Addressing the WFE-Nexus components from an Agricultural perspective

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Food and Agriculture Organization of the United Nations
Agriculture

Food producer

Water consumer
- 70% of total freshwater withdrawal
- 90% of total freshwater consumption

Energy producer/consumer
- 1% of total fuel-based transportation is produced by bio-fuel crops
- 30% of total energy demand is consumed by the food sector, including the supply chain (70% beyond farm gate)

Food and Agriculture Organization of the United Nations
Irrigation/Hydropower (conflicting demands)

Fishery/Rivers-Dams (flow changes impact)
Projected global demands by 2050

~ 9.2 B people
+ 60% food
+ 50% energy

Water needs
1000-5000 l per person per day to provide his dietary need (~1l per kcal)
~2500 l per l of Bio-ethanol

Progressive water scarcity

Food and Agriculture Organization of the United Nations
Where the food will come from?

Supply side

*Expand arable land*
*Increase intensification*
*Higher productivity*

Demand side

*Reduce waste/losses*
*Promote sustainable diets*

Yield Increase (77%)
Arable Land Expansion (9%)
Cropping Intensity (14%)
Where the water will come from?

**Supply side**
- Rainwater harvesting/storages
- Unconventional water use
- Soil-moisture management

**Demand side**
- Increase water productivity
- Increase overall water use efficiency

Where the energy will come from?

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Further Challenges and Nexus implications

Energy and GHG emission

Climate Change

Water quality, use and allocations

Urbanization

Financial crises

Land use changes

Food-prices volatility

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CLEW Framework

Energy
- LEAP: Long range Energy Alternative Planning system

Water
- WEAP: Water Evaluation And Planning System

Climate
- GHG

Land Use
- G/N-AEZ: Global/National Agro Ecological Zoning

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CLEW Network

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Mauritius

- Small island with clear boundaries
- Producer and exporter of sugar (occupying 80% cultivated land area)
- Dependent on fuel imports for its energy requirement
- Highly vulnerable to climate change

**Government vision**: making Mauritius a sustainable island focussing on reducing dependence of fossil fuel and reducing GHG emission ...
The CLEW modelling framework was used to assess the energy, water and land-use system in the context of different scenarios in Mauritius:

- Reduce gasoline imports by producing ethanol, displacing sugar exports
- Considering different energy system alternatives and land use options (e.g. different crops) under uncertain future dryer climatic conditions (lower rainfall)

Results (in 2030):

- Net balance of 43.5 M US$ - export sugar/producing ethanol
- Increased energy security (+1.95 TJ of ethanol)
- Reduction of 148,000 tons of GHG emission
Burkina Faso

- 3% annual population growth rate (17.3 M in 2011; 30 M in 2030)
- Traditional farming is the mainstay of the economy (Agric. Employs 86% of population; 40% of GDP)
- 80% of cultivated land is represented by cereals
- Very extensive agric.
- Cotton main export crop (1/2 of export revenue)
- Fragile environment-prone to droughts/floods
- Significant land use in forests and savannas
- Wood as most widely used primary energy resource
Government aims: increasing food security; shift away from wood as source of energy (to protect forests); increase electrification to 60% by 2020

Scenarios investigated with CLEW:
- Intensification of agricultural production
- Potential introduction of Jatropha as biofuel crop

Results:
- Increasing food production with low intensity agriculture requires expansion of crop-land to the expense of forest land. Intensification of agriculture saves land.
- More intensified agriculture requires more energy (e.g., in the form of fertilizer), i.e., more GHG emission, though compensated by sequestration of saved forest land
- Jatropha introduction, even in marginal land, was not valid
Concluding remarks

- Single resource analysis is limited on medium- and long-term policy development
- Without an integrated approach (nexus), strategies and policies formulation to increase water, food and energy security could be counterproductive
- A nexus approach is even more relevant when addressing trans-boundary water cases
- Analytical frameworks to investigate the nexus are available and can be assembled without dependencies
Thank You

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