Agricultural Water Use Impact on the Eastern Aquifer Basin Sustainability Under Climate Change Uncertainty

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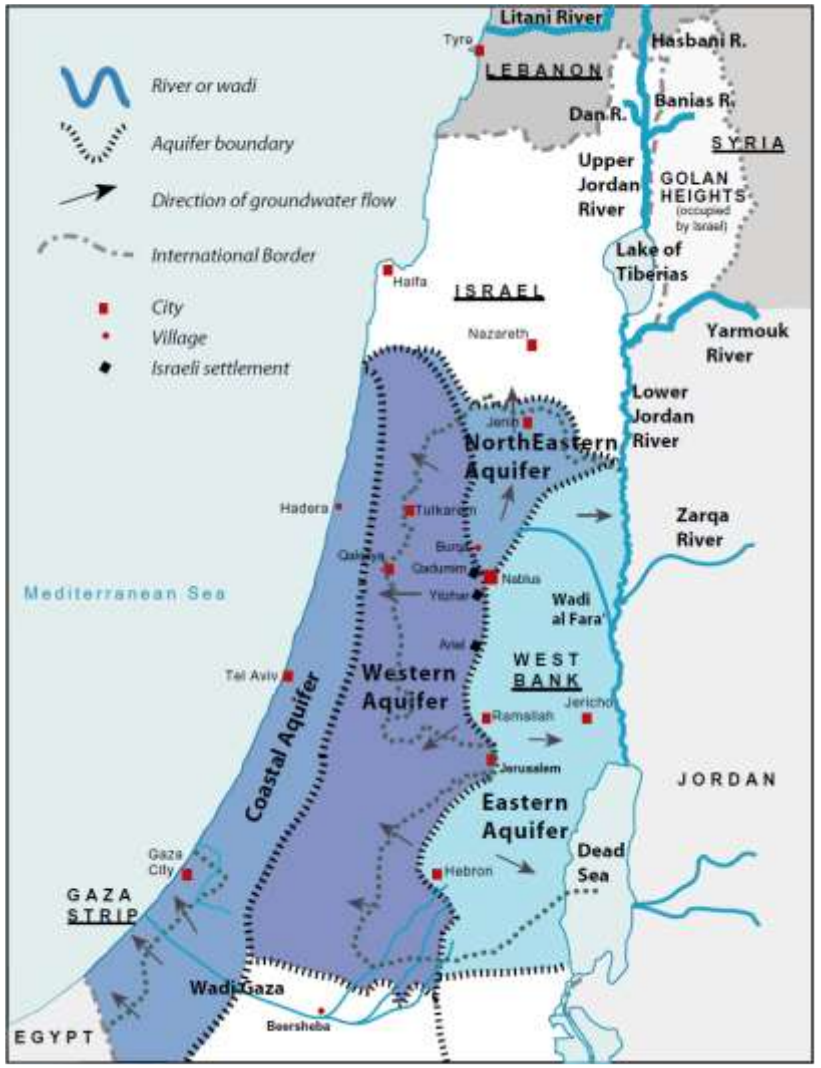
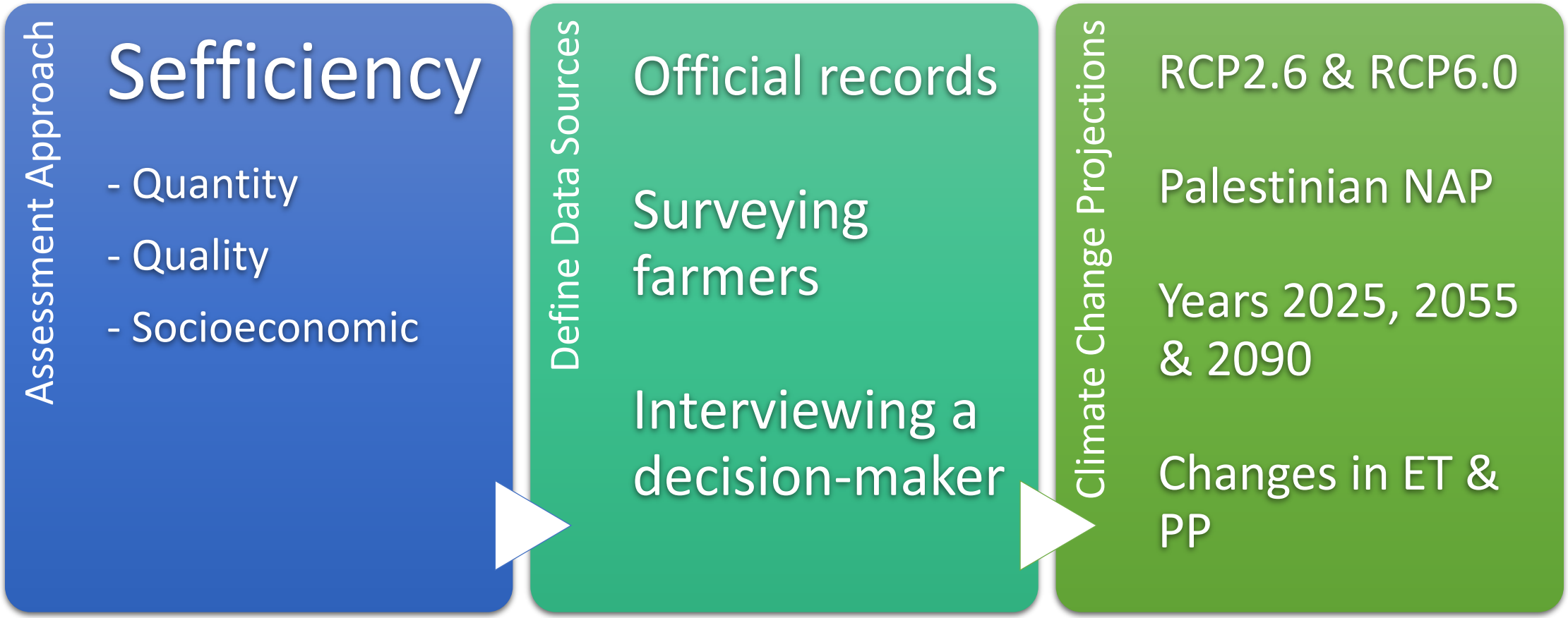
Easter Aquifer Basin (EAB)

- Located entirely in the West Bank and has an area of 2,767 km^2 (49% of West Bank's total area).
- In 2011, Israelis withdrew 50 Mm^3, while Palestinians had 42 Mm^3. Its long-term recharge is 125-197 Mm^3
- The Jordan Valley contains 50% of West Bank's farms, producing 60% of the Palestine's vegetables.
- Jericho used 26 Mm^3 (62%) of the Palestinian abstractions in 2011. The agricultural sector used 24.2 Mm^3 (93%).
- A water scarce region suffering geopolitical complexity, managerial challenges and vulnerability to climate change.
- This study assesses the impacts of these activities on EAB's sustainability under climate change scenarios.

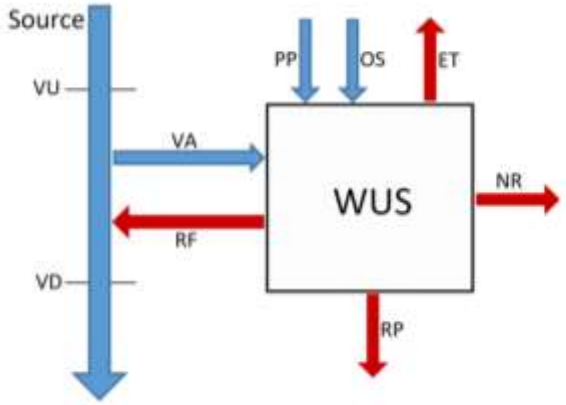


Methodology



Methodology - Sefficiency

- Water use efficiency assessment approach based on water balance.
- Considers water quality, quantity and beneficence.
- Assesses efficiency at Macro, Meso and Micro levels.



Variable	Meaning
ET	Evapotranspiration
NR	Nonreuseable
OS	Other source
PP	Precipitation
RF	Return flow
RP	Potential return
VA	Volume of abstracted water
VD	Volume of water at down stream
VU	Volume of water at upper stream

$$X_s = W_{qX} \times W_{bX} \times X$$

$\mathbf{W_{qX}}$: the quality weight of X; and $\mathbf{W_{bX}}$: the beneficial weight of X.

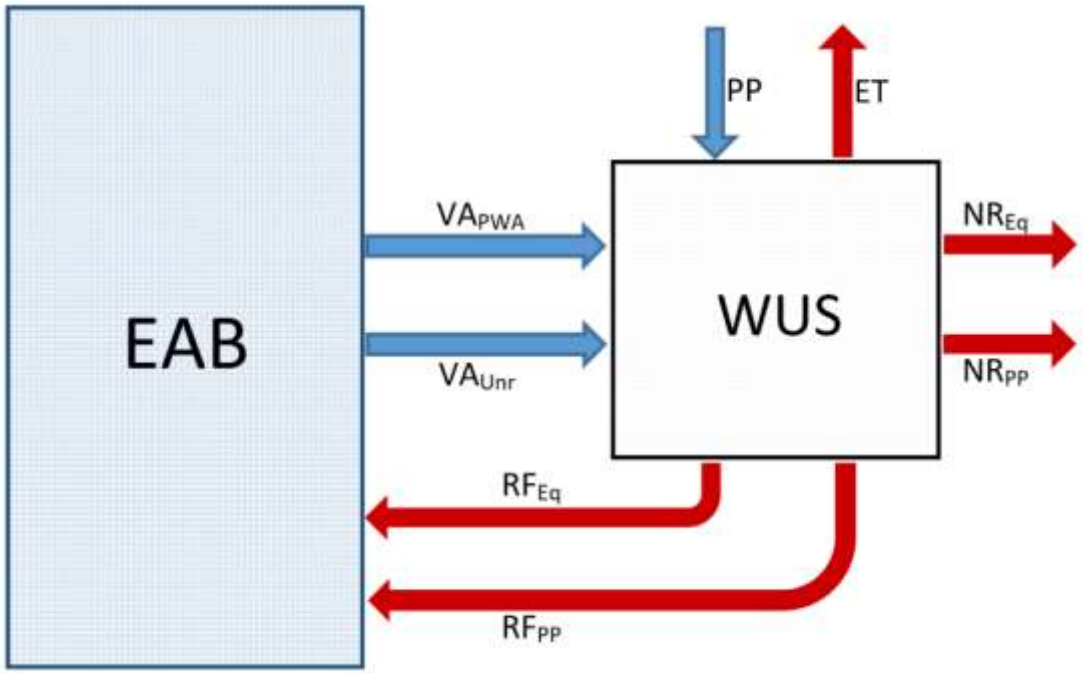
- Full description of Sefficiency is available here.

Climate Change Projections

RCP2.6 2025	RCP2.6 2055	RCP2.6 2090	RCP6.0 2025	RCP6.0 2055	RCP6.0 2090
+0.5°C	+1.0°C	+1.5°C	+0.5°C	+1.5°C	+3.0°C
-2% PP	-5% PP	-10% PP	0% PP	-10% PP	-20% PP

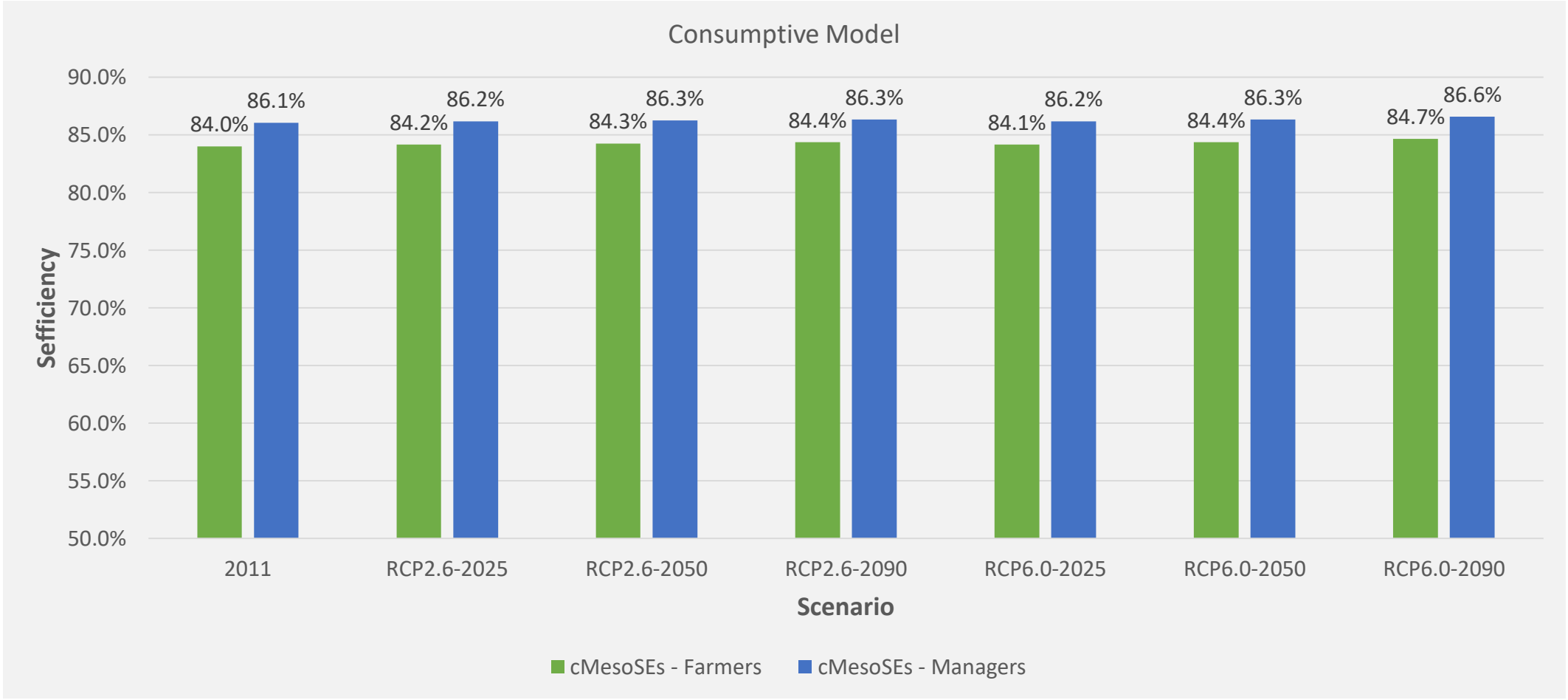
- Projections adopted from the National Adaptation Plan (NAP) to Climate Change published by the Palestinian Environment Quality Authority (EQA) in 2016.
- Follows the guidelines of the United Nations Framework Convention on Climate Change (UNFCCC)
- NAP projections adopted the AR5 dataset and used the self-organising maps (SOMs) simulation technique.

Water Balance Schematic

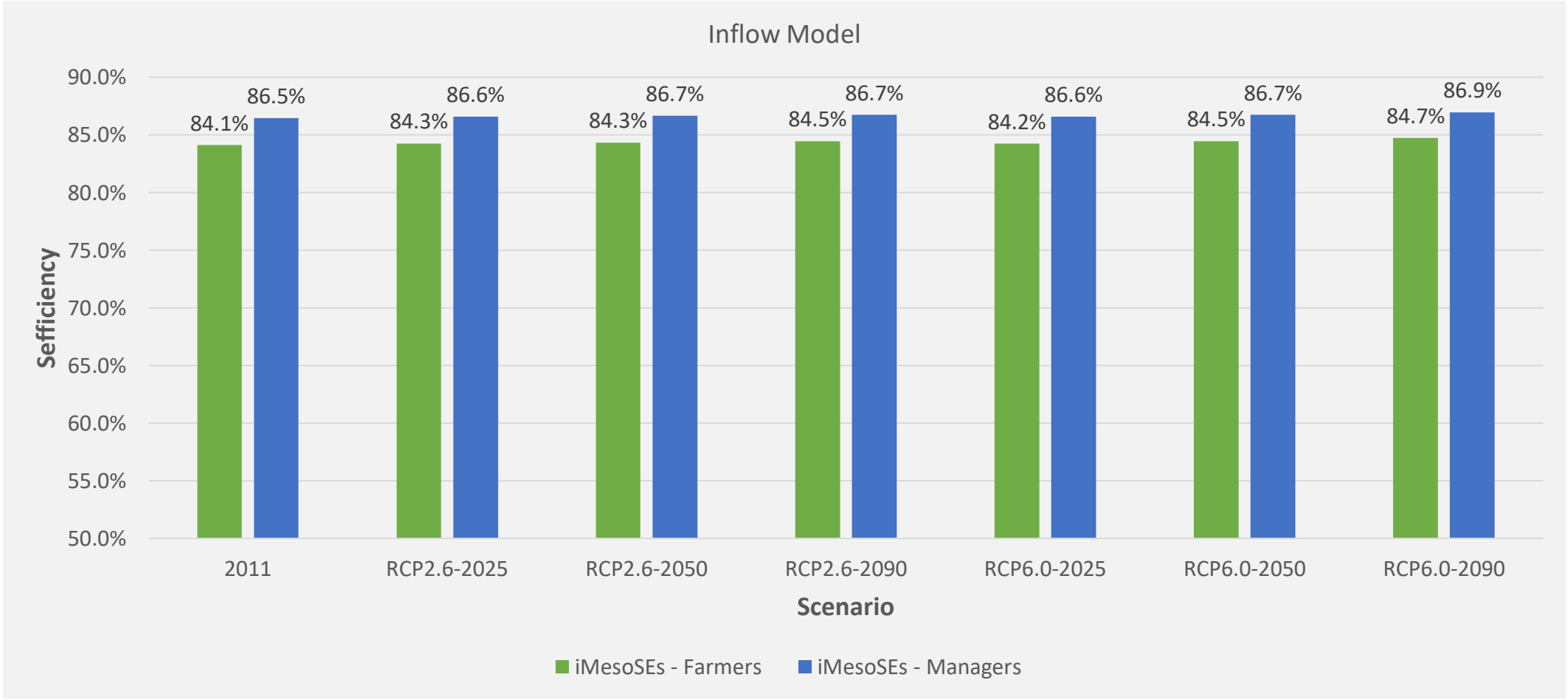


Variable	(Mm^3)		Farmers	Managers	(Mm^3) Farmers	(Mm^3) Managers
PP	3.6	1	0.6	0.6	2.2	2.2
VA_{PWA}	24.2	0.9	1	1	21.8	21.8
VA_{Unr}	14.4	0.9	1	1	13.0	13.0
ET	33.1	1	0.92	0.92	30.4	30.4
RF_{Eq}	3.5	0.2	0.2	1	0.1	0.7
NR_{Eq}	2.3	1	0.1	0.1	0.2	0.2
RF_{PP}	1.2	0.2	0.2	1	0.1	0.4
NR_{PP}	1.3	1	0.1	0.1	0.1	0.1

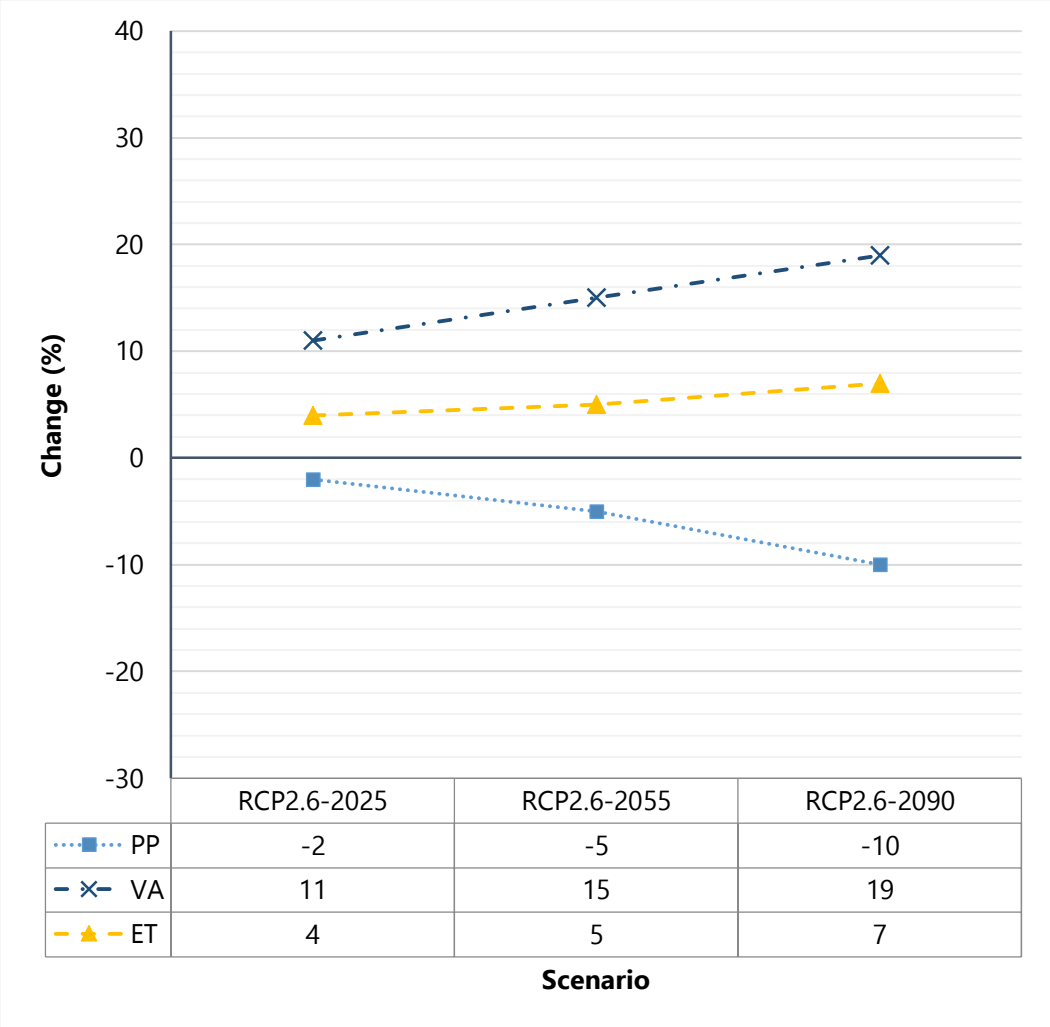
Results – Impact on Sefficiency



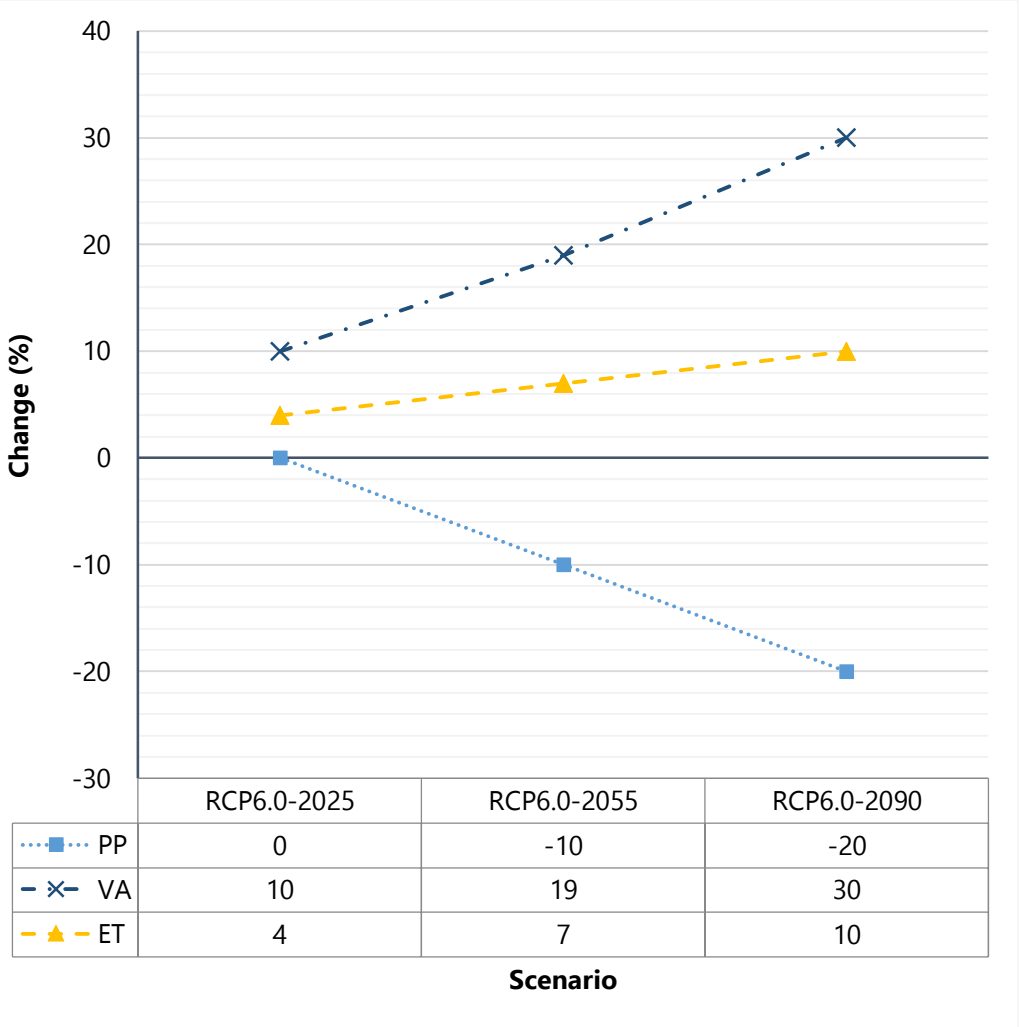
Results – Impact on Sefficiency



Results – CC Impact on ET & PP



	RCP2.6-2025	RCP2.6-2055	RCP2.6-2090
PP	-2	-5	-10
VA	11	15	19
ET	4	5	7



	RCP6.0-2025	RCP6.0-2055	RCP6.0-2090
PP	0	-10	-20
VA	10	19	30
ET	4	7	10

Conclusions

- The efficiency at MesoSE$_s$ can be maintained as long as we were able to supply additional abstractions enough to compensate for the increase in ET.

- 3.0°C increase in temp along with 20% decrease in PP will lead to a 10% increase in ET. To compensate such increase, abstractions need to be increased by **30%**.

- Additional abstractions to maintain the same yield production under climate change impacts, if it was possible, would result in negative impacts on the basin's sustainability.

- Basin's sustainability should be assessed at the macro level including all different neighbouring use systems involved.

Q&A

For further questions, queries, or sharing the slides, please contact nasertouqan@gmail.com