Implementing integrative land use research for the Earth's future -with reference to some Asian countries

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The grand design of Future Earth entitled "Future Earth 2025 Vision" issued in 2014 presented eight "key focal challenges, namely those on water-energy-food, climate change, natural assets, cities, rural futures, health, consumption/production, and governance systems. Land use is one of the issues that are related with them all. However, it is likely to be viewed and studied differently and separately in each of these challenges. In order to meet the diversity of interests or requirements, it is important to conduct integrative basic studies of land use change at different regional levels such as national to sub-national levels, and link them to applied studies specializing in each of the proposed challenges. The paper discusses the structure and elements of such integrative land use study system, priority issues and expected outcomes, with reference to some Asian countries.

Keywords: future earth, land use, resilient city, sustainable rural future, climate change

Climate Change, Agricultural Production and Nutrition: Towards Integrated Policy Design for Food Security

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The issue of climate change and climatic variability and its impacts on human livelihoods are a major concern among the international community (IPCC 2015). This is especially so for the semi-arid tropical Africa where smallholder farmers depend critically on the vulnerable rain-fed agricultural systems. Climate change adaptation is an important policy agenda for food security in the region. Food security has to be considered in a comprehensive manner including production, consumption, marketing, nutrition and health in addition to social organization. Considering future climatic variability that is anticipated, building climate-resilience is an important policy agenda not only for Zambia but also for countries in Africa. Resilience is defined as “the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity (Walker et al. 2004)”. Resilience, either climate-resilience or disaster-resilience, has recently become practical policy agenda in many international development organizations (WB, 2016) and national governments in practice. “Vulnerability and Resilience of Social-Ecological Systems (RIHN)” has proposed qualitative and quantitative approaches to empirically analyze resilience of rural households in Zambia (Kanno et al., 2015; Umetsu et al., 2014; Miyazaki et al., 2013; Ishimoto et al., 2013; Miura and Sakurai, 2012; Sakurai et al., 2011). We argued that in order to operationalize resilience, it is important for us to consider *resilience* in the context of food security, more broadly human security, of rural households in SAT region. We conducted an integrated study for analyzing farmers’ coping strategy against climatic shocks and their effects on food and nutritional status in Southern Zambia. We collected various intensive household level data including on-farm precipitation, agricultural production, off-farm production, consumption, and anthropometric measures as a proxy for nutritional status for three cropping seasons from 2007 to 2010. The objective of this research is to identify ways in which the resilience to environmental variability of subsistence farmers in the SAT can be strengthened. The purpose of the presentation is to show our empirical evidence in Zambia and dynamics of farmers’ livelihoods in response to various shocks, and to explore the possibilities of integrating research agenda that focuses on climate change risk reduction, agricultural production and nutrition.

Keywords: food security, climate change adaptation, agricultural production, nutrition, resilience

Future Earth: solution-driven, interdisciplinary and stakeholder-engaging research for global sustainability

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Recent political developments of global scope, most evidently the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction and the Paris Agreement on Climate Change, have stressed the urgency for solution-oriented knowledge that supports our transformations to a sustainable world. The new international research coordination platform Future Earth aims to facilitate the generation of such knowledge. Apart from the focus on solutions, the strategy also includes broadening of the interdisciplinary range across natural and social sciences and the humanities and to involve stakeholders of sustainability research more centrally in co-designing the research plans and co-producing the output. Several initial successful examples where research contributes to societally pressing issues and manages to engage with decision makers at various levels encourage the further development of a new culture of sustainability research with a worldwide network of researchers and stakeholders. The main vehicle for carrying out knowledge generation in Future Earth will be Knowledge-Action Networks. A first set of eight of them are now being launched on the topics food-water-energy nexus, natural assets, cities, health, oceans, finance and economy, transformations, and the Sustainable Development Goals.

Keywords: Future Earth, sustainability science, transdisciplinarity

“Cross-scale” issues on Protected Areas in India

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In the conceptual framework underlying the Future Earth (FE) program, “Scale” is to be positioned as one of keyword. In the final report (released in 2013), it has been emphasized that changes in human activities and global system of cross-scale (cs) and multi-scale (ms) has an important meaning in the sustainability of society. “The cross-scale interactions between human activities, large scale changes in the Earth system, and local impacts have important implications for human development and create many of the sustainability challenges facing society.” (FE final report: 17).
However, in FE, it cannot be said that discussion about the range to be assumed by the scale and scale itself has been made sufficiently. In this report, the term “cs” used there four times in the text (page 17, 28, 32, 35), twice in the figure (1, 3), and “ms” once (37). In particular, “cs” (in fig.1 and 3) has been used as a key concept. Although “cs” is understood it is widely important as a research guideline, which is not explicitly about what there is a specific research theme.
In this study, based on the results of the past my research projects, I would like to try to arrange the various issues related to “cs” in FE. More specifically, I will deal with the issues related to the Protected Areas (PAs) in India, depending on the scales, which include the expansion of PAs network, its acceptance process in India, and the PAs problems in the regional context.

Keywords: Future Earth, cross-scale, Protected Areas, India

Simulation of the Non-point Source of Nitrogen and Phosphorus Loads under Different Land Uses in the Yangtze River Basin, China

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Objective/Methods

Increasing of nutrient loads due to the rapid economic development worsen the water resource in China. When the nutrient loads exceeds the natural purification capacity of the rivers, it will be released into the East China Sea (ECS) and causes serious coastal eutrophication and red tide. In order to estimate the nutrient loads from the Yangtze River basin (YRB), we have developed a catchment water and material circulation model based on the Soil and Water Assessment Tool (SWAT). The model was calibrated by the observation data during 2004-2006 and validated by the data during 2008-2010 of river discharge, sediment as well as water quality data, such as the total nitrogen (T-N) and the total phosphorus (T-P) at major hydrological stations, such as Pingshan, Zhutuo, Yichang, Shashi, Hukou and Datong at main stream.

Results/Conclusion

As the input data of the model, we, at first, estimated the N inputs to the Yangtze River Basin, including the atmospheric deposition, synthetic N fertilizer, as well as N from human waste and animal excrement based on statistical data of China. The results showed that the total amount of N inputs to the whole YRB was approximately 16.4 Tg N in 2010, which was a 2.0-fold increase over 1980. It increased dramatically in the 1990s and then stabilized at a high level in the 2000s. It was also found that the major N inputs were human and animal wastes as well as synthetic fertilizers, but they varied regionally. The contribution of animal waste gradually decreased from upper to lower reaches, but the contribution of N fertilizer increased from upper to lower reaches. Overall, the noticeable sources were the agricultural land in the Sichuan Basin in the upper reaches, the Jiang-Han Plain, the Dongting and Poyang Lake Basins in the middle reaches, and the urban areas in the lower reaches.

Finally, we applied the validated model to simulate daily, monthly and yearly variation (2001-2010) of both river discharge (FLOW) and nutrient loads, such as NO3-N, NH4-N, T-N and T-P transported to ECS. The simulation results showed that the annual mean total FLOW was 2.71×10^{4} m^{3} /s and the average yearly amounts of pollutants passing the Datong Station were 2.19×10^{6} t of NO3-N, 2.62×10^{5} t of NH4-N, and T-N was 2.74×10^{6} t of and T-P was 1.06×10^{5} t. Comparison with the existing research, the simulation results indicated that NO3-N flows in the 2000s were about 3.6 times those in the 1980s, NH4-N more than 2.5 times, and T-P more than 1.2 times.

Keywords: Non-point Source, Nitrogen and Phosphorus Loads, Land Use , the Yangtze River Basin

Implementing Future Earth -A Japan Challenge

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Future Earth is a global research platform to provide knowledge to solve issues for global sustainability. Knowledge should be generated in collaboration with stakeholders in the society in trans-disciplinary manners from the beginning to the final delivery process of the research. In order to facilitate these processes, Future Earth has provided several concrete platform vehicles, called Knowledge-Action Networks, on rather simple core elements such as Water-Energy-Food Nexus, Sustainable Development Goals, Health, Cities, and more. In addition, transversal aspects, such as capacity building, data management, are focused topics of discussion.
Japanese scientific communities are contributing to Future Earth with their scientific activities and also by supporting a part of Future Earth Global Secretariat via Japan Consortium. Some of the updates will be introduced and further necessary activities will be discussed.

