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Ecosystem services and socio-ecological resilience of a landscape: Case study from three catchments in the Blue Nile Basin of Ethiopia

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Key Message

The state of the existing bundle of ecosystem services (ESs) of a landscape is a useful proxy for assessing trends in socio-ecological resilience (SER) for two reasons: 1. The state of the bundle of ecosystem services is the product of interaction of the four core variables (Figure 1A) in the Socio-Ecological System (SES) structure proposed by Ostrom (Ostrom, 2007, 2009); hence determine the outcome that is the SER; 2. The state of ecosystem services of a landscape determine the response diversity, adaptability and transformability in SES, hence its SER.

Summary

This study demonstrates the use of the bundle of ESs as proxy to assess trends in SER. It is based on a study from three Nile basin districts in Ethiopia. Both primary and secondary data were collected. Analysis employed Ostrom's proposed SES structure (Figure 1A). The followings were the major findings:

1. In the Resource System, there has been a progressive intensification of extraction of ecological resources and ecosystem services in the three landscapes, through a successional adaptation and transformation of livelihood activities. Consequently, the landscapes are exhibiting overall decline in stock and quality of ecosystem services (except for crop and biomass productions) (e.g. Figure 1B).

2. In the Governance System in general, social capital (e.g. kinshipn, religion based ties, marriage and neighborhood ties for labour and resource sharing) are thinning, local/traditional institutions for collective actions are waning and traditional knowledge and practices are declining, while state induced collective actions are trying to replace the traditional systems;

3. Development trajectories show a downward spiral in all sites from productive state towards a degraded state but along different paths due to differences in the natural resource base, cultural conditions and differences in disturbance regimes (Figure 2). The trajectory implies reduced response diversity and options for transformability of SES during shocks;

4. It is proposed that this trajectory results in weakening resilience or increasing vulnerability of the SES, hence declining SER (Figure 2).

Generally, evidence of links between the bundle of ecosystem services in a landscape and SER is rare and this makes this particular study interesting. The findings of this study suggest management of a landscape should focus to enhance supply of diversity ecosystem services to insure SER.

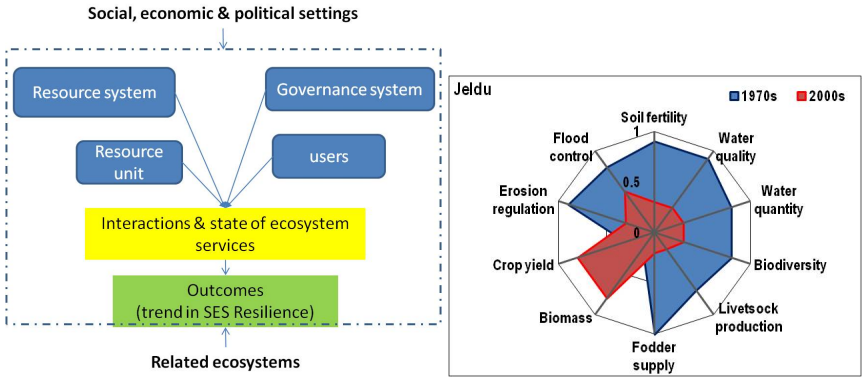

FIGURE 1. A) STRUCTURE OF SER BUILT ON OSTROM'S (2007/2009) PROPOSAL TO INCLUDE ECOSYSTEM SERVICES AS PROXY TO ASSESS SER, AND B) EXAMPLE OF ECOSYSTEM SERVICES DYNAMICS OVER TIME IN ONE OF THE CASE STUDY AREAS AT JELDU (WOREDA PLOTTED BASED ON RECALL BY THE RESPONDENTS IN 2010)

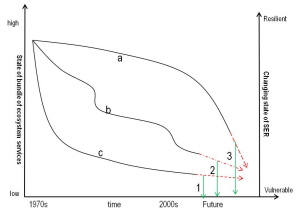

FIGURE 2. RELATIVE CHANGES IN THE STATE OF BUNDLE OF ECOSYSTEM SERVICES AND TRENDS IN SER OF THE LANDSCAPES ACROSS THE SITES ((A) CLOSELY REPRESENT THE CASE IN DIGA WHERE THE STATE OF BUNDLE OF ECOSYSTEM SERVICES WHICH HAD BEEN RELATIVELY STABLE FOR DECADES DROPS SUDDENLY AS THE RESULT OF SHOCKS FROM LARGE SCALE MIGRATION; B) CLOSELY REPRESENTS THE CASE IN FOGERA WHERE SOCIO-POLITICAL CHANGES DRIVE GRADUAL INTENSIFICATION OF THE EXTRACTION OF LANDSCAPE RESOURCES (FOREST, SOIL AND WATER), HENCE LEADING TO A GRADUAL DECLINE IN THE STATE OF BUNDLE OF ECOSYSTEM SERVICES, AND C) CLOSELY REPRESENT THE CASE IN JELDU WHERE CHANGE IN SOCIO-POLITICAL ENVIRONMENT CAUSE AT FIRST A RAPID DROP IN ECOSYSTEM SERVICES BUT TECHNOLOGICAL INTERVENTION SLOWS DOWN THE FURTHER DEGRADATION OF ECOSYSTEM SERVICES, THUS INCREASING THE BUFFERING CAPACITY. THE BROKEN RED LINE EXTENSIONS INDICATE HYPOTHETICAL FUTURE TRAJECTORY (BAU SCENARIO) THAT, OF COURSE, MAY ALSO TAKE DIFFERENT TRAJECTORIES BASED ON FUTURE INTERACTIONS OF THE CORE VARIABLES OF THE SES AND CHANGE.