Oregon Timber Harvest

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Introduction

One of Oregon's most economically important natural resources is timber. The Oregon Department of Forestry has recorded yearly timber harvests by county and land ownership type since 1942. The dataset is available on the state's data portal here.

I am from Portland, and my urban experience growing up largely insulated me from the state's dependence on natural resource extraction. I want to be a more informed Oregonian, better contextualize my environmentalism, and resolve some of the dissonance in my roots (no pun intended!) as a Portland and Oregon native. To do so, I am going to use the department of forestry's data to analyze the change in distribution of timber from public/private ownership and timber county of origin over time.

Setting up and importing libraries and data

To begin, I have to import the necessary libraries. `dplyr` will allow me to manipulate my data. `ggplot2` will allow me to plot my data on a timescale. `knitr` will make my results look nice. `readr` lets me open data, which is key. `scales` allows me to set the limits of my y-axis, which will be important later on.

Library imports:

```
library(dplyr)
library(ggplot2)
library(knitr)
library(readr)
library(scales)
```

I am setting my working directory to a folder in my folder for this class called "Final project".

```
setwd("~/R/Stats 32/Final project")
```

Data imports:

```
timber <- read_csv("Timber_Harvest_Data_1942-2016.csv")
kable(head(timber))
```

Coun ty	Yea r	BL M	USFS	Stat e	County and Munici	Indust ry	NIP	Native Americ an	Total Of Volu	Total Priva te	Total Publi c

		pal							me		
BAKER	1962	5858	58900	0	0	0	6540	0	71298	6540	64758
BAKER	1963	767	61200	0	NA	256	2729	0	64952	2985	61967
BAKER	1964	272	104100	11	NA	0	6252	0	110635	6252	104383
BAKER	1965	68	107800	0	0	0	1151	0	109019	1151	107868
BAKER	1966	17	114900	0	0	0	350	0	115267	350	114917
BAKER	1967	439	93000	0	0	0	2747	0	96186	2747	93439

Data QA/QC

To standardize my analysis, I want to only use years for which all counties have data.

```
table(timber$Year)

## 
## 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976
##   36   36   36   36   36   36   36   36   36   36   36   36   36   36   36
## 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
##   36   36   36   36   36   36   36   36   36   36   36   36   36   36   36
## 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
##   36   36   36   36   36   36   36   36   36   36   36   36   36   36   36
## 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
##   36   36   36   36   36   36   36   36   36   36
```

All years from 1962 to 2016 have 36 entries according to the table. This makes sense because there are 36 counties in Oregon. It appears that the dataset starts in 1962, not 1942. Good to know!

Public and private ownership by year

To start, I will select only the columns in which I am interested.

```
publicprivate <- timber %>% select(County, Year, `Total Of Volume`, `Total Private`, `Total Public`)
kable(head(publicprivate))
```

County	Year	Total Of Volume	Total Private	Total Public
BAKER	1962	71298	6540	64758
BAKER	1963	64952	2985	61967
BAKER	1964	110635	6252	104383

BAKER	1965	109019	1151	107868
BAKER	1966	115267	350	114917
BAKER	1967	96186	2747	93439

I want to sum the volumes from private and public land and total volume by year.

```
pubpritot <- (publicprivate %>%
  group_by(Year) %>%
  mutate(total_volume = sum(`Total Of Volume`)) %>%
  mutate(total_public = sum(`Total Public`)) %>%
  mutate(total_private = sum(`Total Private`)))
```

I want relative contributions, so I need to divide each `total_public` and `total_private` by the corresponding year's `total_volume`. Because all of the counties have the same `total_volume`, `total_public`, and `total_private` volumes, I can just use Baker County's data.

```
pubprirel <- (pubpritot %>%
             filter(County == "BAKER") %>%
             mutate(perc_public = total_public / total_volume) %>%
             mutate(perc_private = total_private / total_volume))
```

Now, I will plot the percentage of timber harvest by year that came from public lands.

```
ggplot(pubprirel, aes(Year, perc_public)) +
  geom_bar(stat="identity", fill="#006633") +
  scale_y_continuous(limit = c(0,1)) +
  ggtitle("Proportion of Oregon Timber Harvest from \n Public Land, 1962-
2016") +
  theme(plot.title = element_text(hjust = 0.5)) +
  labs(x="Year", y="Proportion from public land")
```

Proportion of Oregon Timber Harvest from Public Land, 1962-2016
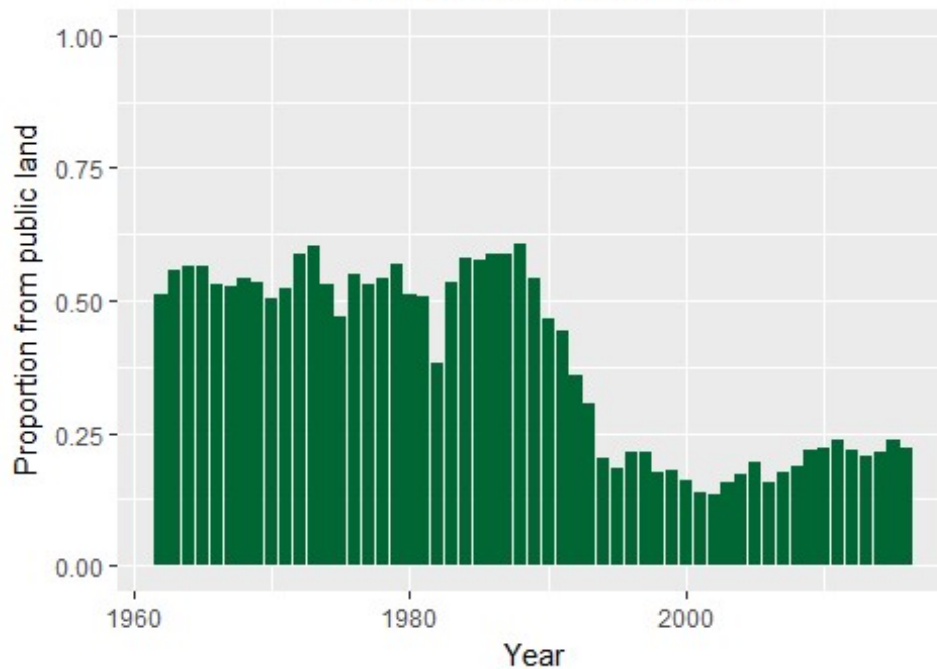
It is clear from the plot that timber harvests from public lands held steady around 50 percent of the state's total volume from 1962 to 1990, dropped off dramatically after 1990, and has hovered around 15 and 20 percent since the mid-1990s.

I really wanted to do stacked bars with `perc_public` and `perc_private`, but I was having a lot of trouble with melting and otherwise deciphering what stackoverflow and other sources told me to try. (If you have suggestions on how to go about stacking bars, I would love that feedback.)

Multnomah County's contribution by year

I am from Multnomah County, the most densely populated county in the state. I will calculate the proportion of the state's timber harvest that has come from the county because I am unable to do stacked bars. To do so, I will first filter to just include Multnomah County's data and then calculate the proportion of the state's total timber harvest produced in the county for each year.

```
MultCo <- (pubpritot %>%
            filter(County == "MULTNOMAH") %>%
            mutate(perc_mult = `Total Of Volume` / total_volume))
ggplot(MultCo, aes(Year, perc_mult)) +
  geom_bar(stat="identity", fill="#333333") +
  scale_y_continuous(limit = c(0,1)) +
  ggtitle("Proportion of Oregon Timber Harvested in \n Multnomah County,
1962-2016") +
```

```
    theme(plot.title = element_text(hjust = 0.5)) +
    labs(x="Year", y="Proportion from Multnomah County")
```


Proportion of Oregon Timber Harvested in
Multnomah County, 1962-2016
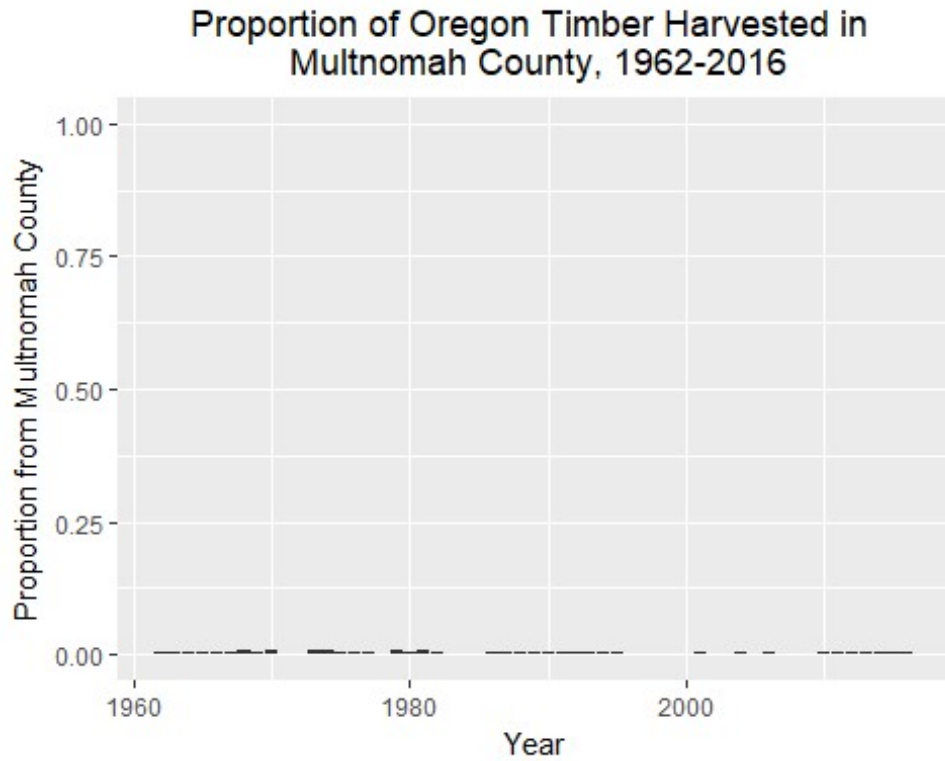
As the plot shows, Multnomah County has not contributed much at all to the state's timber harvest in the last fifty years. This makes sense because it a geographically small and densely populated area.

Josephine and Douglas Counties' contribution by year

Josephine and Douglas Counties have historically been one of Oregon's most timber-producing counties. Because Oregon is largely moving away from intense timber harvesting, the two have been struggling financially, as described by the Oregonian. I will show their contribution to the state's harvest below.

Josephine County

```
JosephCo <- (pubpritot %>%
            filter(County == "JOSEPHINE") %>%
            mutate(perc_joseph = `Total Of Volume` / total_volume))
ggplot(JosephCo, aes(Year, perc_joseph)) +
  geom_bar(stat="identity", fill="#006633") +
  scale_y_continuous(limit = c(0,1)) +
  ggtitle("Proportion of Oregon Timber Harvested in \n Josephine County,
1962-2016") +
  theme(plot.title = element_text(hjust = 0.5)) +
  labs(x="Year", y="Proportion from Josephine County")
```

**Proportion of Oregon Timber Harvested in Josephine County, 1962-2016**
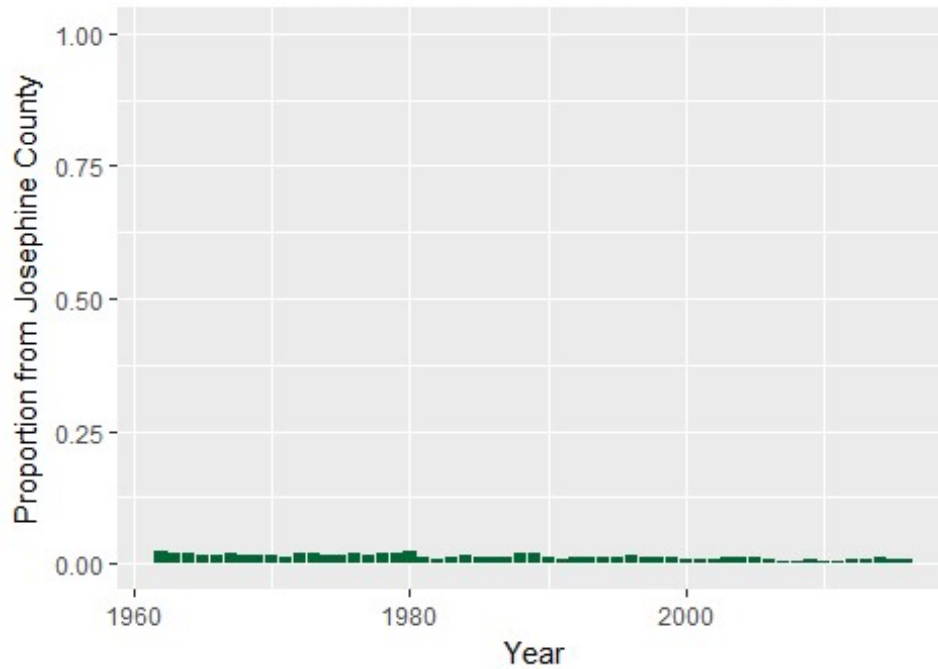
Interestingly, Josephine County does not seem to have contributed as significantly to the state's timber harvest in Oregon as I would have expected based on how culturally important the industry seems to be.

Douglas County

```
DougCo <- (pubpritot %>%
            filter(County == "DOUGLAS") %>%
            mutate(perc_doug = `Total Of Volume` / total_volume))
ggplot(DougCo, aes(Year, perc_doug)) +
  geom_bar(stat="identity", fill="#006633") +
  scale_y_continuous(limit = c(0,1)) +
  ggtitle("Proportion of Oregon Timber Harvested in \n Douglas County, 1962-
2016") +
  theme(plot.title = element_text(hjust = 0.5)) +
  labs(x="Year", y="Proportion from Douglas County")
```

Proportion of Oregon Timber Harvested in Douglas County, 1962-2016
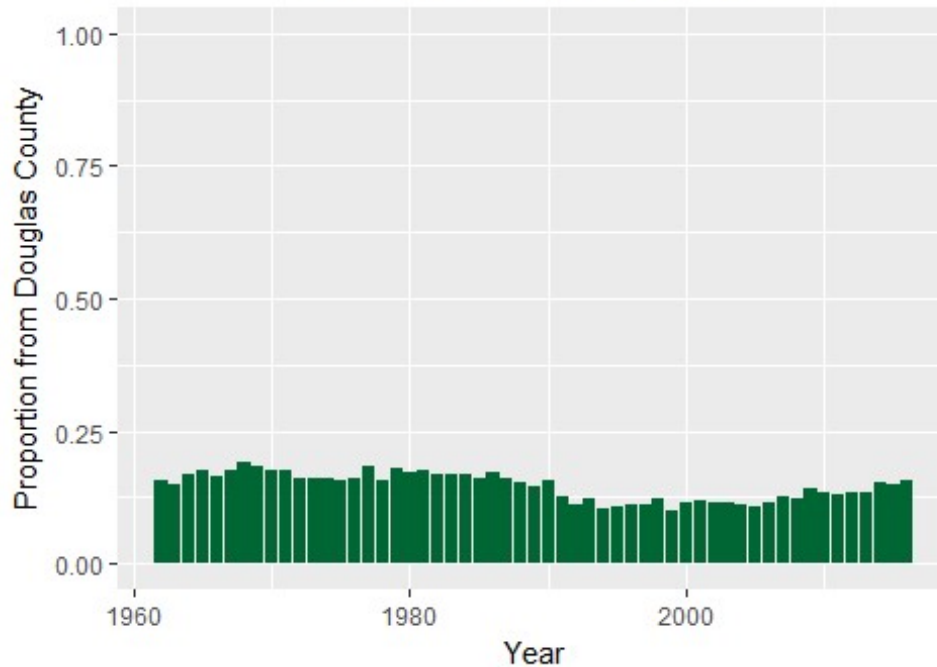
This plot makes more sense. One county contributing between 10 and 17 or so percent of the state's timber harvest is quite impressive and shows Douglas County's outsized influence in that sector.

Absolute volume of timber harvest in Oregon

To round out my analysis, I will look at the absolute timber harvest volumes between 1962-2016. For this, I will use the `total_volume` value calculated above before relative values were necessary. I also created a line of best fit to show the significant downward trend.

```
ggplot(pubpritot, aes(Year, total_volume)) +
  geom_point(stat="identity", fill="#006633") +
  geom_smooth(method='lm', formula = y ~ x, se = TRUE) +
  geom_line(stat="identity") +
  ggtitle("Volume of Timber Harvested In Oregon, \n 1962-2016") +
  theme(plot.title = element_text(hjust = 0.5), axis.text.y =
element_text(angle=90, hjust=0.5)) +
  scale_y_continuous(labels = comma) +
  labs(x="Year", y="Volume (millions of board feet)")
```

Volume of Timber Harvested In Oregon, 1962-2016
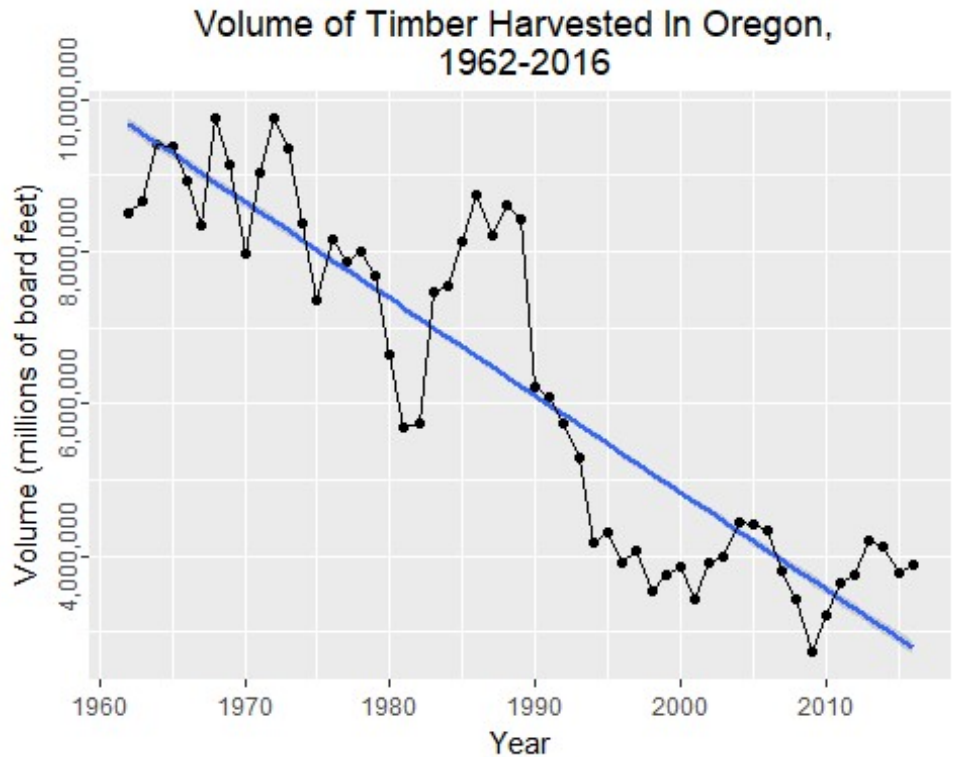
The general trend of the data is downwards sloping; that is, Oregon has been continuously harvesting less timber over the last few decades. Several spikes break the general pattern, as in the last 1980s and mid-2000s.

Conclusions

Oregon's total timber harvest has decreased dramatically since the early 1960s. From its peak harvest around 9,700,000 millions of board feet, the annual harvest has fallen to around 4,000,000 MMBF in the mid-2010s. The source of this timber has also shifted. More timber now comes from private lands, which is different from the about 50/50 public/private land split in the 1960s. Timber's influence is unevenly spread among Oregon's 36 counties. Multnomah County, being small and densely populated, has never contributed much to the state's timber industry. Douglas County, on the other hand, has consistently pulled more than its weight by fairly consistently producing between 10 and 17 percent of the state's annual harvest. The numerical contribution of states sometimes does not reflect the cultural importance that the industry can have. Although Josephine County does not harvest much of Oregon's annual volume, its residents still feel strongly affected by regulations that limit logging activities.

The main deviation from my project proposal is the lack of stacked bar charts. As mentioned earlier, I was unable to finesse my data into the right form to be stacked. I would welcome any suggestions, as I am genuinely curious as to how to do that.