

Oregon Cannabis and Hemp Market Trends

**An Analysis by Brian Eckerman, Pau Rodriguez, and
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Wait .. What ...?

- Since 2012, 18 states have decriminalized and allow for state-licensed sales of recreational cannabis
- CBD infused products sold at gas stations, grocery stores, corner stores and large national retailers.
- Access to open cannabis market database hosted by the State
 - Raw data comes from State CTS
 - Updated regularly
 - New data available every day



Why ?

What will future cannabis sales look like in the State of Oregon by county and product type? Can we predict any trends?

How?

```
url = "https://myosus32022buk.s3.amazonaws.com/County%20Product%20Trend_Full%20data_data.csv"
spark.sparkContext.addFile(url)
CountyProductData_df = spark.read.csv(SparkFiles.get("County Product Trend_Full Data_data.csv"), sep=",", header=True, inferSchema=True)

# Show DataFrame
CountyProductData_df.show()
```

```
D:
+---+---+---+---+---+---+---+---+---+---+
| Date | Product Type | County | Month Name | Month Year | ToolTip Date | Market Share | County | Sales | Sales Detail |
+---+---+---+---+---+---+---+---+---+---+
| 10/1/2016 | Usable M3 | Baker | October | 10/1/2016 | October 2016 | 100.0 | 58637.51 | 58637.51 |
| 10/1/2016 | Usable M3 | Baker | October | 10/1/2016 | October 2016 | 100.0 | 441.0 | 441.0 |
| 10/1/2016 | Concentrate/Extract | Clackamas | October | 10/1/2016 | October 2016 | 15.14 | 803.2 | 803.2 |
| 10/1/2016 | Edible/Tincture | Clackamas | October | 10/1/2016 | October 2016 | 9.31 | 359.68 | 359.68 |
| 10/1/2016 | Other | Clackamas | October | 10/1/2016 | October 2016 | 1.13 | 30.0 | 30.0 |
| 10/1/2016 | Usable M3 | Clackamas | October | 10/1/2016 | October 2016 | 74.42 | 4416.94 | 4416.94 |
| 10/1/2016 | Concentrate/Extract | Clackamas | October | 10/1/2016 | October 2016 | 15.14 | 144.0 | 144.0 |
| 10/1/2016 | Edible/Tincture | Clackamas | October | 10/1/2016 | October 2016 | 9.31 | 223.05 | 223.05 |
| 10/1/2016 | Other | Clackamas | October | 10/1/2016 | October 2016 | 1.13 | 40.5 | 40.5 |
| 10/1/2016 | Usable M3 | Clackamas | October | 10/1/2016 | October 2016 | 74.42 | 238.8 | 238.8 |
| 10/1/2016 | Concentrate/Extract | Clatsop | October | 10/1/2016 | October 2016 | 19.55 | 10808.0 | 10808.0 |
| 10/1/2016 | Edible/Tincture | Clatsop | October | 10/1/2016 | October 2016 | 5.61 | 3177.0 | 3177.0 |
| 10/1/2016 | Other | Clatsop | October | 10/1/2016 | October 2016 | 1.79 | 1014.0 | 1014.0 |
| 10/1/2016 | Usable M3 | Clatsop | October | 10/1/2016 | October 2016 | 73.04 | 42128.05 | 42128.05 |
| 10/1/2016 | Concentrate/Extract | Clatsop | October | 10/1/2016 | October 2016 | 19.55 | 2249.0 | 2249.0 |
| 10/1/2016 | Edible/Tincture | Clatsop | October | 10/1/2016 | October 2016 | 5.61 | 570.5 | 570.5 |
| 10/1/2016 | Other | Clatsop | October | 10/1/2016 | October 2016 | 1.79 | 184.0 | 184.0 |
| 10/1/2016 | Usable M3 | Clatsop | October | 10/1/2016 | October 2016 | 73.04 | 6653.24 | 6653.24 |
| 10/1/2016 | Concentrate/Extract | Deschutes | October | 10/1/2016 | October 2016 | 12.36 | 9588.78 | 9588.78 |
| 10/1/2016 | Edible/Tincture | Deschutes | October | 10/1/2016 | October 2016 | 8.56 | 6546.11 | 6546.11 |
+---+---+---+---+---+---+---+---+---+---+
only showing top 20 rows
```

```
[3] from pyspark.sql import SparkSession
spark = SparkSession.builder.appName("CloudETL").config("spark.driver.extraClassPath", "/content/postgresql-42.2.16.jar").getOrCreate()
```

```
# aws-fp20-instance.cchbtewatphd.us-west-2.rds.amazonaws.com

# Read in data from S3 Buckets
from pyspark import SparkFiles
url = "https://myosus32022buk.s3.amazonaws.com/census_estimates.csv"
spark.sparkContext.addFile(url)
user_data_df = spark.read.csv(SparkFiles.get("census_estimates.csv"), sep=",", header=True, inferSchema=True)
```

```
[5] user_data_df.show()
```

```
+---+---+---+---+---+---+---+---+---+---+
| _c0 | Revised Population Estimate July 1, 2020 | Certified Population Estimate July 1, 2021 | Population Change 2020-2021 | Percent Change 2020-2021 | _c5 | _c6 | _c7 | _c8 | _c9 | _c10 | _c11 | _c12 | _c13 | _c14 |
+---+---+---+---+---+---+---+---+---+---+
| Oregon | 4,243,791 | 4,266,560 | 22,769 | 0.54% | null | null | null | null | null | null | null | null | null | null |
| BAKER | 16,721 | 16,860 | 139 | 0.83% | null | null | null | null | null | null | null | null | null | null |
| BENTON | 95,316 | 93,976 | -1,340 | -1.41% | null | null | null | null | null | null | null | null | null | null |
| CLACKAMAS | 422,185 | 425,316 | 3,131 | 0.74% | null | null | null | null | null | null | null | null | null | null |
| CLATSOP | 41,137 | 41,428 | 291 | 0.71% | null | null | null | null | null | null | null | null | null | null |
| COLUMBIA | 52,748 | 53,014 | 266 | 0.50% | null | null | null | null | null | null | null | null | null | null |
| COOS | 64,958 | 65,154 | 196 | 0.30% | null | null | null | null | null | null | null | null | null | null |
| CROOK | 24,866 | 25,482 | 616 | 2.48% | null | null | null | null | null | null | null | null | null | null |
| CURRY | 23,510 | 23,662 | 152 | 0.65% | null | null | null | null | null | null | null | null | null | null |
| DESCHUTES | 199,259 | 203,390 | 4,131 | 2.07% | null | null | null | null | null | null | null | null | null | null |
| DOUGLAS | 111,214 | 111,694 | 480 | 0.43% | null | null | null | null | null | null | null | null | null | null |
| GILLIAM | 1,995 | 2,039 | 44 | 2.21% | null | null | null | null | null | null | null | null | null | null |
| GRANT | 7,239 | 7,226 | -13 | -0.18% | null | null | null | null | null | null | null | null | null | null |
| HARNEY | 7,497 | 7,537 | 40 | 0.53% | null | null | null | null | null | null | null | null | null | null |
| HOOD RIVER | 23,949 | 23,888 | -61 | -0.25% | null | null | null | null | null | null | null | null | null | null |
| JACKSON | 223,521 | 223,827 | 306 | 0.14% | null | null | null | null | null | null | null | null | null | null |
| JEFFERSON | 24,553 | 24,889 | 336 | 1.37% | null | null | null | null | null | null | null | null | null | null |
| JOSEPHINE | 88,204 | 88,728 | 524 | 0.59% | null | null | null | null | null | null | null | null | null | null |
| KLAIPATH | 69,512 | 69,822 | 310 | 0.45% | null | null | null | null | null | null | null | null | null | null |
| LAKE | 8,165 | 8,177 | 12 | 0.15% | null | null | null | null | null | null | null | null | null | null |
+---+---+---+---+---+---+---+---+---+---+
only showing top 20 rows
```

Resulting Dataset

county	date	product	marketshare	sales	population
Baker	10/1/2016	Usable MJ	100	58637.51	16860
Baker	10/1/2017	Concentrate/Extract	34.13	584636.1	16860
Baker	10/1/2017	Edible/Tincture	6.87	124261.1	16860
Baker	10/1/2017	Other	1.46	20376.67	16860
Baker	10/1/2017	Usable MJ	57.54	1046158	16860
Baker	10/1/2018	Concentrate/Extract	22.76	647949.8	16860
Baker	10/1/2018	Edible/Tincture	7.45	214373.5	16860
Baker	10/1/2018	Industrial Hemp Commodity/Product	1.86	53832.29	16860
Baker	10/1/2018	Other	17.97	517501	16860
Baker	10/1/2018	Usable MJ	49.96	1446808	16860
Baker	10/1/2019	Concentrate/Extract	28.42	333685.5	16860
Baker	10/1/2019	Edible/Tincture	8.01	95065.16	16860
Baker	10/1/2019	Industrial Hemp Commodity/Product	0.8	9478.78	16860
Baker	10/1/2019	Other	5.41	64170.61	16860
Baker	10/1/2019	Usable MJ	57.36	641647.5	16860
Baker	10/1/2020	Concentrate/Extract	24.73	137385.4	16860
Baker	10/1/2020	Edible/Tincture	9.25	51698.32	16860
Baker	10/1/2020	Industrial Hemp Commodity/Product	0.31	1702.5	16860
Baker	10/1/2020	Other	10.17	57025.52	16860

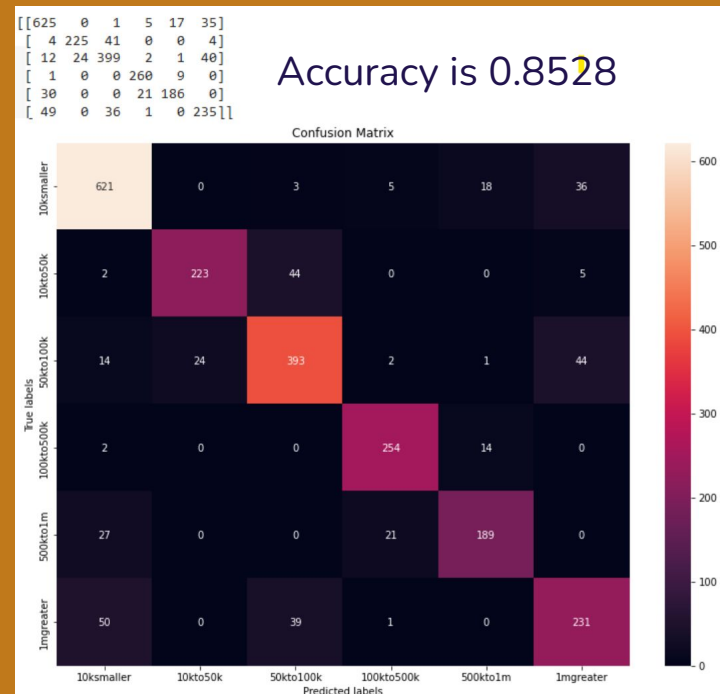
1. Import AWS CSV containing sales data per County and CSV with census data to AWS PostgreSQL using SQLAlchemy
2. Group and order MJ data by County, Date, and ProductType
3. Drop unnecessary columns from census data
4. Remove whitespace and commas from table data
- 5.

```
SELECT
    cannadata.county,
    cannadata.date,
    cannadata.product,
    cannadata.marketshare,
    cannadata.sales,
    public."CountyPop".population
INTO complete_county_data
FROM cannadata
LEFT JOIN public."CountyPop"
ON cannadata.county = public."CountyPop".county
ORDER BY county;
```

Linear Regression

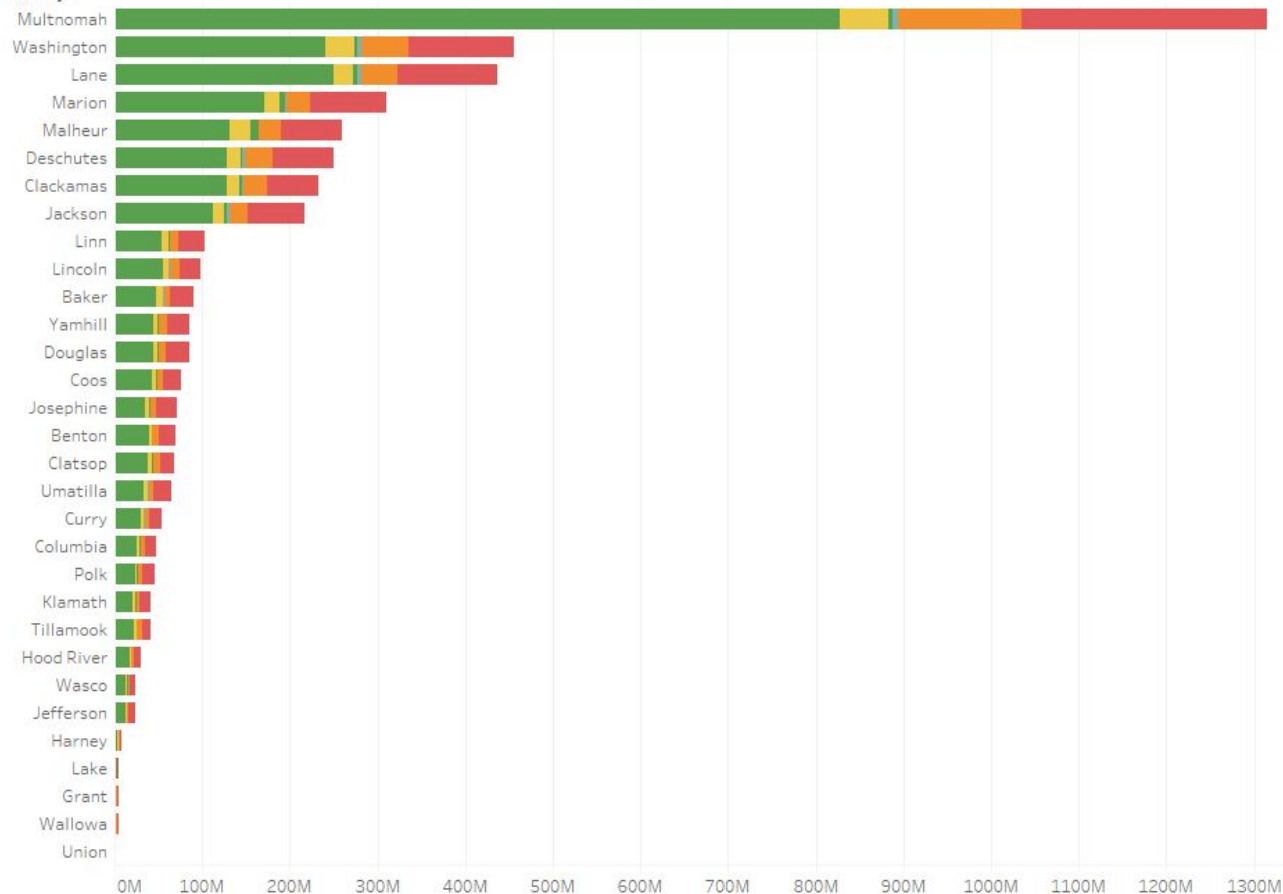
Random Forest Classifier

	Predicted	Observed	Residual	Abs. Error
0	-1.035797e+05	849	-1.044287e+05	1.044287e+05
1	-1.680917e+05	13012	-1.811037e+05	1.811037e+05
2	4.534763e+05	10	4.534663e+05	4.534663e+05
3	3.419492e+06	1818879	1.600613e+06	1.600613e+06
4	7.504363e+05	68059	6.823773e+05	6.823773e+05
...
7130	-3.575317e+05	7556	-3.650877e+05	3.650877e+05
7131	-4.317717e+05	22591	-4.543627e+05	4.543627e+05
7132	-1.624597e+05	43260	-2.057197e+05	2.057197e+05
7133	1.125476e+06	679291	4.461853e+05	4.461853e+05
7134	1.913956e+06	3190012	-1.276056e+06	1.276056e+06



Sales by County and Product Type

County

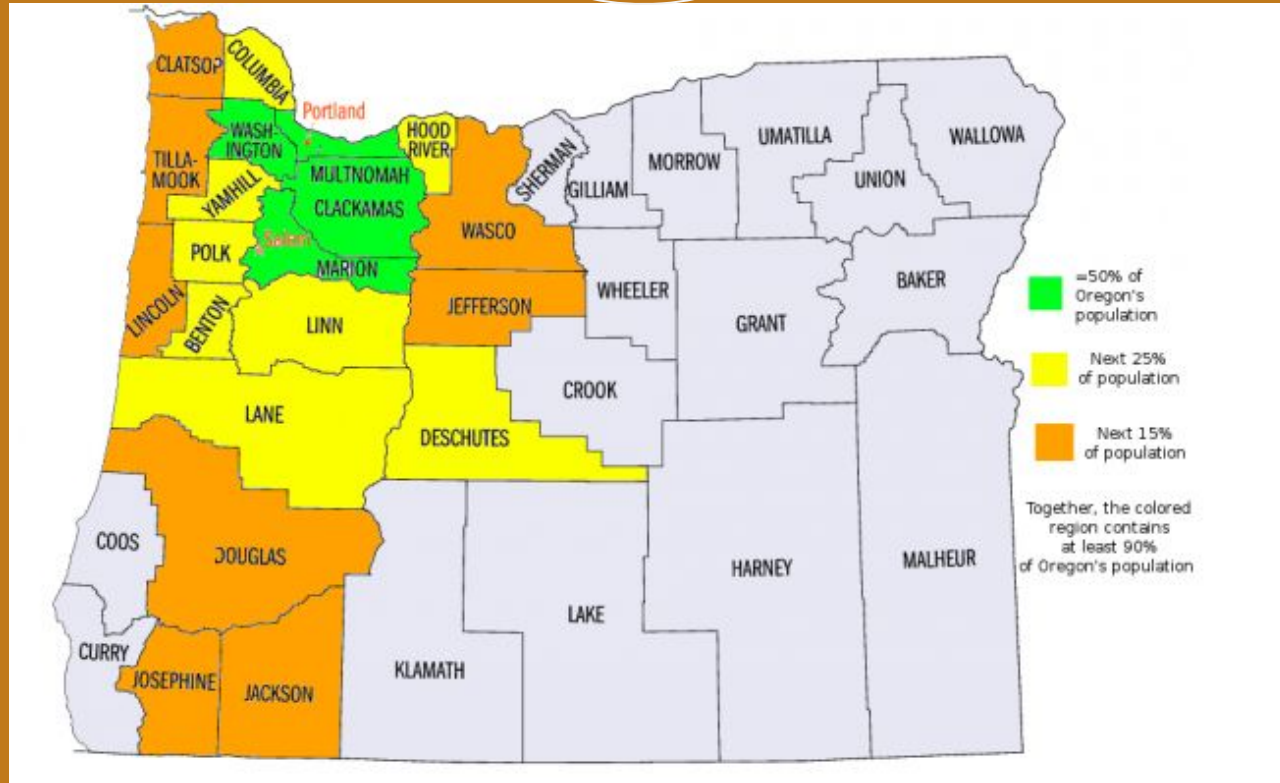


Sales

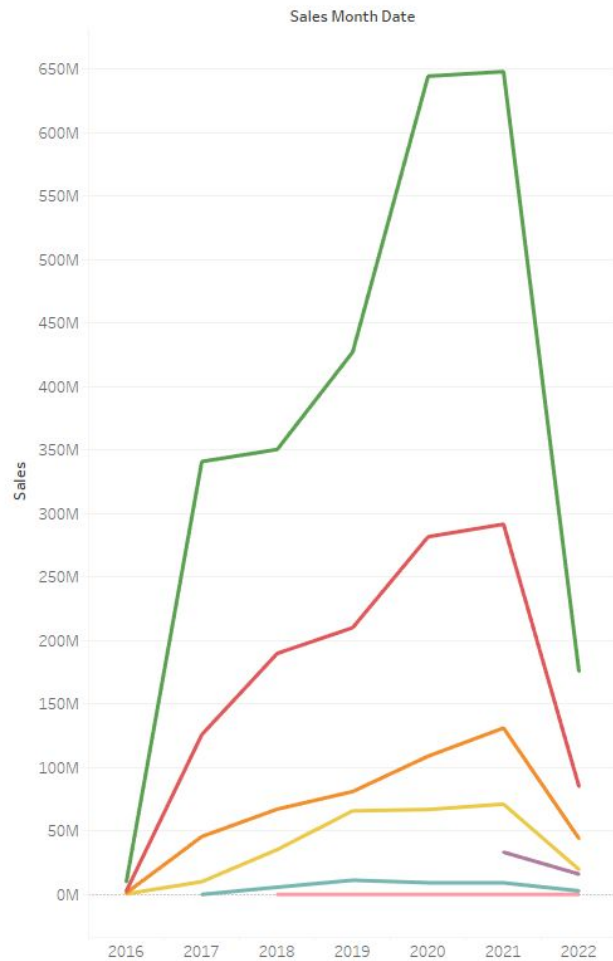
Product Type

- Concentrate/Extract
- Edible/Tincture
- Industrial Hemp
- Industrial Hemp Com..
- Inhalable Product wi..
- Other
- Usable MJ

Oregon Population By County



Sales by Product Type over Time



Product Type

- Concentrate/Extract
- Edible/Tincture
- Industrial Hemp
- Industrial Hemp Commodity/Product
- Inhalable Product with Non-Cannabis Additiv..
- Other
- Usable MJ



Tools and Sources

- Portland State University Census Data for Oregon
 - Oregon.gov OLCC Marijuana Market Data
 - Python
 - SQLAlchemy
 - PostgreSQL
 - Tableau
 - Jupyter Notebook
 - Spark
- 