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Harry Ozier Lafontaine, Magalie Lesueur-Jannoyer

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Sustainable Agriculture Reviews 14

Agroecology and Global Change

Springer

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Preface

I like farmers because they are not learned enough for wrong thinking

Montesquieu

Farming is a profession of hope

Brian Brett

Farmer Thinking

The global food demand will sharply increase in 2050 to feed an estimated population of nine billion. At that time, agricultural extension will not be possible anymore because production has already reached sustainable limits in many parts of the world due to environmental degradation and climate change. Worse, in the name of immediate profits industrial agriculture is actually producing contaminated food and water, increasing atmospheric CO_2 by burning soil carbon, and decreasing soil fertility in the long term. Industrial agriculture has also deepened the social gap between the farmers from the countryside and the customers from the cities, leading to many food security issues. As cleverly foreseen by Montesquieu, we should never have ignored farmer thinking. The actual challenge of agriculture is therefore to be sustainable and ecological and to produce safe food.

On field discussions on a seeder adapted to direct sowing in tropical wet areas. © 2013 Magalie Lesueur Jannoyer

Agroecology

Agroecology is a scientific discipline that uses ecological theory to study, design, manage, and assess agricultural systems that are productive but also resource conserving, according to Altieri (http://nature.berkeley.edu/~miguel-alt/what_is_agroecology.html; Altieri 2012; Altieri and Nicholls 2012; Altieri et al. 2012). The main agroecological goals are thus to feed the world without degrading natural resources and to sustain productivity by optimizing ecological processes. These overall principles are developed for decision makers in the FAO Save and Grow reports for sustainable intensification of smallholder crop production (Food and Agriculture Organization 2011) and in the ONU special contribution of Olivier de Shutter (De Shutter 2011, 2012). The future of agriculture depends on how effectively we understand and manage both social and ecological factors. The science of agroecology involves by nature the study of the whole agrosystem. As a consequence, investigations must be multidisciplinary with contributions from all disciplines relevant to the farming system, such as biological, physical, and social sciences. The major breakthrough versus industrial agriculture is that agroecology does not rely solely on technical knowledge. Farmers and human networks are indeed considered central players of the system. As a consequence, the classical top-down directives are not efficient anymore. Alternatively, bottom-up, participatory, and codesign studies will lead to sustainable innovations that will be accepted by farmers and the public.

Cover crop trials in banana cropping systems. © 2013 Magalie Lesueur Jannoyer

Family Farming

2014 is the International Year of Family Farming. Most farmers worldwide practice family farming, which yields nearly 70 % of the global agricultural production. Family farming is a very good topic for agroecological investigations, because most of the time family farming involves the use of biological regulations in diversified production systems instead of monoculture and chemical solutions. Family farming also provides local knowledge and know-how accumulated over centuries. Family farming is also a good case for agroecological studies, because it involves interactions at various scales and organization levels, from individuals to communities and territories landscapes.

This book shows applications of agroecological principles. The overall finding is that farming diversification and mixed cropping systems lead to both ecological intensification of agriculture and to the mitigation of global change. Chapter 1 by Angeon et al. explains the design of agroecology with a focus on the connection of life with economic and social sciences to build sustainable systems. Chapter 2 by Preston and Rodríguez reviews the recycling of farm products into feed, food and fuel. Chapter 3 by Ratnadass and Barzman reviews advances for crop protection. Chapter 4 by Alexandre et al. focusses on animal science, which is usually overlooked in agroecology. Chapter 5 by Clermont-Dauphin et al. explains how to manage soil biodiversity to design new cropping systems. Chapter 6 by Boval et al. reviews alternatives for grasslands intensification in tropical areas. Chapter 7 by Valet and Ozier-Lafontaine reviews traditional farmer intercropping systems for free ecosystem services, with a focus on participatory and codesign research. Chapters 8 by Chave et al. reviews advances in biocontrol for soil pests. Chapter 9 by

Mixed cropping system: the example of the creole garden in the Caribbean. © 2013 Harry Ozier-Lafontaine

Archimède et al. reviews the potential of local tropical resources for livestock nutrition. Chapter 10 by Le Henaff and Cebesi highlights the need to remove language barriers for agroecological education. Chapter 11 by El Ramady et al. presents an exhaustive review of soil quality and plant nutrition. Chapter 12 by El Ramady et al. presents the advanced concept of micro-farms.

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References

Altieri MA http://nature.berkeley.edu/~miguel-alt/what_is_agroecology.html

Altieri MA (2012) Convergence or divide in the movement for sustainable and just agriculture. Sust Agric Rev 9:1–9. doi:10.1007/978-94-007-4113-3_1

Altieri MA, Nicholls CI (2012) Agroecology scaling up for food sovereignty and resiliency. Sust Agric Rev 11:1–29. doi:10.1007/978-94-007-5449-2_1

Altieri MA, Funes-Monzote FR, Petersen P (2012) Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. Agron Sust Dev 32:1–13. doi:10.1007/s13593-011-0065-6

De Shutter O (2011) Agroecology and the right to food. http://www.srfood.org/en/report-agroecology-and-the-right-to-food

De Shutter O (2012) Agroecology, a tool for the realization of the right to food. Sust Agric Rev 8:1–16. doi:10.1007/978-94-007-1905-7_1

Food and Agriculture Organization, "Save and Grow" initiative (2011) www.fao.org/ag/save-and-grow

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