beginning of FY 20, so we are now forecasting geoduck to make up a bit over half of the aquatic lands revenue for FY 21.

The aquatic lease revenue forecast is decreased by $0.2 million in all years due to low revenue in other aquatic revenue (which are typically dominated by mineral sales) offsetting a slight increase in aquaculture expectations (Figure 27).

By late 2019, geoduck prices had already fallen substantially because of the slowdown in Chinese economic growth and the impact of the trade war. After the lockdown in China due to COVID-19, harvest of geoduck destined for China basically stopped, leaving only about 10 percent of the normal daily harvest—which is bound for other international locations or for domestic consumption.

Demand from China recovered substantially by mid-2020. We had assumed that harvest volumes would recover reasonably quickly to the roughly 95 percent of sales volume that we typically see. However, that was too optimistic and harvest volumes lagged for much longer. Our harvest volume assumptions are 85 percent of the sales volume for the foreseeable future.

Prices held up much better than we had feared at the outset of the pandemic. The April 2020 auction offered indemnification for purchasers if they did not harvest all of their contracted pounds—which led to a surprising $8.98/lb. average price (Figure 28). However, the June 2020 auction had an average price of $8.46/lb. and, importantly, did not offer a blanket indemnification. Prices for the July and September, 2020, auctions fell to $5.05/lb. and $6.11/lb., respectively. The December price rebounded to $8.64/lb. — higher because this auction harvest period covered Chinese New Year, typically a period of very high demand. In January 2021, prices fell back to $6.82/lb. before fetching

almost $10/lb. in the February auction. The most recent auctions, in April and the beginning of June, fetched $10.35/lb. and $9.54/lb, respectively.

The consistency of these prices, combined with the fact that they have fallen in what is seasonally a lower-priced time of the year, suggests that demand has indeed returned from China. Our unchanged price forecast falls in the $7-9/lb range, building in risk of price shocks compared to recent prices.

Forecast geoduck revenue is increased slightly in FY 22 due to updated sales plans, but unchanged in outlying years.

At this point, we don't expect to see prices return to consistently being between $10-12/lb, or even above, though this is obviously still possible. The trade tensions with China don't seem to be easing, and Chinese consumers are moving to other luxury seafoods instead of geoduck.

It's notable that the FY 22 geoduck forecast is much higher than the surrounding years. This is because of the timing of some of the latter sales in FY 21, which will have their revenue come in in FY 22.

Figure 27: Aquatic Lands Revenues
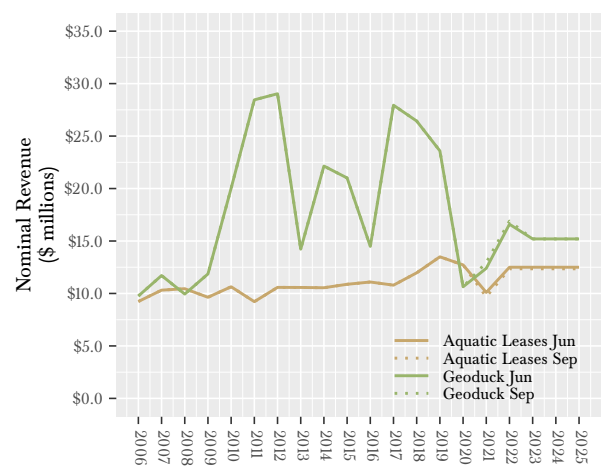
There are, as always, potentially significant downside risks to geoduck revenues, even in the near term and in addition to the pandemic, that are important to consider but difficult to forecast:

- Harvests (and therefore revenues) could be deferred or lost if geoduck beds are closed due to occurrence of paralytic shellfish poison.

- Harvests are slowed or delayed due to injury or death of divers.

- Early in 2021, heavy rains overwhelmed sewage treatment plants in the Puget Sound, spilling untreated sewage into the sound and closing geoduck tracts for several weeks. Although program staff were able to offer alternative harvest from different tracts, this type of risk will continue as climate change grows more severe.

- Furloughs at the Washington State Department of Health have delayed PSP and arsenic analyses and have led to lost fishing days in the past couple of months. It is unclear if these will continue or how disruptive they will be.

- In light of recent Washington Department of Fish and Wildlife surveys of closed South Puget Sound geoduck tracts showing declining recovery rates, and evidence of active poaching, future commercial harvest levels may be further reduced.
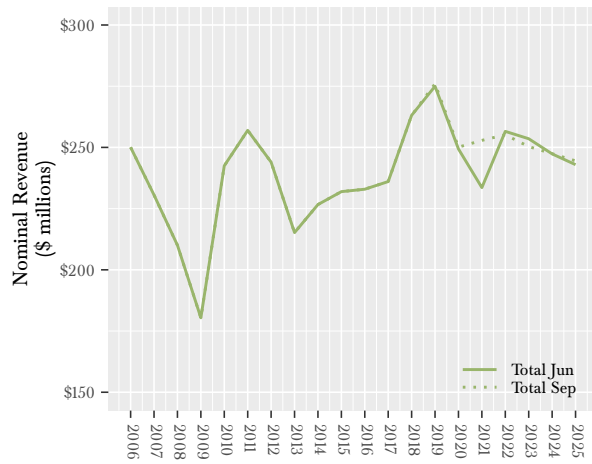
Figure 28: Geoduck Auction Prices
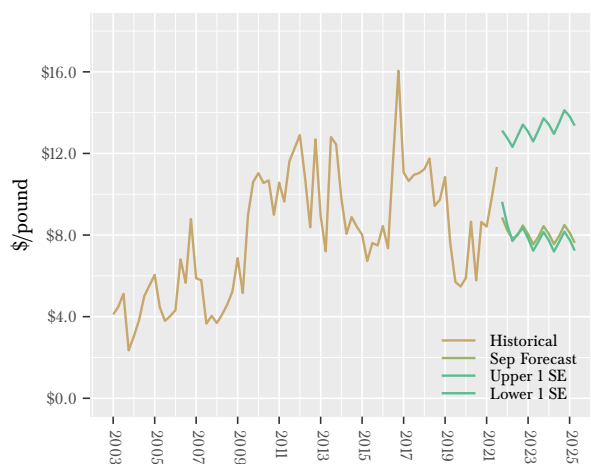
Total Revenues from All Sources

Forecast revenues for the 2021-2023 biennium are decreased by $5 million to $505 million (Figure 29).

Figure 29: Total Revenues

Distribution of Revenues

The distribution of timber revenues by trust are based on:

- The volumes and values of timber in the inventory (sales sold but not yet harvested) by trust;

- The volumes of timber in planned sales for FY 22 by trust, and relative historical timber prices by DNR region by trust; and

- The volumes of timber by trust for FYs 23-25 based on output of the sustainable harvest model and relative historical timber prices by DNR region by trust.

Because a single timber sale can be worth more than $3 million, dropping, adding, or delaying even one sale can represent a significant shift in revenues to a specific trust fund.

Distributions of upland and aquatic lease revenues by trust are assumed to be proportional to historic distributions unless otherwise specified.

Management Fee Deduction. The underlying statutory management fee deductions to DNR as authorized by the Legislature are 25 percent or less, as determined by the Board of Natural Resources (Board), for both the Resources Management Cost

Account (RMCA) and the Forest Development Account (FDA). In biennial budget bills, the Legislature has authorized a deduction of up to 30 percent to RMCA since July 1, 2005. In 2015, they began authorizing an RMCA deduction of up to 31 percent.

At its April 2011 meeting, the Board adopted a resolution to reduce the RMCA deduction from 30 to 27 percent and the FDA deduction from 25 to 23 percent. At its July 2011 meeting, the Board decided to continue the deductions at 27 percent for RMCA (so long as this rate is authorized by the Legislature) and at 23 percent for FDA. At its October 2011 meeting, the Board approved a resolution to reduce the FDA deduction from 23 to 21 percent. The Board decided in July 2013 to raise the FDA deduction to 25 percent and the RMCA deduction to 29 percent. In August 2015, the Board raised the RMCA deduction up to 31 percent for the 2015-2017 biennium.

The Forecast uses the 31 percent deduction for the all forecast years. This assumes that the Legislature will continue to approve RMCA deductions of up to 31 percent.

Given this background of official actions by the Legislature and the Board, the management fee deductions assumed in this Forecast are:

	FY 22	FY 23	FY 24	FY 25
FDA	25	25	25	25
RMCA	31	31	31	31