11th Annual IWREC Meeting
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Session 3A: Agricultural Water Productivity and Efficiency
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There were three papers presented by Susanne Scheierling (World Bank), Samad Azad (Universirty of Sydney) and Shanxia Sun (Purdue University).

The session was opened by Susanne with a critical view on the very frequently-cited statement that water productivity has to be improved to respond to the global food and water crisis. The critical view emerged from several misconceptions, elaborated in the presentation:

a. When talking about water productivity and efficiency in agriculture - what is being talked about and what is actually measure?
b. How is it measured, and what are the limitations?

Based on literature survey and a presentation of concepts they concluded that the meaning of water productivity across reports and studies is often vague and varies considerably across disciplines. Also it is not always clear with which goal in mind it is being measured is the aim to increase welfare, distributional effects or related to water conservation.

Some tools may be more suitable to tackle one issue rather than the other and all of them have their limitations. The first presentation by Susanne gave an overview of 4 approaches to measure agricultural water productivity:

- Very frequently *single factor productivity ratios*, which focus on the physical aspects such as "crop per drop" ratio, which only look at one input, and often neglect prices and costs. This measure is frequently applied on the field/farm level neglects the return flows of irrigation water use affecting the basin and downstream users, and environmental impacts.
- Another measure presented were the *frontier models***,** which, while including several inputs they are often based on farm level and cannot capture the effect on the basin.
- Thirdly, *total factor productivity*¸ which while looking at the overall performance of an agricultural sector, there is limited data availability to include water.
- The fourth measure were the *deductive methods***,** which are quite flexible in reflecting desired future technology or economic conditions, but assume that farms behave on the production frontier.

After a conceptual overview: the second presentation by Samad Azad introduced an approach and case study which addressed some of these limitations: They integrated the Luenberger efficiency indicator in a directional distance function approach, providing a measure of economic as well as environmental efficiency. They compared enterprises across regions in the Murray- Darling River Basin in Australia. Their approach allowed accounting for basin-wide interdependencies by including a ratio of water in- and outflows between region as well as the impact of salinity on ecological assets. The results showed that technological variation of an enterprise across region was the major determinant of environmental performance.

After issues regarding: what is being measured measure, which goal in mind, how can it be done are resolved, questions regarding the institutional environment to ensure a specific behavior come up.

This has been addressed by the last presentation in the session by Shanxia Sun: They focused on the institutional environment to decrease groundwater use in Mexico. She quantified sources of inefficiency in groundwater use, in a community where multiple irrigators share a well and share their electricity bill and received government electricity subsidies. They estimate the input demand function, for water and other inputs and while considering several control variables they found that –policies such as eliminating the electricity subsidies may not have an effect on irrigation demand the eliminating cost sharing regimes seem more promising instruments to conserve groundwater.

Important conclusions of this session:

- Increase transparency about the objective of studies related to water productivity and the limitations of their approach.
- What all presentations have in common is the requirement of all studies: There is also a need to improved availability of data and collaboration across disciplines to be able to assess agricultural water use in its entire complexity