Institute of Technology of Cambodia

Faculty of Hydrology and Water resources Engineering

Irrigated Water Management under the affect of Climate Change using Water Evaluation and Planning Model in Stung Sreng Basin, Cambodia

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CONTENTS

Background

- **Agriculture** is the traditional mainstay of the Cambodian economy. So irrigated water management should be the first thing to consider.

- Statement of problems in this study catchment:
  - Face with the scarcity of water due to climate change.
  - Expense in irrigated area
  - Most of people are famer and live based on rice growing

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Objectives

1. To estimate irrigated water demand in each irrigation schemes under present and future climate scenario
2. To address the problem of water shortage in each irrigation schemes under present and future scenarios.
3. To estimate the different situation of Irrigation requirements under Climate Change Scenario RCP 2.6 and RCP 8.5

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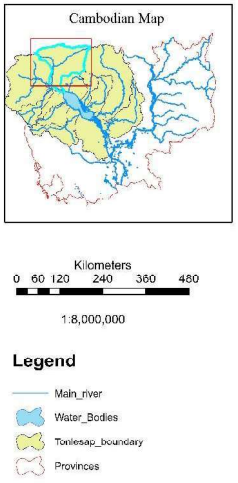
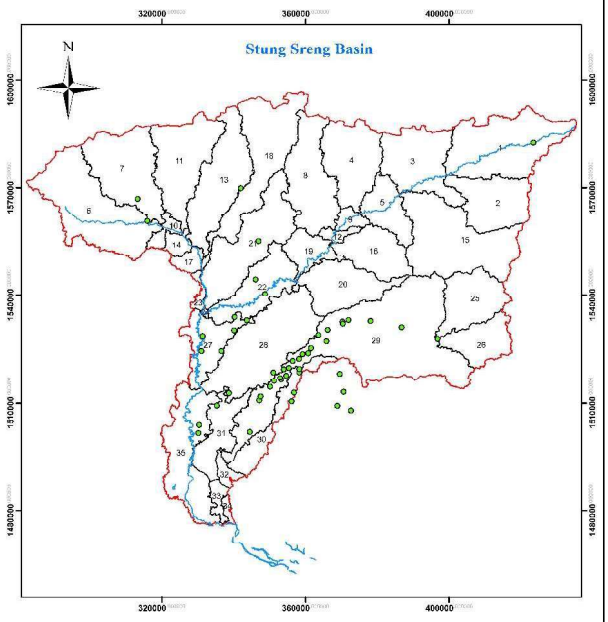
Study Area: Stung Sreng Basin

- Location: The northwest of Cambodia.
- Area: 9986 km²
- Average Annual rainfall: 1100 to 1300 mm
- Average monthly evaporation: 4.2 mm per day at Wet season and 4.6 mm per day at Dry season
- There are 51 irrigation schemes equal to 52600 ha





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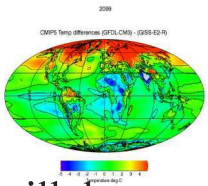
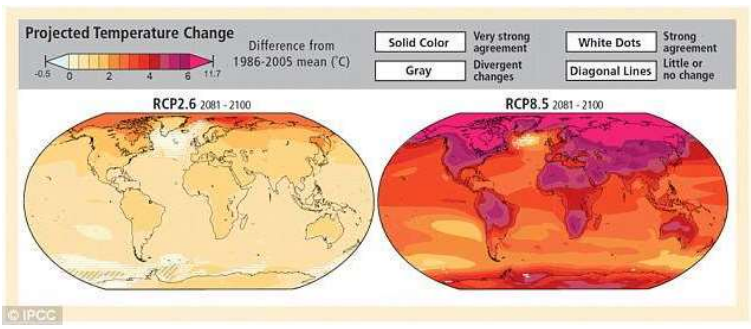
Scenario Description



1. Reference Scenario: All information in current account will be input into each irrigations schemes from 2019 to 2030.
2. Annual Increase in Irrigation Demand Scenario: crop growing area in dry season assume to increase 5% per year until 2030.
3. Climate Change Scenario: RCP 2.6 and 8.5 at 2030s and 2060s

   A Climate Model:

   - GISS-E2-R-CC



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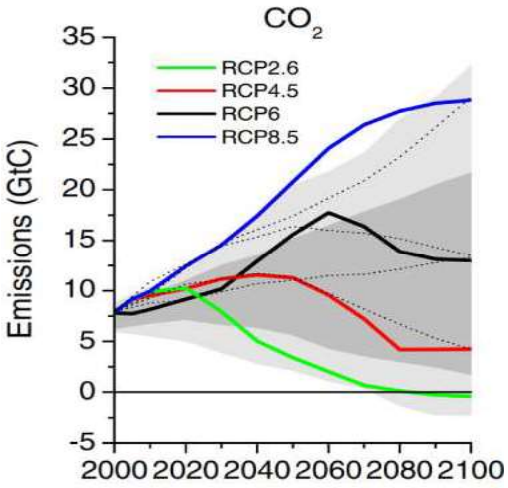
Climate Change Scenario

- RCP 2.6 (low emission of CO_2): radiative forcing reaches 3.1 W/m^2 before it returns to 2.6 W/m^2 by 2100. In order to reach such forcing levels, ambitious greenhouse gas emissions reductions would be required over time



- RCP 8.5 (high emission of CO_2): Increasing greenhouse gas emissions that lead to high greenhouse gas concentrations over time
- GISS-E2-R-CC: drier overall

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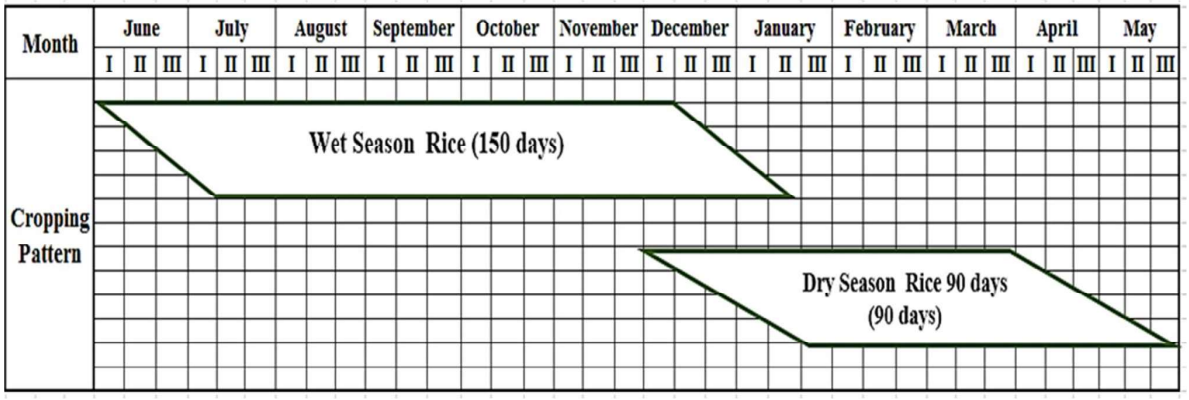
Input Data

Crop growing calendar



Cropping patterns for the season rice crops are based on the assumption that the transplanting method is used as the prevailing and dominant farming practice. This method produces a higher unit yield of rice than the direct sowing method (CDRI, 2015).

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Input Data

Irrigation Water Requirement

- **Current Scenario**

$IWR = (ETo \times Kc + PR + Lp - ER)/IE$ (JICA, 2012)

ETo : Evapotranspiration — *Lp* : Land Preparation

Kc : Crop factor — *ER* : Effective Rainfall

PR : Percolation — *IE* : Efficiency

- **Climate Change Scenario (RCP 2.6 and 8.5)**

$IWR = (ETo \times Kc + PR + Lp - ER)/IE$

$ETo = P \times (0.46 \times Tmean + 8)$ (Blaney-Criddle)

$ER = 0.8 \times R\ (5.0 \le R \le 80mm)$, $ERmax = 64mm$,

- Future Temperature
- Future Rainfall

} (MRC, 2015)

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Input Data

Streamflow

- **Current Scenario**

Streamflow received from SWAT Model

- **Climate Change Scenario (RCP 2.6 and 8.5)**
  - Adjusting meteorological data:

Precipitation
Temperature
Solar Radiation
Humidity

} (MRC, 2015)

  - Driving into SWAT to generate future streamflow

Source: (Heng et Oeurng)

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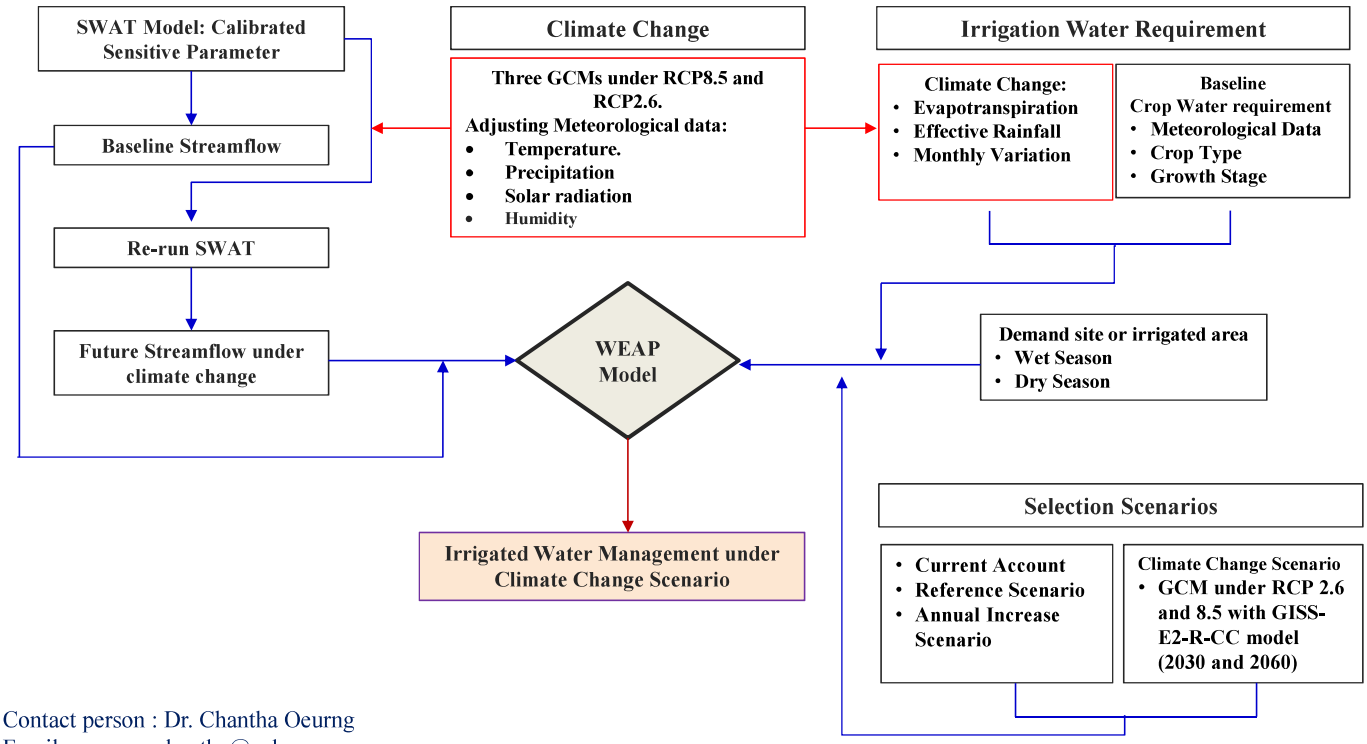
Overall Study Flow Chart



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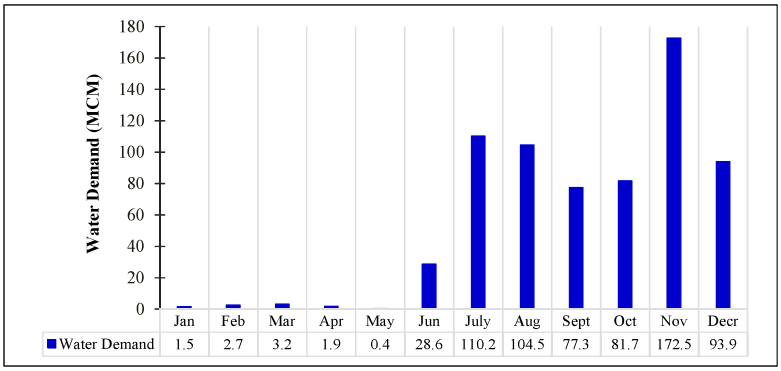
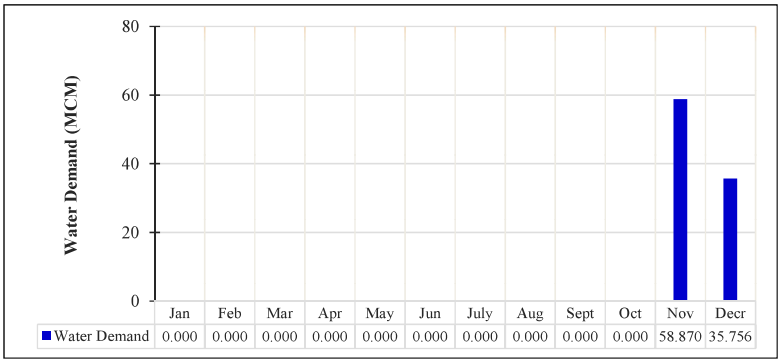
Reference Scenario

- **Water demand:**
  - Irrigation water requirement is 678.35 MCM
  - the most water need is in November.
  - The lowest is in May.



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Decr
Water Demand	1.5	2.7	3.2	1.9	0.4	28.6	110.2	104.5	77.3	81.7	172.5	93.9

- **Unmet demand:**
  - Unmet Demand is 94.6 MCM per annum
  - It occurs only in November and December



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Decr
Water Demand	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	58.870	35.756

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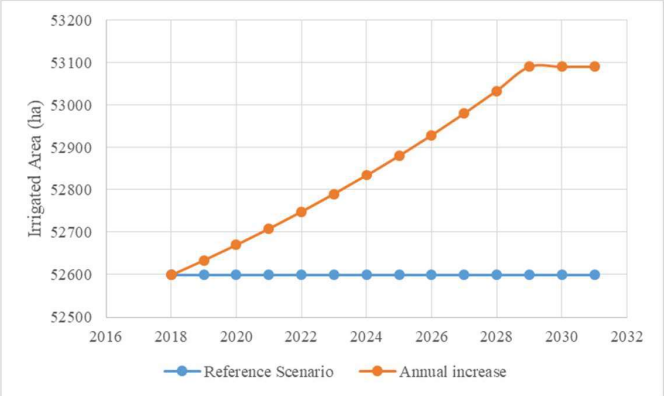
Annual increase scenario

Annual increase in irrigation demand assumes that the command area of dry season rice is increased annually by 5 percent. The command area in 2018 is 52 600 ha, whose irrigated area in dry season is 691 ha and it will go up 5% over the period of 2019 to 2030. The total command area in 2030 is approximately 53 100 ha.



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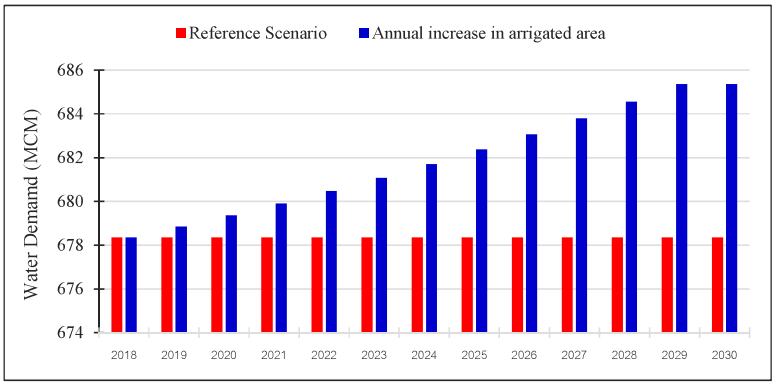
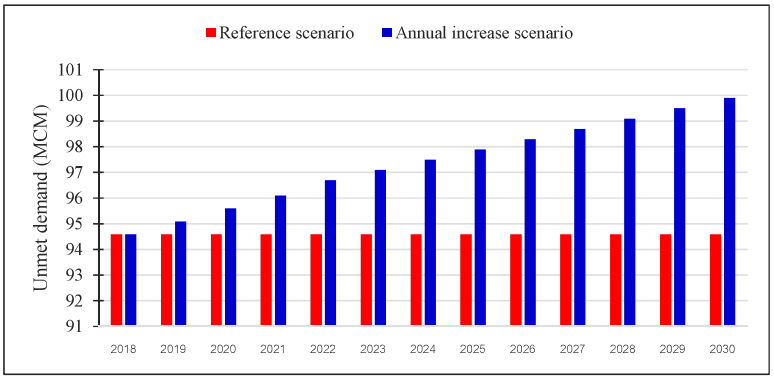
Annual increase scenario

- **Water demand :**
  - Irrigation Water Requirement increase from 678.35 to 684.5 MCM at 2030.



- **Unmet demand:**
  - The trend for unmet demand in this scenario is constantly increased in each years at 94.6 MCM to 99.9 MCM at 2030.



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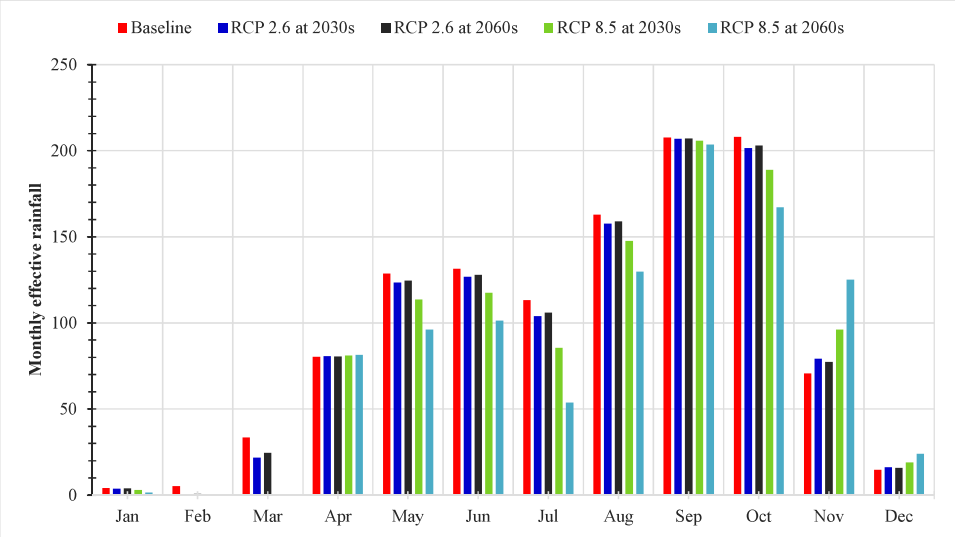
Climate change scenario in RCP 2.6 and 8.5 at 2030s

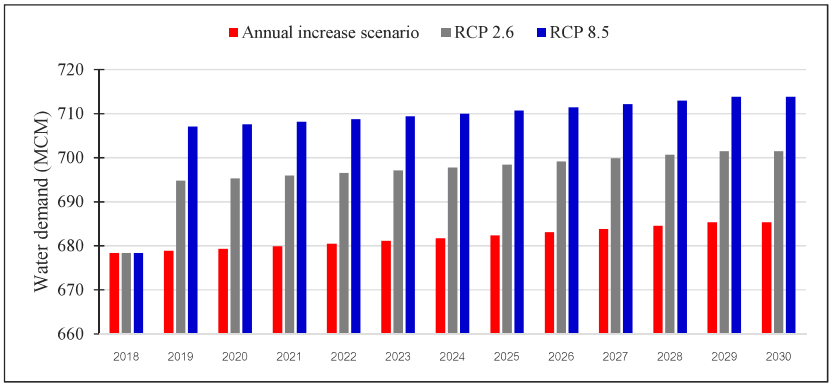
Base on the climate model scenario by using GCM model which selected GISS to study, it is shown that the absolute change of monthly rainfall distribution downscaled by Mekong River Commission (MRC), the monthly rainfall distribution rainfall data was change by simulating in WEAP model. The effective rainfall for climate scenario was calculated based on the combination of monthly effective rainfall and the change of monthly rainfall projected by Mekong River Commission (MRC)

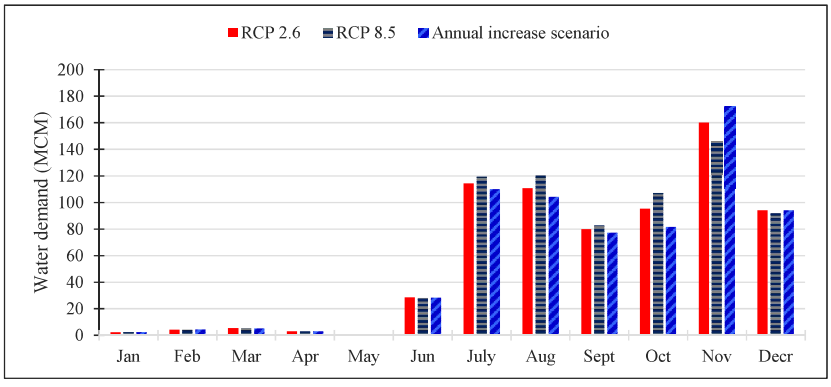


Climate change scenario in RCP 2.6 and 8.5 at 2030s

Water Demand

- **Annual total Water demand**
  - Annual increase scenario is 685.36 MCM
  - RCP 2.6 is 701.51 MCM
  - RCP 8.5 is 713.77 MCM
  - The highest water demand show on November while the lowest is in May





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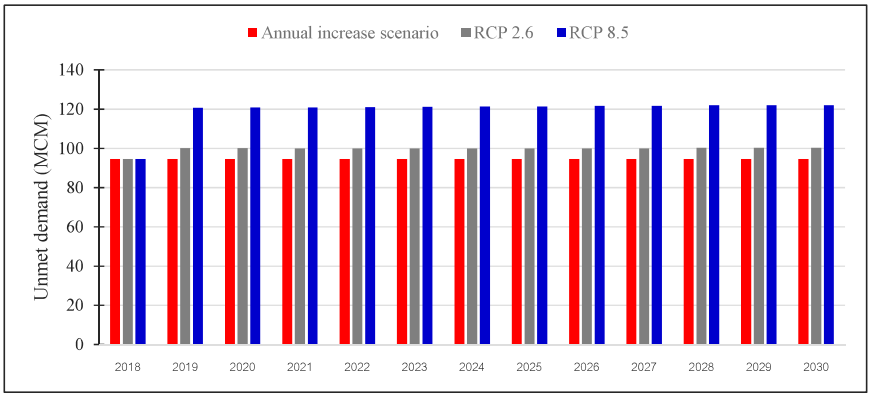
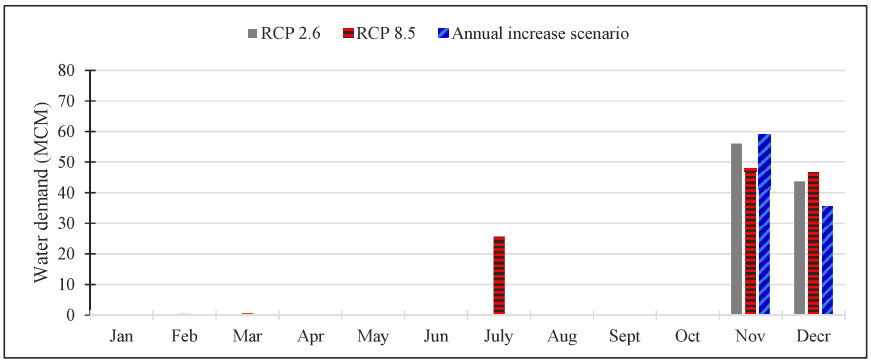
Unmet Demand

- **Annual total Unmet demand**
  - Annual increase scenario 99.9 MCM
  - RCP 2.6 is 100 MCM
  - RCP 8.5 is 122 MCM
  - The highest unmet demand show on July, November and December while the lowest is in February and March





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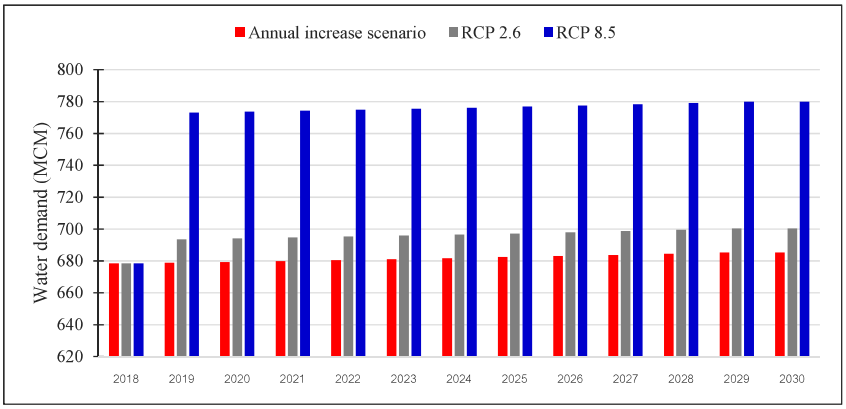
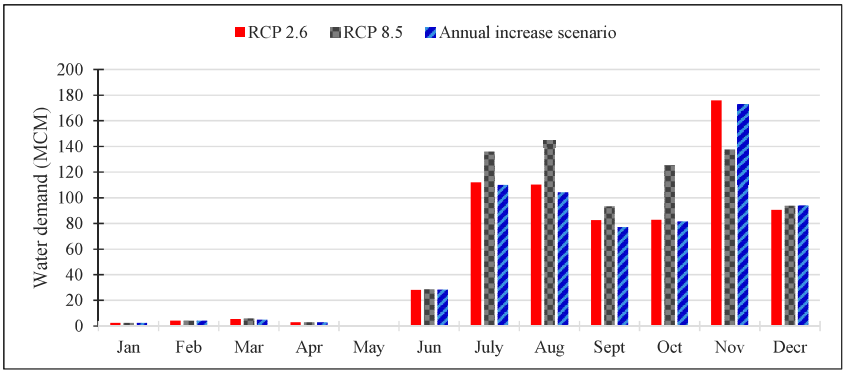
Climate change scenario in RCP 2.6 and 8.5 at 2060s

Water Demand

- **Annual total Water demand**
  - Annual increase scenario 685.36 MCM
  - RCP 2.6 is 700 MCM
  - RCP 8.5 is 780 MCM
  - The highest water demand show on November while the lowest is in May





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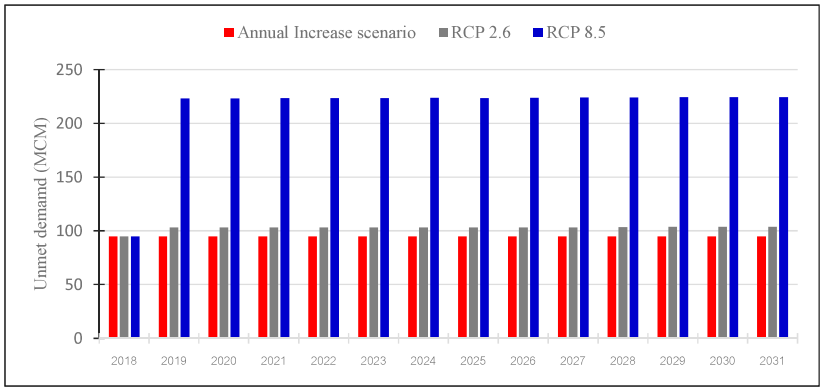
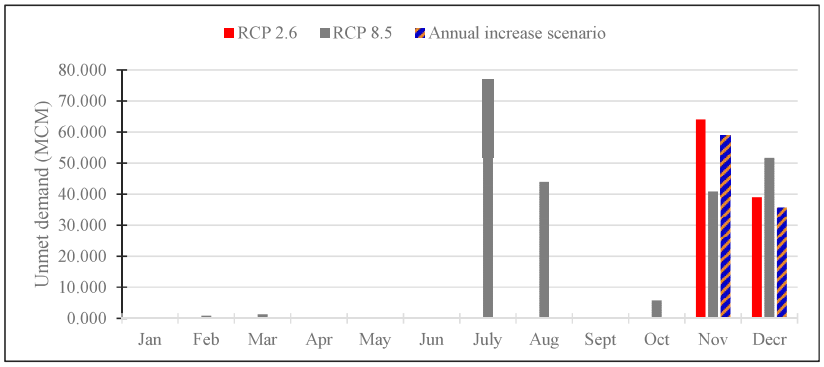
Climate change scenario in RCP 2.6 and 8.5 at 2060s

Unmet Demand

- **Annual total unmet demand**
  - Annual increase scenario 99.9 MCM
  - RCP 2.6 is 103.6 MCM
  - RCP 8.5 is 230 MCM
  - The highest unmet demand show in July , August, November and December while the lowest is in May





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Conclusion

- In reference scenario, the water demand is around 678 MCM and unmet demand 94.6 MCM
- In annual increase scenario, the water demand is increase to 685 MCM in 2030 and unmet demand is 99.9 MCM in 2030.
- The scarcity of water mostly occurs on November and December.
- Climate scenario in RCP 2.6 and 8.5 at 2030s and 2060s:
  - ➢ The water demand is projected to increase 16 MCM and 18 MCM for RCP 2.6 and 8.5 respectively in 2030 .While in 2060s, the water demand increase to 15 and 95 MCM compared to total annual increase scenario.
  - ➢ The scarcity of water is increased 1 and 22 MCM for RCP 2.6 and 8.5 at 2030s. In the other hand, in 2060s the scarcity of water is really quite different from annual increase scenario. It is projected to change 4 MCM for RCP 2.6 and double increase 130 MCM in RCP 8.5

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Recommendation

- The technical in water management and infrastructure for irrigation should be more improved and rehabilitated in each reach to ensure that the farmer can extract water for their consumption..
- The irrigated area in dry season should increase more in each reach that can extract water.
- The additional reservoir should be created to supply water where the scheme that the scarcity of water occur.
- The other cropping pattern should be consider in this area.

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