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Efficient Use of Terrestrial Economic Services: A Case Study in South Korea

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Understanding the linkages between social and ecological systems is crucial for managing potential responses to global change. Agricultural production requires resources, is determined by ecological processes, and results in economic goods and services for society. However, production leads at the same time to both positive and negative externalities. The externalities can be enhanced or mitigated by human behavior in management, which is mainly driven by expectations related to economic gains and losses. Ecological and economic processes are interrelated, and continuously interact in a complex manner. Therefore, understanding potential economic gains and losses in response to global change is a fundamental consideration in order to carry out well-informed decision-making.
The International Research and Training Group TERRECO at the University of Bayreuth has intensively investigated ecological systems and processes in forested and agricultural landscapes as well as at regional scale in South Korea. These ongoing efforts provide a unique opportunity to examine the economic gains, losses and trade-offs that may occur with future climate and land-use change. Within this framework, we first investigated the environmental and economic efficiency of rice farms in Kangwon Province of South Korea, since rice is the most important food crop in this country. We then expanded our analysis to include dry farm highland vegetable crops in an intensively farmed region of the country, Haean Catchment. Our main objectives are (1) to categorize different types of farms, (2) determine their economic and environmental efficiency, and (3) to determine the trade-offs that occur in economic and environmental efficiencies under alternative management schemes and alternative climate regimes.
Our preliminary analysis for rice farms yielded several important findings. First, both the production cost and environmental pollution by rice farms could be reduced significantly. Improvements in technical efficiency would result in both lower production costs and better environmental performance. Secondly, it is not without cost for farms to move from their current operation to an environmentally efficient operation. On average, this shift would increase production costs by 119%, but benefit water resources by a 69% reduction in eutrophication. It was estimated that the average cost of each kg of aggregate nutrient reduction would cost approximately 1.2 thousand won.
These findings have several important policy implications. First, without major policy intervention, rice farms could still improve their economic and environmental performance by being more technically efficient. Training programs for rice farmers that focus on how to manage inputs and how to use the nutrients more efficiently would help farms to consume fewer inputs and cause less eutrophication problems. Second, opportunities exist for policy makers to intervene into the markets to adjust the prices of inputs so that farms, by minimizing their production costs, also improve their environmental performance. Further investigation into such policy options (such as introduction of taxes on fertilizer use, removal of subsidies or provision of incentive schemes) is being conducted.