DAVE, RADHIKA [S14-P55]

Forest ecosystem benefits for agricultural risk reduction for smallholder farmers in western Madagascar
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Tropical dry deciduous forests hold a high density of mammalian biomass and provide essential goods and services to people. Madagascar's endemic dry deciduous forests can be found in the country's western regions where fires, cattle grazing and charcoal production to meet the high urban demand remain the proximate causes transforming remaining forested landscapes into grassland savannahs. Forest loss is perceived to be associated with increasing levels of siltation, sedimentation and loss of fertile topsoil as experienced by farmers in this region. Variability in rainfall and soil quality also influence agricultural yield. Several community forest management groups have been established in Madagascar, including in the western district of Mahajanga II, to meet the daily needs of forest dependent communities, create economic opportunities that can generate income and halt unsustainable forest exploitation and clearance. Our research examines the differential vulnerability of small holder farmers to agricultural risks arising from changes in timing and seasonal patterns of rainfall; and the extent to which risk exposed farming households view forests as providing important risk reduction services. We study the prevalence of risk reduction as a motivating factor within the wider set of forest ecosystem benefits and services, such as income generation and food provision, traditionally considered important as incentives for continued forest management. We apply a comparative case study approach and use household interviews and community focus groups to identify household and community responses in two forest dependent fokontany (smallest traditional administrative unit) with contrasting forest cover trajectories in Madagascar's Mahajanga II district in the western Boeny region. We use a multivariate approach to the statistical analyses of diversity of income sources, agricultural and livestock production, lean season food consumption strategies, type of seasonal risks and consequent hazard impacts upon production, perception of risk reduction services provided by forests, and the stated realized benefits derived from forest and forest resources. Our study finds a recognition by local communities of the benefits to agriculture provided by forests through explicitly regulating the microclimate, protecting against siltation of farmlands and providing a stable supply of water. However factors such as age of household head, length of time in the fokontany, diversity of food crops produced and the geographical location of farmlands are important determinants to be considered. Social research data at the fokontany scale is complemented by analyses of trends in forest cover change, forest management policies, precipitation, occurrence of hazards such as cyclones and heavy rainfall, and agricultural yield at the district level to provide context and establish links to sociopolitical and ecological trends at the higher scale. Our results have practical significance for forest management, particularly in understanding the wider rationale for decision making and incentives for community forest management, and for agricultural risk reduction support activities in low-input subsistence farming communities similar to our case study. Our research contributes to the body of knowledge on the role of natural ecosystems in reducing the risks to food security by mitigating agricultural hazard impacts in regions with little or no formal support services.