



BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: S1b

Title of session:

Ecosystem services and rehabilitation of agroecosystems: Achieving the goals of four main MEAs in smallholder dominated rural landscapes.

Hosts:

	Title	Name	Organisation	E-mail
Host:	Prof.	AbdonSchmitt Filho	Federal University of Santa Catarina	abdonfilho@hotmail.com
Co-host (s):		Paulo A.A. Sinisgalli, Joshua Farley	PROCAM/USP, GUND IE/ UVM	psinisgalli@usp.br, jfarley@uvm.edu

Abstract:

Agriculture is the most important sector of the global economy, without which it would likely be impossible to support more than a fraction of the current global population. Conventional agriculture however may be the greatest threat to the global ecosystems, upon which all complex life depends (Millennium Ecosystem Assessment, 2005), and has been the leading culprit in exceeding critical planetary boundaries (Rockstrom et al., 2009). We risk catastrophic and potentially irreversible outcomes if the ecological impacts of agriculture are not rapidly reversed. Yet nearly one billion people are currently undernourished, and the global population is expected to increase by two billion by 2050.

With conventional agriculture and current economic institutions, both marginal benefits and marginal costs of agricultural production are immeasurably large: there is no 'optimal' outcome, only unacceptable tradeoffs. This same dilemma plays out at a smaller scale in the Atlantic Forest of Brazil, which generates vital ecosystem services for Brazil and the World. Only 15% of the original forest remains, and ecologists predict a massive reduction in



biodiversity and hence ecosystem services unless forest cover is at least doubled (Banks–Leite et al., 2014). Time lags between forest loss and ecosystem collapse may provide a narrow window of opportunity to restore the system’s biodiversity and resilience, and avoid potentially catastrophic outcomes (Metzger et al., 2009). With conventional agriculture, doubling forest cover would leave inadequate farmland remaining to sustain small family farmers (Schmitt Filho et al., 2013). Since markets pay for agricultural output but not ecosystem services, with current technologies the choice is between ecosystem collapse or poverty.

Roughly speaking two solutions to this dilemma have been proposed: sparing or sharing (Phalan et al., 2011). Advocates of sparing maintain that we must use conventional, high input agriculture to maximize food production on some land in order to leave more global ecosystems intact. However, high–input agriculture relies heavily on non–renewable resource inputs that cause serious harm to global ecosystems and must eventually run out.

We advocate sharing: low input and knowledge intensive high biodiversity agroecological practices that improve both food production and ecological function on existing farmland, reducing or even eliminating tradeoffs between the two (Tscharntke et al., 2012). Yields from agroecology can match or exceed those from conventional agriculture (Ponisio et al., 2014; Pretty et al., 2005), and increase with research, development and extension (De Schutter and Vanloqueren, 2011).

Goals and objectives of the session:

To discuss alternatives to improve farmer livelihoods and restore critical ecosystem services while complying with environmental goals.

Planned output / Deliverables:

To have a clear understanding of different proposed practices to leverage social change and environmental recovery in the smallholder dominated rural landscape.

To learn about the relationship of those practices with four main MEAs.

Voluntary contributions accepted:

Yes

Related to ESP Working Group/National Network:

[Sectoral Working Groups– SWG 1 – ES in Agricultural production systems](#)



II. SESSION PROGRAM (S1b)

Date of session: Tuesday, 23 October 2018

Time of session: 15:30–17:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
15:30–15:40	Edmundo	Barrios	Food and Agriculture Organization of the UN (FAO)	The 10 elements of Agroecology: Guiding the transition to sustainable food and agricultural systems.
15:45–15:55	Abdon	Schmitt Filho	Federal University of Santa Catarina – LASSre/UFSC & GUND IE UVM	High Biodiversity Silvopastoral System: Addressing livelihood, ecosystem services and ecological restoration in Brazil's most endangered Biome
16:00–16:10	Sofia	Lopez-Cubillos	The University of Queensland	Bridging the conservation of natural habitat and economic development in agricultural landscapes using pollination services
16:15–16:25	Thais	Buratto	Programa de Pós-graduação em Agroecossistemas PGA/UFSC & LASSre/UFSC	Multifunction Riparian Forests (MultRF): When restoration of agroecosystems generates multiple ecosystem services and increases farmers income.
16:30–16:40	Alice	Ramos de Moraes	Programa de Pós-graduação em Ecologia UNICAMP	Strengthening local-level initiatives for ecosystem service improvement in smallholder-dominated rural areas: a case study from southeast Brazil
16:45–17:00	Joshua	Farley	Community Development and Applied Economics & GUND IE UVM	PSE Santa Rosa: Leveraging social change and ecological restoration in a family farmer dominated landscape.

Date of session: Wednesday, 24 October 2018

Time of session: 13:30–15:00

Timetable speakers



Time	First name	Surname	Organization	Title of presentation
13:30–13:40	Kwadwo	Kusi Kyenkyehene	Mohammed V University	Quantification of ecosystem services in the watershed of Ourika, Morocco
13:45–13:55	Veronica	Maioli	International Institute for Sustainability	Ecological and socioeconomic valuation of pollination services in the Paraiba do Sul River Basin (Brazil)
14:00–14:10	Rodrigo	Macedo	Federal University of Paraná	Land use and land cover mapping in detailed scale: a case study in Santa Rosa de Lima–SC.
14:15–14:25	Eduardo R.	Alexandrino	University of São Paulo – ESALQ/USP	Forest remnants in agricultural landscapes promoting support for regional bird diversity and cultural services for citizens: Assessing factors useful for future
14:30–14:40	Rodrigo	Macedo	Federal University of Paraná	Delimitation of Permanent Preservation Areas: Case study in Santa Rosa de Lima–SC.
14:45–14:55	Joshua, Paulo, Abdon	Farley, Sinisgalli, Schmitt Filho	CDAE UVM, PROCAM USP, LASSre/UFSC	Closing Remarks

III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. *Type of submission: Abstract*

S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
Achieving the goals of four main MEAs in smallholder dominated rural landscapes

Forest remnants in agricultural landscapes promoting support for regional bird diversity and cultural services for citizens: Assessing factors useful for future management decisions



First author(s): Eduardo R. Alexandrino

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The sugarcane plantation and pasture for cattle rising are two economically important agricultural activities in the countryside of São Paulo state, Brazil. Many small Atlantic forest remnants are found immersed in both agricultural matrices, due to rules imposed by Brazilian environmental law. While sugarcane industry often manages its agricultural landscapes similarly as land sparing scheme (homogeneous landscapes), in small family farms with pastures the land sharing scheme is predominant (heterogeneous landscapes). This scenario has been observed in our study area, the Corumbataí river basin (1710km²), a human-modified landscape from which the south is dominated by sugarcane and the north by pastures. In recent years we observed that the remnants in this river basin are supporting approximately 48% (240) of the regional bird species, from a total of 500. Although forest remnants from both matrices are harboring similar bird species and functional groups, sugarcane fields has less bird diversity when compared to pastures field (72 and 132 species respectively). Besides, the bird assemblages occurring in sugarcane fields are much more contrasting with the bird assemblages of adjacent forest remnants, while an opposite situation is observed in pasture landscapes. Using citizen interviews, we also observed that local citizens have been using these forest remnants for leisure. However, remnants with good ecological integrity and distant from urban zones, such as in the pasture landscapes, are prone to attract bird enthusiasts. 214 birdwatchers (69% of our 303 responders) demonstrated willing to pay between 50–200 (R\$) to do birdwatching tours in a proper forest remnant. Therefore, in order to support regional bird diversity, we argue in favor of management practices that incorporate heterogeneity in agricultural landscapes, such as land sharing does. By doing this, such remnants can also promote cultural service, and opens the possibility to implement a payment for the ecosystem services provided by them

Keywords: birdwatching, recreation, forest reserves, γ -diversity, environmental management



2. *Type of submission: Abstract*

S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
Achieving the goals of four main MEAs in smallholder dominated rural landscapes

The 10 elements of Agroecology: Guiding the transition to sustainable food and agricultural systems

First author(s): Edmundo Barrios

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Agroecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system. Agroecology is based on bottom-up and territorial processes, helping to deliver contextualized options to local problems. Agroecological innovations are based on the co-creation of knowledge, combining science with the traditional, practical and local knowledge of producers. By enhancing their autonomy and adaptive capacity, agroecology empowers producers and communities as key agents of change. Agroecology seeks to bring transformative change to agriculture and food systems by addressing the root causes of problems in an integrated way and providing holistic and long-term solutions. This includes an explicit focus on social and economic dimensions of food systems. The 10 Elements emanated from the FAO regional seminars on agroecology and include: biodiversity, co-creation and sharing of knowledge, synergies, efficiency, resilience, recycling, human and social values, culture and food traditions, responsible governance, circular and solidarity economy. As an analytical tool, the 10 Elements can help countries to operationalize agroecology. By identifying important properties of agroecological systems and approaches, as well as key considerations in developing an enabling environment for agroecology, the 10 Elements are a guide for policy makers, practitioners and stakeholders in planning and evaluating agroecological transitions aiming at sustainable food and agricultural systems and contributing to multiple SDGs and Multilateral Agreements.

Keywords: agroecology, biodiversity, ecosystem services, co-creation, multilateral agreements



3. *Type of submission: Abstract*

S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
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Multifunction Riparian Forests (MultRF): When restoration of agroecosystems generates multiple ecosystem services and increases farmers income

First author(s): Buratto Thais

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In Brazil, 68.34% of natural vegetation areas are located on private lands and unappropriated public lands. Only on private lands, there is a legal deficit of 19 million hectares of land that must be preserved, according to the Brazilian legislation. Thus, farmers decision upon different land uses can determinate the future of ecological restoration in the country. These decisions are often influenced by social and economic factors. In such a scenario, strategies that help local farmers to restore their lands and synergically have an economic return of investment could wide spread ecological restoration. Initiatives that incorporate income-generation activities such as exploitation of non-timber forest products are crucial for the adoption any restoration system. Regular income and legitimacy under the current environmental legislation provide security and confidence for family farmers. The goal of this work was to evaluate the economics of Multifunction Riparian Forest (MultRF) as an alternative for ecological restoration with potential to be wide spread adopted among family farmers. The model was developed using participatory approach (PAR) in the rural landscape of Santa Rosa de Lima, Southern Brazil. The Internal Rate of Return (IRR) of 27% and 6-year Payback demonstrate the competitiveness of the investment. Economic return and reduction of environmental liabilities associate with provision of multiple ecosystem services can make MultRF a public police option to ensure restoration targets for climate change mitigation formalized on nationally declared contributions (NDCs).

Keywords: non-timber forest products, NTFP, riparian ecosystem, restoration economy, family farm



4. *Type of submission: Abstract*

S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
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Quantification of ecosystem services in the watershed of Ourika, Morocco.

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This study provides an overview of the current state of the production of ecosystem services by the different land uses in the watershed of Ourika on the western high atlas of Morocco. Ecosystem services are likely to decline due to flooding and the pressure from the inhabitants on these services in the watershed. Hence, the need to quantify these services to assess their contribution to the well being of the local population. A decision making tool, InVEST (Integrated Valuation of Ecosystem Services and Trade Offs) was used to model, quantify and map three ecosystem services in the watershed: climate regulation, water purification and water yield. The results show that the watershed has a very low capacity for water purification due to a great soil loss and low sediment retention. The water yield performed better with a high production of water for the inhabitants to use and this was because of the low evapotranspiration in the watershed. The climate regulation service performed poorer compared to the other services and this is due to the low forest cover of the watershed with a percentage of 35.62 %. The ecosystem services in the Ourika watershed are in a poor or mediocre state and need an immediate attention and management. This assessment can be used by stakeholders to help maximize the production of these services in the watershed.

Keywords: Ecosystem services, Ourika watershed, InVEST, quantify.



5. *Type of submission: Abstract*

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Bridging the conservation of natural habitat and economic development in agricultural landscapes using pollination services

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Pollination services have a great potential for conservation and economic development; however, there is a lack of decision support tools that explicitly show how to achieve these two objectives. By using systematic conservation planning, we developed a framework to the improved land use decisions in Costa Rica that both enhance coffee productivity and conservation outcomes. We investigate land use under five different scenarios, 1) Baseline scenario where there is no coffee expansion, 2) to maximise coffee production without considering pollination, 3) to maximise coffee production incorporating pollination services and 4) to maximise both biodiversity and coffee production with pollination services incorporated and 5) to maximise coffee production and habitat aggregation when considering pollination services. Our work highlights overlapping areas to achieve agriculture production and conservation, particularly in the last scenario when habitat is aggregated. Our results also serve as a tool for engaging local land-holders in conservation endeavours that can enhance their livelihoods.

Keywords: Coffee arabica, wild bees, optimization, spatial planning

6. *Type of submission: Abstract*

[S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
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Delimitation of Permanent Preservation Areas: Case study in Santa Rosa de Lima-SC.



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This work deals with the data integration and the geoprocessing to obtain semi-automated Permanent Preservation Areas (PPAs). The objective of this paper is to systematize methodological procedures for delimitation of PPAs from a hydrography. For this, a case study was carried out in Santa Rosa de Lima/SC. In order to delimit the PPAs through Geographic Information Systems, it was necessary to generate a distance map for each hydrographic feature. The specification of the buffer width is dependent on the type, width and size of drainage network features. In considering the joining of all PPAs, the resulting area is 10,125.04 ha (considering the overlap), representing 50.12% of the area of the municipality. A part of the PPA is not properly covered by forest vegetation and its recovery will take into account the characteristics of the rural properties, such as the size and practice of family farming.

Keywords: Preservation Areas, Forest Code, Geoprocessing.

7. *Type of submission:* Abstract

[S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems](#)
[Achieving the goals of four main MEAs in smallholder dominated rural landscapes](#)

Land use and land cover mapping in detailed scale: a case study in Santa Rosa de Lima–SC.

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It is challenging to reconcile large scale data with the dynamic characteristics present in land use. Such dynamism requires data with a high repetition of sampling. An alternative is the integration of data of high spatial resolution and low temporal resolution, with that of high temporal resolution and low spatial resolution. The aim addressed in this article is related to



the integration of aerial photographs and temporal series for land use and land cover mapping in high detail scale. We conducted a case study in Santa Rosa de Lima–SC. The main data used was the aerial survey that overlaid the state of Santa Catarina, executed in 2010/2011. The interpretation key included typical elements of photointerpretation (color, texture, size, shape), aiming to classify the land use and land cover classes. The mapping evaluation resulted in 75.6% global accuracy, ranging from 54% (Grassland and Wetlands) to 96% (Water Bodies and Rocks). Such results are considered satisfactory. The integration of high-resolution images with high temporal resolution data has enabled the discrimination between classes that present great difficulties of separability. Such discrimination is essential in the territorial management processes of Encosta da Serra and the municipality of Santa Rosa de Lima.

Keywords: change detection, image interpretation, temporal series.

8. *Type of submission: Abstract*

S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems
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Ecological and socioeconomic valuation of pollination services in the Paraíba do Sul River Basin (Brazil)

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There is an urgent need to reconcile the increase of agricultural productivity with the recovery of native vegetation and biodiversity maintenance. To comply with national laws and global agreements, and inform decision making of best practice to improve pollination service in Paraíba do Sul River Basin, we modelled three alternative scenarios: (i) Business As Usual (BAU), with no restoration; (ii) Legal Compliance (LC), where restoration occurs in each rural property; (iii) Sustainable Scenario (SS), where spatial planning guided restoration (maximizing connectivity and minimizing costs) combined with implementation of sustainable productive systems (e.g. AgroForest Systems – AFS), to increase local food production. We found a high



variation of pollinators abundance across landscapes, with higher values for natural vegetation areas. The restoration scenarios (ii and iii) had higher mean abundances due to increased forest cover, which reflected in higher visitation potential values when compared to BAU. Comparing both restoration scenarios, maximum visitation potential values were higher in SS, as AFS had the highest abundance and visitation potential among land use classes. However, mean visitation potential values were higher in LC scenario, as scattered restoration increases landscape heterogeneity, decreasing flight distances between nesting habitat and floral resources. To assess the impact of these changes on agricultural productivity, we analyzed pollination dependency of 104 crops grown in the region where 40% have some level of dependency. Productivity increased in LC and SS compared to BAU, with the biggest increment in AFS areas. The net value of pollination for 2035 was 15 million (R\$) in LC and 31 million in SS, indicating greater economic gain due to increment of production areas and pollination service. The scenarios show where and how decision makers could allocate restoration and sustainable strategies to support agriculture, contributing to biodiversity conservation, food security and also boost the economy in the Basin.

Keywords: Ecosystem service, Modelling, TEEB, InVest, Food security

9. *Type of submission: Abstract*

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High Biodiversity Silvopastoral System: Addressing livelihood, ecosystem services and ecological restoration in Brazil's most endangered Biome

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Agriculture is the most important sector of the global economy. Conventional agriculture however may be the greatest threat to global ecosystems. We risk potentially irreversible outcomes if the ecological impacts of agriculture are not rapidly reversed in the most endangered Biomes. The same dilemma plays out at a smaller scale in the Atlantic Forest of Brazil, which generates vital ecosystem services for 70% of the Brazilian population. Nevertheless, only around 15% of the original forest remains and highly fragmented,



approximately 253.000 fragments, most no bigger than 100 hectares. Agriculture is the main cause, and small scale agriculture plays an important role in this scenario. Even if they are responsible for 75% of food production consumed in Brazil, family farmers are striving to survive which increases pressure to the forest remnants, intensification agrochemicals use, and decrease restoration efforts. High Biodiversity Silvopastoral Systems (SSPnuclei) were designed in a participatory framework to embrace ecological restoration, livelihoods and multiple ecosystem services. Our goal was to provide shade for livestock, revenue from non-timber forest products (NTFP), biodiversity (50 native tree species/ha), connectivity, and an improved landscape matrix. In each hectare 40 nuclei (5 m x 5 m) were fenced off (10% of the pasture area). Inside, 22 native trees from four functional groups were planted. SSPnuclei has been implemented in pilot farms in Southern Brazil where biophysical variables and ES have been evaluated and will be presented – soil quality and carbon, biodiversity (birds, ants and dung beetles), microclimate, carbon sequestration and landscape characteristics. The system provided shade by the 2nd to 3rd year, produced banana and rose pepper in the 4th year, açai from Juçara in the 7th. Farmers recover restoration costs by the 7th – 8th year with revenue from NTFP. As a broad public policy, SPSnuclei could rehabilitate rural landscape of Atlantic Forest Biome ensuring restoration targets formalized on nationally declared contributions (NDCs).

Keywords: Atlantic Forest Biome, SPSnuclei, ecological restoration, ecosystem services, livelihood.

10. *Type of submission: Abstract*

[S. Sectoral Working Group sessions: S1b Ecosystem services and rehabilitation of agroecosystems](#)
[Achieving the goals of four main MEAs in smallholder dominated rural landscapes](#)

PSE Santa Rosa: Leveraging social change and ecological restoration in a family farmer dominated landscape.

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Society must increase food production and restore vital ecosystem services or suffer unacceptable consequences. Unfortunately, conventional agriculture may be the single



greatest threat to ecosystem function. At the same time, reducing ecologically harmful agricultural inputs or restoring farmlands to native ecosystems threatens food production. We fell into this predicament because we designed agricultural and economic systems that failed to account for ecosystem services, and the path forward requires redesigning both systems. Agroecology—which applies ecological principles to design sustainable farming methods that can increase food production, wean us away from nonrenewable and harmful agricultural inputs, and restore ecosystem services—promises to be an appropriate redesign of agricultural systems. In Santa Rosa de Lima, SC, we are working with dairy farmers, local and state government, and NGOs to develop high biodiversity silvopastoral systems and multi-function riparian forests that achieve these goals, as well as the policies required for the adoption and dissemination. Appropriate policies must recognize that agricultural land can be managed for multiple ecosystem services, some of which directly benefit the farmer and market production, while others flow to society as a whole at different spatial levels, and hence are public goods. Ongoing research suggests that high-biodiversity silvopastoral systems (SPSnuclei) and multi-function riparian forests (MultRF) can generate critical ecosystem services at both the private and public level in the long run, but incur high short run costs. Farmers cannot be expected to prioritize the needs of society over those of their family, even when the former is socially optimal. This paper describes a pilot project for payments for ecosystem services for agroecology scheme in Santa Rosa de Lima Southern Brazil, designed as Participatory Action Research (PAR) by Silvopastoral and Ecological Restoration Lab (PGA/UFSC) to address these challenges.

Keywords: Payment for Ecosystem Services, PSA, High Biodiversity Silvopastoral System, Multifunction Riparian Forests, Agroecology.