California Water Use Data Analysis

Retail Comparison:
Normal Year vs. Multi-Year Drought

Introduction

Abundant CA Water Use Data

- State of water supply and demand
- Normal year and multiple-dry year

+

CA Water Utilities' UWMP's

- Future plans for water utilities
- Sustainability analysis of plans

= Case Study!

Data Analysis

The Meaning of the Numbers

Water Use Datasets

2015 UWMP Water Supply Reliability Assessments

Normal Year Data

2020 - 2040 supply and demand projections for all California retail water suppliers.

Table 7- 2

Multiple-Dry Year Data

2020 - 2040 supply and demand projections for first through third dry years for all California retail water suppliers.

Table 7- 4

Supply Change

Change Between Normal Year and Third Year Drought Supplies

1. Create normal year supply & multiple-dry year DataFrames
2. Select suppliers present in both DataFrames

```
# Import normal year retail excel table
normal = pd.read_csv('normal_retail.csv')
# Normal Supply Retail
normal_supply = normal[normal['TOTAL_TYPE'] == 'Supply totals']
# Select suppliers that are present in both normal & drought data
drt_sup = drought_supply.loc[drought_supply['water_supplier']
.isin(normal_supply['water_supplier'])]
```

3. Find change in supplies for third year drought & normal year by utility

```
# Find change between normal & drought supplies
change = drt - nrm / nrm
```

4. Average supply changes over 2020 - 2040
5. Find top 50 utilities for absolute supply change

```
# Top 50 absolute supply changes
top_50_sup = avg_chg_sup.nlargest(50, 'supply_avg_chg')
```

```
top_50_sup
```

	water_supplier	supply_avg_chg	+/-
54	Chowchilla, City of Water Department	61.601601	+
94	Hi Desert Water District	0.783197	-
10	Beaumont - Cherry Valley Water District	0.639903	-
190	South Feather Water and Power	0.611071	-
117	Marin Municipal Water District	0.603575	-
13	Benicia City Of	0.596912	-

Demand Change

Change Between Normal Year and Third Year Drought Demands

Repeat same steps as supply change!

```
top_50_dem
```

	water_supplier	demand_avg_chg	+/-
177	South Feather Water and Power	2.068829	+
61	Daly City	0.593120	+
58	Corona City Of	0.392462	+
105	Lincoln City Of	0.352347	-
142	Placer County Water Agency	0.345214	+
113	Madera City Of	0.325465	-
89	Groveland Community Services District	0.300606	-

Note: Data discrepancies - order of magnitude off

Supply - Demand

Supply Minus Demand for Third Year Drought, Years 2020-2035

1. Create third year drought supply & demand year DataFrames

```
# Third year drought supply
drt3_sup = drought_supply[drought_supply['year_type'] == 'Third year']
.drop(columns = ['year_type', '2040'])
```

2. Find supply minus demand by utility

```
# Find supply - demand
dif = sup_values - dem_value
```

3. Find bottom 50 utilities for 2035

```
# Bottom 50 supply - demand for 2035
bot_50_sup_dem = sup_minus_dem.sort_values(by = ['2035'], ascending = False).nsmallest(50,
'2035')
```

bot_50_sup_dem

	water_supplier	2020	2025	2030	2035
240	San Jose Water Company	-42884.638790	-22120.543700	-37041.476300	-54509.585900
80	East Bay Municipal Utility District	0.000000	-1120.144100	-13441.728800	-23523.025300
16	Beaumont - Cherry Valley Water District	-10517.000000	-11731.000000	-13451.000000	-14768.000000
303	Yuba City	-2163.565940	-4980.804980	-8246.101660	-12033.109260
124	Hayward City Of	-8715.641500	-9482.863460	-10587.663090	-11140.062900
239	San Jose City Of	-3796.000000	843.000000	-3782.000000	-9633.000000
42	California Water Service Company Los Altos/Sub...	-4318.000000	-2161.000000	-3532.000000	-5077.000000
230	San Buenaventura City Of (Ventura)	-2645.000000	-3203.000000	-3653.000000	-4117.000000

Results

Which Utilities That Stand Out?

Top 50 Supply

50 Utilities that experience largest absolute change between normal year and third year drought supplies.

Bottom 50 Supply - Demand

50 Utilities that experience largest shortage in water supplies in third year drought.

Top 50 Demand

50 Utilities that experience largest absolute change between normal year and third year drought demands.

All 50

Utilities that appear in all three categories - aka volatile utilities.

UWMP Analysis

The Reasons Behind The Numbers

UWMP Examination

Analyze Several Utilities Based on Results

Results

Select several utilities to analyze based on Bottom 50 Supply - Demand & All 50

Magnitude

Select utilities with greatest numerical variations

Location

Select utilities that represent the state as a whole

Utility Selection

1. San Jose
2. EBMUD
3. Beaumont
4. Yuba City
5. Ventura

UWMP Findings

1. San Jose
   - Groundwater and imported supply are main supply components
   - **Minimal development** in future sources, concerning considering utilities large supply population
2. EBMUD
   - Only local runoff is not curtailed; Mokelumne and CVP limited
   - **Need supplemental supplies**; projects not yet underway/constructed
3. Beaumont-Cherry Valley Water District
   - Heavy reliance on sources that are precipitation and climate-dependent
   - Serve **lack of diversified sources**
4. Yuba City
   - Only viable water source is the Feather River which experiences restrictions/curtailments
   - Lack of supply in drought years and lack of supply options is **concerning**
5. San Buenaventura City of (Ventura)
   - Decent amount of current water supplies, however not very diversified
   - Utility is very **forward-thinking** though and takes project implementation seriously

Holistic Analysis

Viability of Utilities Based on UWMP's

Supply Sources

Are water supplies capable of meeting demand? For all projected dates?

Future Planning

Holistic view of the future state of water? Does it make sense?

Patterns?

Common oversights?

Population

Does utility adequately account for growing population needs? Infrastructure-wise?

Diversified Sources

Does utility have a diversified water portfolio? Stable and adaptive?

Thank you

San Jose Water Company

- Population:

2015	2020	2025	2030	2035	2040
0.98M	1.03M	1.09M	1.14M	1.20M	1.26M

- Supply Sources: Santa Clara Subbasin Groundwater, Imported Treated Surface Water, Recycled Water

- Projections: Investments in local water sources are necessary to ensure source reliability in multiple-dry years
  - Groundwater and imported supply are main supply components, more diversified water portfolio is needed
  - Regional collaboration, interagency interties, groundwater management/recharge, potable reuse, desalination
  - No specific capacity or supply has been identified

- Summary:
  - Minimal development in future sources, concerning considering utilities large supply population

EBMUD

- Population:

2015	2020	2025	2030	2035	2040
1.39M	1.45M	1.51M	1.58M	1.65M	1.72M

- Supply Sources: Mokelumne River (not most senior water rights), Local Runoff, CVP (dry/emergency periods - allocation curtailment), Recycled Water

- Projections: Multi-year drought supplemental supplies are necessary to meet demand
  - Water transfers, desalination, groundwater, groundwater banking, surface water storage

- Summary:
  - Only local runoff is not curtailed; Mokelumne and CVP limited due to senior rights holders and allocation needs
  - Need for supplemental supplies; projects not yet underway/constructed
  - Water transfers are most likely in dry years, however would just limit supply elsewhere

Beaumont-Cherry Valley Water District

- Population:

2015	2020	2025	2030	2035	2040
48,377	61,386	69,306	78,393	86,949	94,804

- Supply Sources: Edgar Canyon & Beaumont Basin Groundwater, Recycled Water, Untreated Imported SWP Water

- Projections: Groundwater and banked groundwater are reliable sources throughout multi-year droughts
  - Current supplies: groundwater, banked groundwater, stormwater/runoff, imported water (variable), recycled water
  - Planned supplies: more recycled water, groundwater recharge, stormwater/runoff

- Summary:
  - Heavy reliance on sources that are precipitation and climate-dependent
  - Serve lack of diversified sources

Yuba City

- Population:

2015	2020	2025	2030	2035	2040
71,070	82,390	95,513	110,725	128,361	148,806

- Supply Sources: Imported Water from NYWD & SWP, Sacramento Valley Groundwater, Surface Water License/Permit

- Projections: Insufficient water production capabilities are anticipated to support the long-term growth of the community
  - Curtailment/restrictions of surface/imported water are common
  - Aquifer storage only supplemental supply
  - Groundwater is hard and contaminated → emergency supply only

- Summary:
  - Only viable water source is the Feather River which experiences restrictions/curtailments
  - Lack of supply in drought years and lack of supply options is concerning

San Buenaventura City of (Ventura)

- Population:

2015	2020	2025	2030	2035	2040
112,412	115,487	118,647	121,895	125,232	128,661

- Supply Sources: Imported Water (turn back), Surface Water from Casitas and Ventura River, Groundwater from Various Basins (3), Recycled Water

- Projections: Insufficient supplies in multi-dry year until 2030 when planned supplies come online
  - Well planned supplemental supplies: Forest Park Restoration, Recycled Water, IPR/DPR, Desalination, Brine

- Summary:
  - Decent amount of current water supplies, however not very diversified
  - Utility is very forward-thinking though and takes project implementation seriously