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## Social-Ecological Resilience in Cocoa Farming Systems in Alto Beni, Bolivia

JOHANNA JACOBI<sup>1</sup>, MONIKA SCHNEIDER<sup>2</sup>, MARIA ISABEL PILLCO<sup>3</sup>, STEPHAN RIST<sup>1</sup>

<sup>1</sup>University of Bern, Centre for Development and Environment (CDE), Switzerland

<sup>2</sup>Research Institute of Organic Agriculture (FiBL), Intern. Cooperation, Switzerland

<sup>3</sup>Universidad Mayor de San Andrés (UMSA) La Paz, Dept. of Agronomy, Bolivia

### Abstract

Cocoa based small scale agriculture is the basic livelihood of most farming families in the region of Alto Beni in the Bolivian Andes. Cocoa cultivation is affected by climate change impacts, soil degradation, pests and plant diseases, and insecure cocoa prices. From a sustainable development point of view, cocoa farms need thus to become more resilient. Resilience refers to the ability within a farming system to reduce the sensitivity to stress factors while maintaining productivity, the capacity for self-organisation, to learn, and to adapt to change. Resilience can be subdivided in the three features buffer capacity, self-organisation, and adaptive capacity. This study addresses differences in resilience of organic and non-organic cocoa farms, and the most important features that influence social-ecological resilience in cocoa farming systems.

Indicators for resilience were defined in a transdisciplinary process with local experts and cocoa farmers in a workshop and focus groups. Indicators for buffer capacity were tree diversity, crop diversity, and the diversity of income sources of the farming family. Indicators for self-organisation were the interaction with farmers' organisations, their subsistence level, cocoa yields, and the annual family income. Adaptive capacity was assessed by inquiring the number of courses on cocoa cultivation family members had participated in, and the number of information sources they had. We interviewed 52 certified and non-certified households and conducted an in-depth participant observation with 15 households from the sample.

It resulted that organic farms in the research area were more diversified (tree species in cocoa plots: 4.4 vs. 1.9, crop diversity: 8.4 vs. 6.7 crop varieties on cocoa farms), and had higher cocoa yields (506 kg ha<sup>-1</sup> yr<sup>-1</sup> vs. 335.8 kg ha<sup>-1</sup> yr<sup>-1</sup>, both without external inputs). Annual family income was significantly higher on organic farms with 7530.2 vs. 6044.4 USD. Organic farmers had participated in more courses on cocoa cultivation which may be the main reason for the better performance of their farms. We conclude that resilience building was enhanced by local organisations that organise organic certification and go further than basic organic certification principles by providing extension services, tree seedlings, capacity building, and certain social insurances.

**Keywords:** Adaptation to climate change, agroforestry, Bolivia, cocoa, organic agriculture, social-ecological resilience



# Social-ecological resilience in organic and non-organic cocoa farming systems in the Yungas of Bolivia

Johanna Jacobi<sup>1\*</sup>, Monika Schneider<sup>2</sup>, Patrick Bottazzi<sup>1</sup>, Maria Pillco Mariscal<sup>3</sup>, Stephan Rist<sup>1</sup>

1) University of Bern, Centre for Development and Environment (CDE), Switzerland, 2) Research Institute of Organic Agriculture (FiBL), Switzerland, 3) Universidad Mayor de San Andrés (UMSA), La Paz, Bolivia  
\*corresponding author: johanna.jacobi@cde.unibe.ch

**Background & rationale:** Cocoa based small scale agriculture is an important income source for many families in the region Alto Beni in the sub-humid foothills of the Andes. Cocoa cultivation is affected by various climate impacts, soil degradation, pests and plant diseases, fluctuating market prices and a difficult transport situation. Resilience to such stress factors is thus an important feature of sustainable regional development. The concept of social-ecological resilience refers to the capacity of a system to undergo change while maintaining its functions and productivity as well as the capacity for learning and adaptation. Organic agriculture has been discussed with regard to its contribution to resilience building [1]. Therefore, This study compares resilience indicators on organic and non-organic cocoa farms.



Fig.1 (from left to right) Cocoa flower, cocoa pod, cocoa monoculture, agroforestry system with cocoa, the study area (Yungas)

## What is the contribution of organic cocoa farming to social-ecological resilience?

### The concept of social-ecological resilience

Social-ecological resilience can be subdivided into three main features: Buffer capacity (e. g. livelihood assets), self-organization (e.g. of farmers in cooperatives), and adaptive capacity (adaptation possibilities, access to knowledge) [1].

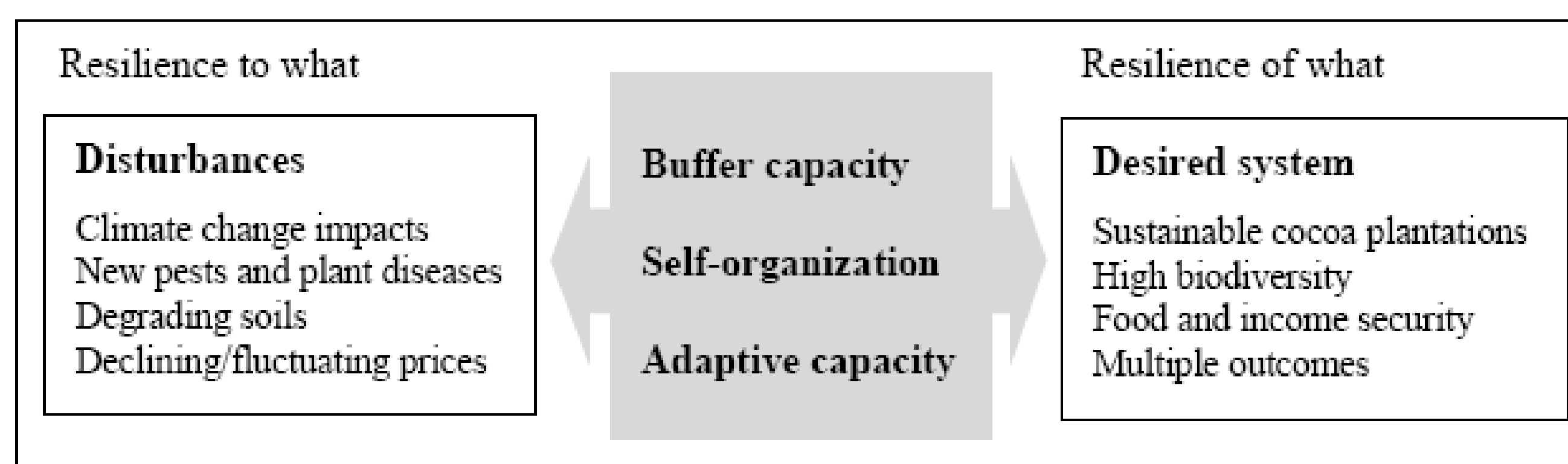


Fig.2 Concept of social-ecological resilience in a farming context [1, modified]

### Indicators

Indicators were defined together with local cocoa producers in focus groups [2] and consulting the literature [3].

**Buffer capacity:** Tree species diversity, crop diversity, cocoa yield, number of different income sources, annual family income

**Self-organization:** Affiliation to farmers' organizations, subsistence level (% of food consumed by the family produced on-farm)

**Adaptive capacity:** Participation in courses on cocoa cultivation, number of information sources on agricultural issues

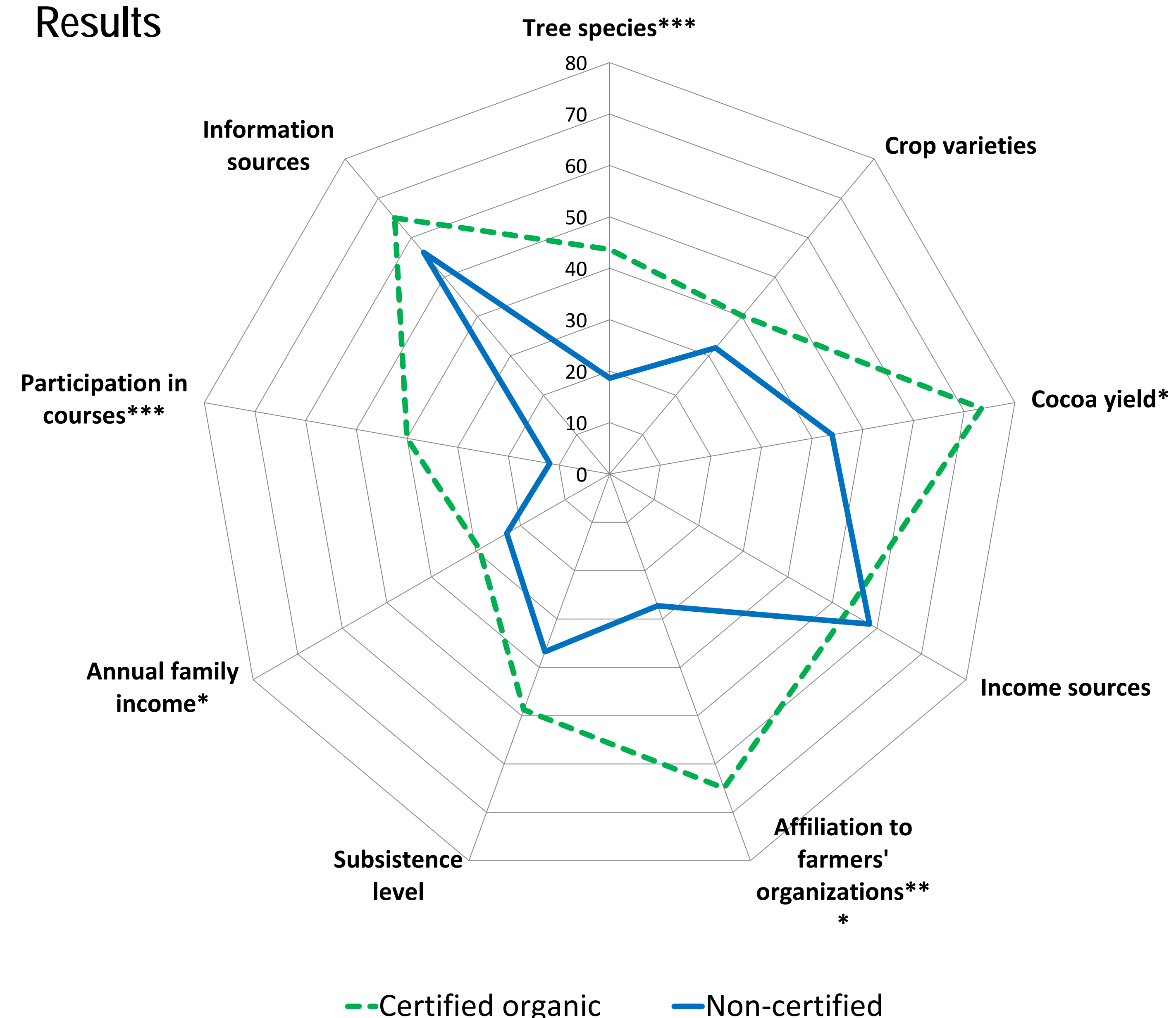
### Research methods

Three focus groups to define indicators, 52 semi-structured open ended interviews with 30 organic and 22 non-organic cocoa farmers [4], transect walks and mapping of trees and crops on the 52 farms, 5 expert interviews, 15 participant observation with cocoa farming families.



Fig.3 Focus group discussion and farmer interviews

## Results



Indicator	Certified organic	Non-certified
Tree species	22.6	2.6***
Crop diversity	12.8	7.4 n. s.
Cocoa yield (kg ha <sup>-1</sup> y <sup>-1</sup> )	506	335.8*
Number of income sources	3.2	3.5 n. s.
Affiliation to farmers' organizations	1.3	0.5***
Subsistence level (%)	48.8	36.8 n. s.
Annual family income (USD)	7530.2	6044.4*
Participation in courses on cocoa cultivation	2	0.6***
Number of information sources	5.2	4.5 n. s.

Fig.4 Comparison of resilience indicators on organic and non-organic cocoa farms. \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, n. s.: not significant, α = 0.05. 100% = the highest value found.

- Most resilience indicators were higher on organic farms
- Cocoa yield and incomes were significantly higher on organic farms
- Price for organic cocoa were 42% higher than for non-organic cocoa
- Organic farmers cultivated mostly under agroforestry with a higher buffer capacity to climate impacts
- Organic farmers organized themselves in cooperatives which organized capacity building and supported agroforestry systems
- Higher levels of self-organization were the main reason for a higher buffer capacity / adaptive capacity (enhanced agricultural knowledge)

### References:

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