computation of resilience/vulnerability indices at the farming system scale. Thirdly, the consistency of the computation method is tested to produce results by defining the test of optimal decision rules considering the effective contexts where decisions are made (external shocks, institutional design etc.). The necessary conditions for actions and policies in favour of SIDS' resilience to emerge are then explained.

Insight on the method suggested in the viability theory

Since late 1980, viability theory has focused on the study of constrained discrete or continuous dynamic systems (partly controlled by humans or regulated by nature), partly subject to known but unpredictable perturbations or to systemic approximate assessment and for which qualitative objectives may be prescribed such as reaching a target in finite time or optimizing some overall criteria. Viability tools can handle complexity which avoids the use of classical methods such as optimal control theory or Monte Carlo as in statistical methods. Typically viability analysis answers the question: starting from a given initial situation, does it at least one viable evolution exist? Above all viability analysis provides the decision rules which when applied will sustain viability.

Expected results

The research contributions are theoretical, empirical as well as practical. Theoretically, a re-foundation of the agricultural sector analysed as a determinant of the SIDS vulnerability is expected. On the empirical viewpoint, a robust protocol that determines the viable evolutions of the agricultural sector should be built. At the practical level, the interpretation of measurement results should provide the rules of decision the different stakeholders (from the producer to the politician) have to follow using a guidebook, in order to generate resilience in SIDS from an agricultural development viewpoint in line with the new requirements of adaptability and sustainability.

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Productivity veterinary services and milk marketing through communities increase milk production and farmers income

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Bangladesh has the largest population density in the world and most of its population is rural, with per capita incomes being among the lowest in the world. This population is continually growing, increasing the demand for food, including animal products. Agriculture has evolved in an attempt to meet this demand. The purpose of rearing cattle has been shifting from traditional utilisation as traction animals to milk and meat producers. Artificial insemination (AI) was introduced in 1969, to help to increase productivity, but growth rates in production lag behind increases in consumption.

To increase productivity, crossbreeding in cattle through artificial insemination has been continued since 1969. There are about 3 million crossbred cattle in Bangladesh, representing 13% of the animal population. Crossbred animals generally perform well, assuming that veterinary services are included in the AI programme and milk marketing opportunities are made available. Veterinary services are required because the crossbred cattle tend to suffer more health and reproductive problems than local animals. Crossbred cows also require more inputs in feed and health care, so an accessible market is necessary to allow the farmer to obtain better returns to cover these increased costs. A project funded by USDA and IAEA-FAO has been working in Bangladesh since 2001 and has developed a model for delivering comprehensive services that address the issues mentioned. The service is called the Community-based Dairy Veterinary Service (CDVS) and is delivered through farmers' groups and associations. An individual veterinarian makes a scheduled farm visit to perform preventive and emergency cattle health care and reproduction and feed management. This has lead to the formation of a foundation that aims to make the programme self-financing. It is called the Community-based Dairy Veterinary Foundation (CDVF). At the same time, a milk processor, BRAC Dairy and Food Projects has installed milk chilling tanks in the community. The impact of such programmes were evaluated in two districts of Bangladesh, Satkhira and Chittagong.

In Satkhira, three farmers associations collect about 9000 litres milk every day and transport them to five BRAC milk chilling centres. BRAC pays 1.65 Bangladesh Taka for each litre of milk (US$ 2.4/100 litres milk) to CDVS in addition to the milk price paid to producers, yielding a yearly income to the foundation of US$ 80 000. This amount of money is sufficient to pay the salary of three veterinarians, two field assistant, rents for three veterinary offices and the cost of vaccines and anthelmintics for all animals of the farm community. In addition, 69 men are employed to collect the milk and transport it to the BRAC chilling centres. Each man earns US$ 45–65 per month. The programme generates a large amount of off-farm employment, which is very important in a country like Bangladesh where unemployment is a big problem.

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A typical pattern that has been observed is for farmers to initially use improved veterinary services to increase the milk yield per cow. Over time, this allows farmers to accumulate funds to also increase the number of cows. This has led to increases on single farms from 35 to 90 times the level of total milk production and allowed farmers to become solvent members in the community. An economic analysis shows that the CDVS has tended to increase net farmers' income as well. More than 75% of farm families had an increase in net income, which ranged from US$ 1.0 to 19.2 per cow per month.

A similar programme was established in the Chittagong in 2002. At the beginning, there were 70 farmers producing about 1500 litres of milk per day. Currently, the programme involves 269 farm families who collectively produce about 10 000 litres/day. In addition, the CDVS developed a farmers association that bargains over milk prices with the sweetmeat industries. Previously farmers used to be exploited by the middleman and sweetmeat producers. Now that the productivity veterinary services are available and the associations bargain a good milk price, numbers of dairy farmers and farm milk production have increased.

CDVF, in collaboration with BRAC, has extended its activity to the Sirajganj District of Bangladesh by using the same model that is successful in Satkhira. The farmers association in Sirajganj was started in Aug 2009 with an initial collection of 260 litres milk. Now the association is producing 1500 litres milk daily. CDVF has received a sub-contract worth US$ 33 200 from Care Bangladesh to test the Satkhira Model in the Joypurhat District of Bangladesh. Current priority is to establish 10 community-based centres and develop those to maximum revenue earning levels incorporating other services like AI, feed and drug shops and community information centres. Each CDVF centre will act as a one stop hub from where the dairy farmers can buy all necessary services.

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Grass based agroecologic dairying to revitalize small family farms throughout student technical support: The development of a participative methodology responsible for 622 family farm projects

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Introduction

Pasture-based animal production has in the last decade assumed outstanding importance worldwide (Rizzoli and Schmitt, 2007). This fact is mostly related to economic advantages, animal welfare, and ecological issues (Murphy, 1998). This tendency seems to be reinforced by growing food security concerns. Increasing social pressure has demanded organic animal products from agricultural methods that are safe, environmentally benign, and pasture-based. The viability of small family farms, through pasture-based ecological dairying, has been highlighted as a way to revitalize rural communities and so avoiding urban social problems in Brazil (Rizzoli and Schmitt, 2007). In this context the Voisin Grazing Group – GPVoisin, a Pasture Outreach Program started in Southern Brazil sponsored by farmers, students and professors (Federal University of Santa Catarina). The main goal of this group of volunteers was to make small farming viable through sustainable agricultural practices, and to make this possible by participative technical assistance from farmers and undergraduate students (Saade, 2003).

Methodology

The field work of the Extension Group (Voisin Grazing Group) is characterized by 17 main steps (1) Demand from organized groups of farmers; (2) Motivational speeches to farmers group showing results from agroecologic dairy farms; (3) Participative selection of farms to become pilot projects; (4) Detailed farm survey; (5) Topographic survey through GPS equipment; (6) Map drawing with CAD tools; (7) Field zoning; (8) Forest recovery planning; (9) Paddock layout. (10) Watering project; (11) Forage planning; (12) Economic summary; (13) Implementation schedule; (14) On-farm project evaluation with the entire family; (15) Construction of module I (30% of the whole project); (16) Monthly pasture walk on pilot farms with whole groups; (17) Ongoing evaluation and selection of the next farms to be planned.

Results

The GPVoisin – Pasture Outreach Program has made 622 projects to small family farms in 58 municipal districts in the state of Santa Catarina since 1998. Whole farm planning has been undertaken by undergraduate students and farmers. About 48 students participated in the group activities in recent years. The group has promoted many events: 61 "pasture walks", 110 farm visits, 6 lecture courses about pasture-based

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