Crime & Weather

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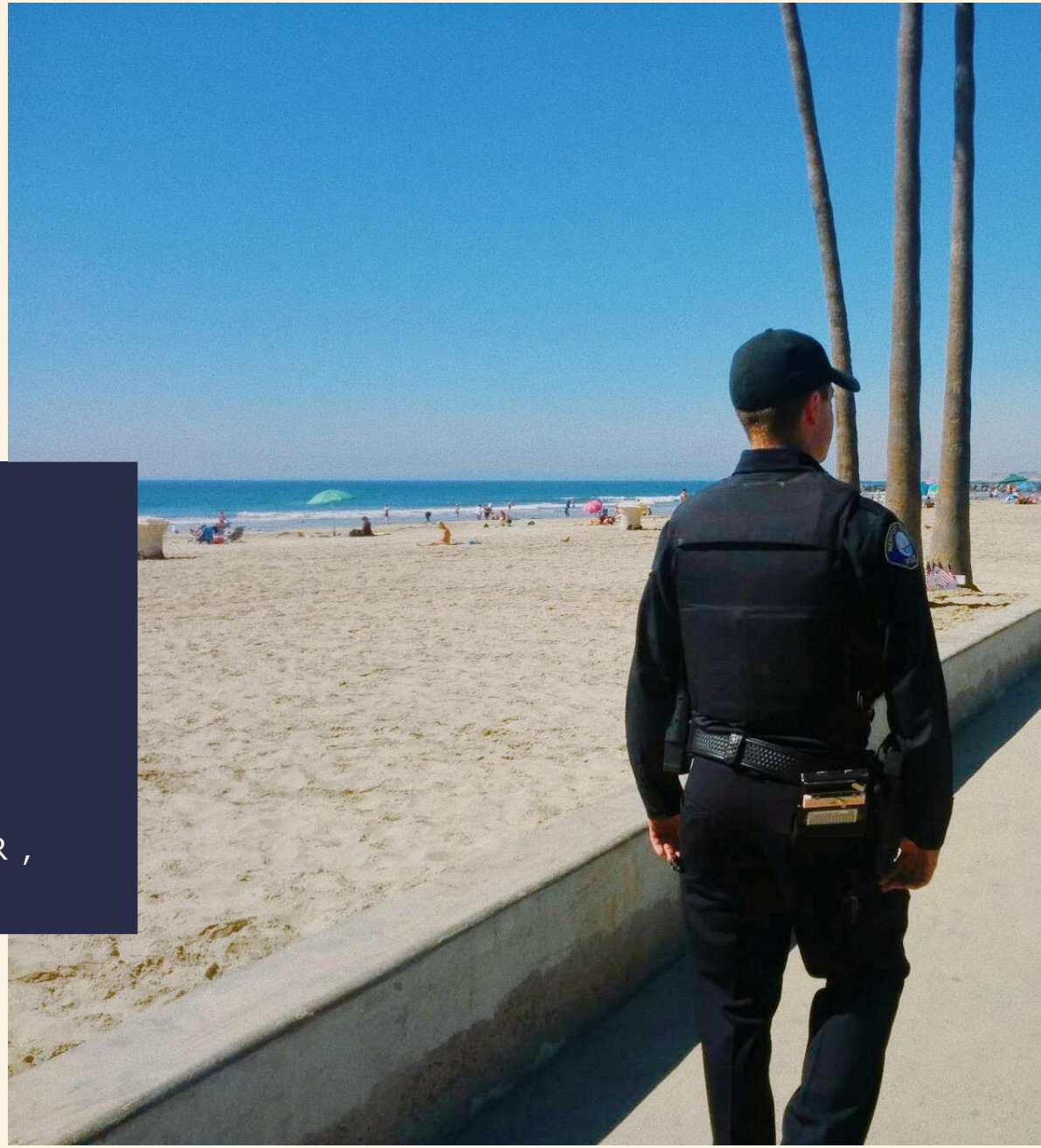


Our Motivation

The Effect of Weather on Crime: An Investigation of Weather and Annual Crime Rates

High temperatures can lead to more violent crime, study finds

8, 2019 | 11:39am

A Rise in Murder? Let's Talk About the Weather

The relationship between tree canopy and crime rates across an urban–rural gradient in the greater Baltimore region

Can Trees Actually Deter Crime?

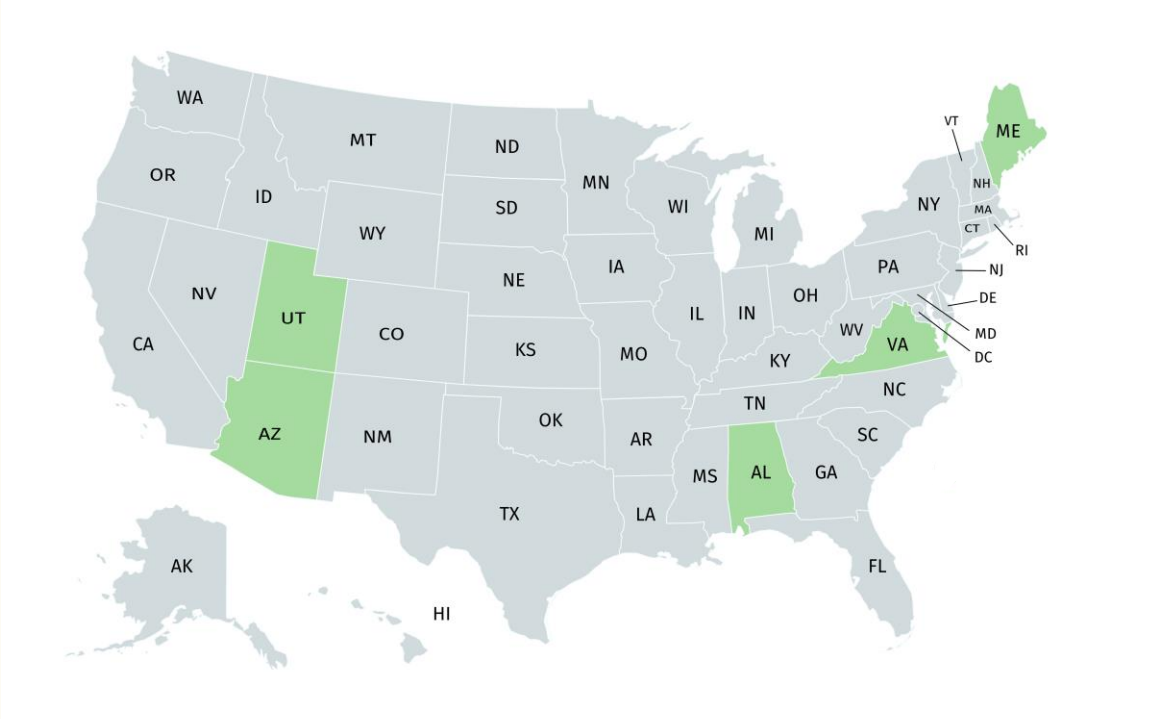
ERIC JAFFE MAY 25, 2012

Our Questions

- Do rates of violent and non-violent crime increase with temperature?
- Do states with more forest cover experience lower crime rates?
- As temperatures continue to increase due to anthropogenic climate change, does our data predict that we can expect a rise in crime?

Our Focus

THE STATES



ARIZONA, UTAH, MAINE, VIRGINIA, ALABAMA

THE DATA WE COLLECTED

- Crime
  - Sourced from state government websites
- Weather
  - National Centers for Environmental Information
- Tree Cover
  - i-Tree Canopy

The Data

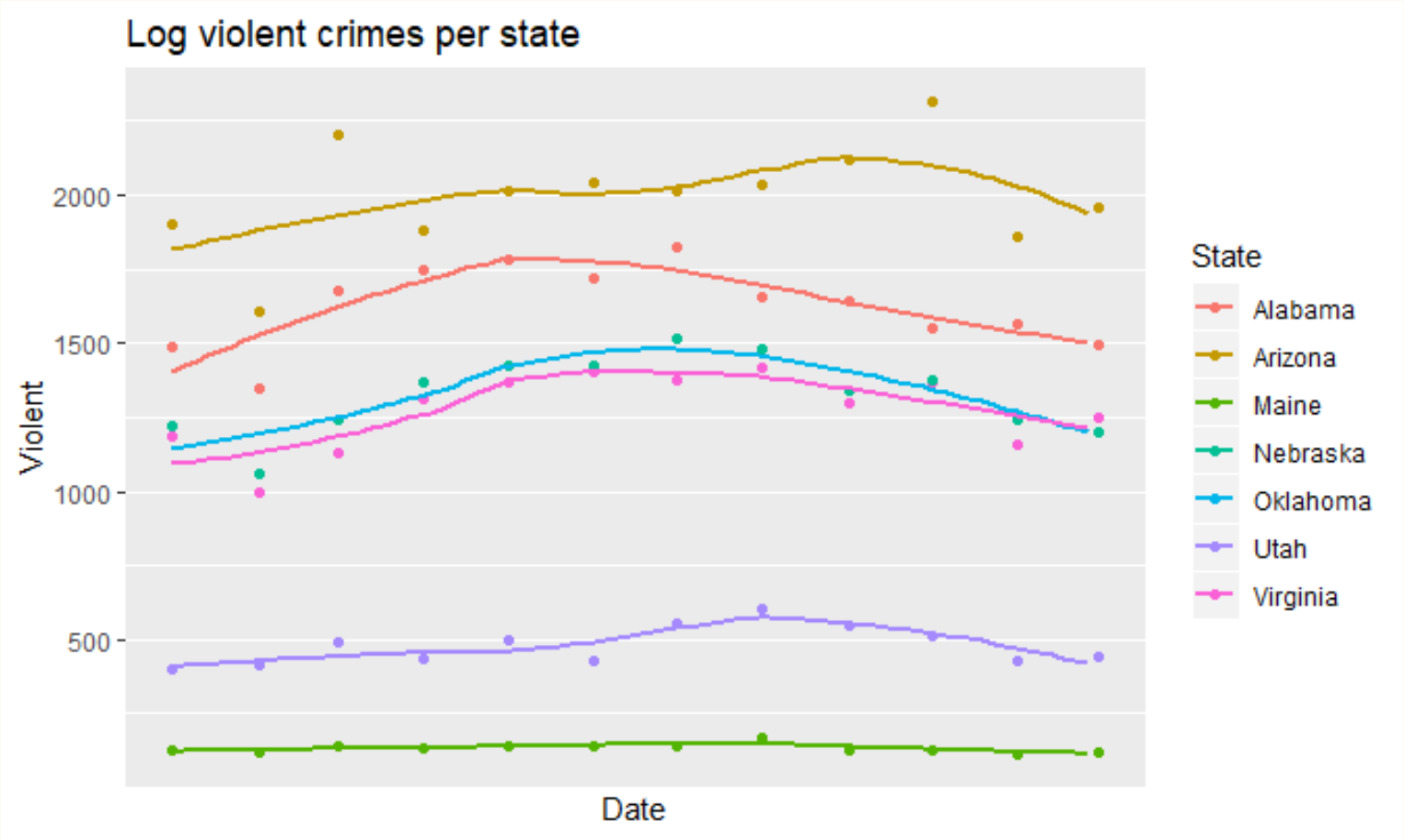
Date	Year	State	Violent	Nonviolent	F_temp
2020-01-14	2014	Maine	124	1950	14.2
2020-02-14	2014	Maine	120	1550	15.7
2020-03-14	2014	Maine	139	1725	18.1
2020-04-14	2014	Maine	132	2125	38.7
2020-05-14	2014	Maine	140	2300	51.7
2020-06-14	2014	Maine	141	2450	61.6
2020-07-14	2014	Maine	143	2875	67.2
2020-08-14	2014	Maine	167	2700	64.4
2020-09-14	2014	Maine	125	2350	56.4
2020-10-14	2014	Maine	125	2300	48.5
2020-11-14	2014	Maine	113	1800	31.8
2020-12-14	2014	Maine	121	1850	26.0

Date	Year	State	Violent	Nonviolent	F_temp
2020-01-15	2015	Utah	552	7090	32.1
2020-02-15	2015	Utah	431	6215	38.9
2020-03-15	2015	Utah	540	6965	44.9
2020-04-15	2015	Utah	487	6725	47.1
2020-05-15	2015	Utah	542	7254	53.8
2020-06-15	2015	Utah	581	7539	70.0
2020-07-15	2015	Utah	597	8004	70.1
2020-08-15	2015	Utah	630	8258	71.0
2020-09-15	2015	Utah	609	7814	65.5
2020-10-15	2015	Utah	560	7852	54.3
2020-11-15	2015	Utah	492	7262	34.5
2020-12-15	2015	Utah	485	7225	26.6

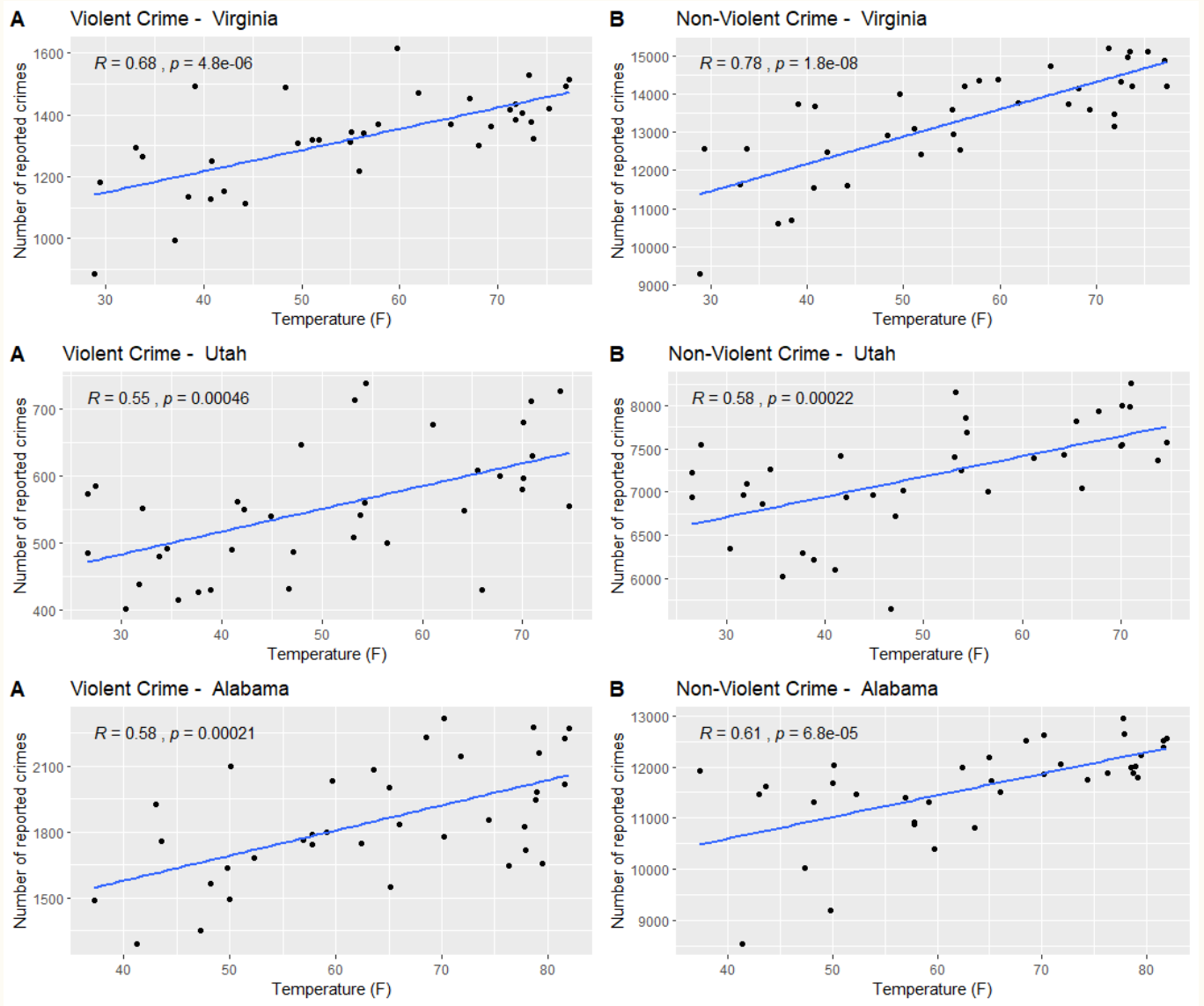
Date	Year	State	Violent	Nonviolent	F_temp
2020-01-16	2016	Alabama	1925	11463	43.0
2020-02-16	2016	Alabama	1635	9200	49.8
2020-03-16	2016	Alabama	2034	10393	59.7
2020-04-16	2016	Alabama	2085	10824	63.6
2020-05-16	2016	Alabama	2318	11859	70.2
2020-06-16	2016	Alabama	2159	11798	79.2
2020-07-16	2016	Alabama	2274	12565	82.0
2020-08-16	2016	Alabama	2224	12509	81.6
2020-09-16	2016	Alabama	2277	11989	78.6
2020-10-16	2016	Alabama	2231	12506	68.5
2020-11-16	2016	Alabama	1790	10880	57.8
2020-12-16	2016	Alabama	2100	12030	50.1

- Working with data over a 3-year period by each month from 2014 to 2016
- Crime data has been separated into Violent and Nonviolent offenses

Exploratory Data Analysis – Discovering Patterns

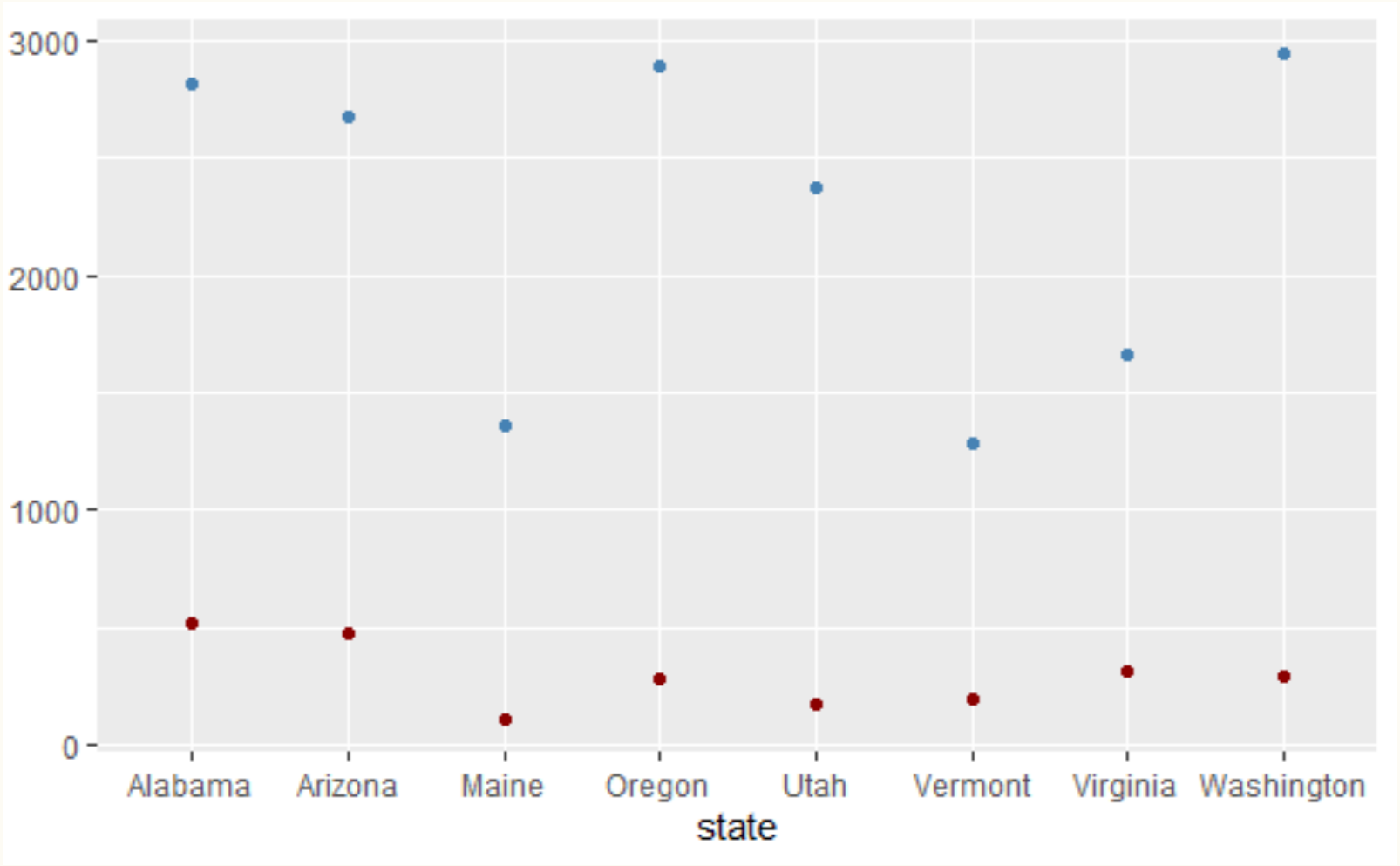


Exploratory Data Analysis – Discovering Patterns



Exploratory Data Analysis – Discovering Patterns

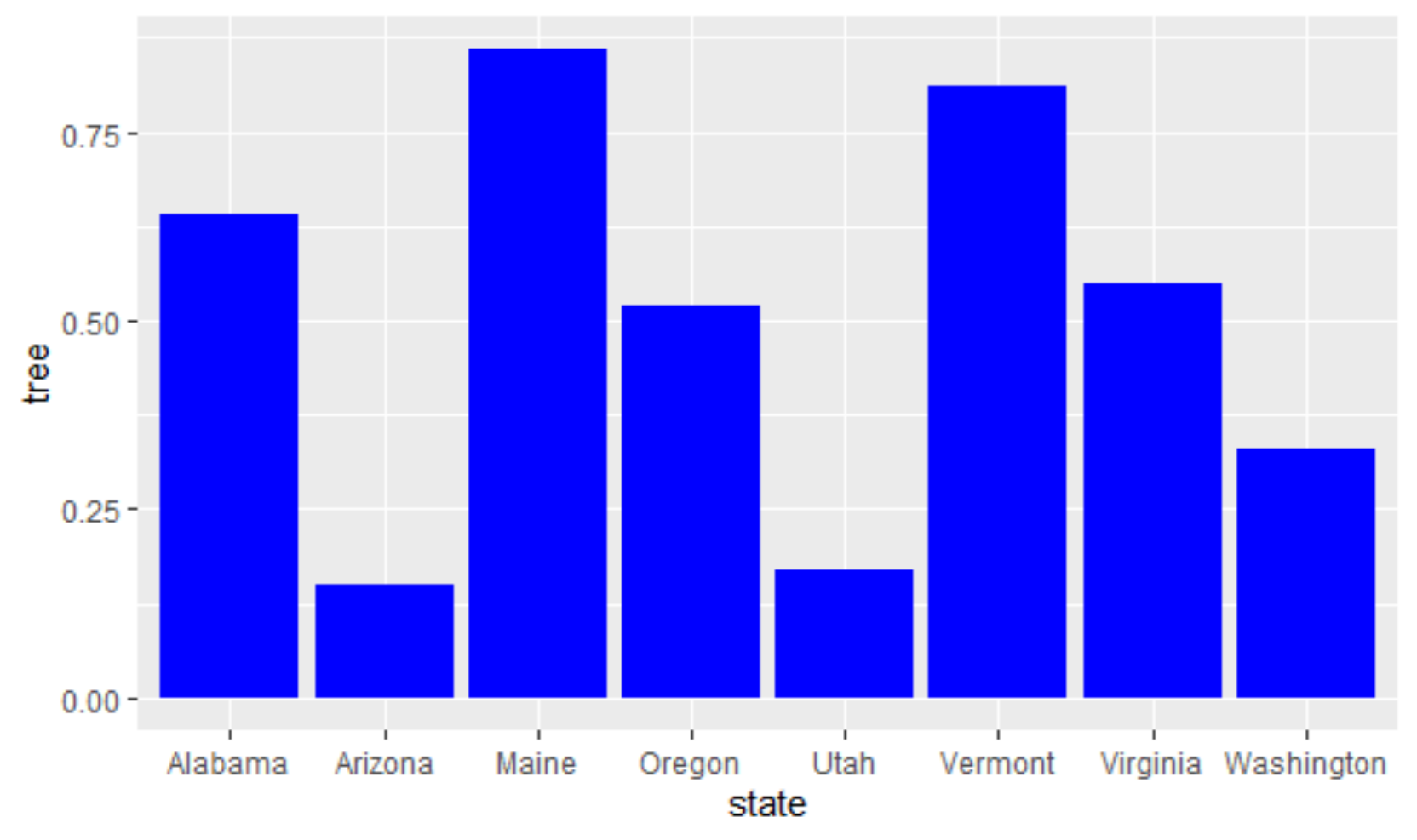
AVERAGE ANNUAL CRIME RATE BY STATE (PER 100K PEOPLE IN 2018)



BLUE: NONVIOLENT CRIMES

RED: VIOLENT CRIMES

Exploratory Data Analysis – Discovering Patterns



Linear Regressions

VIOLENT CRIME

- Explanatory Variables
  - Temperature
  - Tree cover
- Dependent Variable
  - Violent crime

$$ViolentCrime = \beta 0 + \beta 1 * TreeCover$$

$$ViolentCrime = \beta 0 + \beta 1 * Temperature$$

NONVIOLENT CRIME

- Explanatory Variables
  - Temperature
  - Tree cover
- Dependent Variables
  - Nonviolent crime

$$NonviolentCrime = \beta 0 + \beta 1 * TreeCover$$

$$NonviolentCrime = \beta 0 + \beta 1 * Temperature$$

Violent Crime

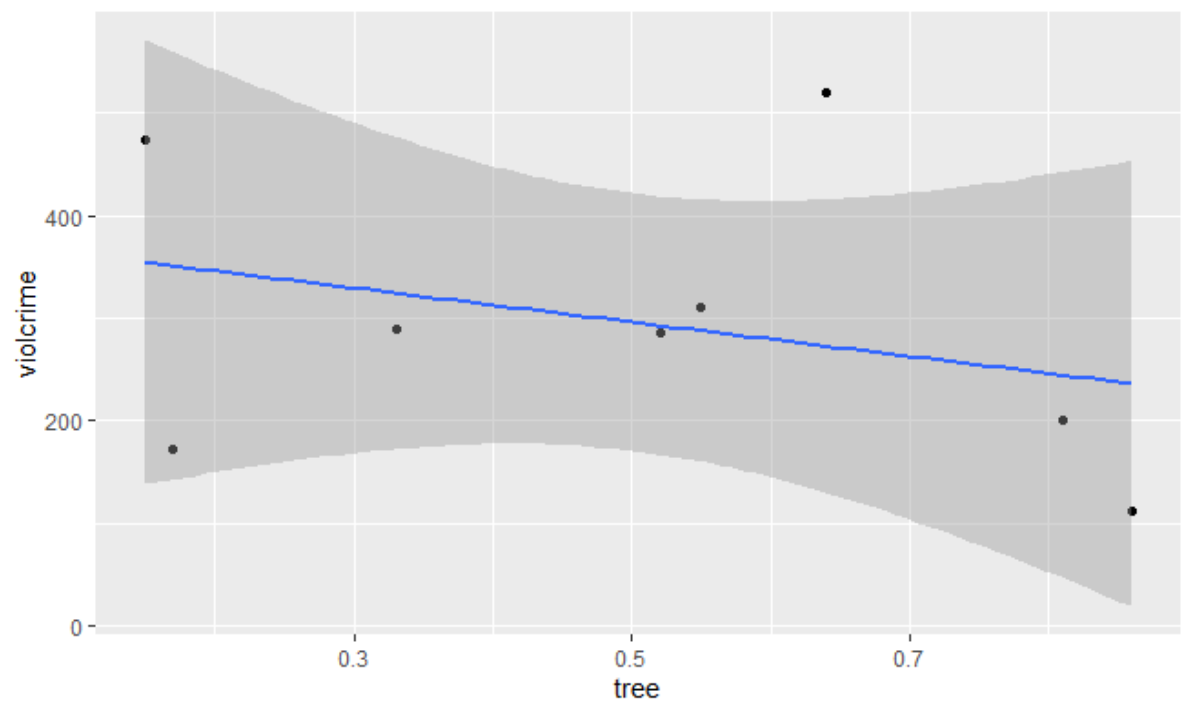
TREE COVER VS VIOLENT CRIME

```
Call:
lm(formula = violcrime ~ tree, data = df)

Residuals:
    Min      1Q  Median      3Q     Max
-179.32  -64.53  -21.11   47.70  246.62

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    379.7      114.8   3.307   0.0163 *
tree          -166.7      203.8  -0.818   0.4446
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 145.3 on 6 degrees of freedom
Multiple R-squared:  0.1003, Adjusted R-squared:  -0.04962
F-statistic: 0.6691 on 1 and 6 DF,  p-value: 0.4446
```



Violent Crime

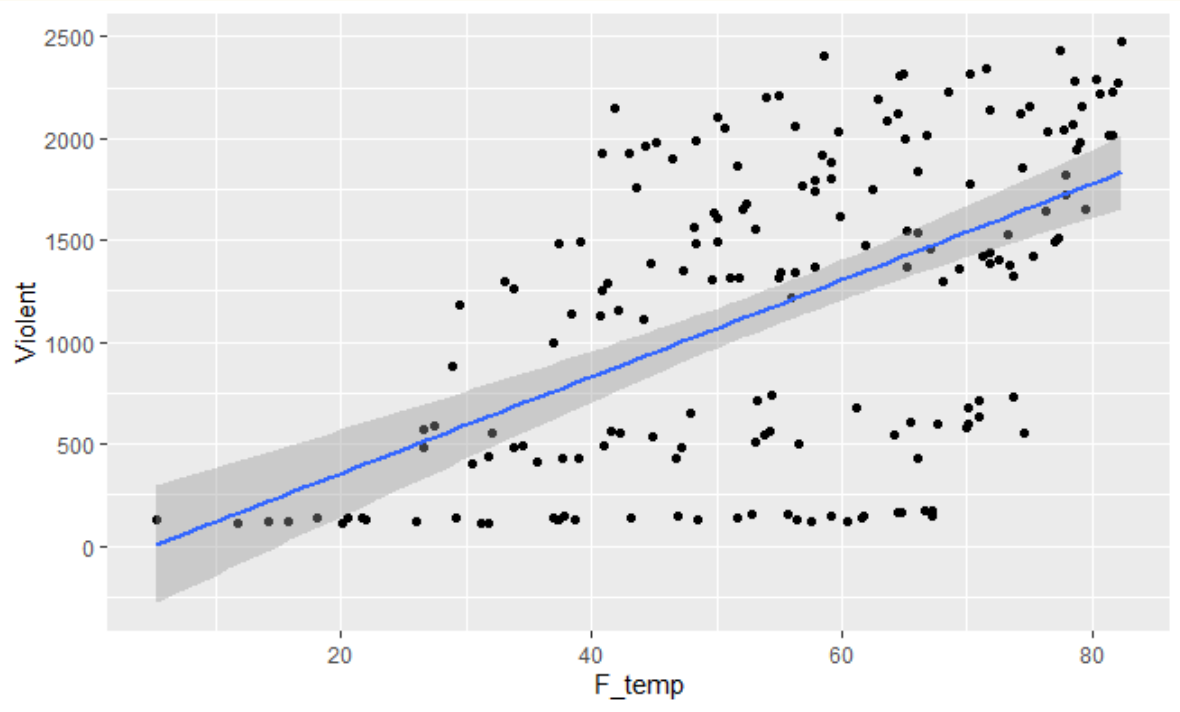
TEMPERATURE VS VIOLENT CRIME

```
Call:
lm(formula = Violent ~ F_temp, data = STATE_CRIME_DATA)

Residuals:
     Min       1Q   Median       3Q      Max
-255.632  -70.307    6.808   39.314  280.416

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  943.436     73.361  12.860 1.29e-14 ***
F_temp         6.858      1.265   5.423 4.85e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 114 on 34 degrees of freedom
  (144 observations deleted due to missingness)
Multiple R-squared:  0.4638, Adjusted R-squared:  0.448
F-statistic: 29.41 on 1 and 34 DF,  p-value: 4.847e-06
```



Nonviolent Crime

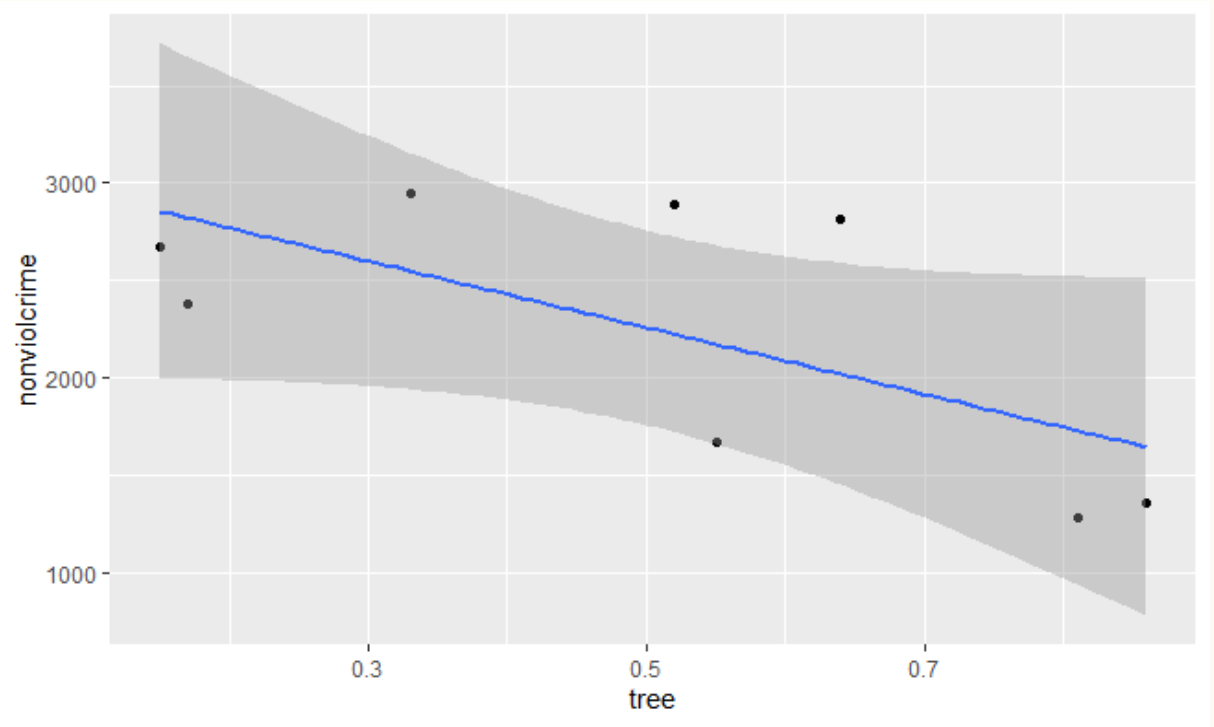
TREE COVER VS VIOLENT CRIME

```
Call:
lm(formula = nonviolcrime ~ tree, data = df)

Residuals:
   Min     1Q Median     3Q    Max
-507.8 -444.9 -232.8  465.4  797.5

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3112.1      457.4   6.804 0.000494 ***
tree         -1706.9      811.9  -2.102 0.080236 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 578.9 on 6 degrees of freedom
Multiple R-squared:  0.4241, Adjusted R-squared:  0.3282
F-statistic: 4.419 on 1 and 6 DF,  p-value: 0.08024
```



Nonviolent Crime

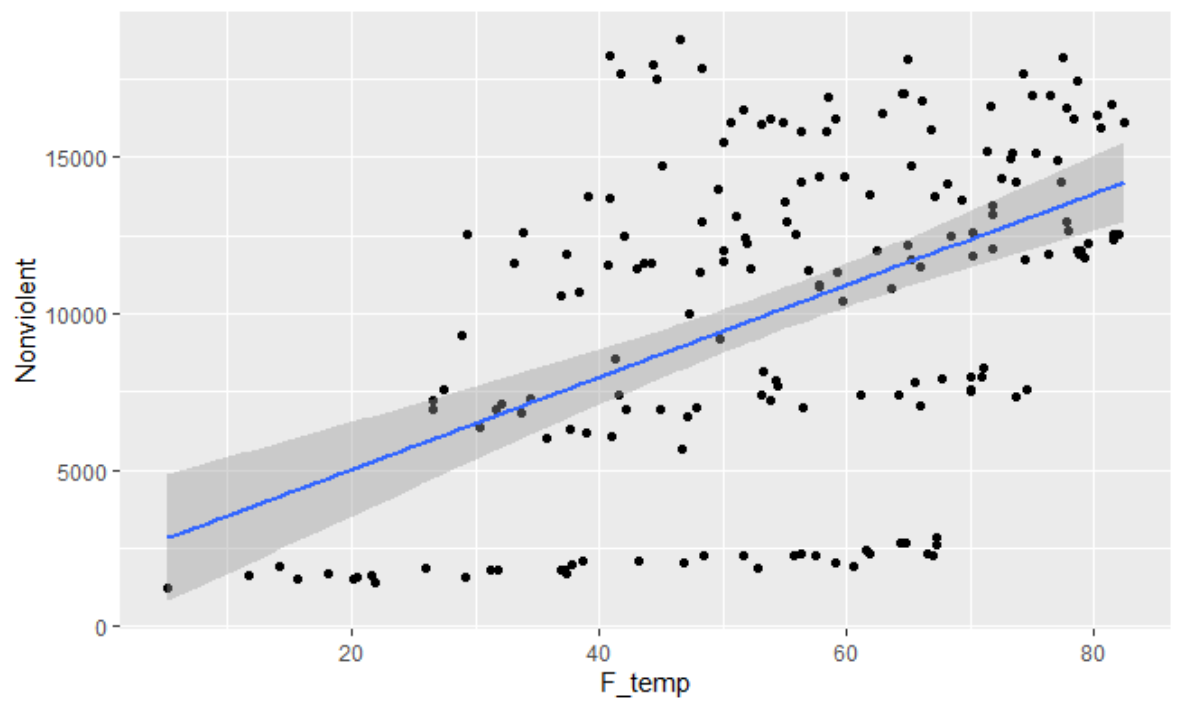
TEMPERATURE VS VIOLENT CRIME

```
Call:
lm(formula = Nonviolent ~ F_temp, data =
STATE_CRIME_DATA)

Residuals:
     Min       1Q   Median       3Q      Max
-2095.62  -638.18    53.61   769.90  1626.45

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 9305.820    568.684   16.36  < 2e-16 ***
F_temp        71.758      9.803    7.32 1.76e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 883.7 on 34 degrees of freedom
  (144 observations deleted due to missingness)
Multiple R-squared:  0.6118, Adjusted R-squared:  0.6004
F-statistic: 53.58 on 1 and 34 DF,  p-value: 1.765e-08
```



Conclusion

- For both Violent and Non-Violent Crimes, increasing temperatures have shown higher rates of crime rates based on data collected. Both linear regressions had a positive correlation between increases in temperature and Violent and Non-violent crime rates.
- While for it was an opposite result for tree coverage, states with higher tree cover coverage showed a lower rate of crime in both Violent and Non-Violent Crimes. Linear regressions for both Violent and Non-Violent crimes with tree coverage supported this claim showing that increased tree coverage decreased the rate of crime.