**INTRO**

- The federal government has been providing subsidies to the dairy industry since 1933 to keep farmers’ incomes steady and prevent price fluctuations to consumers.
- Subsidies incentivize dairy production that causes increases in agricultural production which increase water demand.
- Dry climate, abundant sunshine, and good soil produce greater alfalfa yield, which feeds the dairy cow population.
- Limited surface water supplies and large unregulated groundwater areas create the potential for unsustainable pumping to support alfalfa expansion.
- We explore the impacts of these subsidies on groundwater storage in Arizona.

**Dairy Subsidy History**

- **1933 & 1937- Agricultural Adjustment Act & Agricultural Marketing Agreement Act**
  Ensured reasonable price & supply for both farmers and consumers.
- **1949- Agricultural Act (Milk Price Support Program)**
  Government bought dairy products from farmers to supplement their salary.
- **1981- Temporary Emergency Food Assistance Program**
  Government had a dairy surplus so they distributed 300 million pounds to low income families.
- **1983- Dairy Production Stabilization Act**
  Direct payments to farmers to reduce milk production.
- **2014- Dairy Margin Protection Program**
  Similar to insurance, farmers pay a premium to ensure a margin.

**METHODS**

- Data from 45,000 wells containing water levels & pumping rates from Arizona Department of Water Resources (ADWR) and United States Geological Survey (USGS) were analyzed from 1901-2020.
- Alfalfa & dairy cow locations were analyzed from the United States Department of Agriculture (USDA) agricultural statistics survey completed every 5 years from 1930-2017.
- CropScape, a database which uses satellite remote sensing data to determine ground cover, was used to analyze spatial & temporal changes in alfalfa locations from 2008-2020 in QGIS.

**PRELIMINARY RESULTS**

- Findings show a connection between increased alfalfa growth and declining water levels in areas where alfalfa is mainly irrigated by groundwater.
- Alfalfa is grown in close proximity to natural rivers indicating that surface water is also an important water source.
- Results show a sharp increase in dairy cow population & alfalfa acres in Arizona (See Arizona Alfalfa vs. Dairy Cows).

**FUTURE RESEARCH**

- Investigate the connection between the alfalfa expansion and new groundwater regulation in CA.
- Explore spatial patterns in alfalfa expansion & groundwater declines relative to different groundwater regulation areas in AZ.
- Investigate discrepancies between USDA AG stats and CropScape alfalfa acreage.
- Differentiate alfalfa irrigation sources between surface water and groundwater.
- Analyze how subsidies affect dairy nationally vs. in Arizona.