WORKING PAPER

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University of Lüneburg
Working Paper Series in Economics

No. 225

January 2012

www.leuphana.de/institute/ivwl/publikationen/working-papers.html

ISSN 1860 - 5508

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An evaluation of success factors and barriers by the example of the Philippine farmer network MASIPAG

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Abstract: A twofold challenge arises from the normative aim of environmental justice to the management of agricultural systems: (1) the improvement of food security and livelihood of the rural poor today; (2) the sustenance and enhancement of the long-term productivity and resilience of agricultural systems to future generations. The paper analyzes the success factors and barriers of the Philippine farmer network MASIPAG in simultaneously realizing both objectives - based philosophically on Rawls' "A Theory of Justice" (1971), conceptually on specific determinants of the relationship between the objectives, and empirically on the results of a comprehensive evaluation of the MASIPAG network.

Keywords: environmental justice, ecosystem services, agriculture, agrobiodiversity, Philippines.

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1. From world agriculture to the Philippine farmer network MASIPAG

Although world agriculture produces enough food to sufficiently feed everyone in the world, it has two huge drawbacks: failure in combating hunger and environmental degradation. According to the United Nations Food and Agriculture Organization, 925 million people were undernourished in October 2010 (FAO 2010: 8), most of them living in rural areas and highly dependent on agriculture, grazing, and hunting for subsistence (MEA 2005: 47). Through intensification and expansion of cultivated area, total increases in agricultural yield and livestock have come at growing costs in terms of trade-offs with other ecosystem services, such as biodiversity, pest control, pollination, soil fertility and protection from soil erosion (*ib.*). Hence, the management of agricultural systems is confronted with questions of *environmental justice*.

The conception of environmental justice underlying this study links the ideas of intragenerational and intergenerational justice to the use and conservation of ecosystems and its services (*cf.* Glotzbach 2011). Two big challenges arise from the normative aim of environmental justice to the management of agricultural systems: (1) the improvement of food security and livelihood of the rural poor today regarding intragenerational justice; and (2) the sustenance and enhancement of long-term productivity and resilience of agricultural systems to future generations regarding intergenerational justice.

Under what conditions can agricultural systems enhance both food security of poor farmers today and the prospects for future farmers? How must institutions be designed to attain intragenerational and intergenerational environmental justice in agricultural systems simultaneously? I approach an answer to these guiding questions by analyzing a case study, the MASIPAG farmer network in the Philippines. I choose MASIPAG as the case study object because thoroughly evaluated and comprehensive statistical data about the impact of

MASIPAG on the livelihood of its farmer members and on the ecological state of their farmland are available, and because MASIPAG is well-known as a positive example of small-scale agricultural management in developing countries.

The Philippines are an archipelago in Southeast Asia in the Western Pacific Ocean, categorized into the three main geographical divisions Luzon, Visayas and Mindanao. About one third of the more than 85 million inhabitants in the Philippines are employed in the agricultural sector. Farmers comprised the second poorest sector in 2006 with a poverty incidence of 44% (NSCB 2006), i.e. 44% of all farmer families were not able to meet their basic food and non-food requirements. The staple crop of the Filipinos is rice. Although self-sufficiency in the production of rice is an explicit national policy, even stated in the Philippe constitution, rice imports have increased up to 8% of total rice supply in 2002 (Tolentino 2006: 3).

MASIPAG is a network of small-scale farmers cultivating rice-based agricultural systems in the Philippines, associated with farmers' organizations, scientists and non-governmental organizations (Bachmann *et al.* 2009: 1). The network has been established in 1986 on a rice conference, which was initiated to discuss the negative impacts of the Green Revolution on Philippine farmers (*ib.* 6*f.*). The Green revolution caused most Philippine small-scale farmers to convert their cultivation from traditional rice varieties to the chemically-dependent, genetically uniform "high-yielding varieties" of the International Rice Research Institute (IRRI). Subsequently, many farmers became indebted and lost the self-determination in their agricultural management. The aim of MASIPAG was and still is to improve the situation of resource poor small-scale farmers and to empower them (*ib.* 2).

In 2009 the organization counted approx. 35.000 farmer members, tilling an average farm size of about 1,5 ha (*ib.* 13). Communal seed collection and free seed exchange build the core of their management approach. MASIPAG farmers learn how to breed their own rice varieties from the old traditional rice varieties, collect and share them, enhance their on-farm diversity and farm without artificial fertilizers and pesticides. Until today they have cultivated more than 2000 rice varieties, which are adapted to the specific local environmental conditions (*ib.* 6). To become a member of MASIPAG, farmers have to signify their intention and their willingness to comply with the MASIPAG management approach.

The network is organized in approx. 20 provincial coordinating bodies and approx. 670 people's organizations (POs), which are groups of MASIPAG farming families. The POs develop their own local agendas and action plans, which are processed at provincial, regional and national levels and finally taken up within the work program of the entire organization (*ib.* 68). This institutional structure gives the priority to farmers in decision making structures at all levels, including planning, research, implementation and evaluation (*ib.* 67*ff.*).

An evaluation of the MASIPAG network on *"Food Security and Farmer Empowerment: A study of the impacts of farmer-led sustainable agriculture in the Philippines"* (*ib.*) has been published in 2009. It compares findings from full organic MASIPAG farmers and conventional farmers regarding food security, health outcomes and livelihood, corn yields and productivity, various environmental outcomes, farmer knowledge and empowerment. The quantitative data were gathered by conducting interviews with 280 MASIPAG farming households, selected by computerized pure random sampling, and 280 conventional farming households as reference group, selected by simple random sampling (*ib.* 9). Most variables were analyzed using descriptive statistical tools, some variables were further tested for statistical significance levels using a standard error margin of $\alpha = 5\%$ (*ib.* 11).

Both food security, health outcomes and livelihood, especially of the poorest farmers, have been enhanced, and the state of the agro-ecosystems has been improved in MASIPAG farming systems in comparison to conventional farming systems. These findings point to an improvement of intragenerational as well as intergenerational environmental justice. The paper aims (a) to prove this intuition by developing philosophically founded indicator sets for intragenerational and intergenerational environmental justice, and (b) to reveal the success factors and barriers of the MASIPAG network in realizing both intragenerational and intergenerational environmental justice.

The general relationship between intragenerational and intergenerational justice regarding the use of ecosystem services has been investigated in a systematic manner (Glotzbach and Baumgärtner 2011). The analysis of political documents and of the scientific literature showed that the relationship crucially depends on six determinants: (1) quantity and quality of ecosystem services, (2) population development, (3) substitutability of ecosystem services by human-made goods and services, (4) technological progress, (5) institutions and (6) political restrictions (*ib.*). In this paper, I apply the explanation attempt to the MASIPAG example.

The paper is organized as follows. In Section 2, I discuss the measurement of environmental justice within the Philippines agricultural systems, and build an indicator set for intragenerational environmental justice and one for intergenerational environmental justice. In section 3, I examine the extent of intragenerational and intergenerational environmental justice realized in MASIPAG farming systems with reference to conventional farming systems in the Philippines. In section 4, I investigate how each of the six determinants of the general relationship between intragenerational and intergenerational environmental justice impacts on the indicator sets of environmental justice. In the final section, I summarize the findings of the investigation and discuss what the specific MASIPAG results imply for an ecologically just management of agricultural systems in general.

2. Measuring environmental justice within the MASIPAG agricultural systems

To develop philosophically founded indicators of environmental justice, it is instructive to build on established theories of justice. In a previous paper (Glotzbach 2011) I showed that the “A Theory of Justice” by Rawls (1971) complemented by the capability approach (e.g. Nussbaum 2006, Sen 1982) is an appropriate philosophical foundation for deriving a conception of environmental justice. Rawls' original position can be consistently extended (a) to include representatives from the present and actual future generations as assembly members in the original position, and (b) to include access rights to ecosystem services in his list of primary social goods. This causes the assembly members to acknowledge all ecosystem services which provide necessary resources or conditions to human basic capabilities[1] as primary social goods. The representatives would agree on the following *principle of environmental justice* regarding access rights to ecosystem services: "Inequalities in the distribution of access rights to all vital ecosystem services are to be to the greatest benefit of the least-advantaged members of the present and actual future generations" (*ib.*). This general principle integrates the intragenerational and the intergenerational dimension of environmental justice. To allow the measurement of intergenerational and intragenerational environmental justice in MASIPAG farming systems, it is necessary to derive separate and context-specific indicators for intergenerational and for intragenerational justice.

The principle is about the access to *vital* ecosystem services. An ecosystem service is assumed to be vital if it is required for exerting one or several human basic capabilities, anf if it cannot be substituted by human-made goods or services with regard to its function for human basic capabilities. Following the categorization by the Millennium Ecosystem

[1] Sen (1982: 368) defines basic capabilities as substantive freedoms that people can achieve with certain primary goods. Martha Nussbaum (2006: 76ff.) establishs a list of "central human capabilities", including among others the capabilities life, bodily health, and control over one's environment. She states that a life in human dignity requires attaining a minimum threshold of each human capability for each person (ib. 70).

Assessment (MEA 2003: 56*ff.*), the main vital ecosystem services which are delivered by rice-based agricultural systems to present and future small-scale farmers on the Philippines are listed in table 1. Vital ecosystem services substantially impact on, or even determine, three basic capabilities of commercial small-scale farmers: being able to have good health, being able to have food security, being able to make a livelihood. For instance, enhanced regulating ecosystem services improve the resilience of crop yields (ensuring food security), higher on-farm diversity and biological control instead of pesticide use promote a more diverse and less polluted diet (being able to have good health), practical knowledge in plant breeding improves the performance of the farmers' rice selections and makes them independent from purchase of seeds (making a livelihood).

How to translate the principle of environmental justice into case study-specific indicator sets for intragenerational and intergenerational environmental justice? In the intragenerational dimension, the degree up to which the basic capabilities can be attained with the provided set of ecosystem services can be measured directly. As part of the evaluation study, data have been collected on health outcomes, food security[2] and livelihood that quantify the three capabilities for MASIPAG-farmers and conventional farmers. Hence, theoretical as well as pragmatic considerations point to an *indicator set for intragenerational environmental justice* that consists of three indicators: food security, health outcomes and livelihood per ha of the poorest quartile of farmers (*cf.* figure 1).[3] An increase in one indicator - with the others not getting worse - means an increase in intragenerational environmental justice.

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[2] The MASIPAG evaluation study refers to the definition of food security by the FAO (Bachmann *et al.* 2009: 20).

[3] For the indicators health outcome and food security no data on the poorest quartile of farmers are available. As vital ecosystem services are not sufficiently provided to at least 44 percent of the farmers (*cf.* NSCB 2006), average values are assumed to be a good approximation on whether vital ecosystem services are sufficiently provided to the poorest farmers.

Table 1: Vital ecosystem services delivered by rice-based agricultural systems

categorization of ecosystem services	**ecosystem service**
provisioning ecosystem services	food (especially rice crops)
	genetic resources: agrobiodiversity[4]
supporting ecosystem services	soil formation: maintenance of soil fertility
regulating ecosystem services	erosion control
	biological control
	moderation of extreme events (typhoon, drought, flood, climate change)
cultural ecosystem services	educational values: knowledge in plant breeding (learning from natural selection)
	social relations: communal support and cooperation

To fulfill the principle of environmental justice with regard to future persons, the ecological funds which are crucial to deliver a sufficient amount of vital ecosystem services to all future persons need to be sustained. Whether these ecological funds are sustained depends on the state of certain ecosystem services in the present and their future development. These ecosystem services are either ecological funds themselves, e.g. agrobiodiversity, or ecosystem services that increase the stability and resilience of future food production, including maintenance of soil fertility, tolerance of crops to pests and diseases, moderation of extreme whether events and adaptability to climate change. By contrast, certain human impacts on agricultural ecosystems, including soil erosion, pesticide and fertilizer use, decrease the future quality and quantity of essential ecosystem funds. Based on the data available, I choose an *indicator set for intergenerational environmental justice* that includes six *ecosystem indicators*: (1) on-farm diversity (diversity of rice varieties and crop types), (2) soil fertility, (3) tolerance of crops to pests and diseases, (4) soil erosion, (5) application of chemical

[4] According to the definition by the FAO (1999) agrobiodiversity is "the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries (…) it also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators)".

fertilizer, (6) pesticide and herbicide use. The ecosystem service moderation of extreme events has not been included as a further ecosystem indicator because no data on this ecosystem services have been gathered. As this service is positively influenced by other ecosystem services, especially by on-farm diversity as risk minimization and adaptation strategy, it is indirectly considered within the indicator set.

The ecosystem indicators are indirect measures of the agricultural ecosystem's future potential to deliver vital ecosystem services. But today only the present state of these ecosystem services and the present extent of harmful human impacts can be identified for MASIPAG farming systems with reference to conventional farming systems. The past development of the ecosystem indicators can only reveal trends for their future development if the MASIPAG network shows intertemporal institutional stability. As Petersen (2009) states, intergenerational justice presupposes sustaining a just institutional structure of a community. Hence, the indicator set for intergenerational environmental justice is completed by the indicator "intertemporal institutional stability of the MASIPAG network" for the MASIPAG farming systems. Measurement of intergenerational environmental justice in the conventional farming systems does not require such an indicator.

The ecosystem indicators also need to be supplemented by an indicator on population development as the relation of the number of future persons to the future quantity of vital ecosystem services is decisive for meeting the first principle of environmental justice. The *population indicator* which I choose for assessing the MASIPAG systems is the average household size divided by the average farm size (as approximation for the future quantity of vital ecosystem services available at the household level). Intertemporal stability or decrease of this quotient is introduced as a necessary condition for securing intergenerational environmental justice.

Consequently, an increase in on-farm diversity, soil fertility or tolerance of crops to pests and diseases, or a decrease in soil erosion, fertilizer use or pesticide and herbicide use - with all other ecosystem indicators staying constant – *and* intertemporal institutional stability of the MASIPAG network (for MASIPAG systems) *and* no increase of average household size divided by average farm size *together* mean an increase in intergenerational environmental justice (*cf.* figure 1).

Indicator sets

Indicator set for intragenerational environmental justice:

food security

health outcomes

livelihood per ha of the poorest 25%

Indicator set for intergenerational environmental justice:

on-farm diversity

soil fertility

tolerance of crops to pests and diseases

soil erosion

application of chemical fertilizer

pesticide and herbicide use

intertemporal institutional stability of the MASIPAG network (for MASIPAG systems)

average household size divided by average farm size

Figure 1: ***Indicator sets for intragenerational and intergenerational justice***

3. Transformation to greater intragenerational and intergenerational environmental justice

Having built the two indicator sets, the degree of attainability of intragenerational and intergenerational environmental justice in the MASIPAG and the conventional farming systems in the Philippines is determined in this section. By comparing the indicator sets for

MASIPAG-farmers with the indicator sets for conventional farmers, the differences in environmental justice between conventional and MASIPAG farming systems are identified. Table 2 and 3 describe the specific indicators and the corresponding indicator values for MASIPAG farming systems and conventional systems. The last column "comparison" relates the indicator values of MASIPAG and conventional farmers. The sign + indicates that environmental justice is higher for MASIPAG systems than for conventional farming systems in the dimension of the corresponding indicator.

Table 2: Indicator set for intragenerational environmental justice

indicator	**indicator value for MASIPAG farmers**	**indicator value for conventional farmers**	**comparison**
food security (perceived changes in food security 2000-2007, Bachmann *et al.* 2009: 22)	88% (better or much better) 2% (worse)	39% (better or much better) 18% (worse)	+
health outcomes (perceived change in health status 2000-2007, *ib.* 29)	83% (better or much better) 4% (worse)	29% (better or much better) 16% (worse)	+
livelihood per ha of the poorest 25% (gross agricultural income – production costs + value of farm products consumed by the household , *ib.* 25)	12.610 pesos (mean: 51.448 pesos)	8.590 pesos (mean: 32.062 pesos)	+ (difference statistically significant)[5]

[5] The statistical significance level chosen in the evaluation study is 0,05 (Bachmann *et al.* 2009: 11).

Table 3: Indicator set for intergenerational environmental justice:

indicator	indicator value for MASIPAG farmers	indicator value for conventional farmers	comparison
on-farm diversity : number of rice varieties (Bachmann *et al.* 88) number of crop types grown per farm (*ib.* 25)	 4,8 45	 1,6 30	 + + (differences both highly statistically significant)
soil fertility (observed changes in soil fertility 2000-2007, *ib.* 94)	84% (better) 2% (worse)	3% (better) 53% (worse)	+
tolerance of crops to pests and diseases (observed changes in tolerance of crops to pests and diseases 2000-2007, *ib.* 93)	81% (better) 3% (worse)	13% (better) 41% (worse)	+
soil erosion (observed changes in soil erosion 2000-2007, *ib.* 93)	59% (reduction) 6% (increase)	6% (reduction) 32% (increase)	+
application of chemical fertiliser (*ib.* 89)	0%	75%	+
pesticide and herbicide use (*ib.* 91)	0%	80%	+
Population indicator: average household size divided by average farm size (average number of household members divided by cut mean of farm size for farmers in the 0-4 ha group, *ib.* appendix 2)	5,4/1,17= 4,62 (2000) 5,0/1,47= 3,14(2007)	5,4/1,23= 4,4 (2000) 5,1/1,49= 3,42 (2007)	+ (criterion "no increase in population indicator" fulfilled for both MASIPAG and conventional systems)

The indicator sets show that both intragenerational and intergenerational environmental justice is higher for MASIPAG households as compared with conventional farming households. Because all indicators point into the same direction towards greater environmental justice in MASIPAG farming systems, a weighting or aggregation of the single indicators need not be discussed. The chosen comparative approach produces an unambiguous solution.

The indicator "long-term sustenance of the MASIPAG network" cannot be measured directly with the available information. Still, some elements favoring the long-term sustenance of the MASIPAG network can be figured out, such as high internal satisfaction with the work of MASIPAG among its farmer members, high involvement of the MASIPAG farmers in the organization, and reputation beyond its own members at the communal level. These elements are discussed in the context of the determinant institutions (section 4.5).

4. Determinants of intragenerational and intergenerational environmental justice in the MASIPAG case study

An investigation of the general relationship between intragenerational and intergenerational justice regarding the use of ecosystem services (Glotzbach and Baumgärtner 2011), based on a qualitative content analysis of political documents and the scientific literature, revealed that the relationship crucially depends on six determinants: (1) quantity and quality of ecosystem services, (2) population development, (3) substitutability of ecosystem services by human-made goods and services, (4) technological progress, (5) institutions and (6) political restrictions (Glotzbach and Baumgärtner 2011, *cf.* figure 2). To prove this explanation attempt and to reveal the specific success factors and barriers of the MASIPAG network with respect to environmental justice, I discuss for each determinant how it impacts on the indicator values for intragenerational and intergenerational environmental justice in the MASIPAG farming systems.

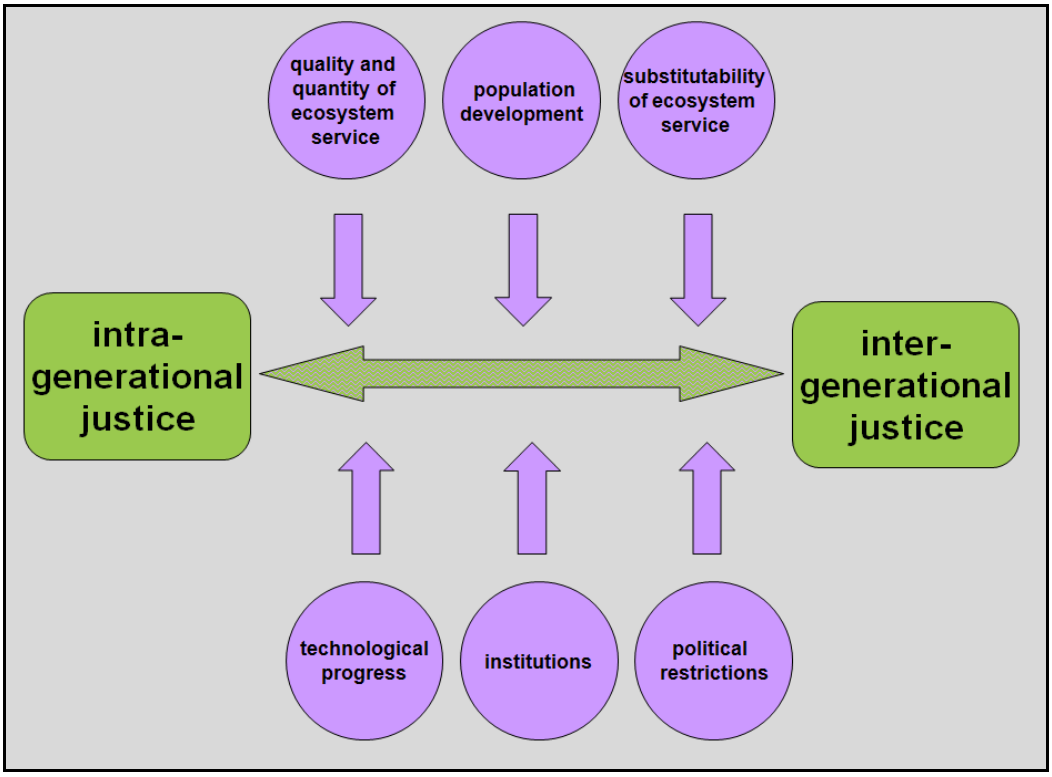

Figure 2: ***Determinants affecting the relationship between the objectives of intragenerational and intergenerational environmental justice (from Glotzbach and Baumgärtner 2011)***

4.1 Quantity and quality of ecosystem services

The MASIPAG farmers have significantly increased vital ecosystem services, including on-farm diversity, maintenance of soil fertility, biological control and erosion control (*cf.* table 4). Probably a positive interaction between these ecosystem services has been occurred, with on-farm diversity being a core link (*cf.* Elmquist *et. al.* 2010). Also the quantity of vital cultural ecosystem services has been increased (*cf.* table 4).

The evaluation results indicate that equally high rice yields (*cf.* table 4), being the most important ecosystem service to present farmers, are compatible with higher on-farm diversity and environmentally sound agricultural management in the short run *and* in the long run. Hence, the MASIPAG management approach produces neither trade-offs between the enhancement of different vital ecosystem services (e.g. rice production versus on-farm diversity), nor trade-offs between the enhancement of vital ecosystem services at different points in time (e.g., rice production today versus rice production in the future). The high crop productivity of the MASIPAG agricultural systems is probably partly due to the local farmers' skills in rice breeding and selection, and partly due to the variable environment that makes risk reducing strategies based on on-farm diversity profitable already in the short run.

Table 4: Quantity of vital ecosystem services in MASIPAG and conventional farming systems

ecosystem service	**MASIPAG farming systems**	**conventional farming systems**
rice yield (rice paddy yields in kg/ha, Bachmann *et al.* 2009: 56)	3.424 (2007)[6] 3.374 (2000)	3.478 (2007) 3.570 (2000)
livestock (carabao ownership, *ib.* 60)	60%	49%
on-farm diversity :		
number of rice varieties	4,8	1,6
number of crop types grown per farm	45	30
maintenance of soil fertility (observed changes in soil fertility 2000-2007)	84% (better) 2% (worse)	3% (better) 53% (worse)
biological control (observed changes in tolerance of crops to pests and diseases 2000-2007)	81% (better) 3% (worse)	13% (better) 41% (worse)
erosion control (observed changes in soil erosion 2000-2007)	59% (reduction) 6% (increase)	6% (reduction) 32% (increase)
knowledge in plant breeding (verification trials of rice seed, *ib.* 57)	70%	3%
social relations:		
involvement in communal labor (*ib.* 80)	32%	18%
development of marketing groups (*ib.* 81)	6-16%	1%

[6] The differences in rice yield between MASIPAG and conventional farmers are not statistically significant (Bachmann *et al.* 2009: 55). Also the trends, a slight decline for conventional farmers and a slight increase for MASIPAG farmers from 2000-2007, are not statistically significant (*ib.* 56).

On-farm diversity, maintenance of soil fertility, biological control and erosion control are itself indicators of intergenerational environmental justice. Therefore, their increase favors an increase of intergenerational justice. These ecosystem services also positively impact on the indicators of intragenerational environmental justice, as the three assessed basic capabilities depend on the whole range of vital ecosystem services (*cf.* table 1).

The *quality* of ecosystem services refers to two fundamental characteristics: *rivalry/non-rivalry in consumption* and *excludability/non-excludability from use*. All ecosystem services that have increased under MASIPAG farming practices are characterized by non-rivalry in consumption, i.e. their use by one person does not diminish another person's ability to use the same service. For example, all MASIPAG farmers can profit from the breeding of new, better adapted crop varieties as it extends the communal seed bank.

4.2 Population Development

The determinant *population development* refers both to the *growth rate of human population* in total and to the spatial *distribution of demographic development* at present and projected into the future. Population development decides on the relation of the number of future persons to the future delivered quantity of vital ecosystem services. Therefore, the relation of average household size of farmer families to average farm size is chosen as an indicator for intergenerational environmental justice within the investigated agricultural systems.

There have been 88,57 million inhabitants living in the Philippines in 2007, more than half of them (56.2 percent) in Luzon, 24.4 percent in Mindanao and 19.4 percent in Visayas (Commission on Population 2007). The average annual population growth rate for the Philippines was 2,04 percent for the period 2000 to 2007, being the lowest rate recorded for the Philippines since the 1960s (*ib.*). The average household size has decreased from 5,0 persons in 2000 to 4,8 persons in 2007 (*ib.*).

The available data on MASIPAG and conventional farmers' household size show that there is no significant difference in their average household size (Bachmann *et al.*: appendix 2). For the period 2000 to 2007 the average household size of both MASIPAG farmers (from 5,4 household members in 2000 to 5,0 household members in 2007) and conventional farmers (from 5,4 household members in 2000 to 5,1 household members in 2007) has decreased (*ib.*). Hence, the average household size of the farmers under study shows a greater rate of decrease than the national average. Regarding average farm size (cut mean of farm size for farmers in the 0-4 ha group), there has been a positive development occurred for both MASIPAG farmers and conventional farmers from 2000 to 2007 (*cf.* table 3), probably due to the acquisition of land under the Comprehensive Agrarian Reform Program (*cf.* section 4.6).

No reliable data are available on projections about the future development of total agricultural population in the Philippines and about the future demographic development of small-scale farmers' household size in specific. Therefore, no scientifically based statement can be given on how the indicator "average household size divided by average farm size", which influences the degree of intergenerational environmental justice, will develop during the next decades.

4.3 Substitutability of ecosystem services by human-made goods and services

The substitutability of ecosystem services refers to the availability of human-made goods or services that can equally function as means to attain human basic capabilities. MASIPAG reverses the management practice to substitute for ecosystem services by artificial inputs - focussing on the enhancement of regulating ecosystem services such as biological control and moderation of extreme events. The evaluation results indicate that human-made goods cannot fully substitute for several regulating ecosystem services: Chemical fertilizers have not achieved the same effects as ecosystem based measures in terms of soil fertility from 2000-2007 (*cf.* table 4); pesticide and herbicide use have not achieved the same effects as biological control in terms of tolerance of crops to pests and diseases (*ib.*). Substitutes for the ecosystem service moderation of extreme events (such as typhoons, flooding and droughts, increased in frequency and intensity by climate change) are partly technically possible, but locally not available or not affordable in contrast to on-farm diversity. On-farm diversity cannot be fully substituted because of its multifunctionality for agricultural systems, such as its function for pest control, pollination, maintenance of soil fertility, protection of water courses against soil erosion, and for resilience and adaptiveness of agricultural systems in the face of climate change.

The provisioning ecosystem service crops (especially rice) impacts on several capabilities: being able to have good health, being abel to ensure food security, being able to make a livelihood. In its function for health and food security crops are non-substitutable for small-scale farmers in the Philippines, but in its function for livelihoods they are partly substitutable. Lower input costs[7] and higher market value can partly substitute for lower rice yields. In case of the MASIPAG network, the dropped expenditures for external inputs and the enhancement of market value (*ib.* 39) have increased livelihood under constant crop yields. This is one determinant for the increase in livelihood, an indicator for intragenerational justice.

[7] Agricultural inputs, i.e. chemical fertilizers, pesticides, herbicides and seeds, are the single most important production cost of conventional farmers, and would increase the expenses of MASIPAG farmers by an average of 9.334 pesos (Bachmann *et al.*: 41). Thus, the MASIPAG management approach reduces farm expenditures by promoting the free and more effective regulating ecosystem services.

4.4 Technological Progress

In the context of environmental justice, technological progress is defined as the rate of increase in ecological efficiency realized by innovation of new technologies, or by means of technology and knowledge transfer of already existing technologies. Referred to farming systems in the Philippines an increase in ecological efficiency means less environmental impacts, including soil erosion, pesticide use, fertilizer use, fossil fuel use and greenhouse gas emissions, and/or enhanced ecosystem services, such as on-farm diversity and soil fertility, per unit rice yield.

A significant increase in ecological efficiency in MASIPAG farming systems has been realized through adoption of sustainable agricultural management (*ib.* 85*ff.*), encompassing the elimination of chemical fertilizers and pesticides, better soil management techniques, alternative pest management, participatory and on-farm breeding activities as well as higher on-farm diversity (i.e., more rice varieties and crop types).

The increase in ecological efficiency in MASIPAG systems goes along with a direct positive impact on the indicators of intergenerational environmental justice, and an indirect positive impact on the indicators of intragenerational environmental justice (*cf.* table 1). Hence, the increase in ecological efficiency promotes both intragenerational and intergenerational environmental justice.

4.5 Institutions

The determinant *institutions* includes all mechanisms which structure and govern human use of ecosystem services at all levels of society. In this paper, the focus stays with the institution MASIPAG although there are further institutions impacting on the relationship between intragenerational and intergenerational environmental justice (*cf.* section 4.6).

The MASIPAG network has enhanced intragenerational and intergenerational environmental justice by establishing technological and social change. Technological change, basically the adoption of environmentally sound and long-term oriented agricultural management, has been discussed in the previous subsection. Social change has promoted environmental justice in three ways: first, it has enhanced the cultural ecosystem services; second, it has facilitated broad adoption of technological change; third, it has improved the intergenerational institutional stability of the MASIPAG network. In the following, these points are outlined in detail.

The type of ecosystem management established by the MASIPAG network favoured cultural ecosystem services, especially knowledge in plant breeding and social relations (*cf.* table 4). The service "knowledge in plant breeding" can be measured by the indicator "verification trials of rice seed" (*cf.* Bachmann *et al.* 2009: 56*f.*). In verification trials farmers test different varieties of rice seeds for their performance under local conditions: first on a local "trial farm", then on their own farms (*ib.* 74). They learn to observe how the rice plant grows and reproduces, what influences growth of different varieties, and which variety performs best under specific local conditions. This type of seed selection is sensitive to environmental changes, e.g. triggered by climate change, equips MASIPAG farmers with good skills and practical knowledge in seed selection and plant breeding, and thereby improves quality and performance of their rice selections. The evaluation results on rice yields, which are equally high for MASIPAG farmers as for conventional farmers using the "high-yielding varieties" of the IRRI (*ib.* 56), support the success of the MASIPAG farmers' skills in seed breeding and seed selection.

Community based ecosystem management, including participatory seed breeding on trial farms, communal seed collection and free seed exchange in the MASIPAG network, went along with the improvement of the cultural ecosystem service "social relations". Better social relations manifested in higher involvement in communal labour and more frequent development of marketing groups of MASIPAG farmers in comparison to conventional farmers (*ib.* 80*ff.*). Involvement in communal labour has helped poor farmers to increase their income and food security, e.g. by the sharing of carabao (*ib.* 80*f.*). Marketing groups had a significant positive effect on income (*ib.* 82), and hence on the intragenerational justice indicator livelihood.

The institutional structure of the MASIPAG network is crucial to the broad adoption of technological improvements. In February 2011 more than 35.000 farmers were members of MASIPAG, whereas the staff was only 42 persons in four MASIPAG offices. To reach a wide range of people, the farmer-led approach of MASIPAG is indispensable. Around 200 farmer-trainers provided trainings, coaching and monitoring support to other farmers in February 2011. The success of the farmer to farmer dissemination of technology becomes appeared in two evaluation results: Both training rates of organic farmers and adoption rates of trained farmers are high (*ib.* 75). 83% of MASIPAG farmers have received training in cultural rice management; more than 75% have received training in soil fertility management and alternative pest management. The adoption rates are between 65-78%, depending on the training topic (*ib.*).

Long-term sustenance of the MASIPAG network is a *necessary* precondition for intergenerational environmental justice as it allows the ecosystem indicators to become effective in the future. The MASIPAG network is characterized by some elements that favor its long term sustenance and hence intergenerational justice. First, the network has been established as and still is a bottom-up approach. As it gives the priority to farmers in the decision making structures at all levels - farmer leaders, farmer breeders and farmer knowledge loom large in the network. This can probably make MASIPAG more independent from permanent external funding and technical support while at the same time facilitating the empowerment of the farmers. Second, there is high internal satisfaction with the work of MASIPAG among its farmer members (*ib.* 76) and high involvement of the MASIPAG farmers in the organization, with half of them being leaders in people's organizations and a third being farmers' trainers or committee members (*ib.* 72) . Third, reputation beyond its own members is relatively high as compared with reputation of government agencies and other NGOs, and MASIPAG technologies are used by non-member farms at the community level (*ib.* 79). These three elements probably promote the intergenerational justice indicator "long-term sustenance of the MASIPAG network".

4.6 Political restrictions

Political restrictions are limits to an alteration of social institutions. The MASIPAG network could obviously establish within the national political institutions, and it could change institutional structures in the Philippine farming systems. Although the MASIPAG network proved to enhance both intragenerational and intergenerational environmental justice, there are political restrictions on higher institutional levels that have restricted and will restrict further improvement of environmental justice. The main political restriction on the national level is the deficiency in agrarian reform; one important political restriction on international level is the failure in climate change mitigation. Discussing such higher-level restrictions is important because most MASIPAG farmers are still close to the poverty threshold, average farm size both for conventional and MASIPAG farmers is only about 1,5 ha[8] (*ib.* 13), and household annual balance is still in the red for the poorest quartile of MASIPAG farmers (*ib.* 49).

[8] The national average in farm size was 2,0 ha in 2002 (NSCB 2005).

Agrarian reform

Historically, as legacy of the Spanish and American colonial periods, the Philippines were characterized by sharp inequalities in the distribution of land ownership (Fuwa 2000: 26*ff.*). As a consequence, cycles of rural insurgencies and subsequent partial land reform occurred (*ib.* 1). Land reform has been on national political agenda at least since the early 20th century, and national reform legislation has gradually expanded the scope for land redistribution over time (*ib.*). Nevertheless, land reform has faced and still faces implementation deficiencies (Balisacan and SEARCA 2007, Fuwa 2000). The latest legislation, the Comprehensive Agrarian Reform Program (CARP) from 1988, is the most comprehensive land redistribution program in Philippine history, and includes the transfer of public land and private agricultural lands from the big landlords to landless farmers. With CARP(ER)[9] landless farmers have gained the right to acquire up to 3 ha of a landlord's land, on condition that they have tilled this land before as tenant farmers or farm workers. CARP is criticized to suffer "from legal loopholes[10], budgetary shortage, and lack of adequate administrative capacities, which hinder swift and massive land redistribution" (Fuwa 2000: 75). As there is only a poor land information system existing in the Philippines, controlling evasion and monitoring land ownership faces serious problems (Ballesteros and dela Cruz 2006: 17). Although some MASIPAG farmers in the survey were able to access more land with the extended agrarian reform programs of the government from 2000-2007 (Bachmann *et al.* 2009: appendix 2), 38% of the MASIPAG farmers and 45% of the conventional farmers under study did not own any of their tilled farmland in 2007 (*ib.*).

Beyond land reform, agrarian legislation in the Philippines is characterized by distortionary government interventions, such as taxes, output and input subsidies and

[9] CARP has been renamed into *CARPER* (CARP-Extension with Reforms).

[10] Land used for industrial purposes, for fish farming and as pastureland does not fall within the scope of CARP. As a consequence, several landlords signed over their land to a company, or declared it as pasture land or land for fish farming.

subsidized credit schemes that favor larger farms (Fuwa 2000: 64). Such distortions are for example high import protection for sugar producers that favor the hacienda-organized sugar farms (*ib.*). In contrast, small-scale farmers have very limited access to credit facilities except at the highly inflated interest rates of informal money lenders, making them economically vulnerable (Bachmann *et al.* 2009: 48). Furthermore, foreign investors compete with small-scale farmers for farmland. The Philippine government has permitted foreign investors to lease 1,37 million ha of the total of 13 million ha agricultural land (USDA 2009) during the presidency of Gloria Macapagal-Arroyo (2001-2010) (Kwok 2010).

Legal loopholes, prolonging and evasion of reform implementation and distortionary government interventions reflect the strong political force of the landlords on national political dynamics (Fuwa 2000: 49). In addition, farmers who claim their right to land through CARP(ER) reform are often exposed to physical and legal harassments by their landlords and other opposers of the CARP reform (Narjes and Dürselen 2008). These local and national political restrictions limit the scope for increasing intragenerational justice as they hinder CARP-implementation and, thereby, the transfer of land ownership to landless small-scale farmers.

However, after the fall of the Marcos dictatorship in 1986, local peasant organizations have emerged and linkages among these local organizations, national non-governmental organizations and pro-reform state actors have been strengthened (Fuwa 2000: 49). There are some cases where these new movements could counter-balance the political force of the landlords and successfully enforce implementation of legal land rights (*ib.*). Also MASIPAG states the issue of genuine land reform (land conversion, CARP assessment, food security) as one of its advocacy issues (MASIPAG 2004).

International climate politics

Global climate change is a serious threat to small-scale farmers in the Philippines. MASIPAG farmers report increases in droughts, typhoons, flooding and salt water intrusion, both in frequency and intensity (Bachmann *et al.* 2009: 103*ff.*). The IPPC (2007: Chapter 10.2) confirms these observations by MASIPAG farmers. Although MASIPAG farmers use on-farm diversity as risk minimization strategy and although they have established a good social support infrastructure, they will be affected by an increasing number of extreme whether events (*ib.* Chapter 10.3). Thus, intergenerational environmental justice will depend on the enforcement of climate mitigation measures in international and regional climate negotiations which underlie severe political restrictions.

National agrarian reform and international climate politics show that higher-level political restrictions limit the degree of intragenerational and intergenerational environmental justice which the MASIPAG network can attain.

5. Conclusion

In this paper I investigated the success factors and barriers of the Philippine farmer network MASIPAG in realizing both intragenerational and intergenerational environmental justice. Approaching from the principle of environmental justice that inequalities in the distribution of access rights to all vital ecosystem services are to be to the greatest benefit of the least-advantaged members of the present and actual future generations, I derived indicator sets for intragenerational and intergenerational environmental justice. The measurement of environmental justice within MASIPAG and conventional farming systems, based on the results of a former evaluation study, indicated that MASIPAG farming systems perform better than conventional farming systems regarding both indicator sets. Following this, I analyzed how the six general determinants of the relationship between intragenerational and intergenerational environmental justice impact on the two indicator sets. The results can be summarized as follows:

Higher quantity of all regulating and cultural ecosystem services as well as enhanced on-farm diversity, "re-substitution" of human-made goods (such as artificial fertilizers and pesticides) by free and more effective regulating ecosystem services, agricultural management that increases ecological efficiency, an institution that facilitates both technological and social change, and the possibility of MASIPAG to establish within the national political structures promote both intragenerational and intergenerational environmental justice. Still, one determinant clearly opposes the enhancement of environmental justice: political restrictions limit the scope for intragenerational and intergenerational environmental justice. To further increase environmental justice, the MASIPAG approach should especially integrate measures that strive to tackle deficiencies in national agrarian reform.

To conclude on the general explanation attempt, the six determinants have proved to be fruitful and complete categories to reveal the relations between intragenerational and intergenerational environmental justice for the MASIPAG case study.

What do the specific MASIPAG results imply for an environmentally just management of agricultural systems in general? The existence and success of the MASIPAG network is essentially based on the high involvement of the MASIPAG farmers in the organization. Therefore, the MASIPAG approach as a whole cannot be established in other regions using a top down approach. But the network's core success factors and barriers, as identified with the determinant analysis, can be valuable guidelines for already existing or evolving farmer networks in other regions. They should be scaled-up to Rural Development and Biodiversity Strategies at the national and international level.

6. Acknowledgements

I wish to thank Stefan Baumgärtner as well as the participants of the BIOECON Conference 2011 for critical discussion and valuable comments. Financial support from the German Federal Ministry of Education and Research (BMBF) under grants 01UN1011A/B is gratefully acknowledged.

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