# Developing A Multi-sector, Multi-basin Drought Decision Support System Incorporating Economic Consequence Assessment


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# Why Multi-sector, Multi-basin?

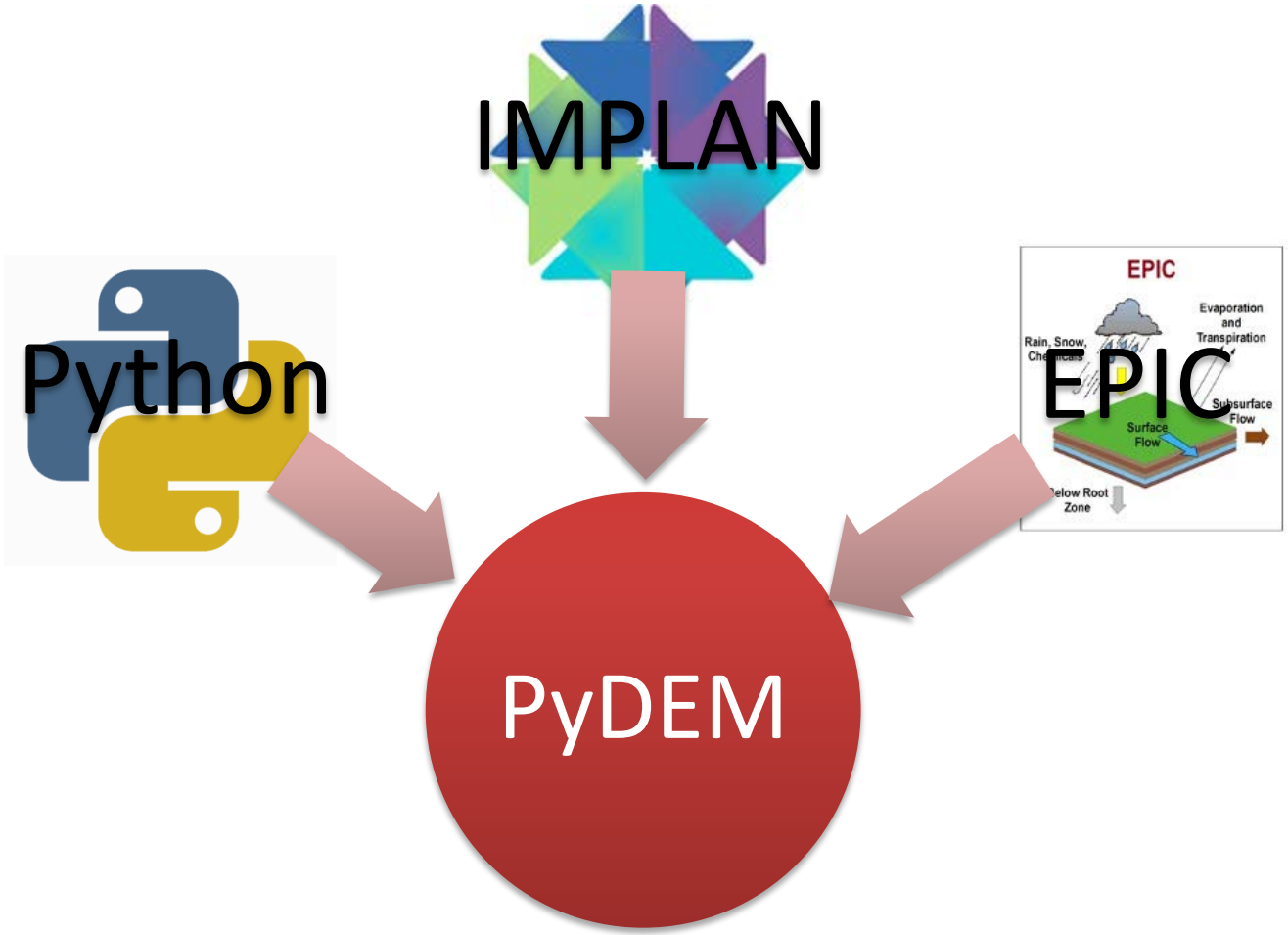
- Almost all models deal with drought impact just in the agricultural sector within a single basin
- While drought impacts are rarely restricted to basin boundaries, and not only significant in agricultural

PyDEM

# Drought Economic Impact Model

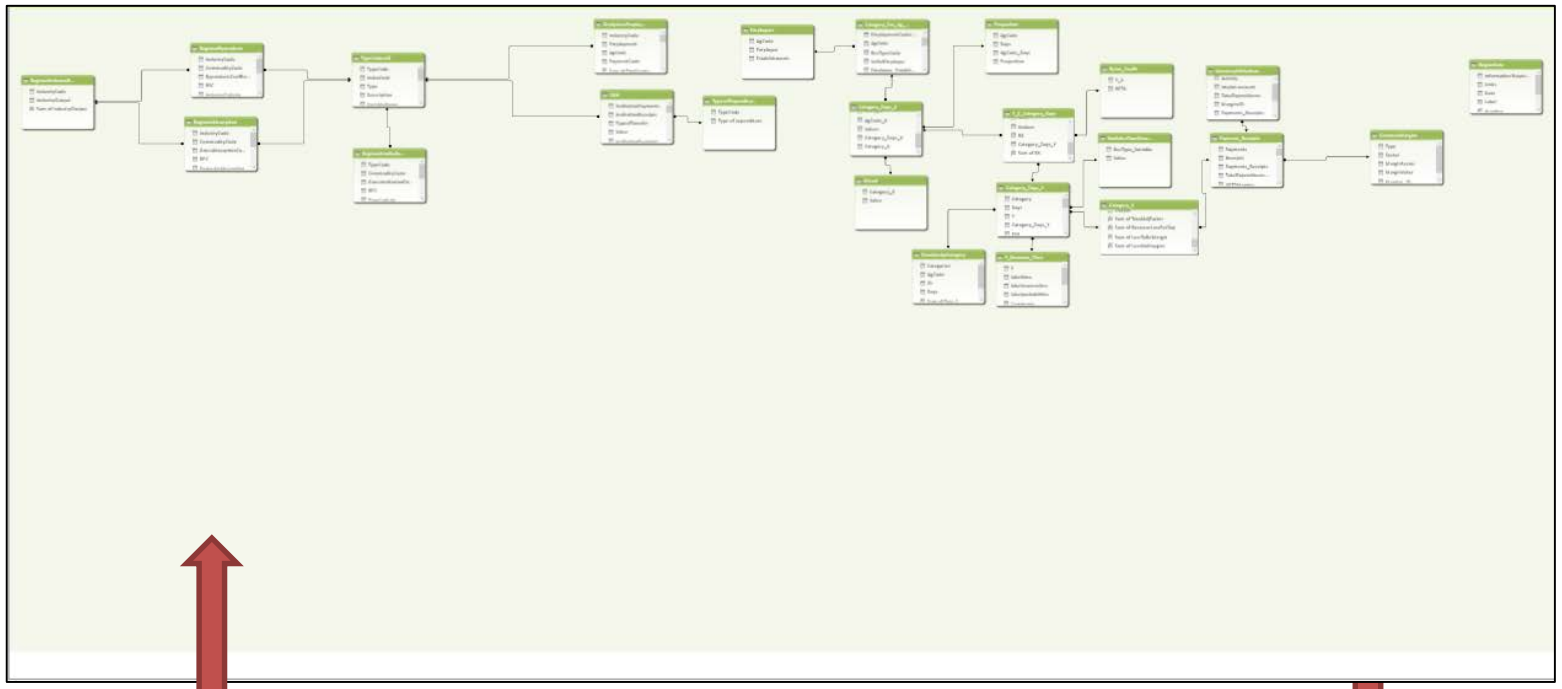
- PyDEM (Drought Economic Impact Model in Python) is a continuous system dynamics drought economic impact model:  developed based on social accounting matrix and input-output model(IO model), and coupled with Environmental Policy Integrated Climate model for analyzing drought caused soil erosion together with agriculture production.

# Drought Economic Impact Model



# Drought Economic Impact Model

Logic diagram of PyDEM

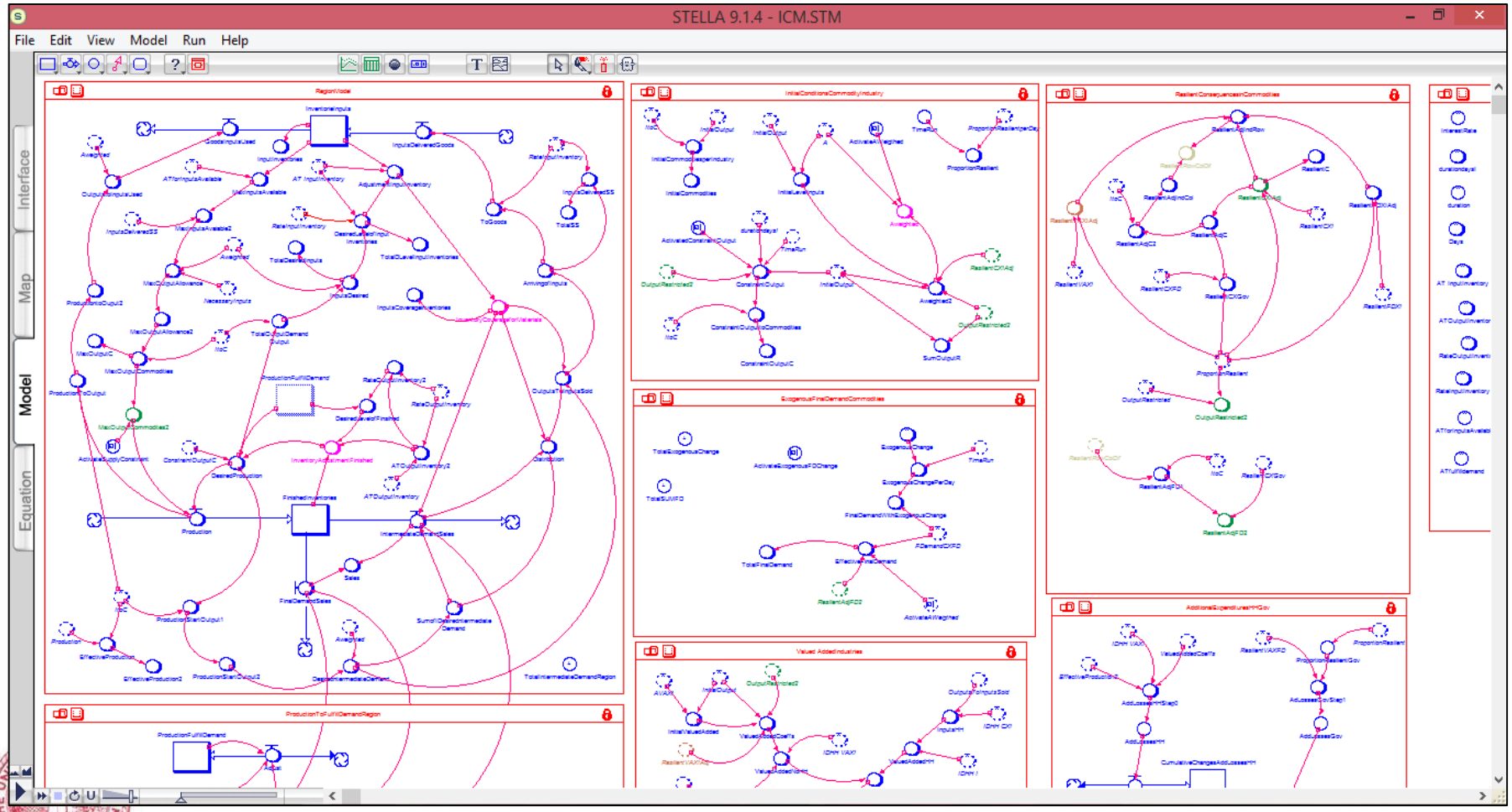


IMPLAN Data
536 sectors

NAISC Code
13 sectors

# Drought Economic Impact Model

Logic diagram of PyDEM



# Drought Economic Impact Model

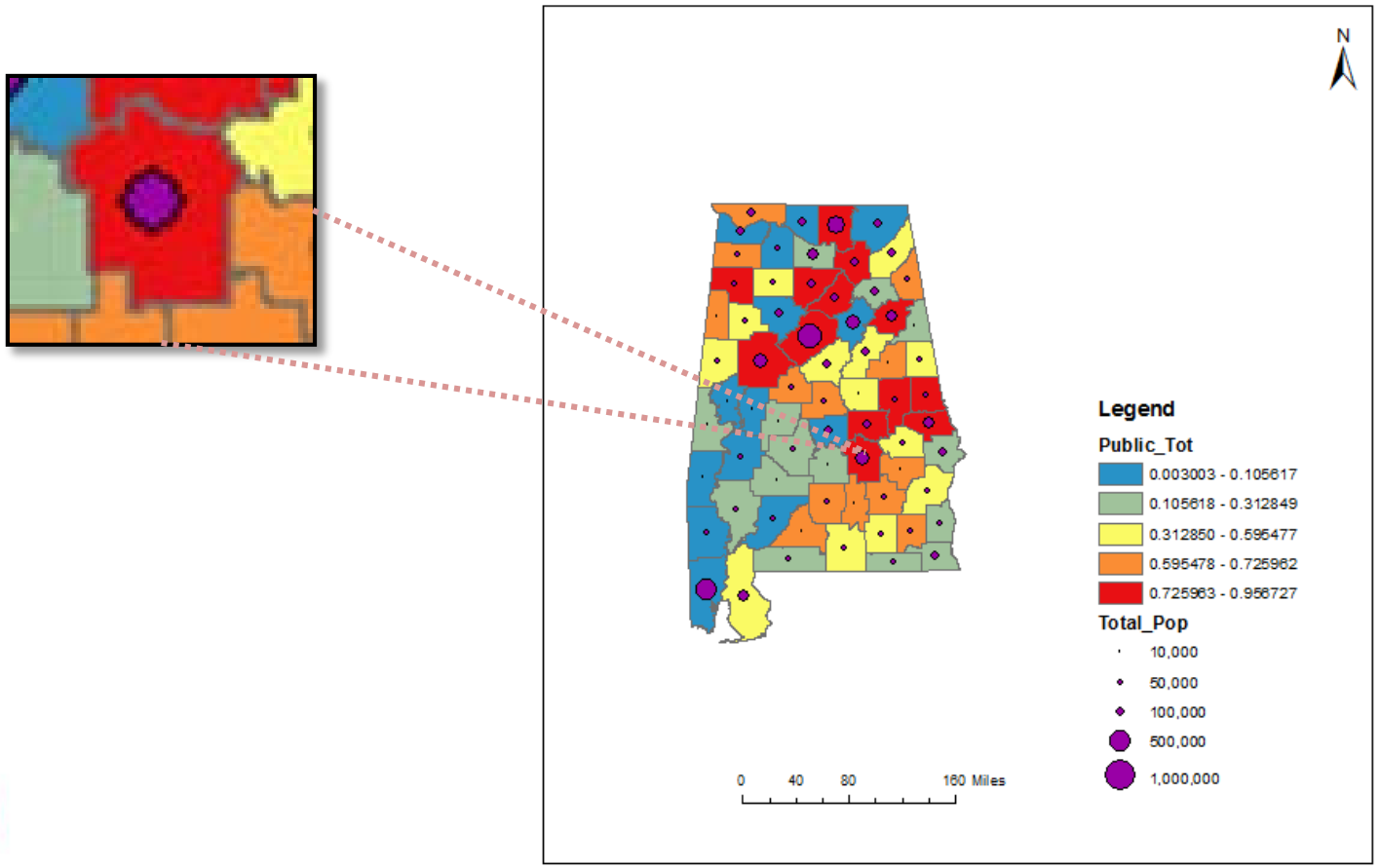
- In PyDEM, the structure of industry in the modeling area was considered.
- The drought economic impact of each industry sector can be simulated with this model.
- With PyDEM, it is easy to figure out the most susceptible industry sector in the specific area.
- Knowing which sector will have the most serious economic impact will help manage the limited resources efficiently.

# Drought Economic Impact Model

- EPIC
  - Environmental Policy Integrated Climate (EPIC) model was developed to assess the effect of soil erosion on soil productivity.
  - EPIC considered hydrology, snowmelt, water table dynamics, weather, erosion, nutrients, pesticide fate, soil temperature, crop growth, tillage, plant environment control, and economics.

# Case study—Montgomery county, AL

- Population & percentage of public supply water in total fresh water withdrawals

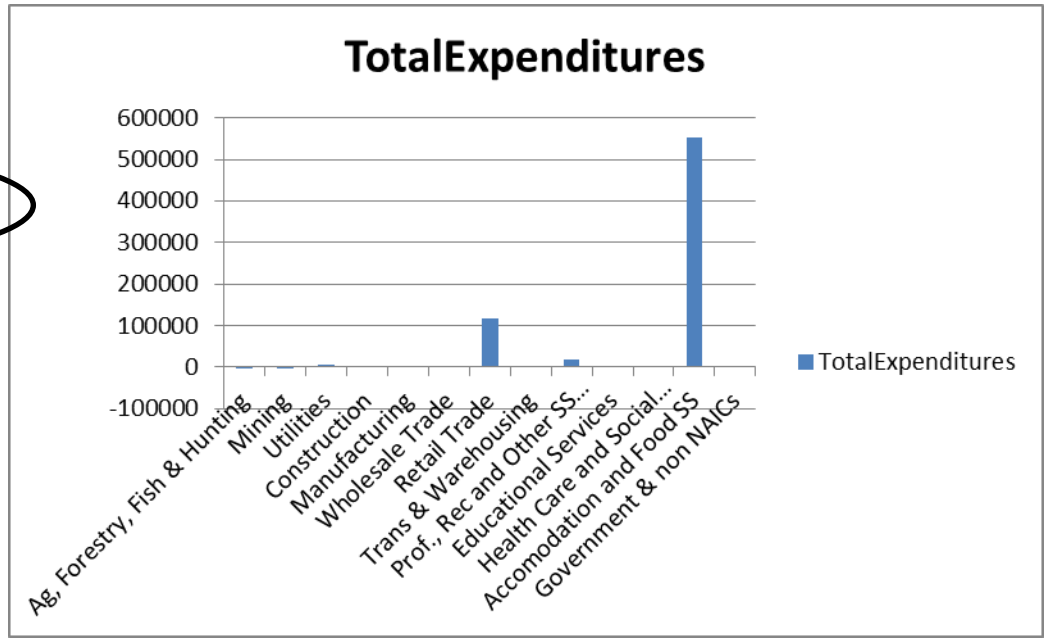


# Case study—Montgomery county, AL

- Montgomery County, AL, population 226,659, 98% of the population are served by utility, Gross Regional Production was $13 billion in 2013. Montgomery County associates with five watersheds: Upper Conecuh, Patsaliga, Lower Coosa, Lower Tallapoosa, Upper Alabama.
- A 30 days drought in Montgomery county was simulated.

# Model Result

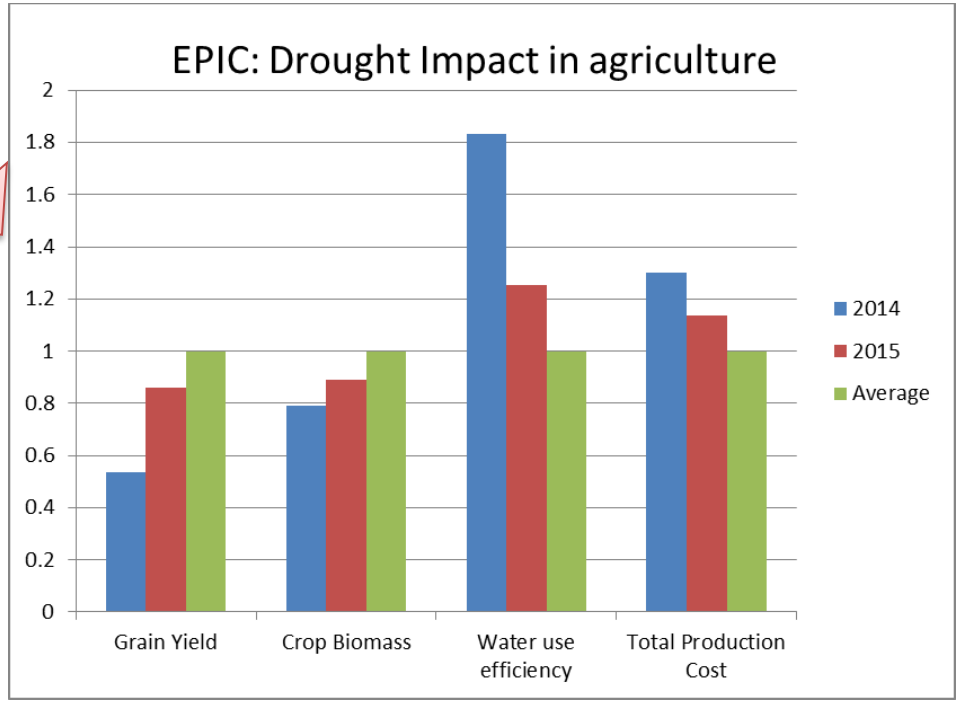
| Sector | TotalExpenditures |
|---|---|
| Ag, Forestry, Fish & Hunting | -0.915456658 |
| Mining | -0.898546261 |
| Utilities | 6473.083685 |
| Construction | -0.059849919 |
| Manufacturing | 117.988903 |
| Wholesale Trade | 0 |
| Retail Trade | 118097.4331 |
| Trans & Warehousing | 0.017328634 |
| Prof., Rec and Other SS (No Public Ac | 18444.42346 |
| Educational Services | 0 |
| Health Care and Social Assistance | 1297.248183 |
| Accomodation and Food SS | 554152.5384 |
| Government & non NAICs | 616.8125097 |
| Employee Compensation | 1389.90646 |
| Households | 34226.51266 |
| Grand Total | 734814.0909 |



# Model Result

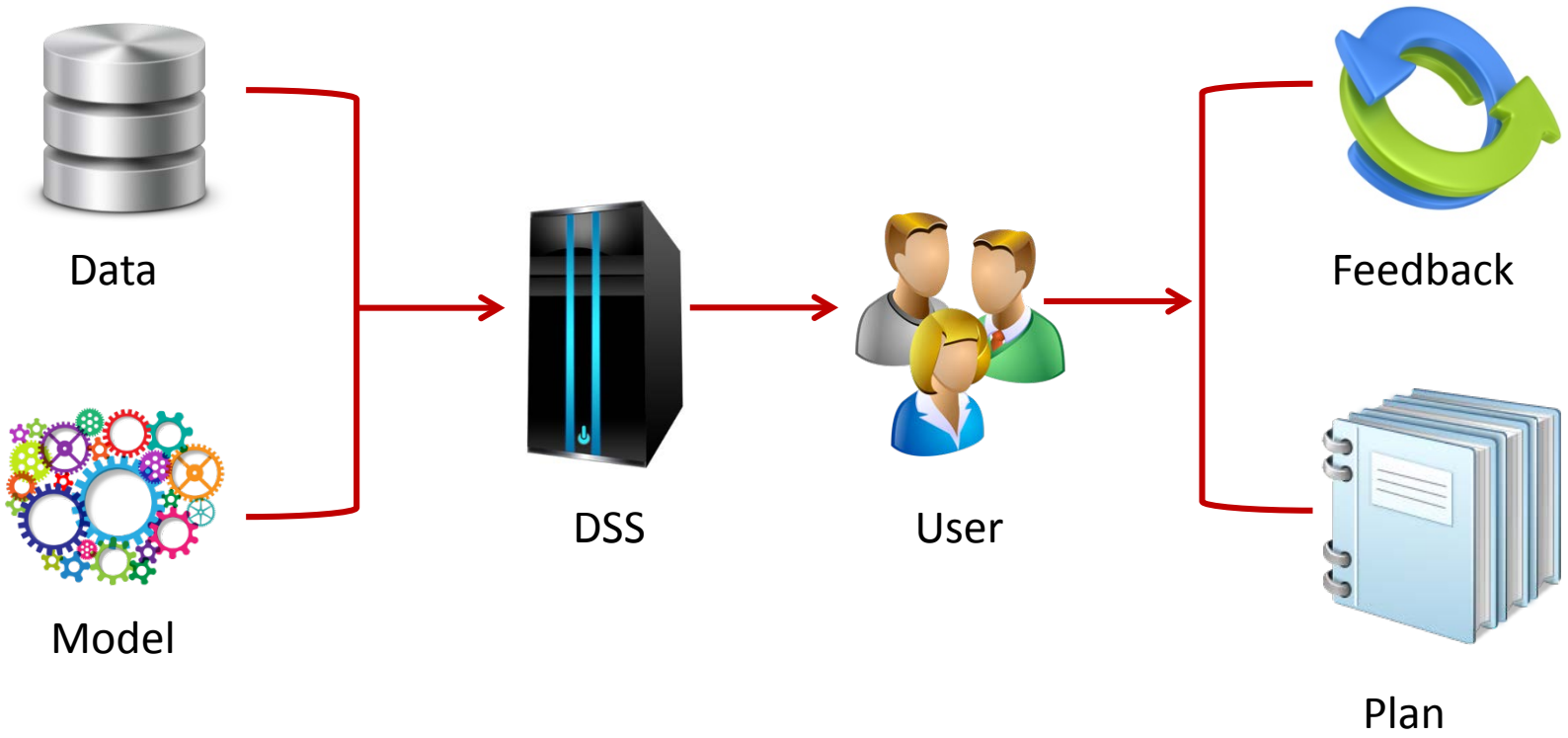
| Feb. Current | Feb. New | Mar. Default | Mar. Current | Mar. New | Apr. Default | Apr. Current | Apr. New | May Default | May Current | May New | Jun. Default | Jun. Current |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.00 | | | 8.00 | | | 8.00 | | | 5.00 | | | 10.00 |
| 1.63 | | | 2.18 | | | 3.25 | | | 2.83 | | | 1.62 |
| 0.24 | | | 0.26 | | | 0.21 | | | 0.22 | | | 0.22 |
| 0.40 | | | 0.39 | | | 0.42 | | | 0.41 | | | 0.42 |
| 275.... | | | 336.... | | | 454.... | | | 520.... | | | 527.... |
| 0.40 | | | 0.43 | | | 0.53 | | | 0.61 | | | 0.65 |
| 42.96 | | | 42.48 | | | 41.54 | | | 39.69 | | | 37.29 |
| 43.23 | | | 42.60 | | | 40.21 | | | 38.55 | | | 37.35 |
| 0.00 | | | 0.00 | | | 0.00 | | | 0.00 | | | 0.00 |
| 2.99 | | | 3.04 | | | 2.45 | | | 2.68 | | | 2.39 |
| 38.89 | | | 43.20 | | | 54.00 | | | 61.11 | | | 70.50 |
| 63.39 | | | 68.50 | | | 77.40 | | | 84.79 | | | 90.61 |

Climatological Data



# Decision Support System

- Drought Decision Support System



# Decision Support System

- **Drought Policy**
  - **Policy objectives**: the institutional structures and processes for determining the objectives of drought policy.
  - **Policy administration**: the institutional structures and processes for implementing drought policy.
  - **Analytical support**: the data, modelling and reporting systems used to support the development and implementation of drought policy.

# Conclusion

- Impacts in Retail Trade and Food SS were significant
- Long term impact in agriculture can’t be ignored
- Increase water use efficiency in agriculture
- Drought decision support system improve drought policy

# Questions?