

Heterogeneity among smallholder farm households affecting the Water-Energy-Food nexus in Ethiopia

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Abstract

This study assesses and describes the dimensions or sources of heterogeneity in relation to the dynamics of water-energy-food (WEF) nexus affecting the decisions of smallholder farm households. Although, gender is one of the aspects of heterogeneity, in this study we further explored the dissimilarities between male and female farm-households by co-developing a conceptual model of the target socio-ecological system in two major regions in Ethiopia, i.e., Amhara and Oromia regional states. We used the ARDI (**actors, resources, dynamics and interactions**) method in the development of conceptual model as part of companion modeling, which will support in the designing of agent-based model. Results show that there are four aspects that make the male and female farm households different such as gender specific productive roles, perception of resource, access to external actors, and the decision to manage and utilize resource, which may affect the dynamics of WEF nexus.

Research question

The central discussion questions posed were:

- 1) How do (male and female) farmers manage their land for food and energy (fuelwood) production, and to conserve water?, and
- 2) What drives (or may be the driver of) change of the same food and energy resources?

Method

We conducted six gender-segregated focus group discussion (FGD) based workshop and key stakeholder interviews. we applied the Actor, Resources, Dynamics, and Interactions (ARDI) method developed by Etienne et al. (2011). This method focuses on encouraging stakeholders to describe, explain, and predict the purpose, form, function, and state of a given system so as to elicit causal knowledge.

We explored the following questions:

- Who are the main stakeholders that interact with farmers regarding land management (**actors**)?
- What are the main resources of the managed land (**resources**)?
- What are the main processes that drive changes in resource production (**dynamics**)?
- How do farmers use the WEF resources (**interactions**)?

Synthesizing the key elements identified by participating farmers resulted in the conceptual model of the local WEF system according to gender. Although the mental models of both male and female farmers identify very similar resources and drivers of change, there is some differentiation in terms of actions performed with the target resources and their uses.

Results:

Actors:

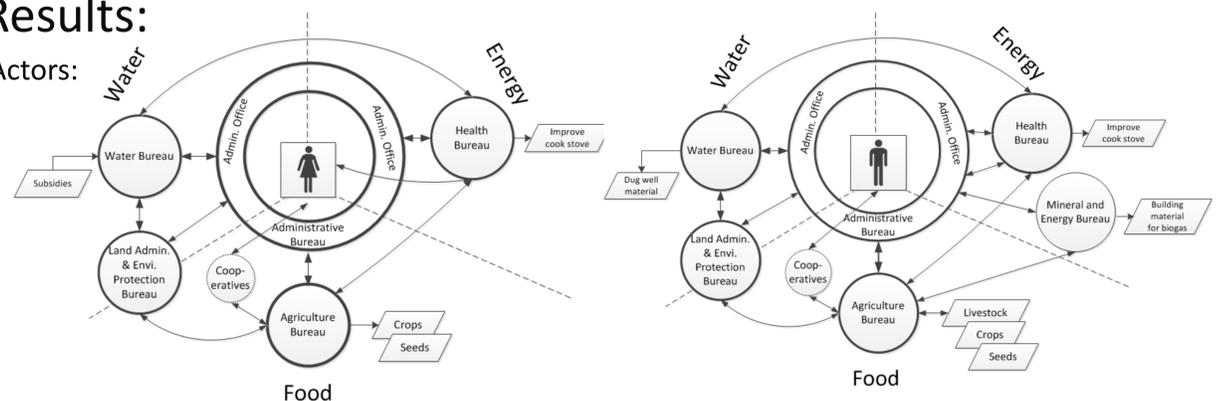


Fig. 1 Graphical representation of actors identified by female-only and male-only groups.

Resources, dynamics & interactions:

Gender specific perspectives of the direct actors involved in access to and the management of local nexus resources among farmers are presented in Fig 1 whereas the resources, dynamics, and interactions are presented in Fig 2. The interactions represent actions undertaken by key farmers to utilize the target resources.

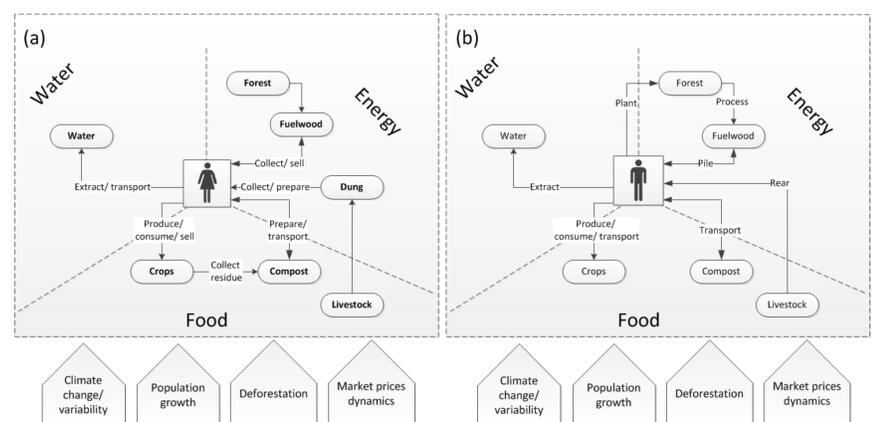


Fig. 2 Simplified conceptual frameworks of the local WEF nexus system according to gender

Lessons learned

(1) Access to external actors—Our findings show that male and female farmers have differential access to external actors. (2) Perception of resources—Men explicitly regard livestock as a resource, whereas females were more likely to identify products

derived from livestock such as cattle dung and milk as resources. (3) Gender-specific roles—The role of females is dominant in the reproductive sphere, while time and efforts are largely concentrated in the productive sphere among men. (4) Decision to utilize

resources- decisions of whether or not to use cattle dung for domestic energy use or for compost are commonly made by household females. Contrarily, decisions regarding livestock and eucalyptus production are mainly made by household males.