Sea Level Rise, Groundwater and the Future of Agriculture in Oman

Slim Zekri[1]*; Ali Al-Maktoumi[1]; Mustafa El-Rawy[2];
Edda Kalbus[3]; Osman Abdalla[1]

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Sultan Qaboos University

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Oman's agricultural sector depends totally on irrigation from small coastal alluvial aquifers that are recharged temporally and sporadically. Most of these aquifers are already stressed. Expected sea level rise due to climate change will exacerbate seawater intrusion and the consequent salinization of the aquifers. Crop yields heavily depend on the quality of the irrigation water. The higher the salinity the lower the crop yields are.

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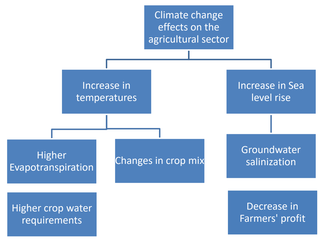
Groundwater is an open access resource in most countries around the globe. The absence of ownership dscourages farmers from saving groundwater and planning properly for the long run. Climate change will result in sea level rise leading to higher pressure on stressed aquifers. This paper considers the effect of sea level rise on the quality of water in two aquifers located in Oman's Northern Coast. The effects of higher temperatures are not included as they are marginal.

- The paper is based on the numerical simulation on the effects of sea level rise on Jamma's aquifer and Suwaiq aquifer (Al Maktoumi et al. (2015) ; Kalbus et al. 2016)



- Two Climate Change scenarios are considered. The first is the RCP2.6 and the second is RCP8.5. Both scenarios are considered until 2050 with SLR of 0.24 m and 0.30 m respectively by 2050.

[1]Sultan Qaboos University, P.O.Box 34, PC 123, Muscat, Oman.
*Corresponding author: Slim@squ.edu.om
[2]Department of Civil Engineering, Faculty of Engineering, Minia University, Minia 61111, Egypt
[3]Auckland Council, Research & Evaluation Unit, Newzealnd

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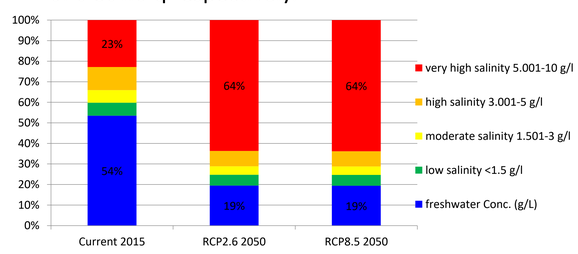
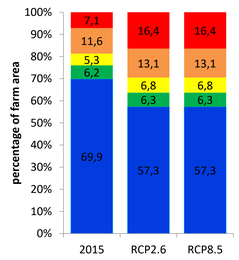
- The effect of SLR on groundwater quality was undertaken by considering the 1500 mg/l iso-concentric line. The percentage of salinized agriculture land for base case (2015) and RCPs scenarios at 2050 are presented for Jamma and Suwaiq respectively.





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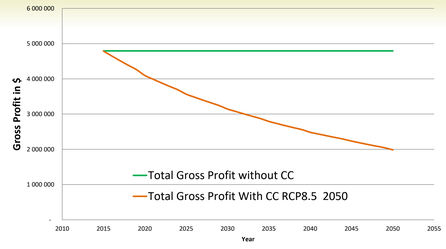
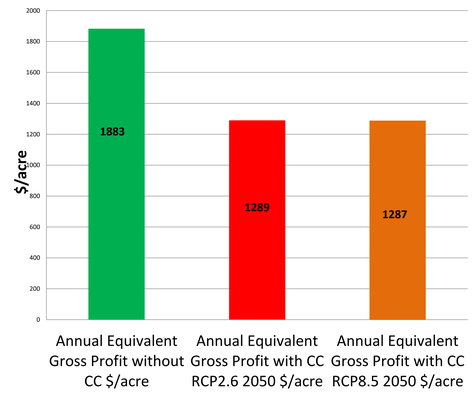
- The economic losses due to groundwater salinization are estimated based on MODFLOW simulations and salinity-yield relationship (MAF, 2012). The estimation of present costs of production and salinity effects is undertaken at the region level. It is assumed that farmers will produce the same types of crops and same crop mix all over the planning period. Constant 2015 prices are used. A discount rate of 2% is used given the very long period considered for analysis.





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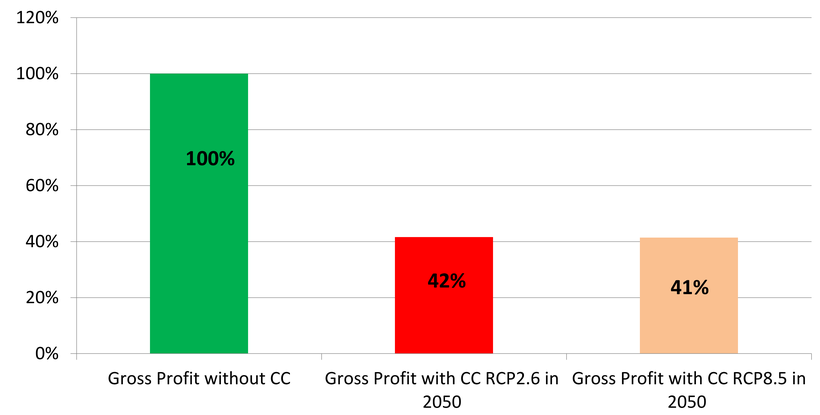
It is expected that the gross profit will fall from a current 100% to 40% by 2050 considering 2015 constant prices. The losses are due to both effects of mismanagement of groundwater and sea level rise.



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Conclusions: The alarming results show the urgent need for determining the best combination of adaptation measures to reduce the impact on farmers' communities. Our analysis has shown the major portion of the salinization of groundwater is due to the aquifer mismanagement. Sea level rise does exacerbate the problem. Among the solutions to be considered are the (1) closing of wells in the beach front area, (2) the control of pumping rates from the individual wells and (3) the introduction of smart irrigation techniques.

7 References

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