Department of Natural Resources

Economic & Revenue Forecast

Fiscal Year 2022, Second Quarter
November 2021

Forecast Summary

Coronavirus pandemic[1]

The COVID-19 pandemic has significantly altered the economic landscape. It has affected almost every aspect of economic life, from consumer behavior and purchasing decisions to production and supply chain operations. And although the threat of large-scale COVID-19 lock-downs no longer completely overshadow all of the normal constituent parts of the forecast, the ongoing pandemic is still creating significant uncertainty across the economy.

Earlier in the year, we were optimistic that the U.S. would be approaching herd immunity or something like it by mid-2021 and that the pandemic's economic impact would largely be a problem external to the U.S., though it would have still had implications and risks for the U.S. economy[2]. At that time, extremely effective vaccines were becoming more widely available and cases were falling from their January peaks. However, because of resistance to vaccination, waning vaccine efficacy over time and the emergence of more contagious COVID-19 variants, another wave of infections peaked in September, and cases are again rising.

More contagious variants mean that a higher proportion of the population must be immunized (either through vaccination or from infection) to reach a herd immunity. As of writing, 196 million people (59 percent of the population) have been fully vaccinated[34]. Additionally, an estimated 146 million people in the U.S. have been infected, which appears to confer meaningful immunity, though it may be less effective than vaccination[5].

With the overlap between these two groups, and with waning immunity, it's unclear how many U.S. residents have some sort of immunity and, ultimately, it is unclear if or when the U.S. will reach some version of herd immunity. Currently, case rates are going up across the country after having fallen from an average of over 162,000 cases per day in September to a low of around 69,000 cases per day in October. There doesn't appear to be any consensus from experts on the likely trajectory of the pandemic in the U.S., though numerous experts are warning of a large winter wave. Additionally, it doesn't seem like there is much risk of more stay-at-home orders in the U.S., either because there is less risk of massive outbreaks or because of constraints from the political environment.

From the perspective of the economy, assuming there are no more shutdowns, it's not clear how much herd immunity would matter in the short-to-medium term. Many of the larger economic effects of the pandemic are already working their way through the economy — including chip shortages, supply chain bottlenecks, altered consumer behavior from services spending to more goods spending, etc. As an example of how things might not change, car manufacturing delays due to chip shortages emerged in late 2020, leading to constrained car supplies and extraordinary prices[6]. Even if COVID-19 were to disappear from the U.S., the chip shortage would not end immediately and it would still take some time for car manufacturing to return to normal.

Taken all together, the forecast is now built with

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[1]As a reminder, we are not epidemiologists or experts on public health or pandemics. This section is written with our best understanding of the pandemic and its dynamics gathered from reputable sources with the aim of translating those into likely broader economic effects and then more direct effects on DNR revenue. In addition to the significant uncertainty still surrounding the future path of the epidemic even for experts, uncertainty arises from our limited experience and understanding.

[2]With "herd immunity" being broadly defined as when enough of a population has enough immunity that small outbreaks of disease will not become large disruptive outbreaks. See the discussion and definition here: `https://publichealth.jhu.edu/2021/what-is-herd-immunity-and-how-can-we-achieve-it-with-covid-19`

[3]See `https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total` for a definition of full vaccination.

[4]This may no longer be the case with the new omicron variant, which a pre-print study suggests has a much higher reinfection rate than previous variants `https://www.medrxiv.org/content/10.1101/2021.11.11.21266068v2`

[5]`https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(21)00676-9/fulltext` and `https://www.cdc.gov/mmwr/volumes/70/wr/mm7044e1.htm?s_cid=mm7044e1_w`

[6]`https://www.ft.com/content/13094950-fb45-4686-9ef9-8199c674b90d`

the expectation that the pandemic will continue indefinitely, but this is unlikely to *seriously* affect DNR revenue. DNR revenue comes predominantly from timber, with some from agriculture and other uplands leases as well. Timber prices are largely driven by the demand coming from housing markets and agricultural revenue is largely driven by the prices of agricultural products. These will be discussed in their respective sections of the forecast — but in short, unless there is a massive change in the nature of the pandemic, they are likely to be largely untouched.

Even without clear effects such as stay-at-home orders, the ongoing pandemic will probably still have some effect on the economy, though it will likely be more insidious and more difficulty to quantify. The repercussions could include things such as:

- 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 [7].

- 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 about 11 million people in the U.S., or about 30 percent of those infected, are affected by long COVID [8].

To summarize, the assumptions underlying this forecast are:

- There will be no more stay-at-home orders or significant limitations on economic activity by governments in the U.S.

- Successive waves of COVID-19 will not cause major disruptions to DNR revenue streams, which are relatively insulated from the direct effects of COVID-19

- Even if COVID-19 new-infections drop substantially, it will not create a meaningful boost in economic activity

Having written all that, the COVID-19 pandemic is still a wild card and significantly increases the potential risks and volatility of DNR revenue. This doesn't affect the point forecasts provided, but it does increase the range of potential and *equally likely* outcomes.

Lumber and Log Prices. Lumber prices plummeted to $414/mbf in August, after peaking at around $1,600/mbf in May (West Coast standard or better 2x4, Douglas-fir/Hemlock). However, these have rebounded to $641/mbf in November. Demand remains high and extreme weather shutting down production in British Columbia has caused prices to spike from what they were in October. Currently, the cash price on the Chicago Merchantile Exchange is over $1000/mbf. It's unclear if prices will continue to increase as they did in 2020. However, even if they fall from the current spike, prices are expected to remain relatively high through the first quarter of 2022.

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 $681/mbf in November. 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

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

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

slower production at mills, furloughs, layoffs, and some mill closures. However, 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.

Timber Sales Volume. DNR currently plans to offer around 590 mmbf for sale in FY 22. However, around 60 mmbf of that is at risk of not being brought to auction. Additionally, through September, although stumpage prices remained relatively elevated, stumpage demand appears to have softened, with around 10 percent of sales passed in.

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

Timber Sales Prices. Given the recent weakness in lumber and timber prices and weakness in stumpage demand, the sales price forecasts for all years are unchanged. This may be too conservative for FY 22 as lumber prices are already climbing again and auction prices have remained high (the November auction prices were very strong, but came in after the forecast numbers were finalized and were not included in this forecast). However, auction prices have been volatile, so it remains a reasonable forecast, though it may be on the lower side of the likely range.

Timber Removal Volume and Prices.

The removal volume forecast is unchanged in outlying years. Removals to date in FY 22 are in line with expectations.

Removal prices are slightly decreased due to changes in the value of timber in inventory.

Timber Revenue. Timber revenue in all years is changed slightly due to the adjustments in removal prices.

Timber revenues for the 2021-23 biennium are $357 million — around 1 percent higher ($2 million) than previously forecast. Forecast revenues for the 2023-25 biennium are decreased slightly.

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

Forecast uplands revenue for FY 22 is decreased by $1 million to $46 million, due to significant damage to wheat harvests from the drought and heat wave this summer. This drop in revenue outweighed a small increase in expected revenue from mineral and hydrocarbon leases.

The aquatic lease forecast for FY 22 is reduced slightly due to slower mineral and hydrocarbon extraction on aquatic lands.

The geoduck forecast revenue for FY 22 is increased slightly to $17 million based on much higher harvests for contracts from the June auction. Additional harvest pounds were made available so that around 481,000 pounds of geoduck were harvested, instead of just the 393,000 that were originally auctioned. The revenue forecast for geoduck would have been increased more, to a little more than $18 million, if harvests for the rest of the year didn't face significant risks. Harvesting on one of the more valuable tracts was unavailable for a time due to paralytic shellfish poison. And now that tract will be unavailable until early next year because of weather conditions, so it is unlikely that those lost pounds will be recovered for this fiscal year.

Additionally, there are serious issues with compliance vessel availability. Of the five boats DNR has for compliance monitoring, only two are regularly in working order at any given time. The rest need repairs, but these have been delayed indefinitely because the parts are unavailable.

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 on-

going 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 or the slow-moving default by one of China's largest real estate developers that threatens to become a "contagion" and cause a cascading wave of defaults across the country. Additionally, although 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 Russia appears to be moving forward with legislation ban-

ning 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.

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. Most recently, in September and October, extraordinary rainfall in British Columbia destroyed roads and railways, essentially halting timber harvests and lumber production and timber exports through the port of Vancouver. Additionally, the drought in Washington this year appears to have decreased wheat production on DNR lands by about 40 percent.

Droughts and high temperatures are also increasing wildfires. Although 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[9].

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[9]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: November 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				-	-	-	-	-
	% Change				0%	0%	0%	0%	0%
Price ($/mbf)		458	325	291	395	340	340	340	340
	Change				$ -	$ -	$ -	$ -	$ -
	% 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				$ -	$ -	$ -	$ -	$ -
	% Change				0%	0%	0%	0%	0%
Timber Removals									
Volume (mmbf)		528	508	529	528	520	520	510	500
	Change				-	(0)	0	0	-
	% Change				0%	0%	0%	0%	0%
Price ($/mbf)		338	382	345	341	347	340	339	340
	Change				-	2.9	1.8	(0.6)	-
	% Change				0%	1%	1%	0%	0%
Timber Revenue		**178.6**	**194.3**	**182.5**	**180.2**	**180.3**	**177.1**	**172.8**	**170.0**
	Change				-	1.4	1.0	(0.2)	-
	% Change				0%	1%	1%	0%	0%
Upland Leases									
Irrigated Agriculture		10.4	8.9	9.0	8.8	9.4	9.0	9.0	9.0
	Change				-	-	-	-	-
	% Change				0%	0%	0%	0%	0%
Orchard/Vineyard		8.5	9.0	8.8	9.4	9.0	9.0	9.0	9.0
	Change				-	-	-	-	-
	% Change				0%	0%	0%	0%	0%
Dryland Ag/Grazing		6.6	6.6	6.2	6.8	5.0	6.0	6.0	6.0
	Change				-	(1.0)	-	-	-
	% Change				0%	-17%	0%	0%	0%
Commercial		10.9	10.2	10.3	11.3	10.8	10.8	10.8	10.8
	Change				-	-	-	-	-
	% Change				0%	0%	0%	0%	0%
Other Leases		9.8	10.0	10.0	13.7	12.0	12.1	12.2	12.3
	Change				-	0.2	0.2	0.2	0.2
	% Change				0%	2%	2%	2%	2%
Total Upland Leases		**46.1**	**44.6**	**44.3**	**50.0**	**46.2**	**46.9**	**47.0**	**47.1**
	Change				-	(0.8)	0.2	0.2	0.2
	% Change				0%	-2%	0%	0%	0%
Aquatic Lands									
Aquatic Leases		12.0	13.5	12.7	9.7	12.3	12.4	12.4	12.4
	Change				-	(0.1)	-	-	-
	% Change				0%	-1%	0%	0%	0%
Geoduck		26.4	23.6	10.6	13.0	17.1	15.2	15.2	15.2
	Change				-	0.2	-	-	-
	% Change				0%	1%	0%	0%	0%
Aquatic Lands Revenue		**38.4**	**37.1**	**23.4**	**22.6**	**29.4**	**27.6**	**27.6**	**27.6**
	Change				-	0.1	-	-	-
	% Change				0%	0%	0%	0%	0%
Total All Sources		**263.1**	**276.0**	**250.1**	**252.9**	**255.9**	**251.6**	**247.4**	**244.7**
	Change				-	0.7	1.2	(0.0)	0.2
	% Change				0%	0%	0%	0%	0%

Table 2: November 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	40.2	40.2	39.9	39.6
	Change				-	(1.1)	0.5	0.1	0.1
	% Change				0%	-3%	1%	0%	0%
041	RMCA - Aquatic Lands	17.6	16.7	9.9	10.2	12.8	11.9	11.9	11.9
	Change				-	0.1	-	-	-
	% Change				0%	1%	0%	0%	0%
014	FDA	22.1	25.6	28.3	27.2	21.4	21.4	21.3	21.1
	Change				-	1.0	0.0	(0.0)	0.0
	% Change				0%	5%	0%	0%	0%
21Q	Forest Health Revolving	4.4	7.5	8.7	13.5	14.8	12.5	9.7	8.2
					-	1.1	(0.2)	(0.2)	-
					0%	8%	-1%	-2%	0%
Total DNR Key Operating Funds		**84.7**	**89.7**	**80.5**	**84.4**	**89.3**	**86.0**	**82.7**	**80.9**
	Change		-		-	1.0	0.3	(0.1)	0.1
	% Change				0%	1%	0%	0%	0%
Current Funds									
113	Common School Construction	62.6	64.2	59.5	53.2	63.6	66.0	65.9	65.7
	Change				-	(3.6)	0.5	0.1	0.0
	% Change				0%	-5%	1%	0%	0%
999	Forest Board Counties	59.6	69.5	68.7	69.5	50.1	51.0	51.8	51.8
	Change				-	2.4	(0.4)	(0.2)	0.0
	% Change				0%	5%	-1%	0%	0%
001	General Fund	2.1	1.9	4.7	4.4	3.9	3.7	3.5	3.4
	Change				-	(0.1)	0.1	0.0	-
	% Change				0%	-4%	2%	1%	0%
348	University Bond Retirement	3.2	1.3	0.6	1.6	3.1	1.9	1.9	1.9
	Change				-	0.6	(0.1)	(0.0)	-
	% Change				0%	23%	-6%	-1%	0%
347	WSU Bond Retirement	1.6	1.4	1.9	2.6	1.5	1.5	1.6	1.6
	Change				-	(0.0)	0.0	0.0	0.0
	% Change				0%	-2%	0%	0%	0%
042	CEP&RI	5.3	2.7	3.6	2.2	3.7	4.2	4.4	4.4
	Change				-	(0.3)	0.2	0.1	0.1
	% Change				0%	-8%	4%	2%	2%
036	Capitol Building Construction	6.2	9.8	4.4	7.7	6.5	7.3	7.4	7.4
	Change				-	(0.3)	0.1	0.0	0.0
	% Change				0%	-5%	1%	0%	0%
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				-	(0.0)	-	-	-
	% Change				0%	-2%	0%	0%	0%
Other Funds		1.1	1.2	1.1	0.6	1.8	0.5	0.2	0.1
	Change				-	1.0	0.1	0.0	-
	% Change				0%	125%	23%	13%	0%
Total Current Funds		**141.7**	**152.1**	**144.7**	**141.9**	**134.3**	**136.3**	**136.8**	**136.4**
	Change				-	(0.5)	0.4	(0.0)	0.1
	% Change				0%	0%	0%	0%	0%

(Continued)

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				-	0.0	-	-	-
		% Change				0%	0%	0%	0%	0%
Permanent Funds										
	601	Agricultural College Permanent	4.2	4.1	5.4	5.7	4.5	4.2	3.9	3.8
		Change				-	(0.1)	0.1	0.0	-
		% Change				0%	-2%	2%	1%	0%
	604	Normal School Permanent	4.1	2.9	2.6	2.8	2.7	2.8	2.7	2.6
		Change				-	(0.0)	0.1	0.0	-
		% Change				0%	0%	5%	1%	0%
	605	Common School Permanent	0.8	0.2	0.2	0.4	0.3	0.3	0.3	0.3
		Change				-	-	-	-	-
		% Change				0%	0%	0%	0%	0%
	606	Scientific Permanent	7.0	5.4	3.1	4.9	7.6	5.7	4.8	4.6
		Change				-	0.3	0.3	0.1	-
		% Change				0%	4%	5%	1%	0%
	607	University Permanent	0.3	0.7	0.1	0.3	0.6	0.5	0.5	0.5
		Change				-	0.0	(0.0)	(0.0)	-
		% Change				0%	7%	-4%	-1%	0%
Total Permanent Funds			**16.5**	**13.3**	**11.4**	**14.2**	**15.7**	**13.6**	**12.2**	**11.8**
		Change				-	0.2	0.5	0.1	-
		% Change				0%	1%	4%	1%	0%
Total All Funds			**263.7**	**275.4**	**250.1**	**252.9**	**255.9**	**251.6**	**247.4**	**244.7**
		Change				-	0.7	1.2	(0.0)	0.2
		% Change				0%	0%	0%	0%	0%

Figure 1: Timber Forecast Charts
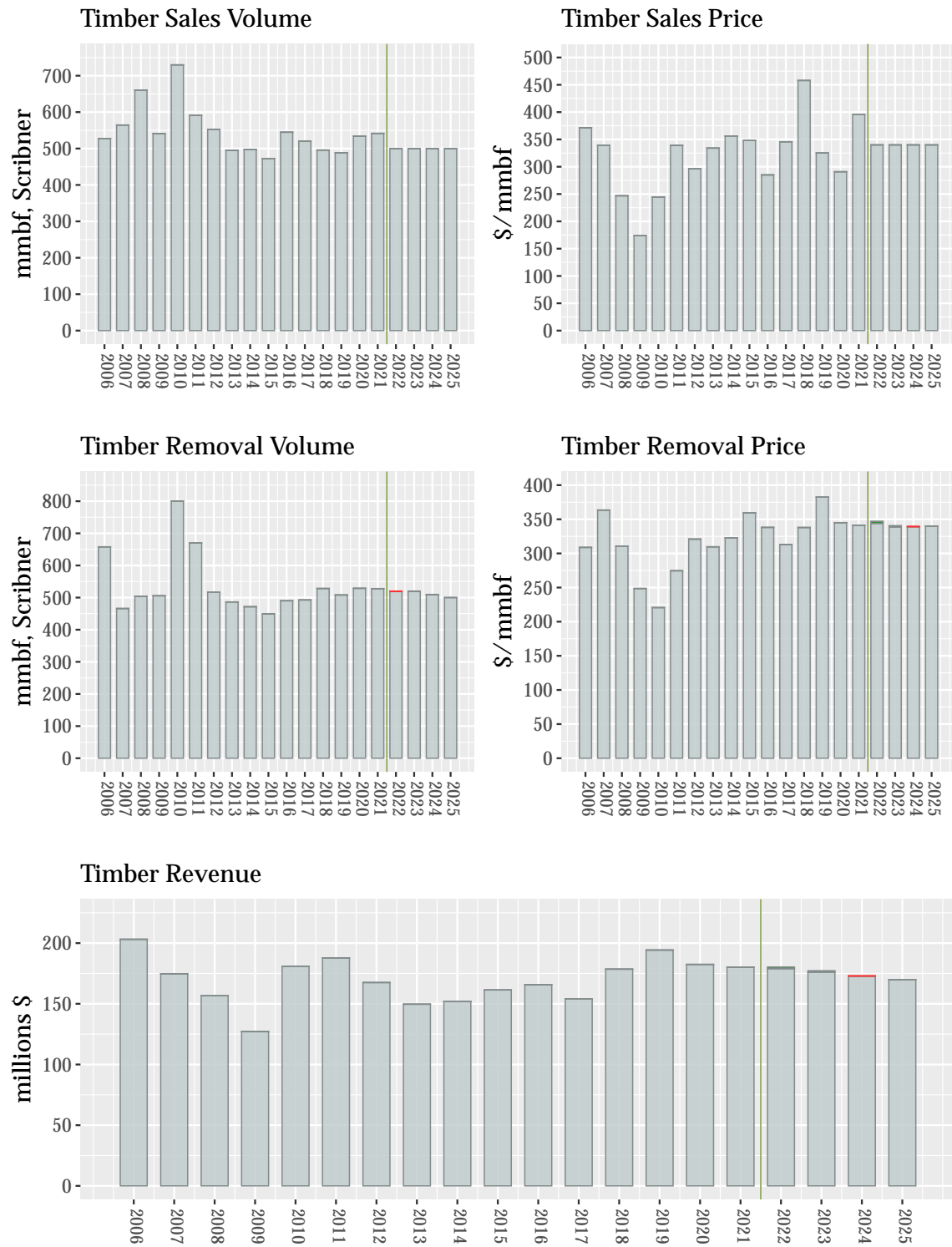
Figure 2: Other Uplands Forecast Charts
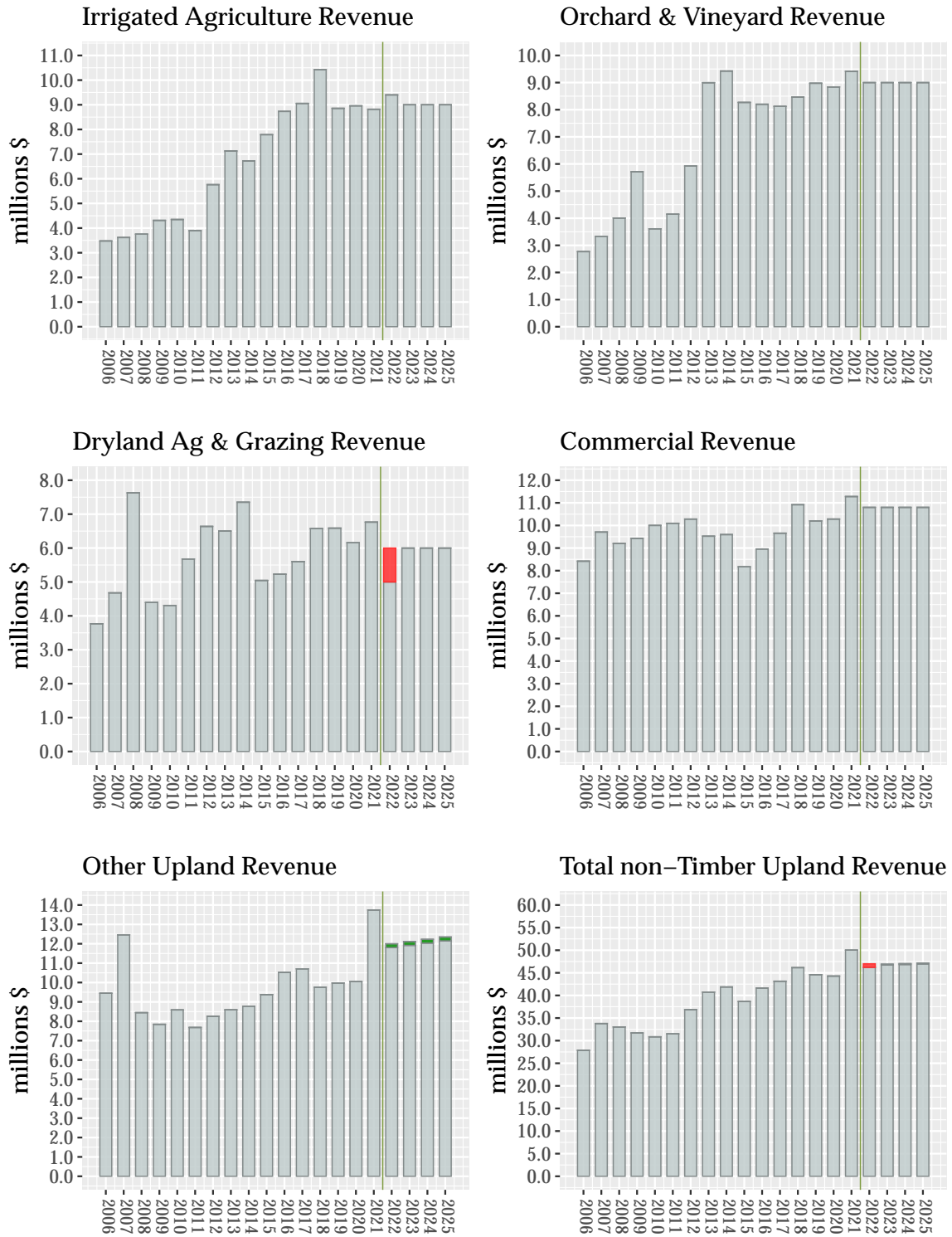
Figure 3: Aquatics and Total Forecast Charts

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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 October 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

In addition to the real health and economic problems caused by the pandemic reviewed in the summary, 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[10].

Altogether, 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. 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 is and will continue to be strong. However, as mentioned in the summary, the COVID-19 pandemic is still a wild card and has the potential to suddenly change and undermine recovery progress.

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.

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

Figure 4: U.S. Gross Domestic Product
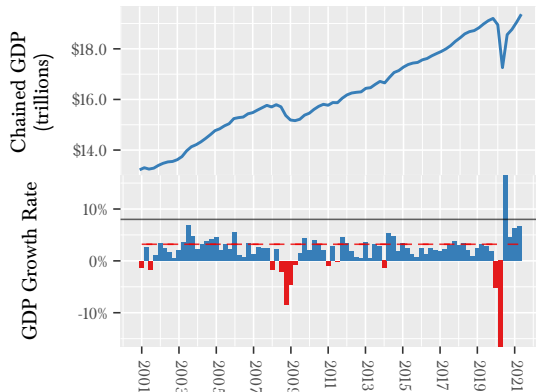
Note that the y-axis of the bottom chart is limited to 15 percent because the Q2 and Q3 2020 GDP growth are such outliers.

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, though third quarter growth slowed markedly to 2.1 percent (SAAR).

The strong growth rates of the first two quarters are broadly expected to resume in the fourth quarter. In their June forecast, the FOMC projected that GDP would grow by between 6.8 and 7.3 per-

cent in 2021, but this was lowered in the September meeting to between 5.8 and 6.0 percent. This seems pretty representative of other forecasts as well.

Figure 5: Unemployment Rate and Monthly Change in Jobs
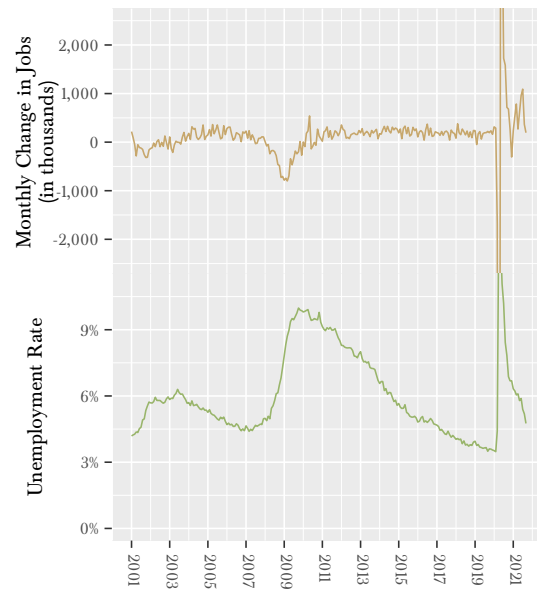
Note that the y-axes for these charts are limited because of the extreme changes in Q2 2020.

The Atlanta Fed's GDPNow, a high-frequency forecast, now predicts Q4 2021 GDP growth of about 9.7 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 previously, 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 percent 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 considerably, with the unemployment rate decreasing to 4.2 percent in November 2021 and the labor force participation rate increasing to 61.8 percent.

Overall, despite the rebound, there are around 4 to 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).

The speed of job regrowth 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 picked up again and has averaged 590,000 jobs/month from January through October. If this average rate were to continue, the economy will have recovered all of the jobs lost to the pandemic around mid-2022.

Figure 6: Employment and Unemployment
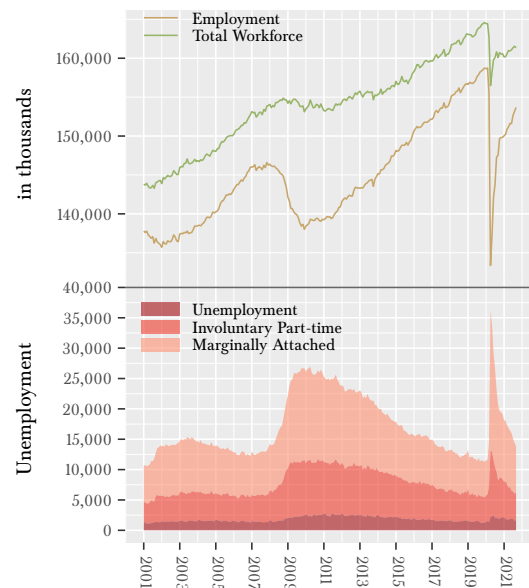
However, it is unclear what job growth will look like, even in the near future. It will likely continue to be characterized by fits and starts: for instance, July had more than 1 million jobs added, while September had only 379,000. Although job growth has been strong in some areas — services and, the 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-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 was for the 2021 fourth quarter unemployment rate to be between 4.2-5.0 percent, but this was revised up to 4.6-4.8 percent in September. With the current unemployment rate being at the bottom end of the June range, it seems likely that fourth quarter average unemployment

rate will be below their current expectations.

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 2.2 million in October.

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 December 2, 2021, is continued claims of 1.9 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. 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 7.8 percent in November 2021 (Figure 6).

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).

Figure 7: Labor Market Indicators
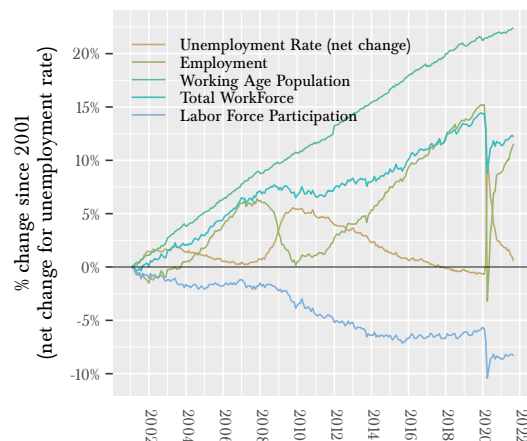
For policy purposes, the FOMC uses the core Personal Consumption Expenditures (PCE) index as the measure of inflation, which removes the more volatile fuel and food prices. Except for short periods in 2012 and 2018, this measure shows inflation at or below the 2.0 percent target since September 2008. 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 3.5 and 4.2 percent year-on-year for fourth quarter 2021.

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 well below pre-pandemic levels, 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 is no indication that they are resolving and, in fact, they 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 well into 2022.

Figure 8: U.S. Inflation Indices
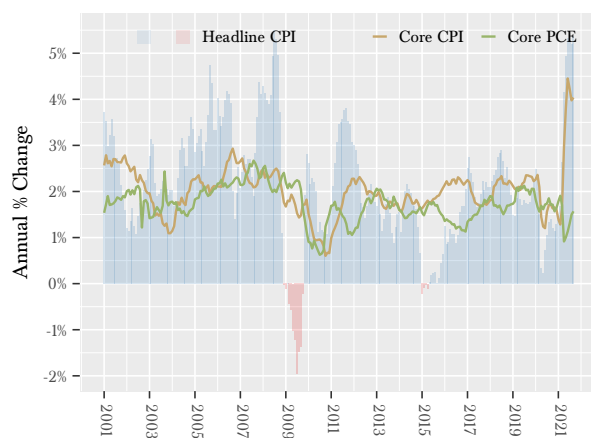
Interest Rates

Interest rates are a powerful tool used by the Federal Reserve Bank to influence the U.S. economy[11]. 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. It's 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 and September.

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

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[11]We refer to interest rates broadly, but the Fed governs the Federal funds rate, which heavily influences interest rates across the economy.

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
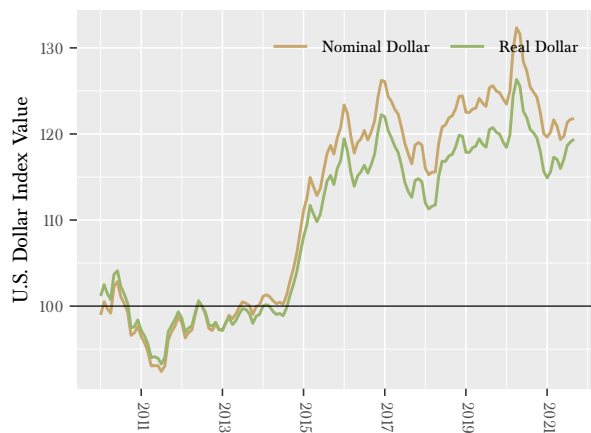
Foreign trade and access to export markets is normally important for DNR revenues. Chinese demand for timber and lumber was a major support for lumber prices after 2010, even though DNR timber cannot be exported directly. Additionally, much of the soft white wheat produced in Washington is exported to 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 with China, 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.

Another recent issue is that the United States has increased the taxes on imported Canadian lumber. This will likely put upward pressure on lumber prices, and by extension, timber prices.

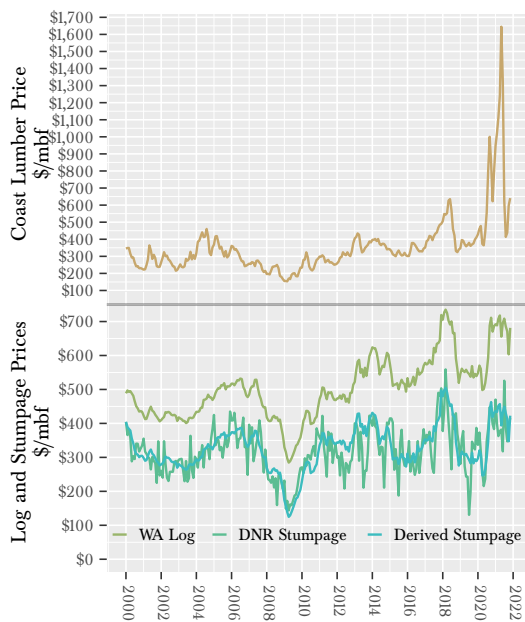Figure 10: Crude Oil Prices
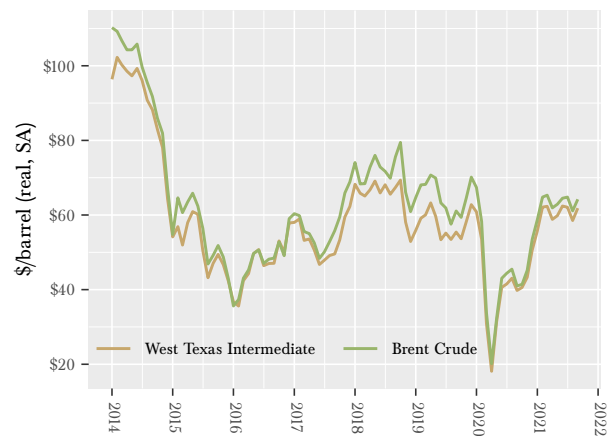
Petroleum

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 increased oil price volatility, even sending the spot prices negative for a short time (Figure 10). However, since then, prices recovered to around $70/barrel in real terms — around what it was in mid-2019. These are fairly middling prices historically, so they are unlikely to put much of a drag on economic growth, though there has been some media consternation about rising fuel prices recently.

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

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

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,

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.
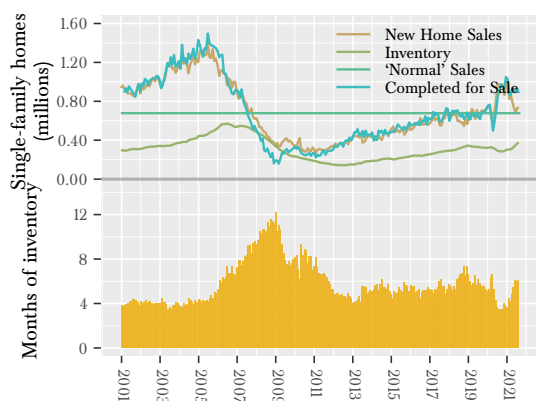
U.S. Housing Market

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

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 and 2020. Since January, sales have fallen to a low of 683,000 (SAAR) in June, but have increased since to 745,000 in October.

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.

Figure 14: Housing Starts
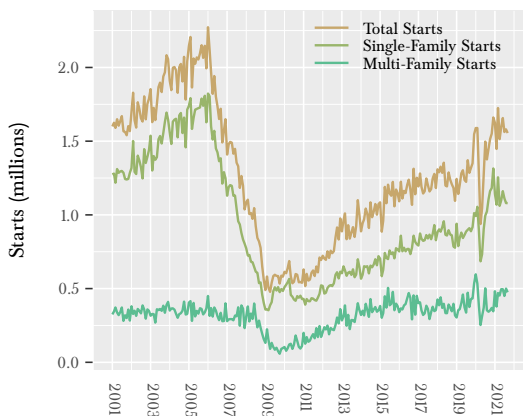
Starts hit 1.6 million in January and February 2020 before dropping sharply in April to 0.9 million. Again, as with sales, April 2020 was the nadir, and starts climbed back quickly increased to more than 1.5 million in October through January. Through October 2021, starts have averaged 1.6 million.

Like sales, expectations for starts are high for the foreseeable future based on the continued economic 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. 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 their 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 15: Case-Shiller Existing Home Price Index
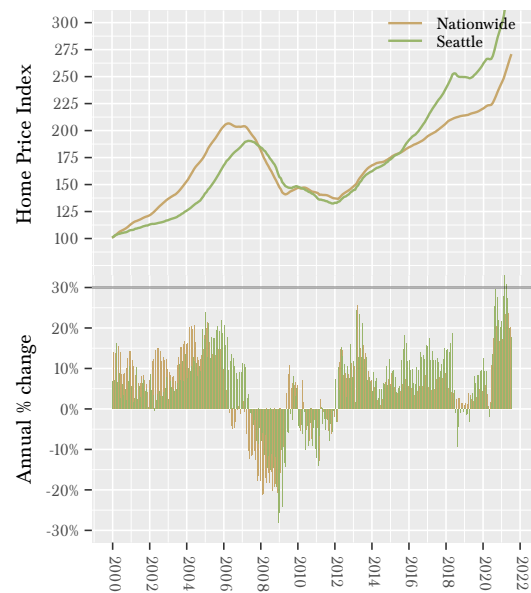
Although the pandemic initially stalled national price growth, the national Case-Shiller ended the year with 10 percent year-over-year price growth in December. Locally, the Seattle Case-Shiller Index actually fell from a high of 267.1 in March to a low

of 265.9 in June, but prices grew rapidly in the latter half of 2020. In December 2020, the year-over-year price growth was 13 percent. Since then, prices have increased even faster. Through September 2021, year-over-year prices nationwide were 17 percent higher, and Seattle prices were 21 percent higher.

This rapid price growth is the result of both strong demand — largely due to low interest rates but also possibly due to demand from teleworkers 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
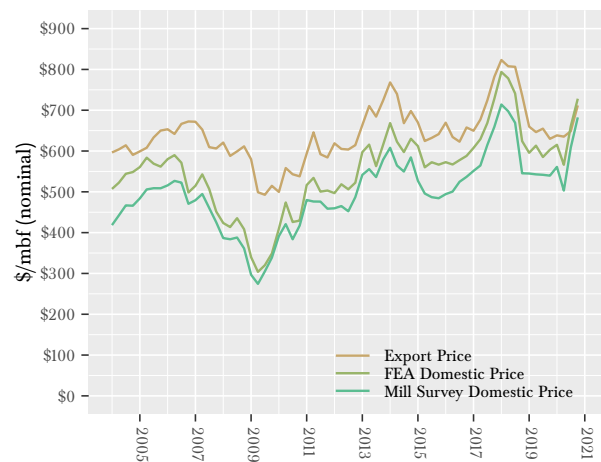
Export prices are almost always higher than domestic prices, a difference which is referred to as the "export premium" (Figure 16). The export premium is primarily due to the characteristics of the export markets, which can include a demand for higher-quality wood, a high value placed on long-term contracts, 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[12]. 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

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[12]Trade data is from the U.S. International Trade Commission Dataweb at urlhttps://dataweb.usitc.gov/

China continue to fall, and were down 41 percent in 2020 compared to 2019.Through September, exports to Japan are down by 2 percent, but exports to China have rebounded and are up around 60 percent — though this is still well below the levels of the mid-2010s.

There is currently legislation in Russia that would ban log exports from January 2022 *and* the country just recently increased export duties for lumber. These both seem targeted to get more revenue from China, though Russia supplies around 12 percent of the world's export logs, so the ban itself has the potential to seriously shock global timber trade. China imports a significant amount of lumber from Russia, as well as timber to supply mills located close to the border. These policies will almost certainly push up prices of timber and lumber in international markets, as Chinese buyers look elsewhere for supply. However, it may not have much of an impact on U.S. prices, at least in the short term, as prices here are largely being driven by demand from housing.

Figure 17: Log Export Volume
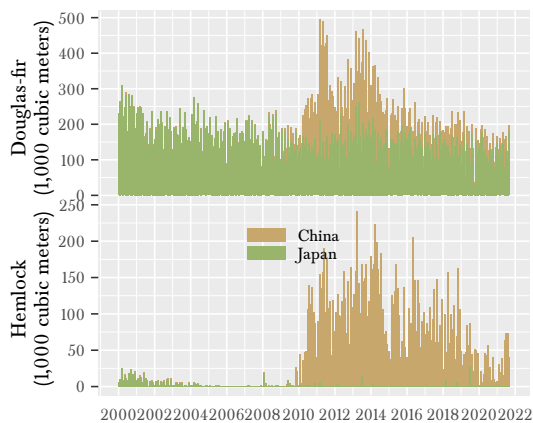
Current Lumber Prices

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. From June through August, prices plummeted to around $410/mbf, which is still much higher than the average price in the past decade. Since August, prices rebounded to $640/mbf in November. Additionally, it seems like prices have risen even since November, as the cash price and futures prices through March 2022 on the CME are now over $900/mbf and still rising.

Broadly, at least four key factors made lumber prices explode earlier in the year, and many of these are coming into play again now:

- 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 prices.

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 wood in the future. To do so meant that purchasers had to bid up prices 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 devastated 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, albeit 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 second quarter of 2021 was lumber production on the West Coast higher than in 2018 (when West Coast lumber prices spiked to $635/mbf).However, third quarter production for the West Coast and North America as a whole has fallen by about 6 percent from the second quarter.

Similar to 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, earlier in 2021 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 contributing to the volatility of prices. 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 did. Since August, prices have started climbing rapidly again, rising from $410/mbf in August to $640/mbf in November. In the past couple of weeks the cash price for lumber on the CME has jumped significantly, and is again over $1,000/mbf. It's unclear how long this price spike will last, but 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, a large population of people are 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 between $500 and $550/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.
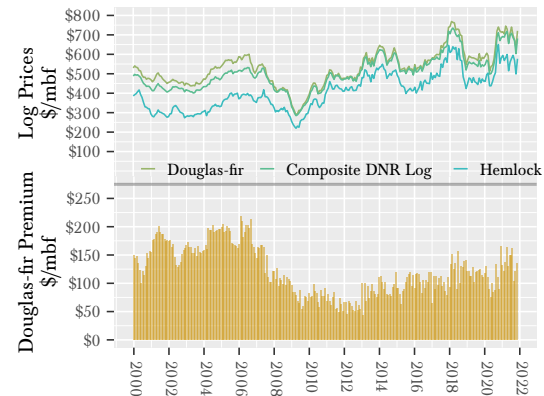
Stumpage Prices

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 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 November FY 22 auction was $416/mbf. These auction prices are broadly in line with where we would expect, given current log prices.

Figure 18: DNR Composite Log Prices

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.

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
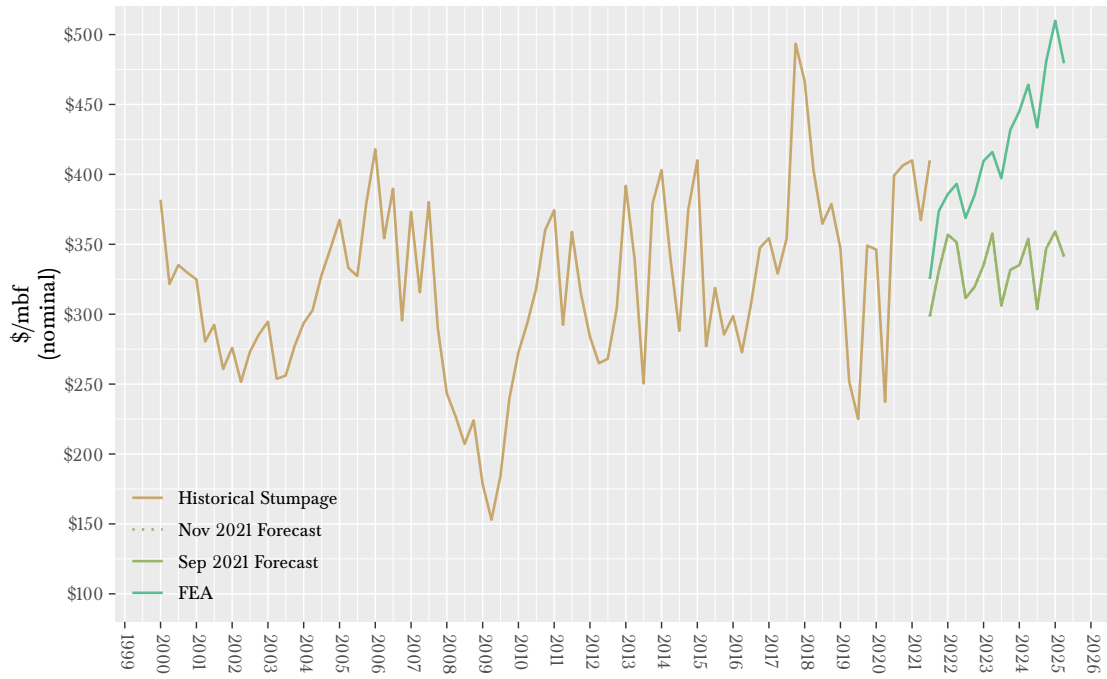
DNR Revenue Forecast

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 about two years in length. 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.

Figure 20: Forecast Timber Sales Volume
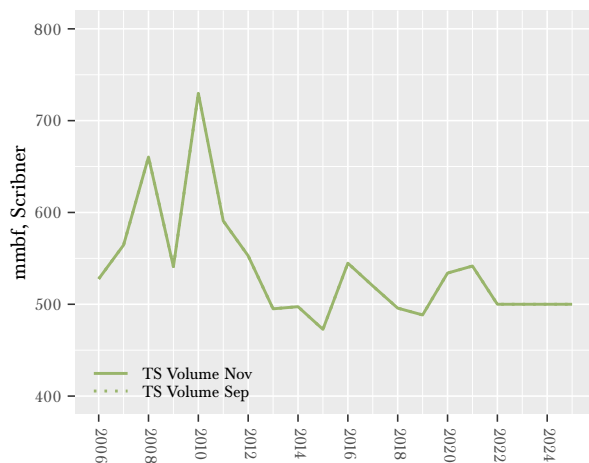
Timber Sales Volume

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 560 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 21: Forecast Timber Removal Volume
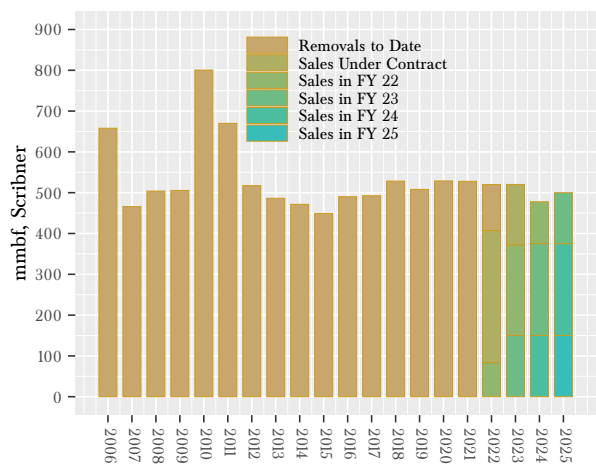
Timber Removal Volume

The removal volume forecast in unchanged in outlying years. Removals to-date for FY 22 are in line with expectations.
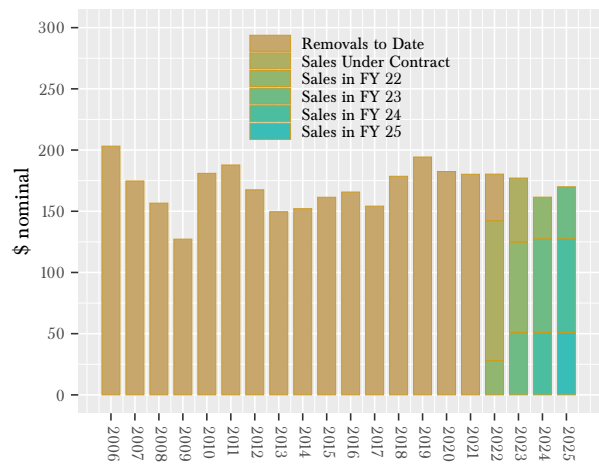
Figure 22: Forecast Timber Sales Price

cast of $300/mbf in the June 2020 — and this was very close to the final FY 20 average price of $396/mbf.

Timber price forecasts are unchanged for all years. This is likely too conservative given the recent auction price results, with a year-to-date average price of $412/mbf as of the November auction. However, the forecast was finalized before the auction. Additionally, caution around the price forecast is likely warranted, given the high volatility in lumber prices, and the weakness in stumpage demand and lower prices in August and September.

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 auctioned timber removed in each time period (Figure 23). Removal prices are slightly altered for all years based on changes in the value of the current inventory.

Figure 23: Forecast Timber Removal Price

Figure 24: Forecast Timber Removal Value
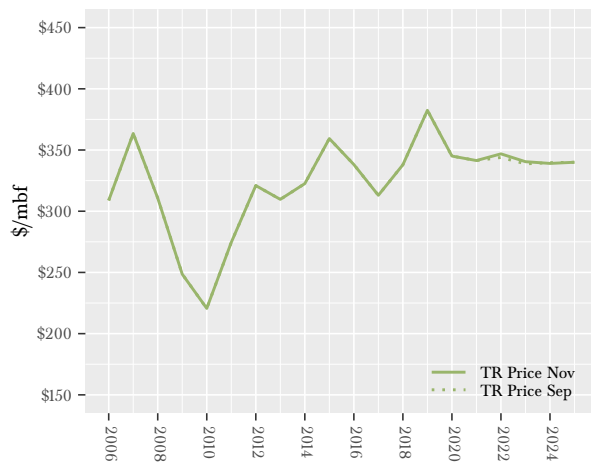
Timber Sales Prices

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 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 fore-

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).

Figure 25: Forecast Timber Removal Revenue
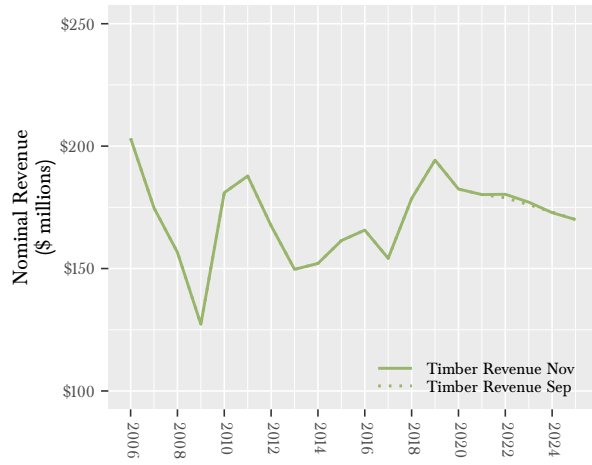
Upland Lease Revenues

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

Forecast uplands revenue for FY 22 is decreased by

$1 million to $46 million due to significant damage to wheat harvests from the drought and heat wave this summer. This drop in revenue outweighed a small increase in expected revenue from mineral and hydrocarbon leases.

Figure 26: Forecast Upland Lease Revenue
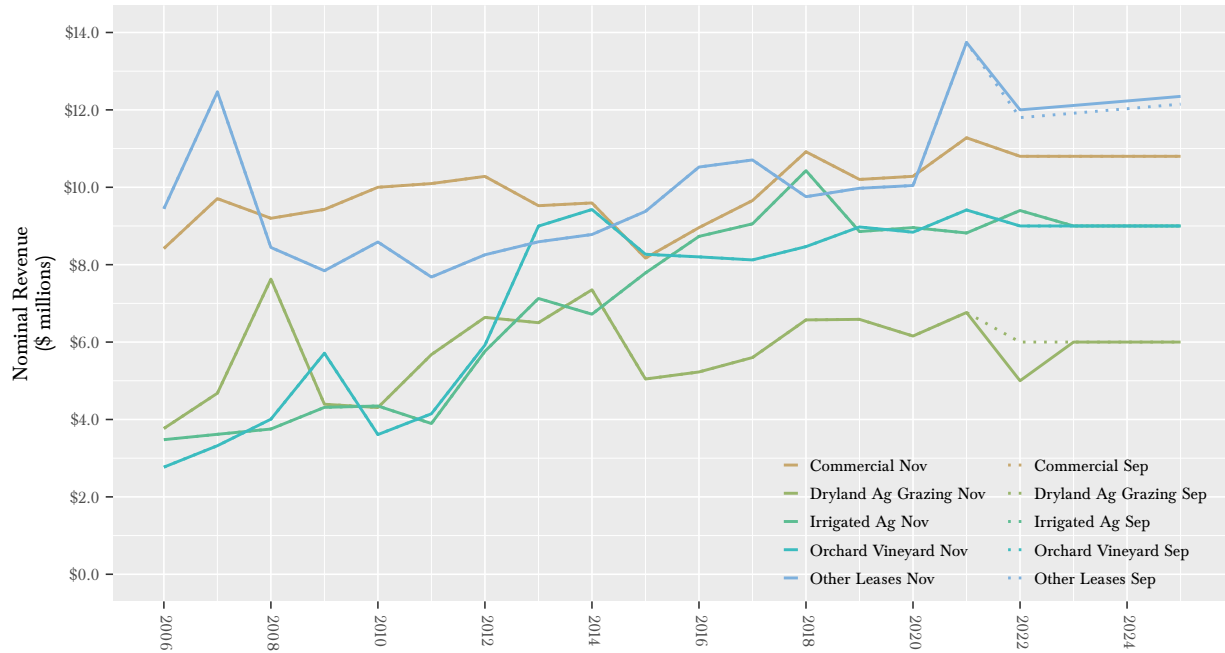
Aquatic Lands Revenues

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, but they have recovered somewhat and are now forecast to account for around 60 percent of aquatic revenue.

The aquatic lease forecast for FY 22 is reduced slightly due to slower mineral and hydrocarbon extraction on aquatic lands (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 considerably 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.

The geoduck forecast revenue for FY 22 is increased slightly to $17 million based on much higher harvests for contracts from the June auction. Additional harvest pounds were made available so that around 481,000 pounds of geoduck were harvested, instead of just the 393,000 that were originally auctioned. The revenue forecast for geoduck would have been increased more, to a little over $18 million, if harvests for the rest of the year didn't face significant risks. Harvesting on one of the more valuable tracts was unavailable for a time due to paralytic shellfish poison. And now that tract will be unavailable until early next year because of weather conditions, so it is unlikely that those lost pounds will be recovered for this fiscal year.

Additionally, there are serious issues with compliance vessel availability. Of the five boats DNR has for compliance monitoring, only two are regularly in working order at any given time. The rest need repairs, but these have been delayed indefinitely because the parts are unavailable.

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 seafood 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 have their revenue come in in FY 22.
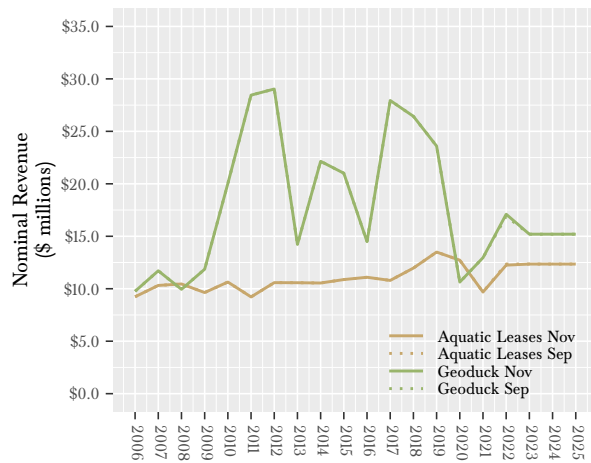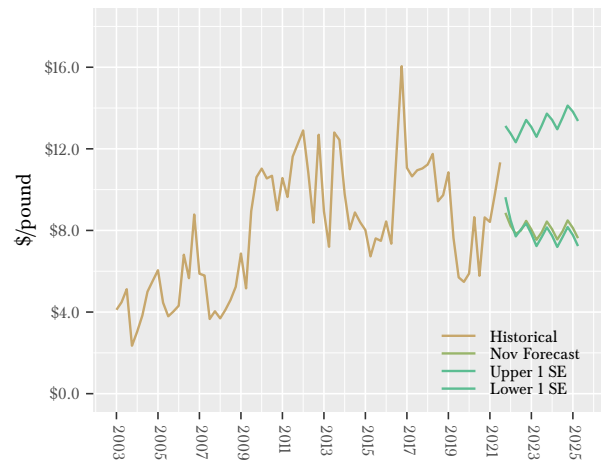
Figure 27: Aquatic Lands Revenues

Figure 28: Geoduck Auction Prices

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.

- 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.

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
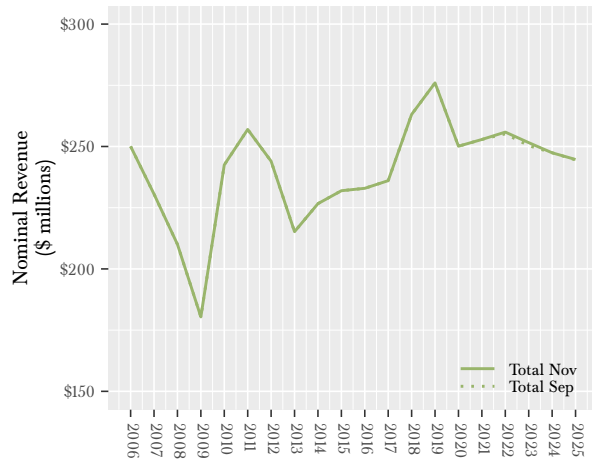
Distribution of Revenues

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 repeatedly authorized a fee of 25 percent for FDA since 2013, and a fee of 31 percent for RMCA since 2015.

The Forecast uses these deduction rates for the all forecast years based on the assumption that the Legislature and Board will continue to approve them.

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

Comparison of Forecast and Actual Values 2019-2021 Biennium

At the close of each biennium, the Office of Budget and Economics publishes a comparison of all past projections with final realized values for each of the two years. We do this to assess forecast accuracy, and as an exercise in improving our understanding of the history of our projections and of the models underlying the forecast. This comparison is for the 2019-2021 biennium — FY 20 and FY 21.

The comparison is made graphically, via waterfall charts instead of within tables, to make changes between forecasts readily visible and easily understandable. The charts share the same order as the revenue sources and funds in the main tables of each forecast. We address major influences narratively.

Additionally, it is useful to note that the initial forecasts are typically made based on the average revenue of the previous several years, adjusted for any underlying changes that we know about in the revenue source.

Waterfall Chart Guide

- The blue bar on the left of the chart is the initial projection, while the one on the right is the final value for the fiscal year.
- Red bars indicate a decrease in the projection from the previous forecast.
- Green bars indicate an increase in the projection from the previous forecast.
- The shading at the top of the final value shows the difference between the final value and the last forecast. In the example below the red signifies a final value lower than our last forecast in June. If the realized revenue was higher than expected, that section will be green.

Figure 30: Example - Normal School
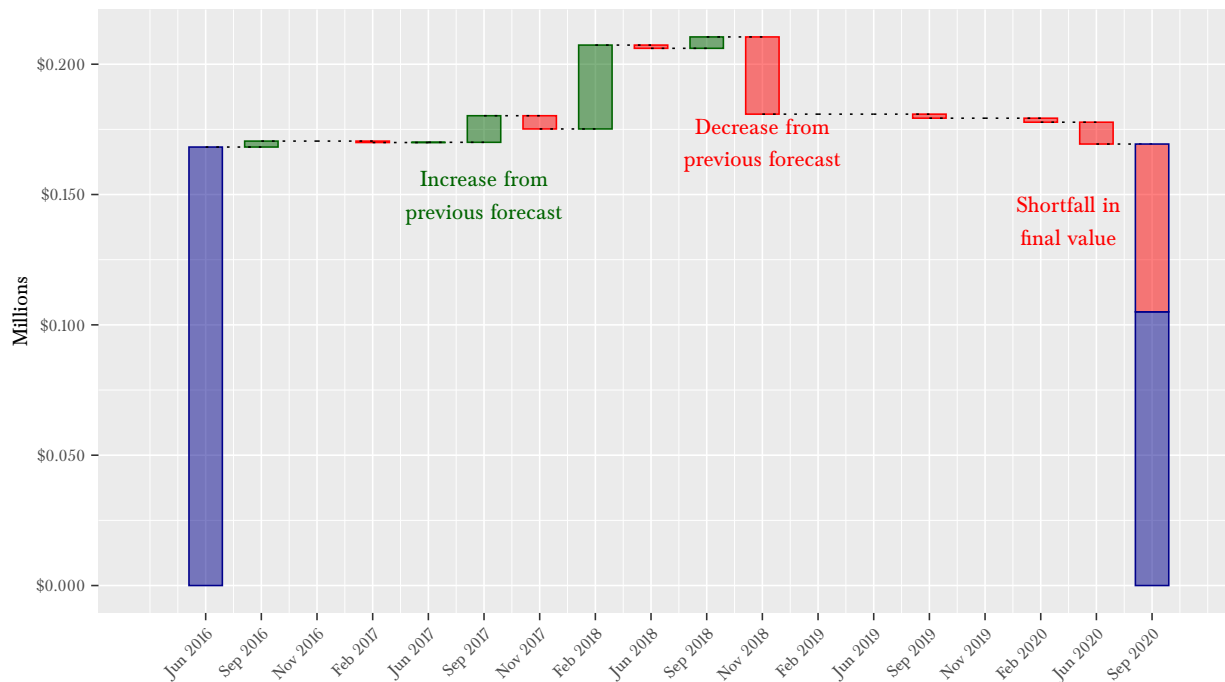
Revenue by Source

Timber Sales Volume

Figure 31: Timber Sales Volume
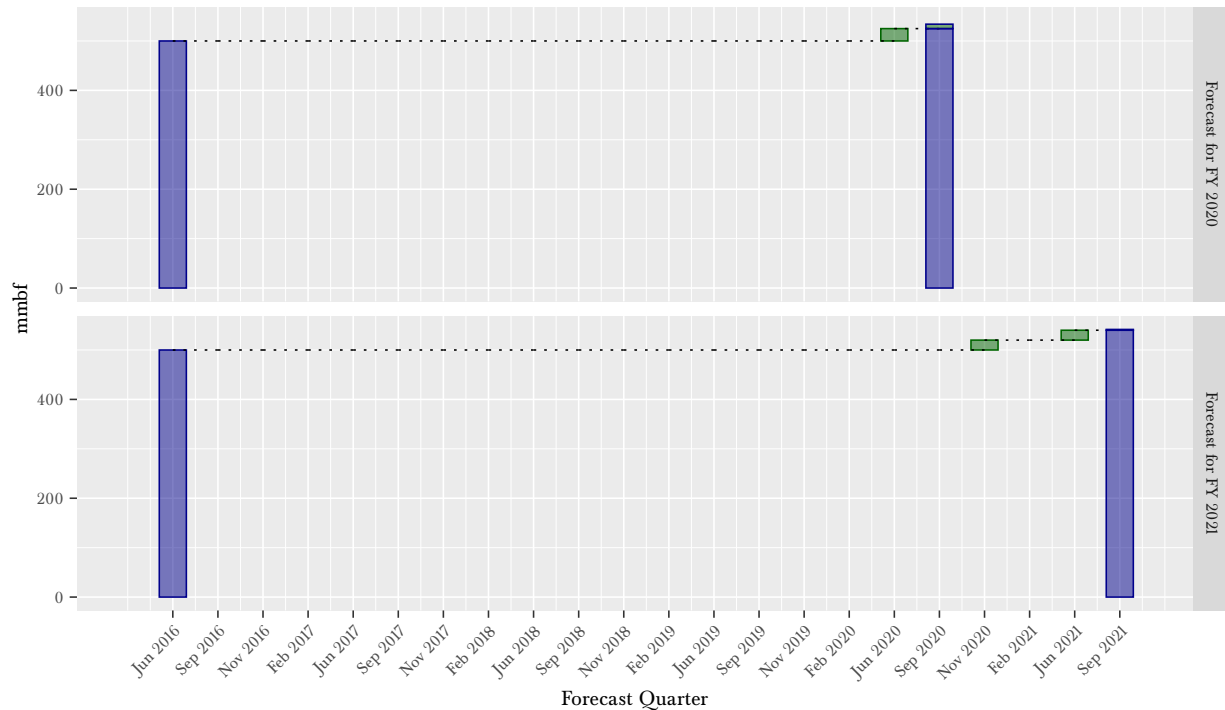
Typically, planned timber sales are not particularly concrete until a fiscal year starts, meaning that we do not often update the sales volume before September — the first forecast of a fiscal year. Even when there is a more solid plan, the volume of planned sales at the beginning of a fiscal year is frequently larger than the amount that actually sells. The plan often includes not only the new sales planned for the year, but also older sales from previous years that either received no-bids or were delayed for some reason.

A number of factors can keep a sale from being sold, but the main issues are either that the sale does not receive any bids when offered at auction, or that some unforeseen issue arises before the sale can be brought to auction. This can be from community opposition, road permitting or land access issues, or other planning issues.

As a general rule, planned sales from previous years are disregarded when forecasting timber sales. These sales have already had some issue, suggestingan increased risk of further issues. Additionally, some amount of the planned sales will likely not receive bids, even if they make it to auction. As a result, the forecast for a fiscal year is typically left at the annual long-term planned sales volume of 500 mmbf.

In September 2019, the first forecast of FY 20, the program was planning to bring 535 mmbf of new sales to auction and another 47 mmbf from previous years, for 582 mmbf of total planned sales. In September 2020, the planned auction volume for FY 21 was 578 mmbf, with 50 mmbf coming from previous years.

Taking only the new planned sales, and deducting between 8 and 10 percent for no-bids, each year was left at 500 mmbf.

The FY 20 forecast was not updated in the February forecast because, although sales volume was a bit higher than expected, there were a large number of no-bid sales for the fiscal year to date. In June, it was clear that actual sales volume would exceed the forecast. The FY 21 forecast was increased first in November 2020 when it became clear that there was very strong market demand for stumpage.

Timber Sales Price

Figure 32: Timber Sales Price
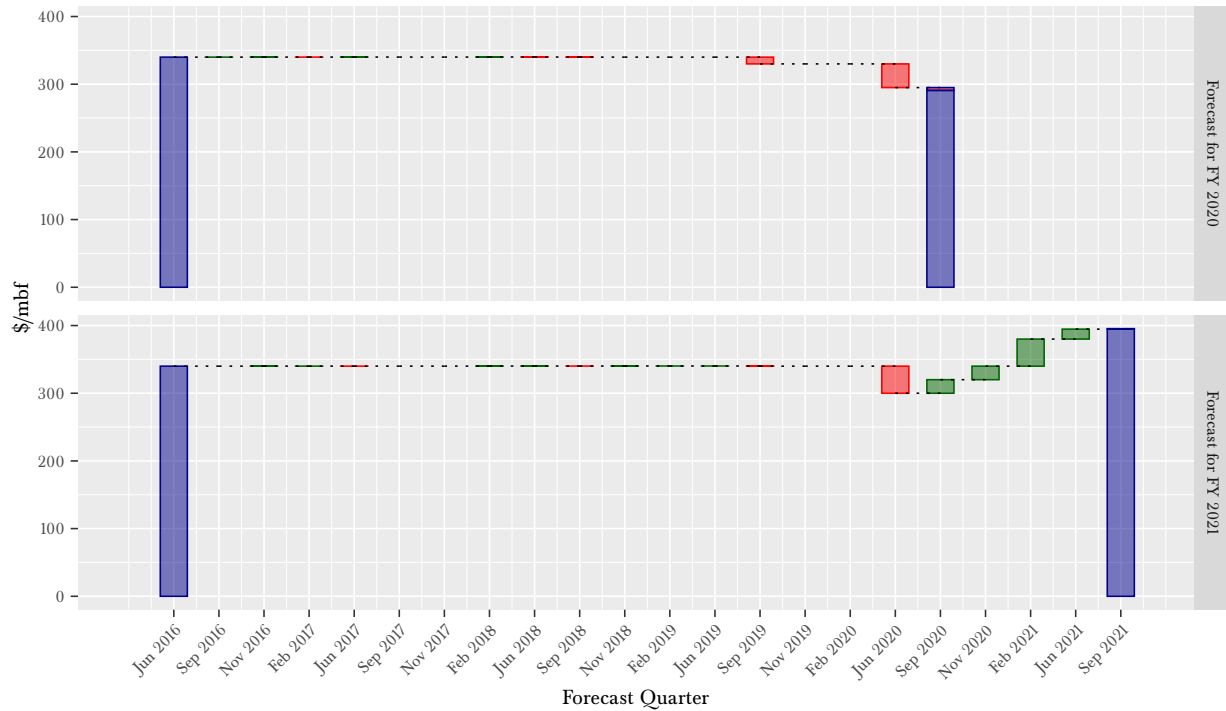
The initial sales price forecasts are based on the long-term average price. The average timber sales price forecast for FY 20 was reduced in September 2019 after the first two auctions of the year had very low prices. There was no apparent change in log prices or timber demand to cause the price drop. It seems instead that the low prices were due to the characteristics of the sales in those two months, with lower quality wood and/or higher costs associated with the sales. Prices recovered substantially in the subsequent sales, so that by February the forecast of $330/mbf was achievable. However, when it became apparent that COVID-19 was becoming a pandemic prices fell dramatically, so that in June 2020 the price forecast for both FY 20 and FY 21 were reduced.

However, prices recovered in July — jumping from $238/mbf in June to $347/mbf. From September 2020, the FY 21 forecast sales price was raised every forecast as prices remained remarkably strong on the back of strong timber and lumber demand.

Timber Removal Volume

Figure 33: Timber Removal Volume
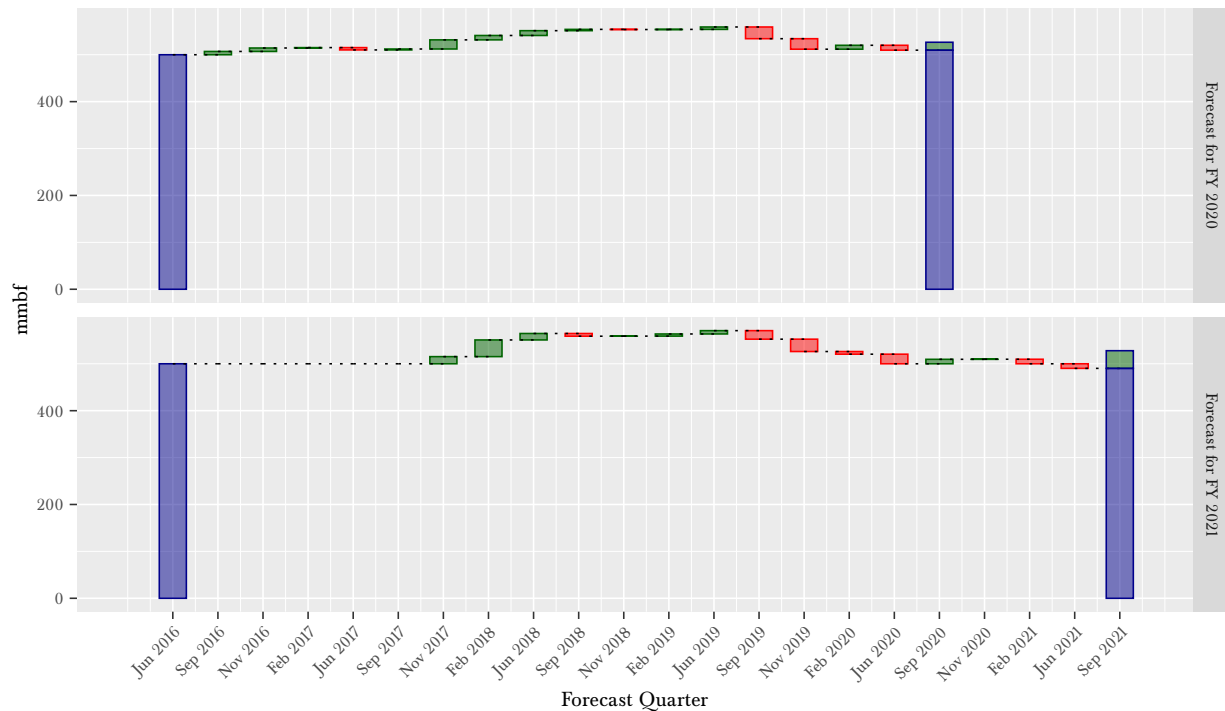
Similarly to the previous forecast comparison, in September 2019, these two charts illustrate an issue with our removal volume forecast. Briefly, the issue was with the structure of our previous volume forecast model. It was a deterministic model that assumed that the entire volume of current inventory would be harvested within four years and that harvest volume would equal sales volume after that. This seemed reasonable because stumpage contracts typically don't last longer than four years, and are generally only half that length.

However, this meant that if harvests were lower than expected as a fiscal year progressed, and the harvest forecast was lowered, that volume was pushed out to future years. This created a systemic overestimate of harvests that propagated through future forecasts.

The model didn't allow for the possibility for a large volume of inventory to remain over several years.

This forecast model was replaced in the September 2019 forecast, and the volume forecast was pulling down to closer to the average historical removal volume.

The final forecast of the removal volume in a given fiscal year is typically fairly accurate, as by that point most of the volume has already been harvested. FY 21 is an exception. It appears that one DNR region had yet to account for a large amount of timber that had been harvested over the year. This was all updated in June, after the forecast was completed, but before the end of the fiscal year.

Timber Removal Price

Figure 34: Timber Removal Price
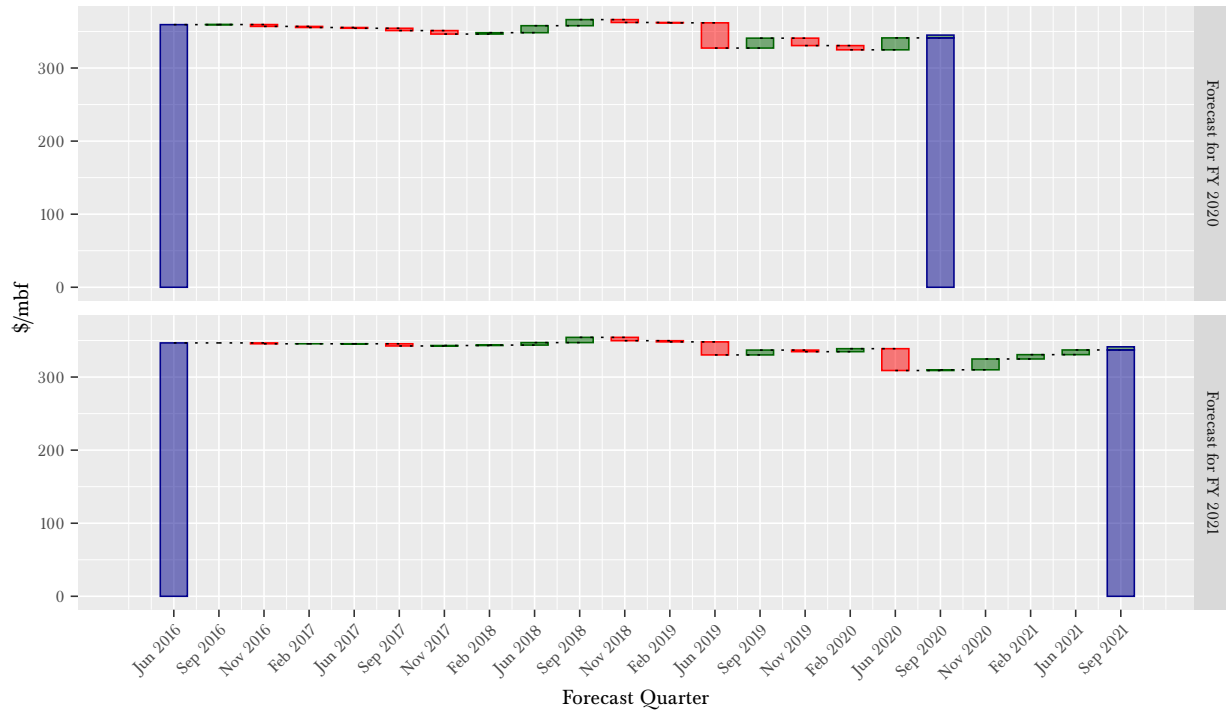
Timber removal price forecasts are a function of lagged sales prices or price forecasts, and the timing of harvests. The only notable change to the price forecast not seen in the sales forecast was in June 2019. The drop in the removal price forecast then was due to FY 19 harvests having much higher value than expected. Purchasers were harvesting higher-value timber, essentially pulling that value from future years into FY 19.

Timber Removal Revenue

Figure 35: Timber Revenue
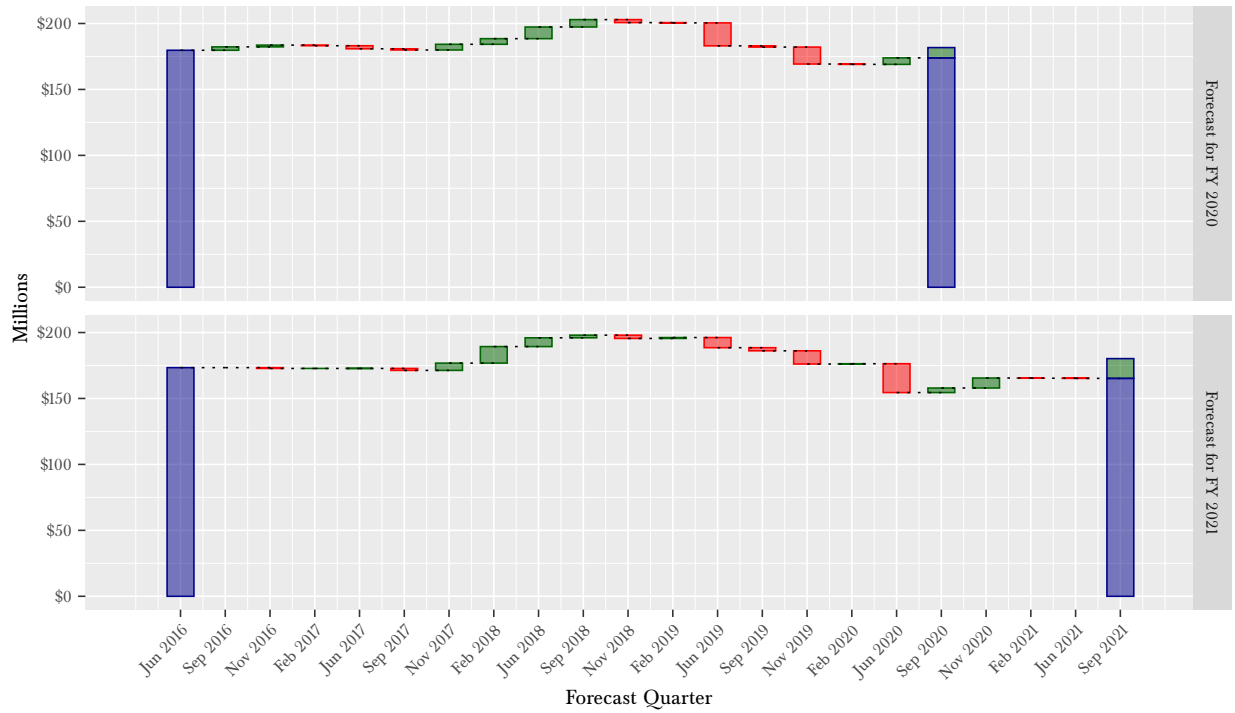
Timber removal revenue is a direct outcome of the removal price and the removal volume at a given time; the causes of changes in revenue can therefore be found in those sections above.

Agriculture and Other Uplands

Figure 36: Irrigated Agriculture
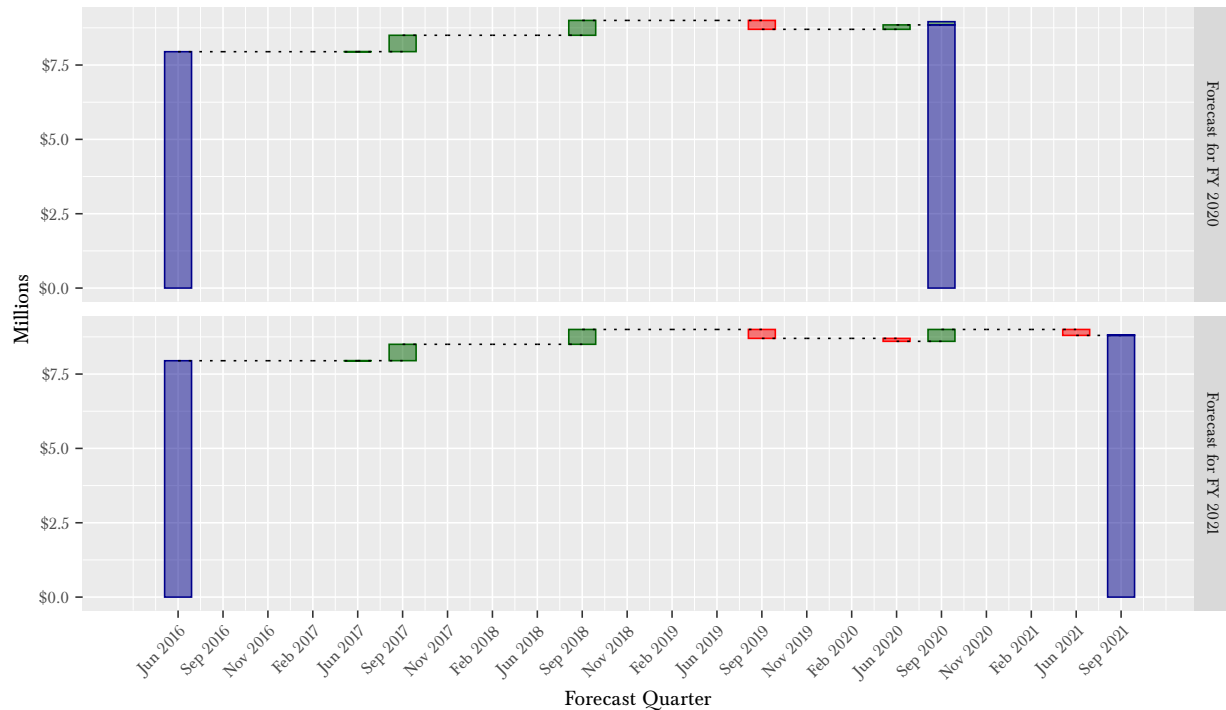
Increases to the revenue forecast for both fiscal years in the September 2017 and September 2018 forecasts were due to strong revenue in the previous fiscal years. Internal consultation with the agriculture program managers suggested that those revenue levels were not one-off events and were likely indicative of the longer-term underlying revenue potential.

In September 2019, the irrigated lease forecast was decreased for both FY 20 and FY 21 due to low irrigated agricultural prices. Changes in irrigated product prices tend to affect DNR revenue in the following years because of the structure of the leasing contracts. Some of those contracts are on a crop-share basis, where DNR receives some value of what is actually produced. For those leases, prices in one year actually drive revenue in the following fiscal year. The remaining leases have a set rental payment are typically increased annually based on a five-year average of the agricultural PPI. This means that the price changes in any one year have a muted effect on the revenue from these types of leases in the following years.

FY 21 forecast revenue was increased in September 2020 due to consistently high revenue through FY 20, and new leases that had been signed and were starting to generate revenue.

Figure 37: Orchard/Vineyard Agriculture
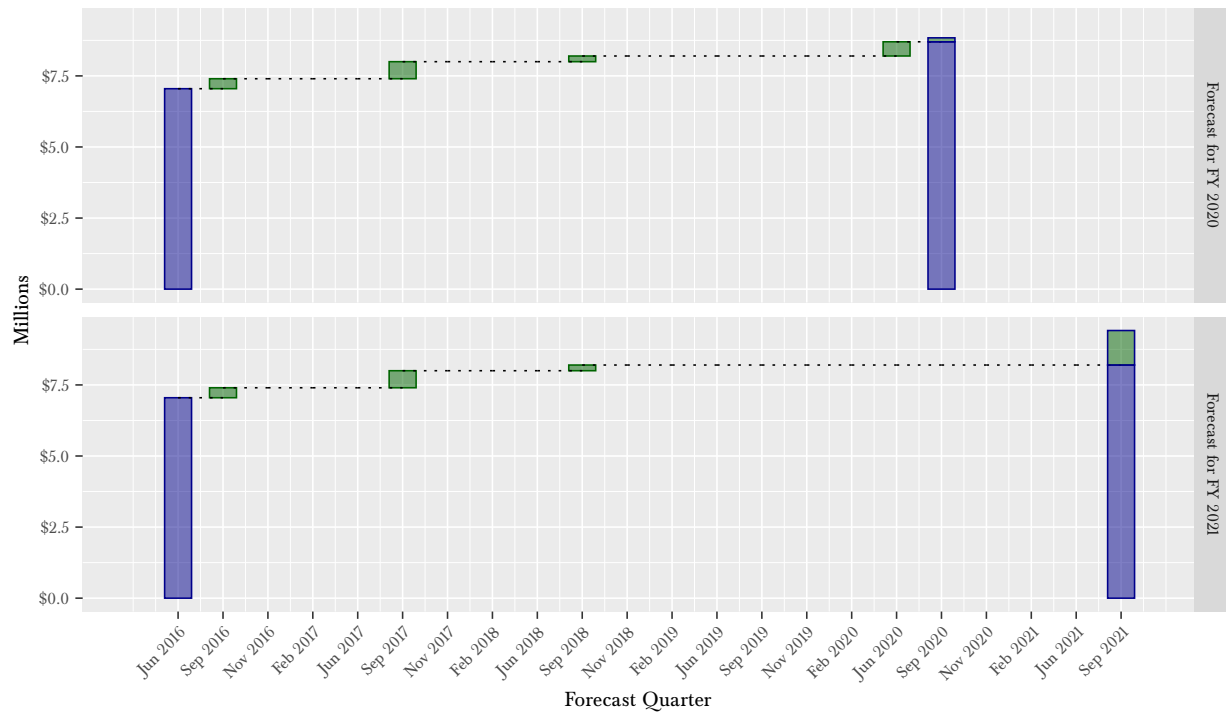
Similarly to irrigated agricultural leases, in the September 2016 and 2017 forecasts, the orchard/vineyard revenue forecast was increased due to prior years' higher-than-expected revenue. For instance, in September 2017 we noted that orchard/vineyard revenue had been above $8 million for the previous five years, but our then-current forecast was only $7.4 million. Additionally, new projects were coming online at the time that would further bolster revenues.

The forecast for both years was increased again in September 2018, again due to higher revenue in the previous years. However, the changes in that forecast were smaller than previous changes because there was also a rent abatement agreement with a lessee done to support an irrigation project in the Paterson area in Benton County.

The FY 20 revenue forecast was increased in June 2020 due to higher-than-expected revenue through that fiscal year.

The final revenue forecast in June 2021 for FY 21 was well off from the actual revenue for the year. The monthly revenue through the year had varied much more than previous years. Months that typically have lower revenues had much lower revenues, but months that typically have high revenue generally made up for the shortfall with much higher revenues. The forecast used data through April, and although they were a bit lower than normal, it was assumed that May and June 2020 would be a reasonable indicator of May and June 2021 revenue. That was not at all the case and the May-June 2021 revenue was the highest it has ever been. So instead of being accurate or a little bit under, the June 2021 forecast was around $1.2 million lower than the final revenue for the year.

Figure 38: Dryland and Grazing Agriculture
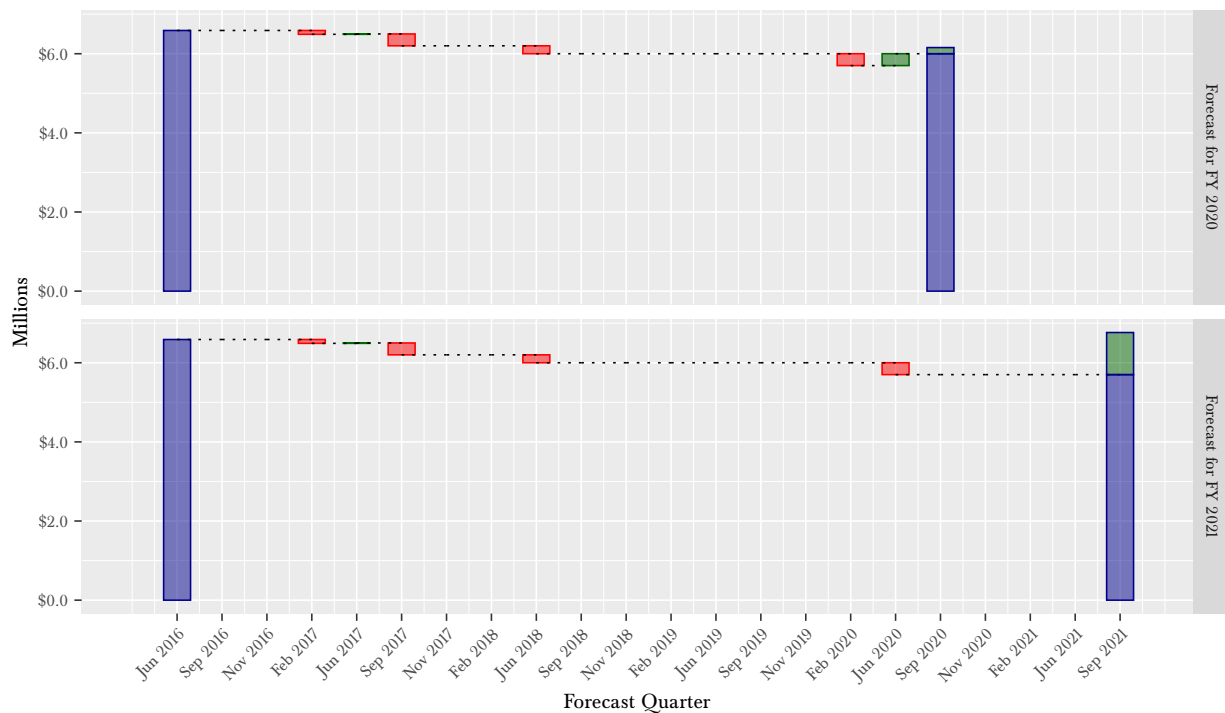
The dryland lease forecasts were decreased in the February and September 2017 forecasts because of consistently low wheat prices. The grazing forecast were reduced in June 2018 because grazing lessees had been disputing rent rates and rolling back rent increases.

In February 2020, the FY 20 forecast was reduced. By February the dryland program had around 17 percent of the wheat harvest remaining to sell. Given the wheat prices at the time, it looked like this would result in around 80 to 85 percent of the average revenue. It's unclear why this calculation didn't work, but by June it was clear that actual revenue was already just shy of the original $5 million forecast.

In June 2020, the FY 21 dryland forecast was reduced based on lower prices and the likelihood of slower economic growth suppressing demand. Although wheat prices increased through FY 21, the flow of revenue supported our forecast. By the June 2021 forecast, the agriculture program had sold all of the wheat for the year and had enough cash-on-account (monies that have been received but not yet recognized as revenue) to bring the actual revenue up to our forecast.

However, in the end, the forecast was much lower than the actual revenue received, with the largest revenue ever in May and June. We were unable to determine why our final forecast was so far off.

Figure 39: Commercial
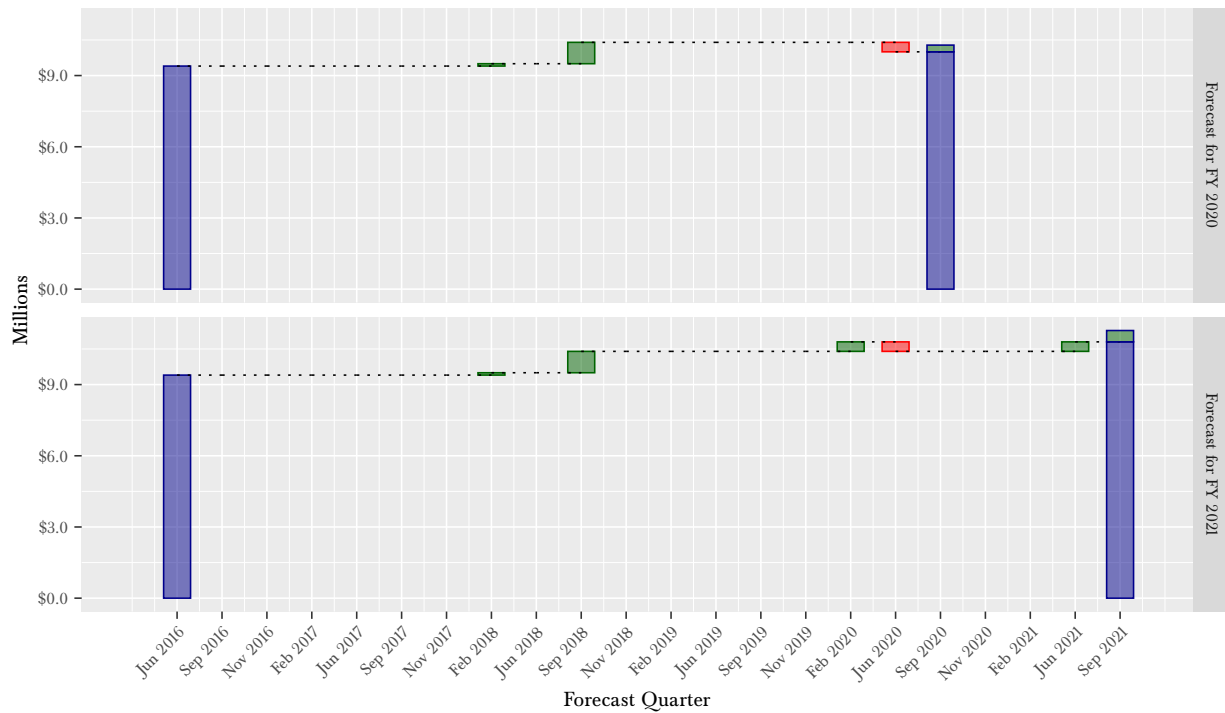
In September 2018, the commercial revenue forecast was increased in both FYs 20 and 21 to $10.4 million. This was based on a review of all of the commercial leases at the time and policies implemented by the program to better contain management costs.

In February 2020, the addition of a new lease warranted an increase to the FY 21 and outlying years' commercial revenue forecast.

In June 2020, both FYs 20 and 21 revenue forecast were reduced due to the effect of COVID-19 on revenue. At the time of that forecast, a number of lessees had requested rent deferments and there were serious downside risks. These weren't as severe as we expected for either year. Very little revenue was missed in FY 20, and commercial lessees were able to pay all of their regular rents and pay back the little that had been deferred.

Figure 40: Other Non-Timber Uplands
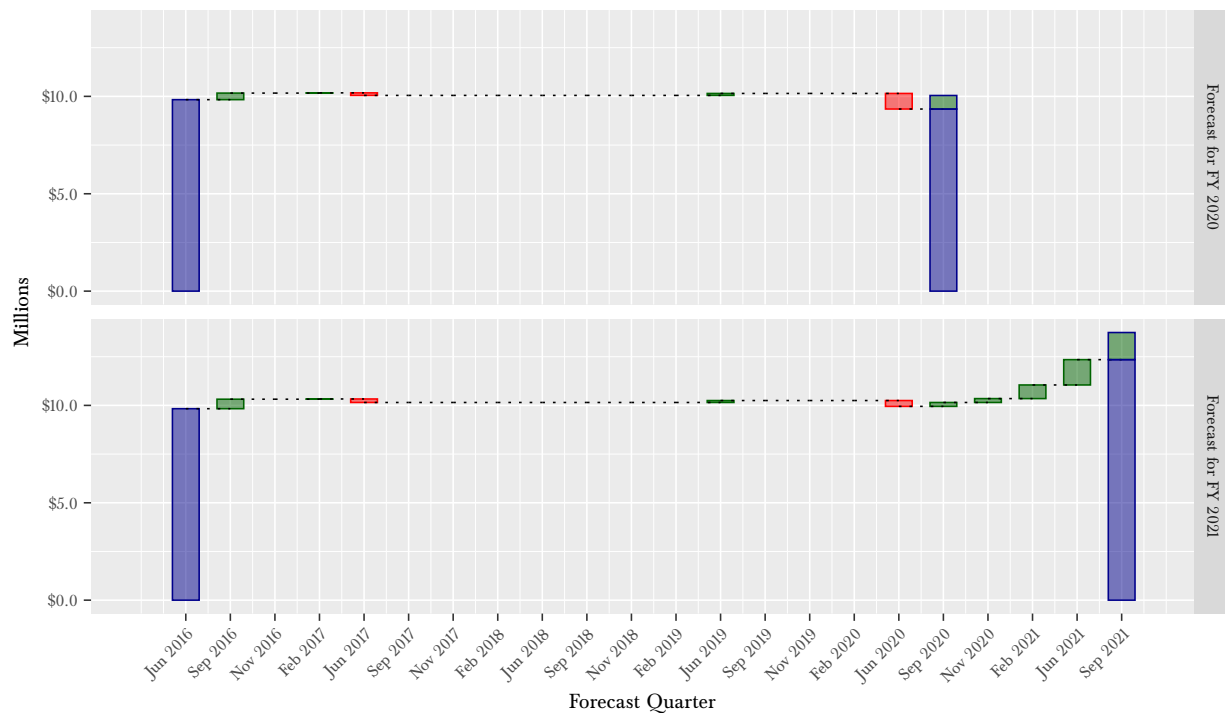
Other non-timber uplands is mainly comprised of communications, mineral and hydrocarbon, and special use leases. Special use leases are a catch-all category for leases that include solar and wind power leases, among others.

In September 2016, the communications lease forecast was increased due to these leases having incremental lease increases built into their contracts.

In June 2020, again, these sources were reduced based on the impacts, and the risk of further impact, from COVID-19. Again, for FY 20 these were not as bad as expected.

From September 2020, the FY 21 forecast was increased every forecast. In September 2020, this was due to a minerals and hydrocarbon increase, influenced by the higher-than-expected FY 20 revenue and strong demand. In November, it was due to increased expectations for communications because a number of leases were being renegotiated and had lump-sum back-rent payments due.

In February and June 2021, the forecast was increased dramatically due to communications and minerals and hydrocarbon generating more revenue than expected, as well as much more revenue coming from special uses and rights-of-way easements. The increased easement revenue was the result of concerted efforts by the program to get closer to market rates for the rights-of-way agreements, while the increase in special uses appears to be due to renewable energy projects.

In the end, even the final forecast was too conservative, with higher-than-expected revenue in communications, commercial, and special use leases.

Aquatic Lands

Figure 41: Aquatic Leases
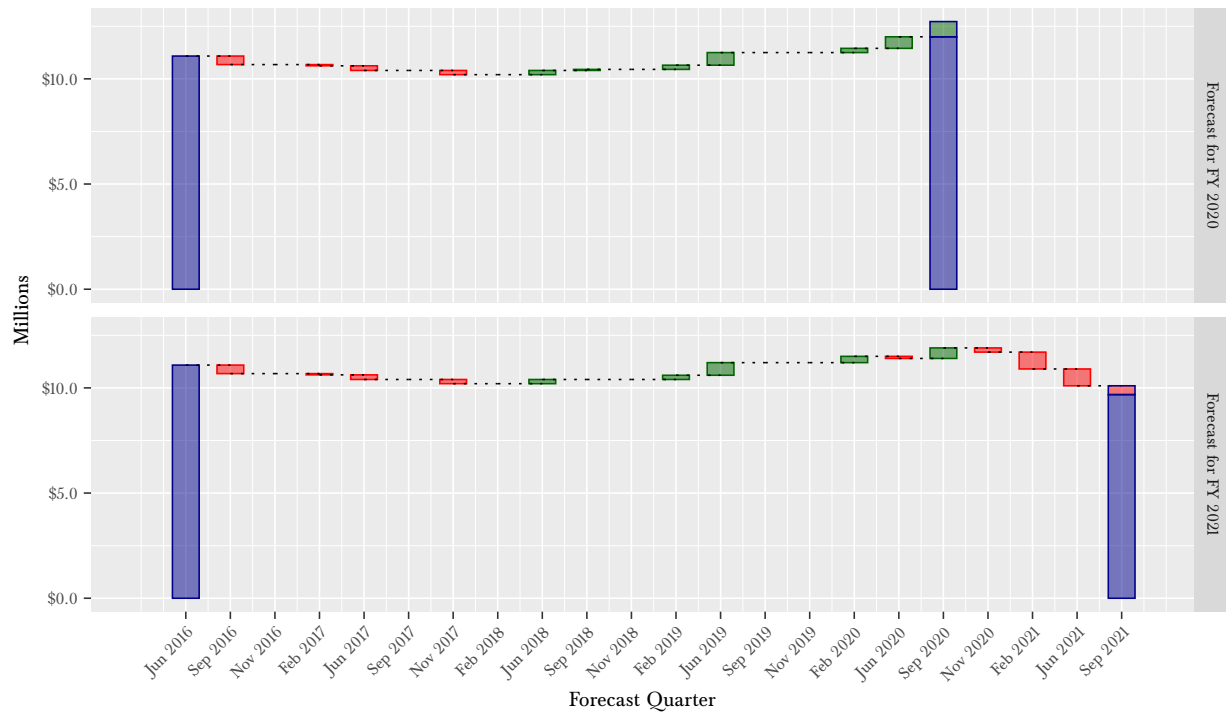
In September 2016, aquatic lease revenue was reduced for all outlying years because asset valuations of water-dependent leases, which drive lease rates, continually came well under program expectations. This undermined previously built-in increases.

In June 2019, aquatic leases were increased based on continued stronger-than-expected revenue in a number of different lease sources that looked likely to continue.

In June 2020, FY 20 aquatic lease revenue forecast was increased based on revenue to date, while the FY 21 forecast was decreased slightly due to reversals of aquaculture rent increases. At the time of that forecast, it was not thought that COVID would have a significant impact on aquatic leases.

Indeed, the aquatic lease forecast was increased in the September 2020 forecast due to revenue for water-dependent and non-water-dependent rents that have been consistently higher than expected. At the time, we wrote that we had no reason to suspect that revenues would be lower in the future. However, at the time of that forecast, we were unaware that a major non-water-dependent lessee was already having difficulty paying rent and had agreed to a rental deferment.

In November 2020 we reduced the non-water-dependent revenue forecast because to-date revenue was much lower than we expected, although, at this point the lessee had started paying its monthly rent again.

In February 2021, non-water-dependent rents were reduced because the division was having issues getting the deferment and payback agreement into the financial system — although the lessee had paid DNR,

the money was not recognized as revenue.

In June 2021, aquatic revenue was dropped further because rents were still below even our lowered expectation. In September 2021, we discovered that much of the rent from FY 21 for that single lessee was held in cash-on-account instead of applied to revenue because of the difficulties with the internal financial system. This revenue was applied in the first quarter of FY 22. This, effectively, reduced the recognized revenue of FY 21 and pushed up the revenue for FY 22.

Geoduck

Figure 42: Geoduck
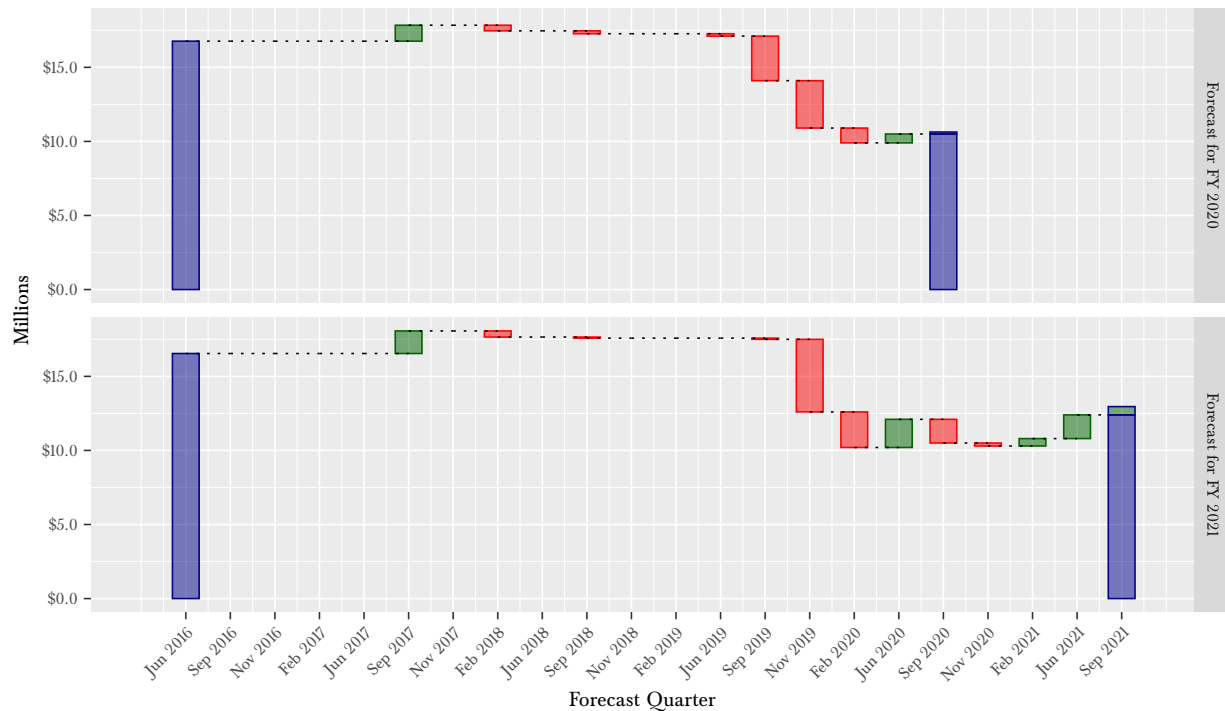
In the September 2017 forecast, geoduck revenue for all years was increased based on consistently high auction prices. This suggested that a new, higher equilibrium price level had been reached, relative to previous assumptions.

This new price assumption remained relatively intact until September 2019. In early 2018, the U.S. administration started imposing tariffs on Chinese imports. In retaliation, China imposed tariffs on a number of U.S. imports to China, one of which was geoduck. The 25 percent tariff on geoduck was introduced in June 2018. We were initially wary of the tariffs, unsure of the effect they would have. Previously, China has imposed bans or restrictions on Washington geoduck, but these have not always had a noticeable effect on prices or demand. Additionally, DNR offered rebates for harvesters who were affected by the tariffs.

Prices fell a little in late 2018, but geoduck prices are notoriously volatile and the prices were still largely in line with historical averages . However, from the May 2019 auction, prices fell dramatically, from an average of $10.07/lb. in the first three auctions to only $7.63/lb. By the beginning of FY 20, it was clear that this drop was not an outlier. In September 2019, FY 20 was reduced to reflect the new prices and, in November 2019, both FYs 20 and 21 were reduced based on the new prices and demand.

These decreases were significant enough that in June 2020, when the COVID pandemic was first affecting most other parts of the forecast, the geoduck forecast was increased based on stronger-than-expected prices. This was reversed in September 2020 as the pandemic continued.

As China progressed on containing the pandemic, demand for geoduck started to return. Prices were

higher in the latter half of 2020, so in February the forecast was increased slightly. Additionally, the first two auctions of 2021 had much higher prices than expected, and the June 2021 the forecast was further increased.

Total Revenue

Because timber revenue is such an overwhelming proportion of total revenue, changes to timber removal volume or prices largely drive changes in total revenue. Figure 43 presents a summary of all of the foregoing forecast changes.

Figure 43: Total All Sources
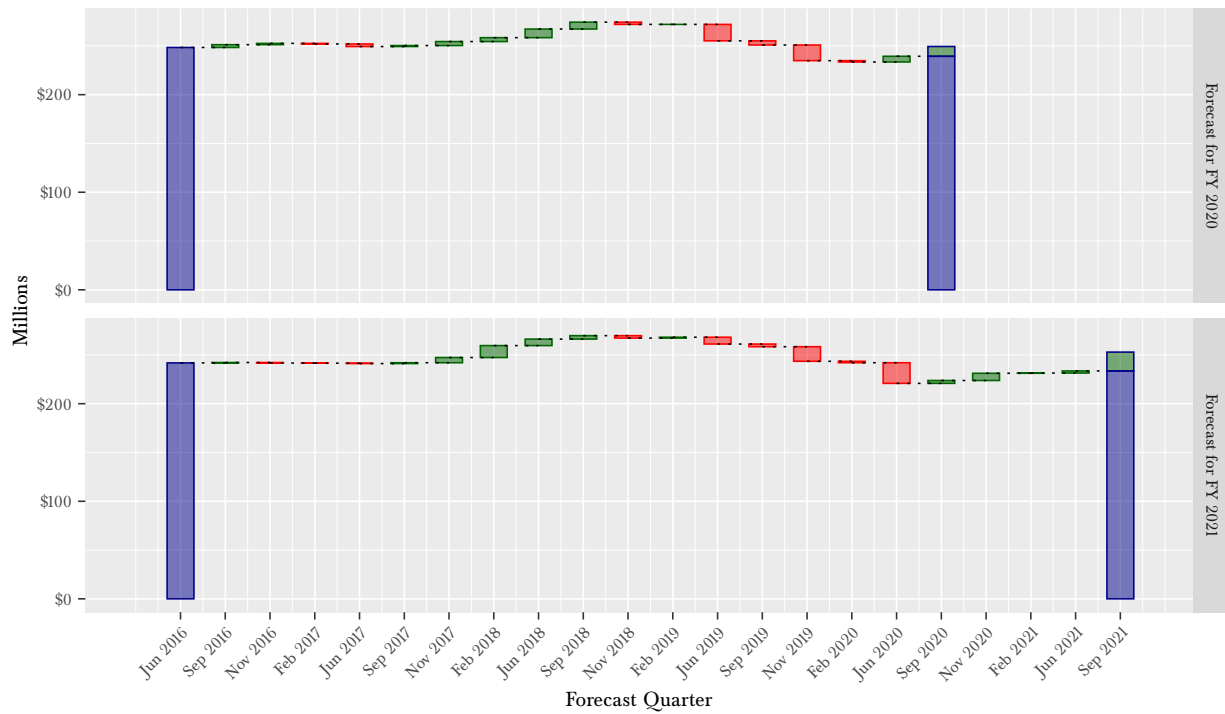
Revenue by Fund

Fund revenues are entirely driven by source revenue, and they are overwhelmingly derived from timber revenue for all but the aquatic funds. Because actual fund revenues are driven by specific lands where timber is harvested, or other revenue-generating activities take place, the forecasts for these revenues are based upon the best available information about inventory and planned sales by trust. Small changes in where timber sales are planned or small differences between where we assume timber will be harvested and where it actually is harvested can have outsized effects on individual fund revenue forecasts. This is particularly true for funds with smaller land bases.

RMCA Uplands
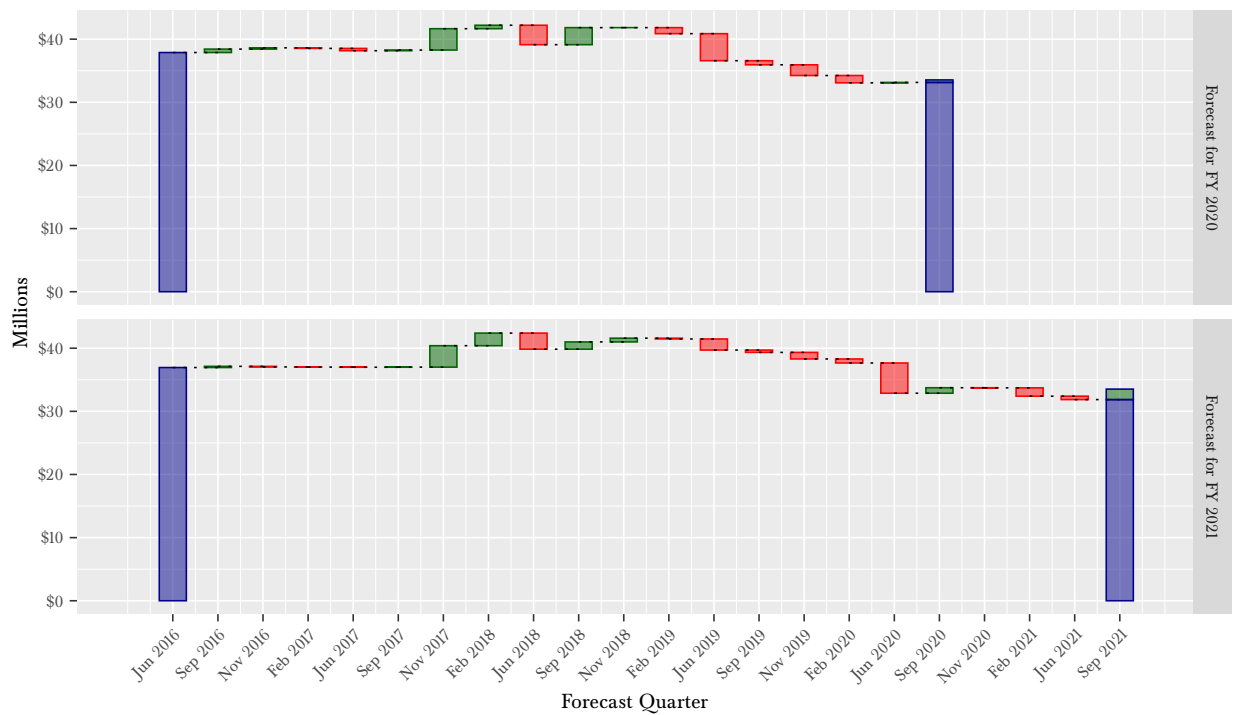
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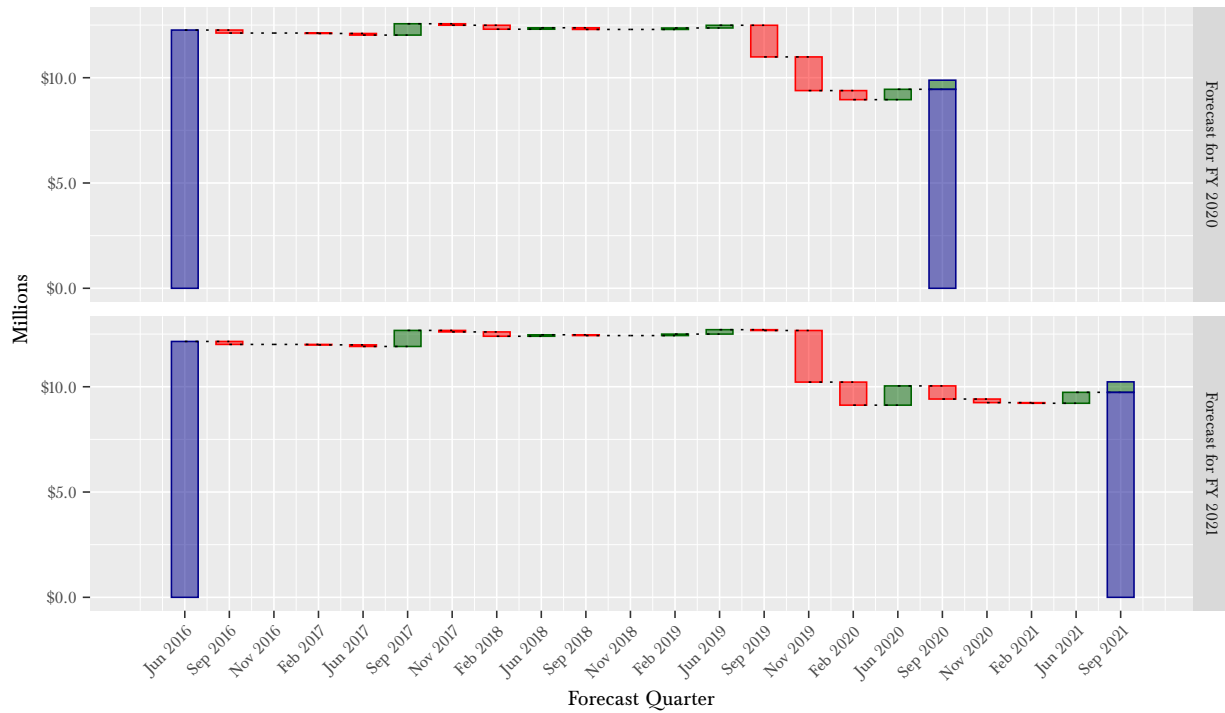
FDA
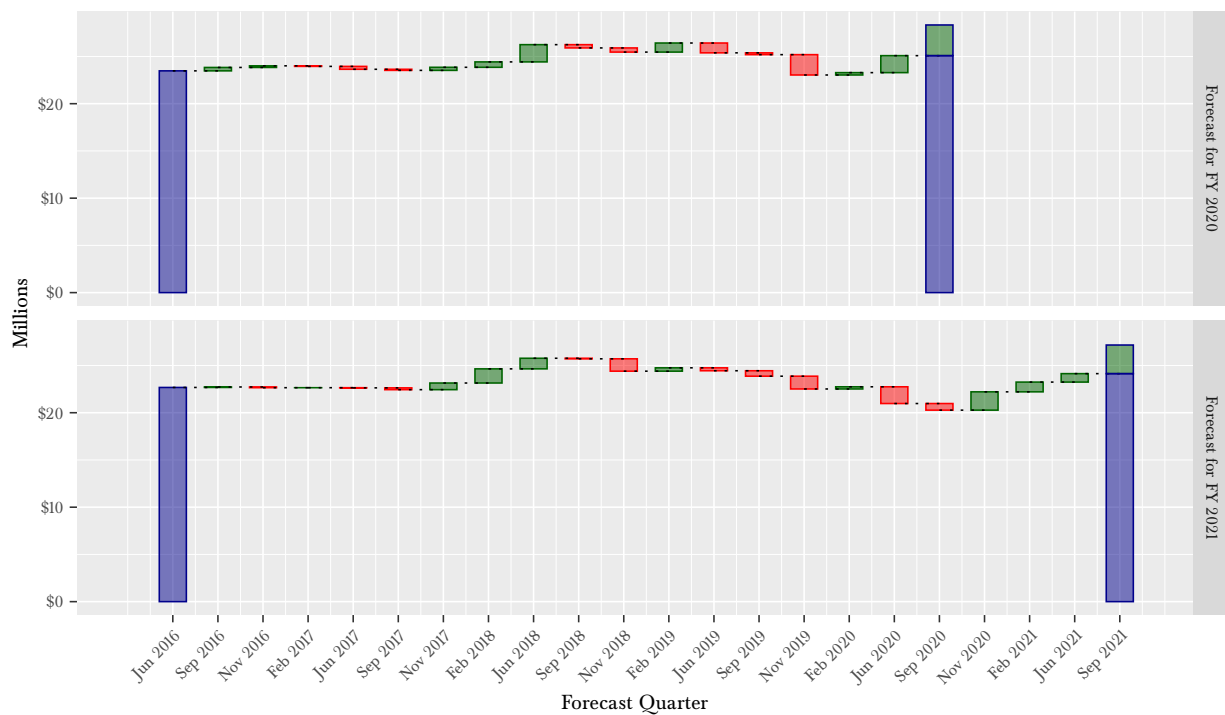
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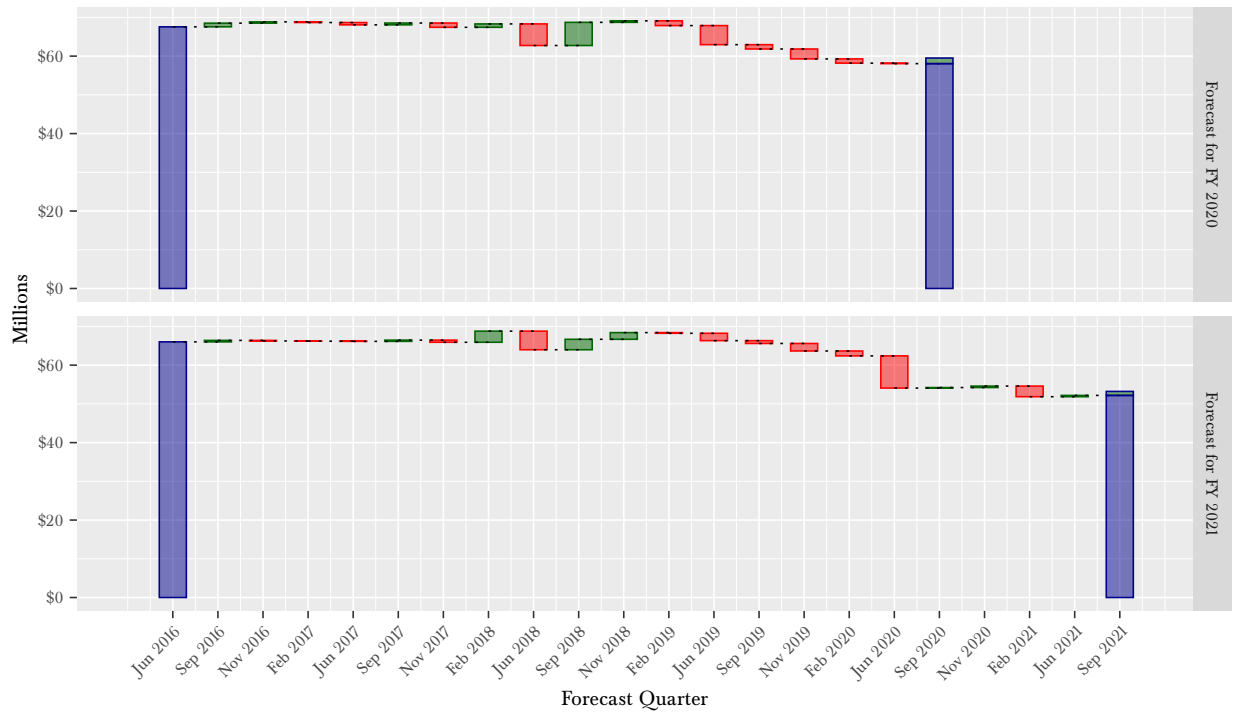
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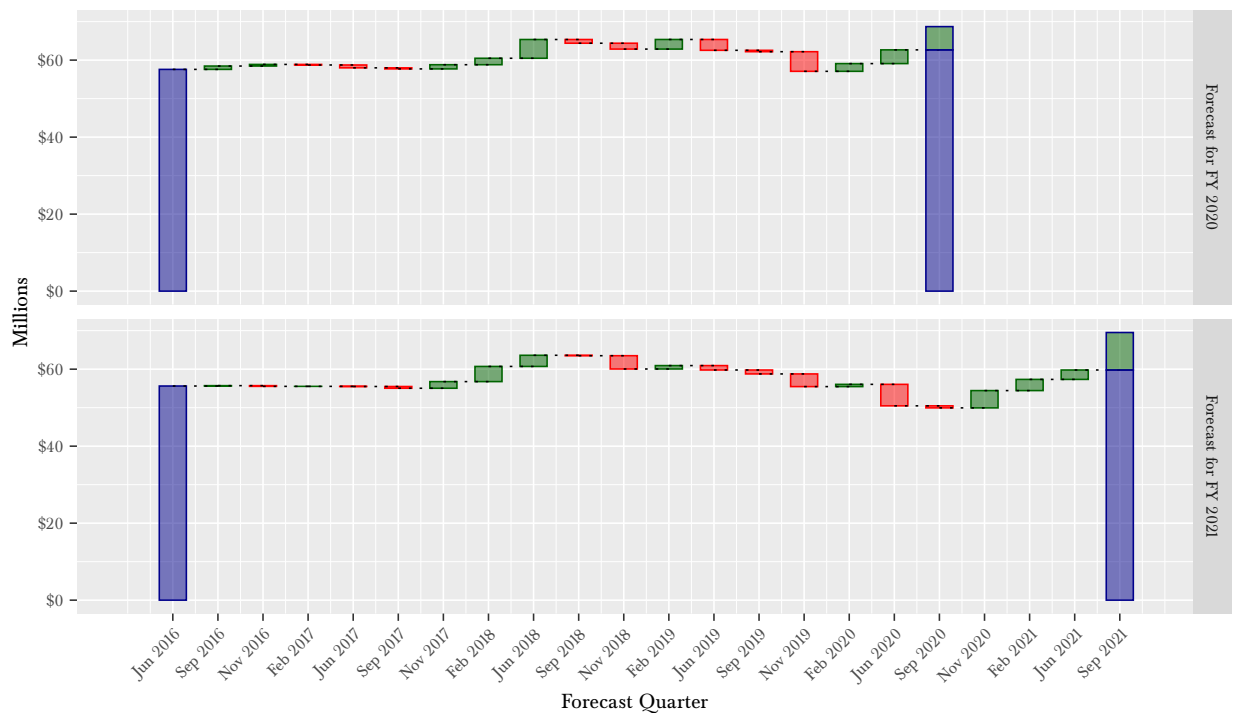
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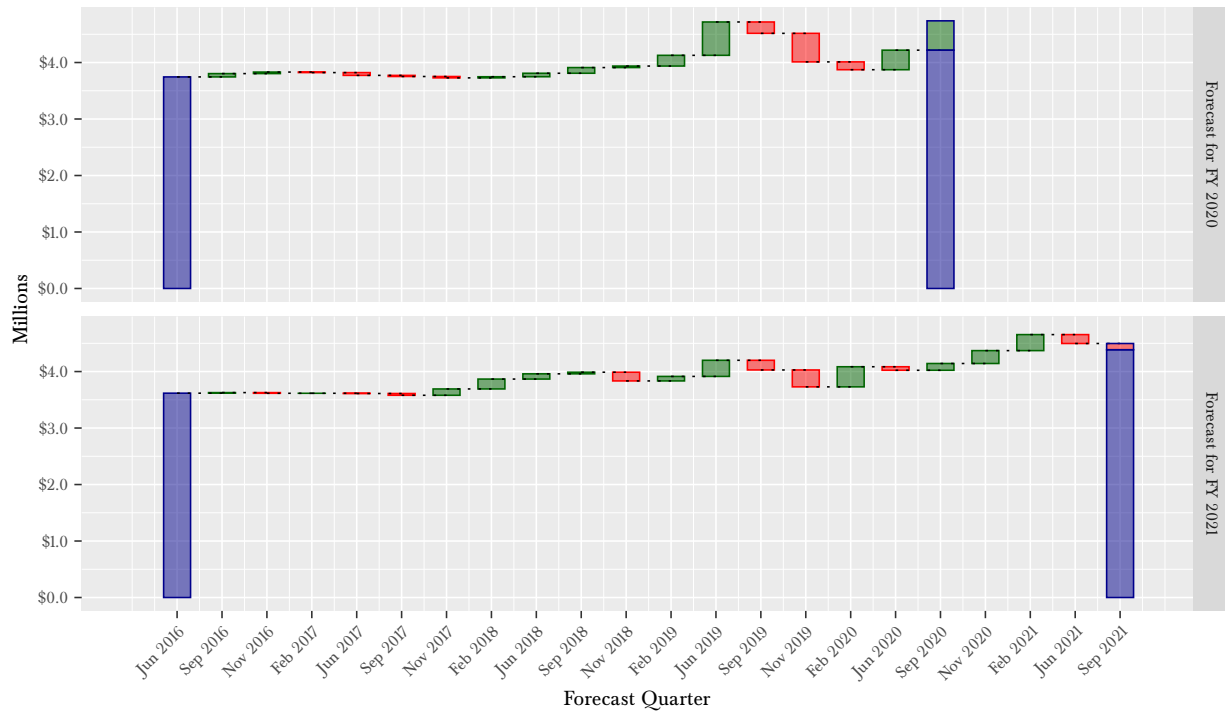
University Bond Retirement
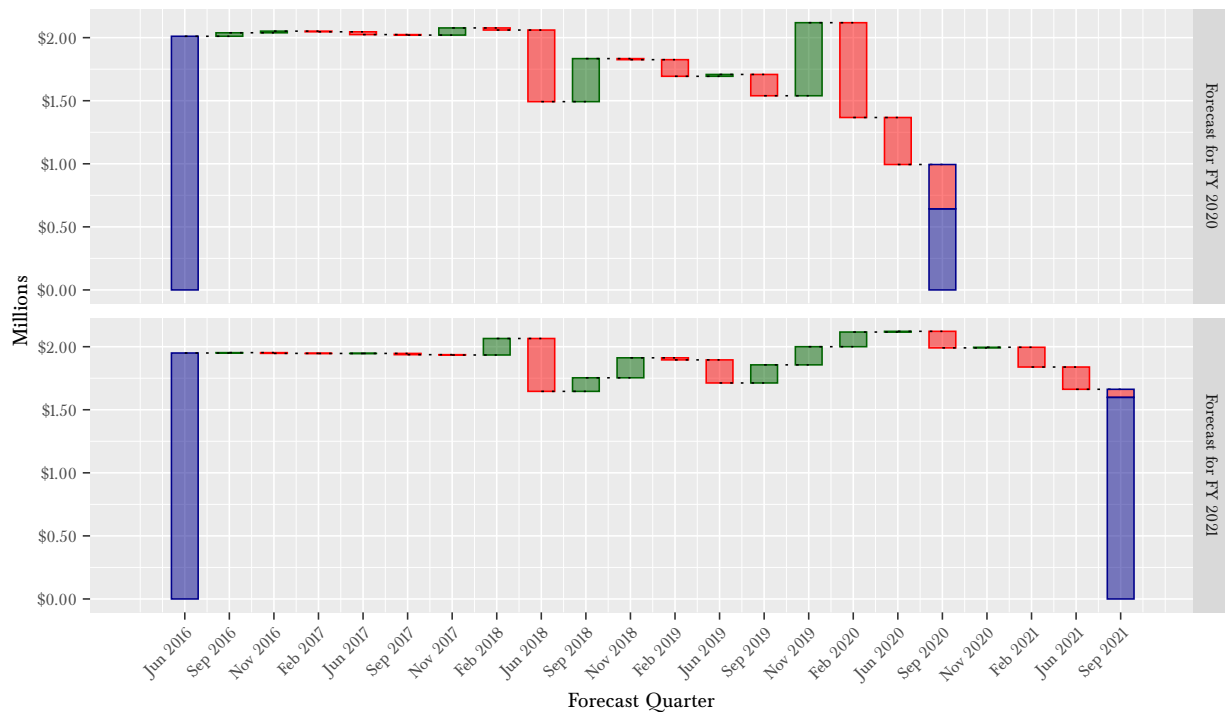
WSU Bond Retirement
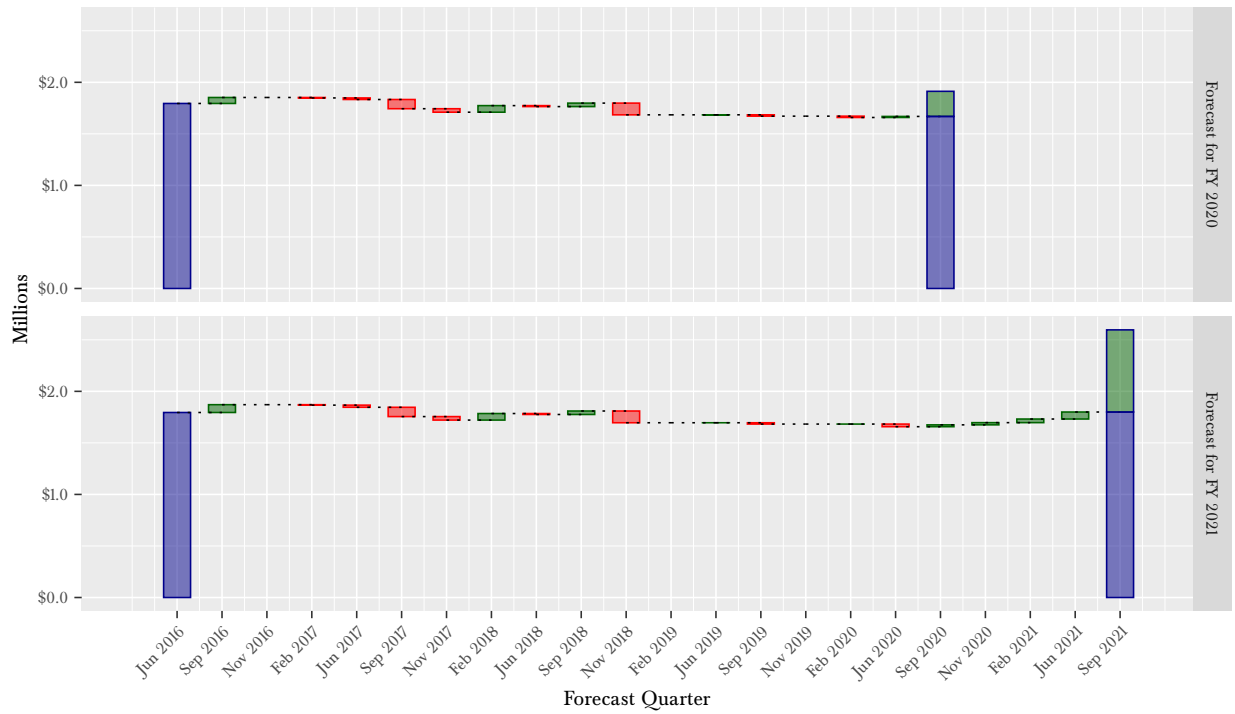
CEP&RI
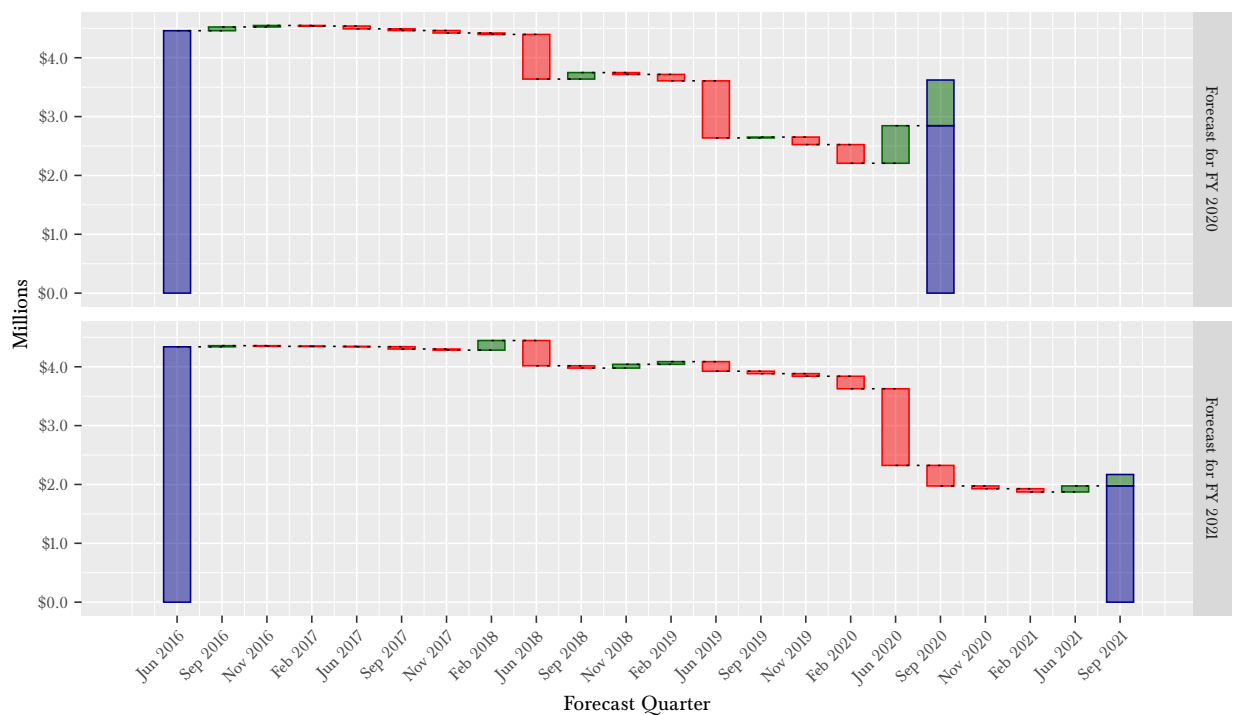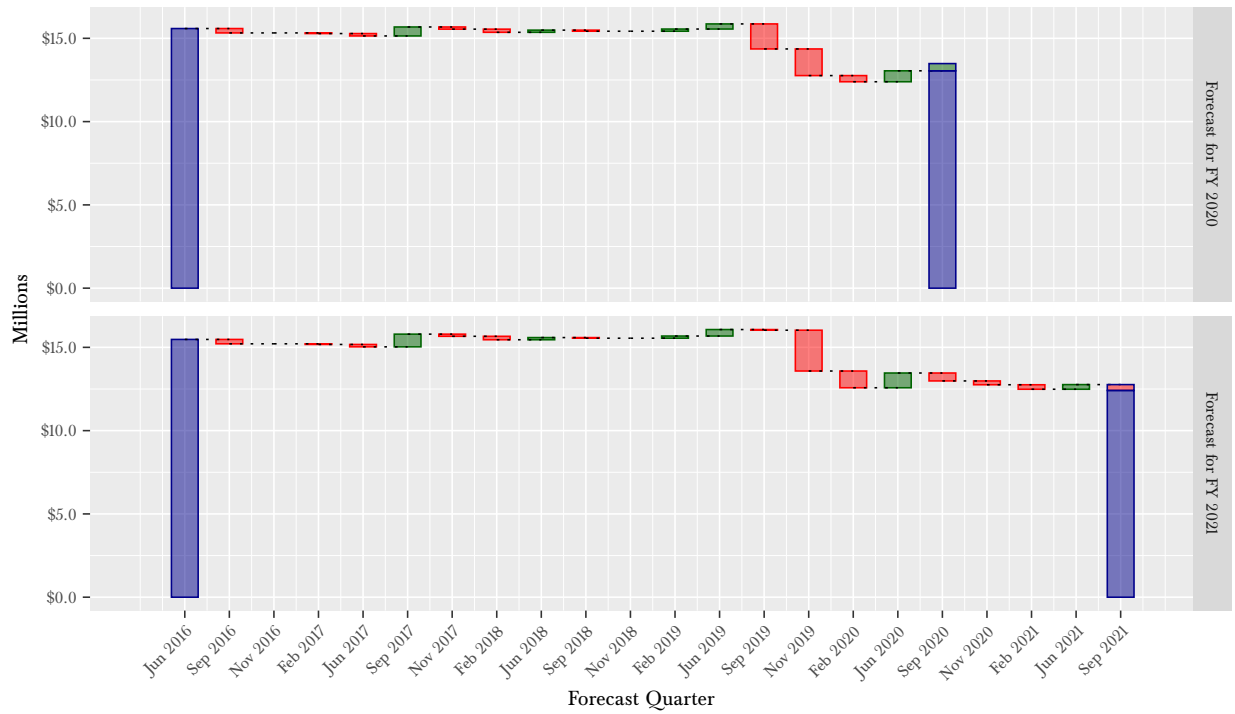
Capitol Building Construction
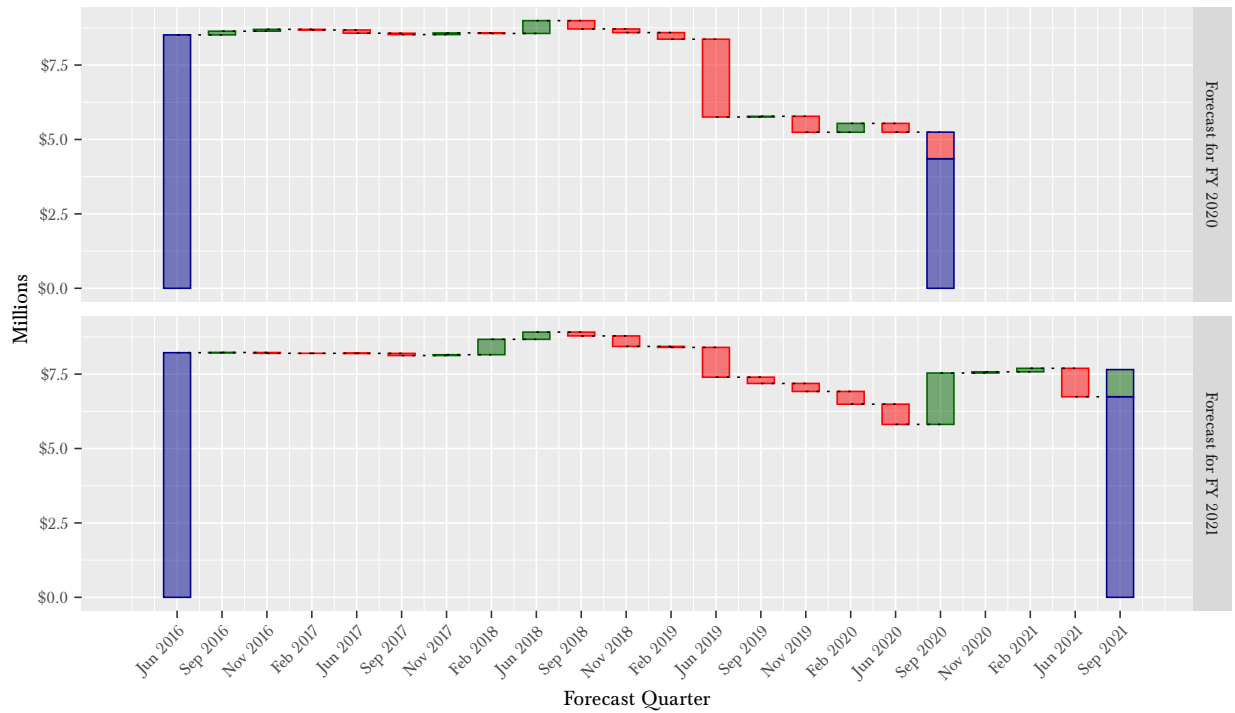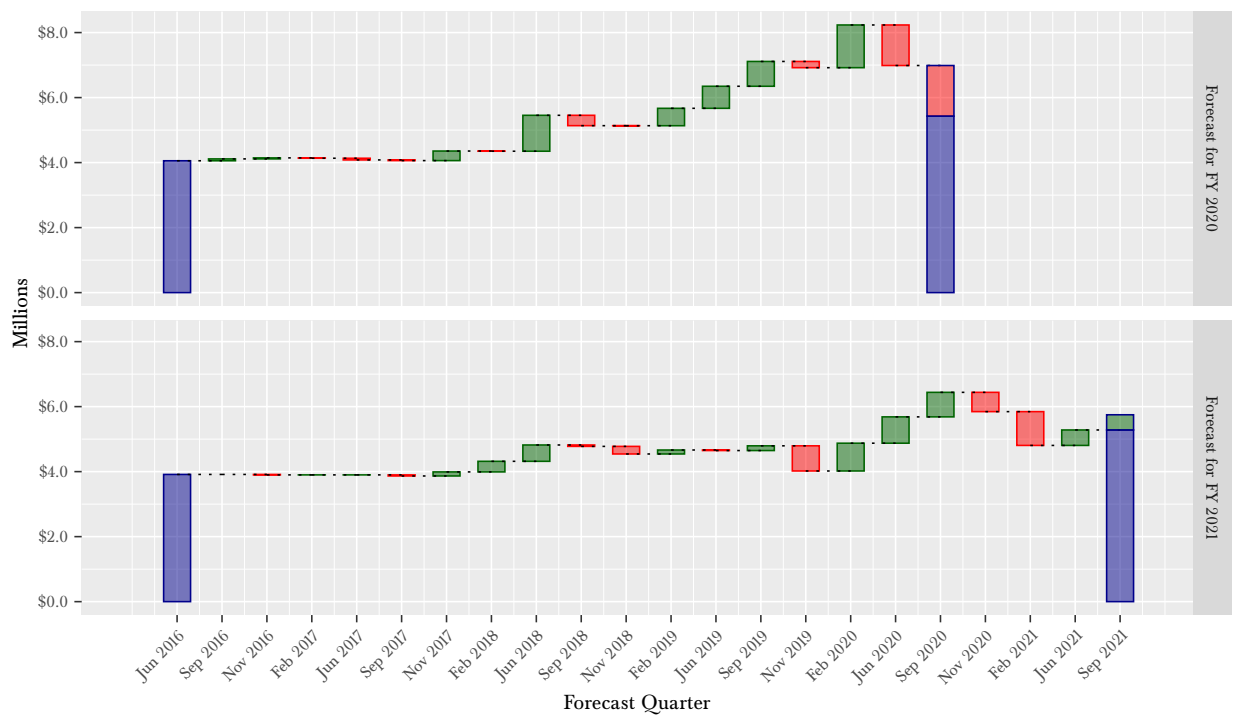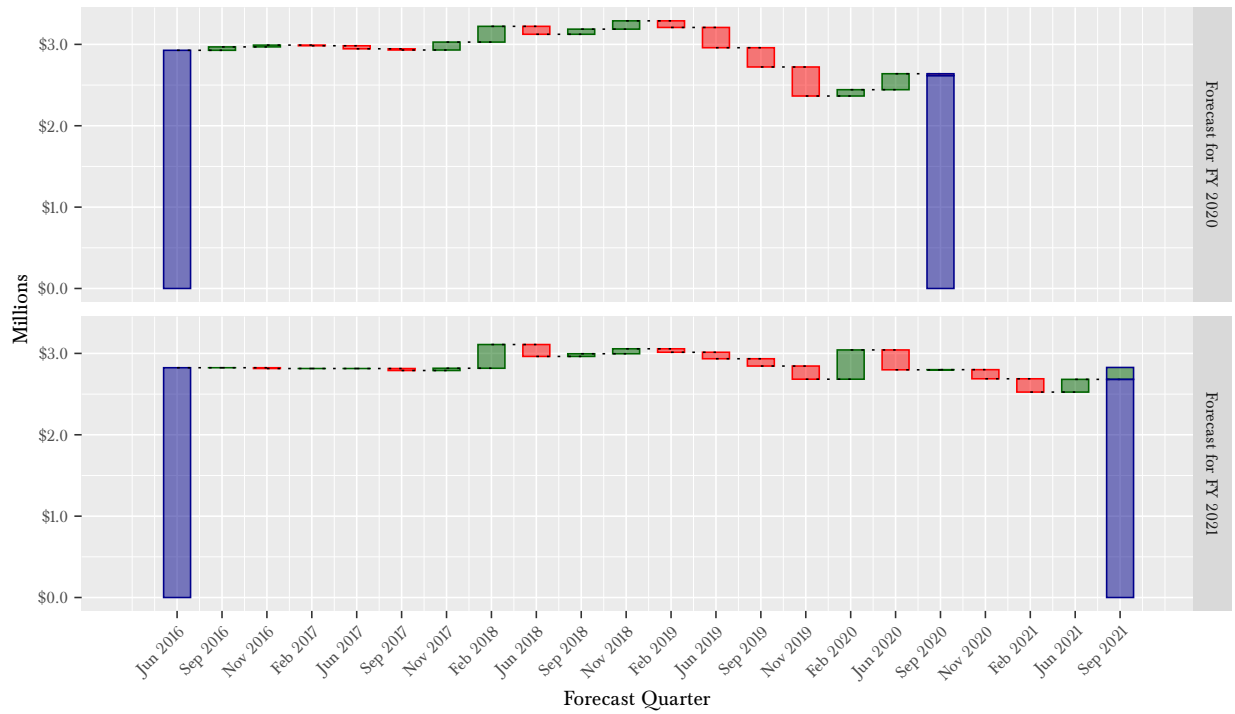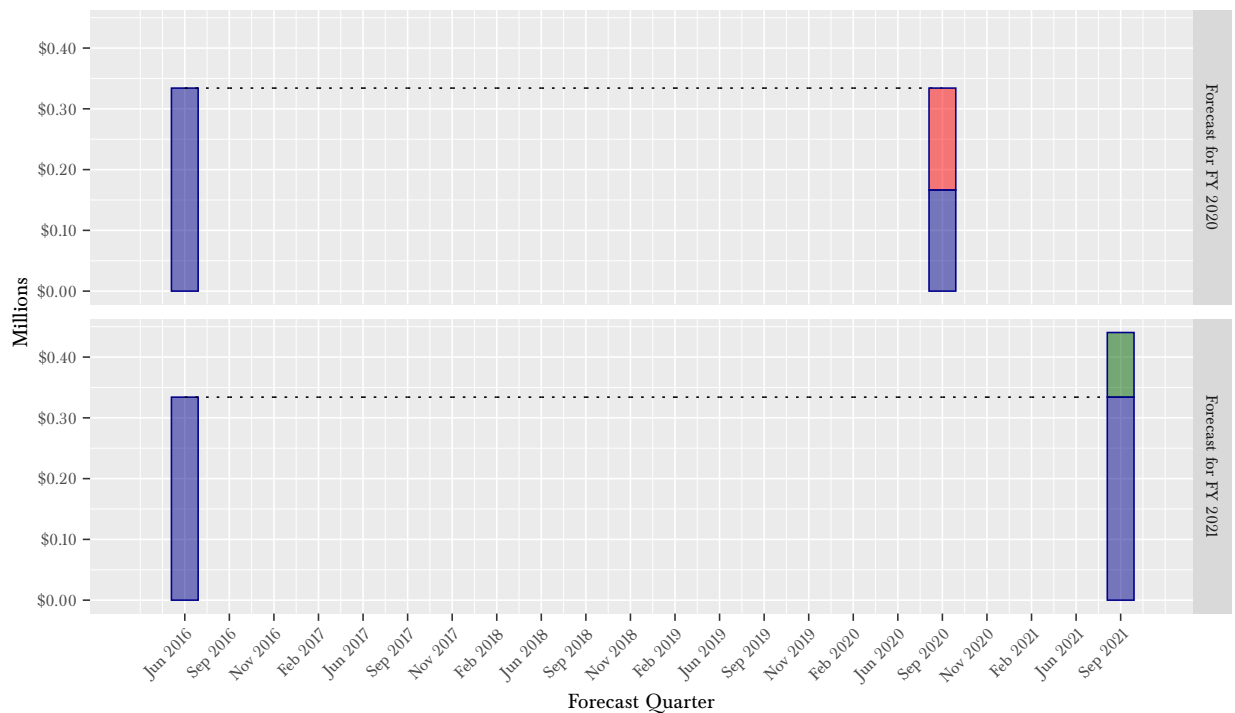

Normal School
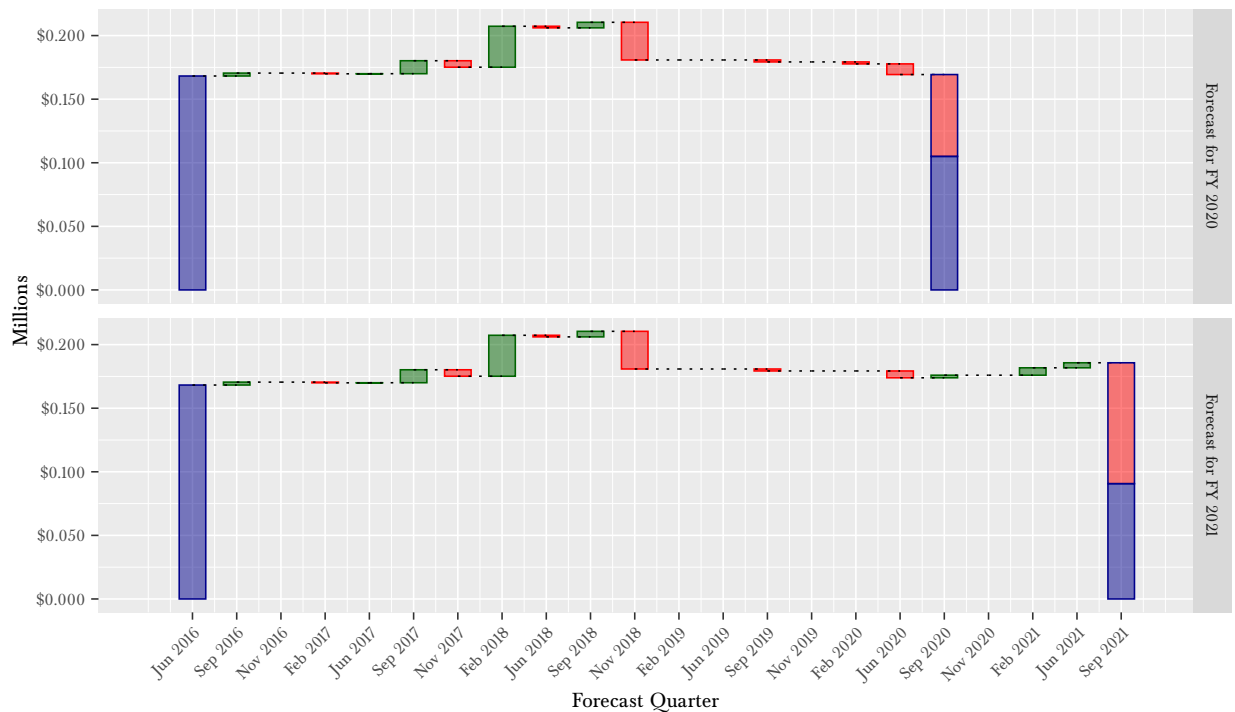
ALEA

Agricultural College Permanent

Normal School Permanent

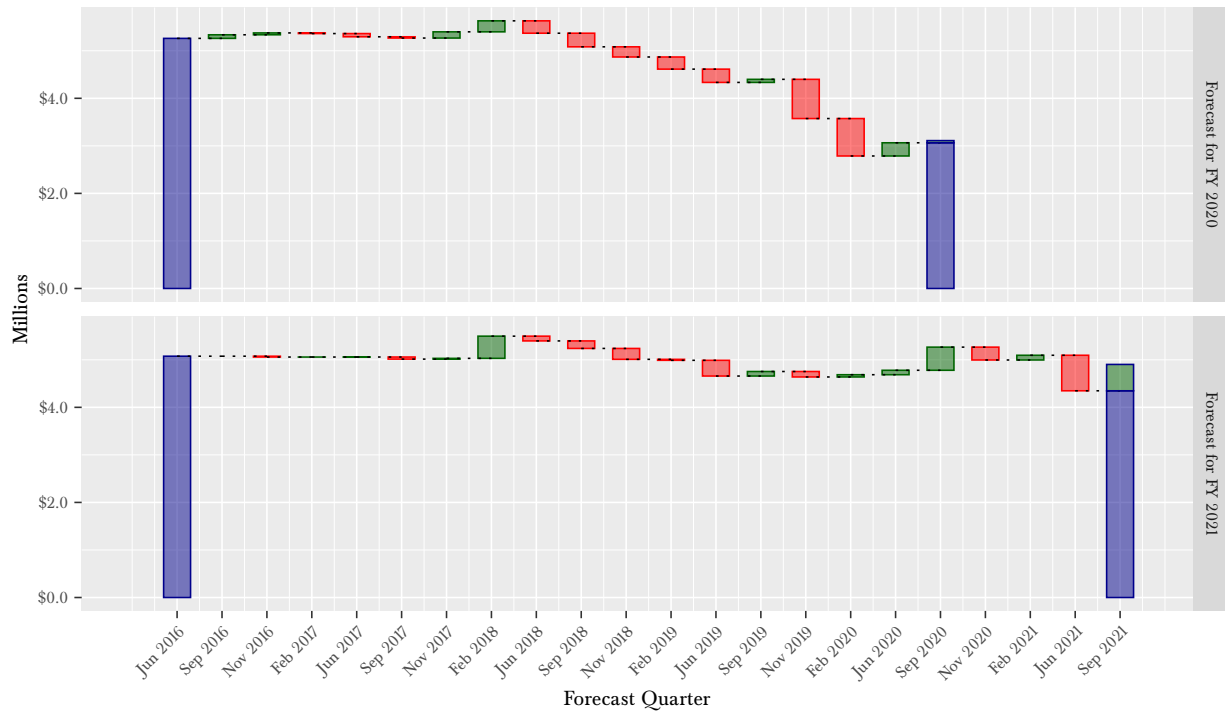## Common School Permanent

Scientific Permanent

University Permanent