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▶ **To cite this version:**

Emmanuelle Reynaud, François Fulconis, Gilles Paché. Agro-ecology in action: The environmental oasis projects. Environmental Economics, 2019, 10 (1), pp.66-78. 10.21511/ee.10(1).2019.05 . hal-02395815

HAL Id: hal-02395815

https://amu.hal.science/hal-02395815

Submitted on 5 Dec 2019

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“Agro-ecology in action: The environmental oasis projects”

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ARTICLE INFO	Emmanuelle Reynaud, Francois Fulconis and Gilles Paché (2019). Agro-ecology in action: The environmental oasis projects. *Environmental Economics*, *10*(1), 66-78. doi:10.21511/ee.10(1).2019.05
DOI	http://dx.doi.org/10.21511/ee.10(1).2019.05
RELEASED ON	Thursday, 05 December 2019
RECEIVED ON	Wednesday, 13 November 2019
ACCEPTED ON	Monday, 02 December 2019

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JOURNAL	"Environmental Economics"
ISSN PRINT	1998-6041
ISSN ONLINE	1998-605X
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
50	3	6

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BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Received on: 13th of November, 2019
Accepted on: 2nd of December, 2019

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AGRO-ECOLOGY IN ACTION: THE ENVIRONMENTAL OASIS PROJECTS

Abstract

Agro-ecology is now considered as an alternative model to the industrial agricultural model. Faced with the limitations of conventional production models, agro-ecology is emerging today as a possible response to the challenges of the 21st century: food security, circularity, respect for the environment, and development of employment. More generally, the adoption of circular principles aims to decouple environmental pressure from agricultural productivism. Agro-ecology is a relevant research topic because it aims to ensure sustainable and resilient agricultural production, to empower local farmers, to protect the environment and to fight against climate change. This article focuses on the French Oasis projects, as part of the "Hummingbird movement" initiated by Pierre Rabhi, and which represent a successful agro-ecological experience, in economic, social and environmental terms. Different data were collected by compiling information available on the website of 76 Oasis projects across France: people living in the community; lodging possibilities; availability of a school; and direct relationship with local farmers. Then, a social factorial correspondence analysis and an environmental factorial correspondence analysis were realized to evaluate the impacts of environmental Oasis projects. The results show that profitable organizations seem to conduct more social and environmental activities in an agro-ecology context, and they put in place more actions than those who have no profitable aims.

Keywords agro-ecology, environmental strategy, farming, hummingbird movement, Pierre Rabhi

JEL Classification L33, Q18, Q57

INTRODUCTION

The impact of greenhouse gas emissions on climate change and the effect of this change on the agricultural economics are widely accepted in the academic world (Yue et al., 2017; Fellmann et al., 2018; Whiteman & Yumashev, 2018; Wiebe, Robinson, & Cattaneo, 2019), after years of denial. According to The State of Food and Agriculture (Food & Agriculture Organization, 2016), the agricultural sector is responsible for 21% of greenhouse gas emissions (just behind the energy sector), of which 98% are due to industrial agriculture, while only 2% come from cultivation of organic soils. In addition to primary agriculture, the entire food supply chain, from producers to consumers, is involved in climate change (Food & Agriculture Organization, 2016), including small-scale farmers (Mugiya & Hofisi, 2017). Agriculture both contributes to and is affected by climate change. The increase of extreme events, such as droughts, storms or floods, results in the loss of crop and livestock production and, more dramatically, in food insecurity in some parts of the world. This type of agriculture, which values productivity and controls and improves outcomes through the use of harmful chemicals, is embedded in the paradigm of growth. Economic legitimacy is based on an ideology which states that societal progress can only be achieved through increased production, consumption, and economic growth. But how can we manage infinite economic growth in a finite world with limited resources and absorption capacity?

http://dx.doi.org/10.21511/ee.10(1).2019.05

Boulding (1966/2015) was the first thinker to raise this question. In an iconoclastic but pedagogical way, he introduces the notion of "spaceship Earth," which addresses the idea of a finite world. For spaceships, space shuttles come in and deliver all the goods needed, but for "spaceship Earth," there are no vessels to provide external natural resources or external carbon sink, excluding solar power, as underlined by Georgescu-Roegen (1975). Industrialized forms of agriculture are widely responsible for the overuse of agricultural resources. This is why academics such as Wittneben, Okereke, Banerjee, and Levy (2012) call for transformational change: incremental change is no longer sufficient. The Food & Agriculture Organization (2014) identified six main goals for agriculture in the short run, improving the efficiency of natural resource use, conserving, protecting and enhancing natural resources, improving and protecting rural livelihoods and social well-being, enhancing the resilience of people, communities and ecosystems, and promoting and improving effective governance. To achieve them, agriculture should move toward a totally new economic model of farming: agro-ecology.

This article is organized as follows. In the first part, a general theoretical background is introduced, focusing on the challenges of an environmental strategy with reference to the main principles of the circular economy. A second part presents the field study chosen to explore the determinants of an agro-ecological approach in a specific context: that of the French environmental Oasis projects, under the leadership of Pierre Rabhi. The quantitative methodology used is also introduced. A third part presents the results obtained, first, from a social factorial correspondence analysis, and second, from an environmental factorial correspondence analysis. A fourth part discusses the results, which highlight in particular the importance of a mix of profit and nonprofit driven values in the French environmental Oasis projects and suggests potential research avenues for the future.

1. GENERAL BACKGROUND

According to Schaller (2013, p. 1), agro-ecology can be defined as "a coherent whole that makes it possible to devise agricultural production systems that harness functionalities provided by ecosystems, reduce pressure on the environment, and protect natural resources." Agro-ecology is concerned with the environmental impact of agricultural practice and, thus, may offer a solution that will reduce the interdependence between agriculture and climate change and develop an alternative food system (Gliessman, 2016; De Sartre, Charbonneau, & Charrier, 2019). The French activist Pierre Rabhi is recognized as one of the fathers of practical agro-ecology (Wezel et al., 2009). Philosopher, writer and farmer, Pierre Rabhi is a pioneer in linking agriculture, sustainability and frugality (Rabhi, 2018; Rabhi & Caplat, 2018). He emphasizes the importance of connecting environmental protection in agriculture with the social well-being of all people and envisages a society that respects population and land. Pierre Rabhi is involved in several programs and leads the Oasis projects' program, which groups and supports projects according to their social and environmental principles. Some observers like Ilea (2009) and Woodhouse (2010) think that industrial agriculture has already failed to feed the world, while others claim that agro-ecology is not an option because it is not economically viable (Kershen, 2012). Avoiding this partisan debate, the aim of this viewpoint is to understand how the Oasis projects balance natural resource consumption and environmental protection with the needs of economic viability and social well-being.

The current study will focus on three main aspects of the Oasis projects. Firstly, the social aspect of the projects' sustainable strategy will be analyzed. Pierre Rabhi thinks that agro-ecology is inseparable from the ethics of respecting others. This is linked to research emphasizing the importance of values that imply that social interaction with others is an important dimension of a sustainable strategy. Secondly, the study will analyze how environmental protection is addressed. Waste that exceeds assimilative capacity harms the environment, but it is also costly for the firm (e.g., the fee for dumping, as well as the cost of raw materials linked to the bad use of resources). Thus, improving material efficiency will simultaneously decrease the quantity of raw material used and decrease the quantity of waste. By adopting circular

economy principles that promote recycling and reuse, organizations may help to decrease waste and increase their economic viability (Andersen, 2007), which is the final aspect that will be analyzed. The objective of this viewpoint is to explore whether the environmental Oasis projects respect these precepts and to comprehend their economic viability.

1.1. Social aspect of an environmental strategy

To avoid catastrophic consequences for large parts of the world, due, for example, to erratic rainfall patterns, Chifurira, Chikobvu, and Dubihlela (2016), Rockstrom et al. (2009), and Whiteman, Walker, and Perego (2013) have conceptualized nine "planetary boundaries," in areas such as biodiversity loss, climate change, and global freshwater consumption, that are transgressed step by step (see Table 1). According to Rockstrom et al. (2009, p. 5), the position of a planetary boundary is "a function of the degree of risk the global community is willing to take [and] a function of the social and ecological resilience of the impacted societies." This issue is raised by many observers who note that three of the nine planetary boundaries have already been exceeded. Faced with the environmental crisis related to the transgression of "planetary boundaries," seen as "the greatest civilization threat" (Mujačić & Nuhanović, 2013), a wealth of literature on management focuses on the role of social values in the implementation of a sustainable strategy. The literature argues that the values of individual managers in an organization are essential elements in the adoption of responsible corporate practices because leaders' values will substantially affect the policies (e.g., corporate social responsibility [CSR]) that an organization puts in place.

The motivation to promote the welfare of others appears to be a more efficient driver. It represents an appreciation of all people, encompassing the ideals of equity, caring and justice. Crilly, Schneider, and Zollo (2008) show that self-transcendence has a positive impact on the social aspects of a sustainable strategy. Their study shows it to be a predictor of both a proactive form of social responsibility and a more passive form, in the context of a propensity to refrain from doing harm. In terms of environmental issues, research shows that promoting the welfare of others is positively related to an awareness of environmental responsibility. Stern and Dietz (1994) note that these issues include environmental damage that can impact the health of others, environmental concerns that can affect others in terms of availability of natural resources, and a direct concern for the vegetal and/or animal worlds. Egri and Hornal (2002) find similar pro-environmental results in Canada, as do Schultz et al. (2005) in their six-country study, and De Groot and Steg (2007) in their five-country study. Looking at both social and environmental issues, Fukukawa, Shafer, and Lee (2007, p. 381) conclude that "the universalism value type is positively associated with general support for social and environmental accountability." In brief, most social and environmental responsibility literature sees the promotion of the welfare of others as an important dimension of a sustainable strategy.

1.2. Key role of circular principles

The unrestricted exploitation of resources is difficult to sustain. In order to avoid exceeding the planetary boundaries, many scholars call for a disruptive circular economy (for a synthesis of main design perspectives, see Charter [2018]). This model aims to imitate natural ecosystems, where there is no landfill and where the waste of some organisms becomes the food of others (raw materials in a circular economy). To stay with this biological metaphor, academics speak about a life cycle or cradle-to-cradle (McDonough & Braungart, 2003; Bakker, Wever, Teoh, & De Clercq, 2010; Bjørn &

Table 1. Transgression of the nine "planetary boundaries"

Worldwide scale transgression	Local or regional scale transgression
1. Change in global or regional climate patterns	1. Alteration of global cycles of carbon and nitrogen
2. Decrease in the pH of the Earth's oceans	2. Global concentration of aerosols
3. Tropospheric ozone depletion	3. Decrease of available freshwater resources
	4. Human destruction of the natural landscape
	5. Extinction of species (plant and animal)
	6. Increase of chemical pollutants in the environment

http://dx.doi.org/10.21511/ee.10(1).2019.05

Hauschild, 2013), rejecting the previous cradle-to-grave approach. The challenge of environmental transition will be to move from a linear economy (extract, manufacture, consume and discard) toward a circular economy based on closing the life cycle of products and services.

The adoption of closing-the-loop production patterns aims to decouple environmental pressure from economic growth (Ghisellini, Cialani, & Ulgiati, 2016). By promoting a reduction-reuse-recycle approach, called the triple R (3Rs) approach[1], a circular economy tries to reconcile the economy and the environment in a new business model (Su, Heshmati, Geng, & Yu, 2013; Park & Chertow, 2014). Indeed, the circular principles go beyond waste management and require a totally new approach that Fulconis, Reynaud, and Paché (2019) call "frugal supply chains." All along the supply chain, the challenge consists of finding the most sustainable solutions based on new technology or products. Disruptive innovation and incremental improvements are promoted. The aim of the triple R approach is to achieve the most resource-efficient and environmentally friendly solutions. This framework helps to determine environmental viability, to make trade-offs between cost and benefit when needed and, even better, to avoid trade-offs, due to innovative solutions.

1.3. Nonprofit vs. for-profit organizations: which pursue the best environmental strategy?

To solve environmental problems, two competitive approaches are suggested: one led by nonprofit organizations and the other by for-profit organizations. Nonprofit organizations are assumed to have altruistic values that lead them to express socially desirable behavior, such as concern for environmental protection. On the other hand, for-profit organizations, with their private interests, are seen as failing to allocate resources in a way that serves the public interest (Valentinov, 2008). However, nonprofit organizations have no incentive to take advantage of market failures, to the detriment of society. Furthermore, according to Rose-Ackerman (1996), nonprofit organizations are better suited to those who challenge the capitalist system and would like to put more sustainable actions into practice. This is particularly true in France where the nonprofit sector is built on strong ideological principles.

From an empirical point of view, Weisbrod (2004) finds that the nonprofit sector has broader objectives (both profitable and not profitable), providing numerous services and actions that the for-profit sector does not. This approach seems consistent with authors who suggest that a private firm's responsibility is exclusively economic: to produce goods or services and sell them for profit (George, 2014). Some scholars defend another approach. In their seminal article, Porter and Kramer (2011) claim that only business can create prosperity and that healthy businesses need a healthy community. This is why they develop the idea of a shared value that "encompasses the simultaneous creation of business value and social value" (Mühlbacher & Bobel, 2019, p. 314). This business model offers fresh benefits to a variety of stakeholders, while the new way of thinking enhances competition and improves organizational benefits (Michelini & Fiorentino, 2012). According to Porter and Kramer (2011, p. 64), "capitalism is an unparalleled vehicle for meeting human needs, improving efficiency, creating jobs, and building wealth." To summarize, some scholars think that nonprofit organizations pursue the best sustainable strategy in both their environmental and social actions, while others think that only for-profit organizations can effectively address environmental and social issues.

2. MATERIALS AND METHODS

To better understand the environmental and social actions of both nonprofit and for-profit organizations, the 76 Oasis projects across France were analyzed. The data were collected by compiling information available on their websites. Oasis projects are part of the Hummingbird movement, created by Pierre Rabhi in line with his "decentered and eco-centric humanism" (Moser, 2016). Both

1 According to Sang-Arun (2012, p. 2), the triple R approach tries "to minimize resource consumption in the level that sufficient for basic need (reduce), use goods and materials until it cannot be repaired or fixed to perform its function (reuse), and reprocess the materials that being discarded into new products (recycle)."

terms – oasis and hummingbird – refer to the idea of how individual actions can initiate massive change. An oasis is a fertile spot in a desert, while hummingbird refers to the tale of a little bird that brings tiny drops of water to put out a fire, saying it was doing what it could (see Box 1).

Box 1. The Hummingbird tale

Once upon a time, a terrible fire broke out in a forest. Scared, all the animals ran out of the forest. They stopped near the river and watched the fire, feeling very powerless, except for one little hummingbird. This hummingbird decided it would do something. It picked up a few drops of water from the river, went into the forest, and put them on the fire. Then it went back and did the same thing again, and it kept going back, again and again. All the other animals tried to discourage it: "Don't bother, it is useless, you cannot stop a fire with your tiny drops." Some made fun of it, thinking it was crazy. But the hummingbird answered them: "I am doing my part."

Established in 2007, the Hummingbird movement is multifaceted. It aims to support a healthy and sustainable community to foster dynamic transition that benefits everyone. The movement promotes assistance through a web page[2] where project directors describe their needs (in terms of volunteers, equipment loans, etc.). The Hummingbird movement also offers training via a magazine and MOOCs on food and farming, buildings and energy, and health. In addition, there is Hummingbird Agora, a participatory think tank, where members can contribute and reflect. Finally, the movement organizes events (such as choral activities), produces films, edits books, and provides open source tools. The authors chose to study the Oasis project organizations, which aim to produce local food, because their focus on agro-ecology promotes a method of production that integrates agricultural activity with the environment.

To capture the social and environmental aspects of a sustainable strategy, various actions were selected. The data were collected by compiling information available of their website. Social interaction with others is approximated by:

1) number of people living in the community;

2) number of lodging possibilities;

3) presence of a school, to share knowledge with the youngest; and

4) direct relationship with local farmers. For the sustainable strategy, the authors considered issues raised by the approach to reduction, reuse and recycling of resources in this type of organization:

- to reduce is indicated by: no spreading of phytosanitary products; ecological wastewater treatment; passive or low energy buildings; and organic housing construction materials;
- to reuse is indicated by: rainwater harvesting; production of renewable energy; and production of seeds;
- to recycle is indicated by: partial food autonomy; composting; tree planting; and dry toilets.

The first descriptive analysis shows that some environmental actions are carried out by almost all the organizations, while others are initiated by only one third of the organizations (see Table 2). Composting, partial food autonomy, dry toilets, absence of phytosanitary products, organic housing material, tree planting and rain harvesting are attempted by more than two thirds of the sample, while production of seeds is realized by only one third; ecological waste water treatment, production of renewable energy and passive or low-energy buildings are actions carried out by between 41% and 47% of the sample. There may be several reasons for these differences. The Hummingbird movement and Oasis projects are based on strong values; it may be the actions perceived as the closest to these values which are performed. For example, the reduction of waste through composting seems to be the cornerstone of pro-environment actors. This movement mainly consists of very small organizations with limited budgets that may reject more expensive actions. Finally, more technical actions such as the productions of seeds may only be achievable by a minority of projects.

2 https://colibris-lafabrique.org/liste-des-projets

http://dx.doi.org/10.21511/ee.10(1).2019.05

Table 2. Environmental actions undertaken by the Oasis projects (2018)

Issues	Environmental actions	Number of Oasis projects (76 in total)
To reduce	No spreading of phytosanitary products	58
	Ecological wastewater treatment	31
	Passive or low energy buildings	36
	Organic housing construction materials	55
To reuse	Rainwater harvesting	52
	Production of renewable energy	33
	Production of seeds	26
To recycle	Partial food autonomy	61
	Composting	70
	Tree planting	53
	Dry toilets	58

To see the link between environmental and social actions and legal status, the various organizations were scored.

Economic viability has been assessed by considering the legal status of an organization. If organizations choose a legal status that forbids profit-making, it means that they have other priorities. By contrast, if the legal status chosen allows profit-making, it is considered that the organization is motivated by being economically viable. The aim of this viewpoint is to understand the link between economic viability, assessed by legal status, and social and environmental practices. As this study dealing with categories – and not metrics – analyzed in a quantitative manner, it used factorial correspondence analysis. Correspondences assess the links between nominal variables, similar to the way in which correlations do for numeric variables. Two factorial correspondence analyses were performed: one to analyze the profitable/nonprofitable organizations and their social actions, and the other to examine the link between profitable/nonprofitable organizations and their environmental actions.

To understand the role of legal status in the adoption of different types of social or environmental actions, it is essential to assess what would be a random situation (where legal status would have no impact) and how the present situation is getting further away from it. To do so, this method uses the entry matrix T, where the categories are the absolute frequency of different environmental actions or different social interactions by legal status, and compares it to the independence matrix, with theoretical independent frequency between legal status and environmental actions, or type of social interaction. The residual matrix (the difference between the entry matrix and the independence matrix) is broken down into several matrices. Each matrix must be factorizable. The data are represented on two axes to facilitate interpretation.

3. ANALYSIS AND RESULTS

To control the different steps of the analysis, environmental and social factorial correspondence analyses were independently performed. As underlined by Hoffman and Franke (1986), a factorial correspondence analysis aims to collect most of the initial qualitative information in a reduced number by focusing on the correspondences between variables; it scales the rows and columns of a data matrix in corresponding units displayed graphically in the same space. In these two factorial correspondence analyses of the Oasis projects, each organization was given a grade (A, B, or C) reflecting their environmental and social actions. Grades were awarded depending on the number of actions supporting the natural environment: grade C from 0 to 4; grade B from 5 to 7; grade A from 8 to 11. The grades related to environmental actions were labelled Ae, Be, and Ce. A similar analysis was performed for social actions and these grades were labelled As, Bs, and, Cs. For the number of people living in the community and the number of lodging possibilities, scores of 0, 1 and 2 were assigned: 0 for no people or lodging possibilities, 1 for between 1 and 9, and 2 for more than 9. The presence of a school and a direct relationship with local farmers are a binary variable: 0 or 1. The resultant grade was obtained from the sum of these variables: Cs from 0 to 1; Bs from 2 to 4; As from 5 to 6.

3.1. Social factorial correspondence analysis

Table 3 concerns social grades and summarizes the number of profitable and nonprofitable Oasis project organizations allocated As, Bs, or Cs grades.

Table 3. Social grades

		Social grade			
		As	Bs	Cs	Total
Legal status	Profitable	6	18	6	30
	Nonprofitable	2	35	9	46
	Total	8	53	15	76

The entry matrix T is:

$$\begin{bmatrix} 6 & 18 & 6 \\ 2 & 35 & 9 \end{bmatrix} \quad (1)$$

The independence matrix is:

$$\begin{bmatrix} 3 & 21 & 6 \\ 5 & 32 & 9 \end{bmatrix} \quad (2)$$

So, the residual matrix is:

$$\begin{bmatrix} 6 & 18 & 6 \\ 2 & 35 & 9 \end{bmatrix} - \begin{bmatrix} 3 & 21 & 6 \\ 5 & 32 & 9 \end{bmatrix} = \begin{bmatrix} 3 & -3 & 0 \\ -3 & 3 & 0 \end{bmatrix} \quad (3)$$

This can be broken down into Ts1 and Ts2:

$$\begin{bmatrix} 3 & -3 & 0 \\ -3 & 3 & 0 \end{bmatrix} = \begin{bmatrix} 2 & -2 & 0 \\ -2 & 2 & 0 \end{bmatrix} + \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 0 \end{bmatrix} \quad (4)$$

Each of them is factorizable in a column and row matrix. For Ts1, one can have:

$$\begin{bmatrix} 2 & -2 & 0 \\ -2 & 2 & 0 \end{bmatrix} = \begin{bmatrix} 2 \\ -2 \end{bmatrix} \cdot \begin{bmatrix} 2 & -2 & 0 \\ -2 & 2 & 0 \end{bmatrix} \quad (5)$$

The social matrix column is labeled "Cs" and the social matrix row is labeled "Rs." When referring to "Ts1," these labels become "Cs1" and "Rs1." The same will be done for "Ts2." For Ts2, one can have:

$$\begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix} \cdot \begin{bmatrix} 1 & -1 & 0 \end{bmatrix} \quad (6)$$

Table 4 indicates the coordinates for the social aspect graph. The graphical representation of the social aspect is presented in Figure 1. It is essential to note that because As, Bs, and Cs are already aggregate grades and some contingency cells in the table have values inferior of 5, it is not possible to calculate χ^2 and know the p-value, so the results should be read with care. However, the results remain interesting because they show important differences between profitable and nonprofitable organizations. Profitable organizations are close to the maximum grade As, while nonprofitable organizations are close to the middle Bs grade. Neither profitable nor nonprofitable organizations are close to the Cs grade. The graph represents 100% of the variance.

Table 4. Coordinates for the graph: social aspect

Categories	Cs1 Rs1	Cs2 Rs2
Profitable	2	1
Nonprofitable	–2	–1
As	1	1
Bs	–1	–1
Cs	0	0

3.2. Environmental factorial correspondence analysis

Table 5 concerns environmental grades and summarizes the number of profitable and nonprofitable Oasis project organizations allocated Ae, Be, or Ce grades.

Table 5. Environmental grades

		Environmental grade			
		Ae	Be	Ce	Total
Legal status	Profitable	17	11	2	30
	Nonprofitable	21	17	8	46
Total		38	28	10	76

This is represented by the entry matrix T:

$$\begin{bmatrix} 17 & 11 & 2 \\ 21 & 17 & 8 \end{bmatrix} \quad (7)$$

The independence matrix is:

$$\begin{bmatrix} 15 & 11 & 4 \\ 23 & 17 & 6 \end{bmatrix} \quad (8)$$

The residual matrix Re is:

$$\begin{bmatrix} 17 & 11 & 2 \\ 21 & 17 & 8 \end{bmatrix} - \begin{bmatrix} 15 & 11 & 4 \\ 23 & 17 & 6 \end{bmatrix} = \begin{bmatrix} 2 & 0 & -2 \\ -2 & 0 & 2 \end{bmatrix} \quad (9)$$

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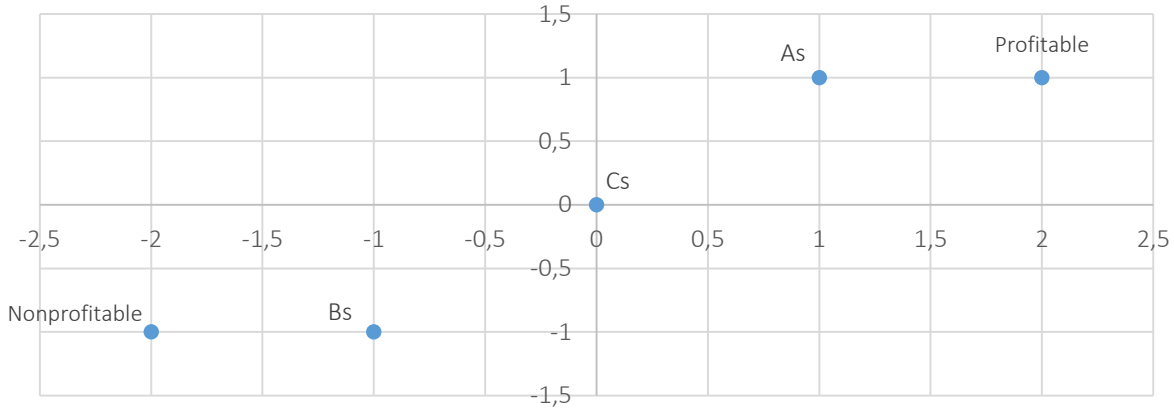


Figure 1. Representation of the social factorial correspondence analysis

This can be broken down into Te1 and Te2:

$$\begin{bmatrix} 2 & 0 & -2 \\ -2 & 0 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -1 \\ -1 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 0 & -1 \\ -1 & 0 & 1 \end{bmatrix} \quad (10)$$

Each of them is factorizable in the same column and row matrix:

$$\begin{bmatrix} 1 \\ -1 \end{bmatrix} \text{and} \begin{bmatrix} 1 & 0 & -1 \end{bmatrix} \quad (11)$$

As previously, the environmental matrix column is labeled "Ce", and the environmental matrix row is labeled "Re." When referring to "Te1," it becomes "Ce1" and "Re1", and for "Ts2," it becomes "Ce2" and "Re2." The coordinates for the environmental aspect graph are indicated in Table 6. The graphical representation of the environmental aspects is presented in Figure 2. The graph shows the superposition of profitable organizations and Ae, and nonprofitable organizations and Ce. In both cases, scalar products are positive and show conjunction circumstances. Similar to the social factorial correspondence analysis, as Ae, Be, and Ce are already aggregate grades and some figures are smaller than 5, one cannot calculate χ^2 and know the p-value, so the results should be interpreted with caution. However, in this sample, profitable organizations seem to be more frequently associated with an Ae grade than nonprofitable organizations, which mostly obtain a Ce grade. And because grades are linked to the number of environmental actions, this means that the profitable organizations in this study conducted more environmental actions than the nonprofitable ones.

Table 6. Coordinates for the graph: environmental aspects

Categories	Ce1 Re1	Ce2 Re2
Profitable	1	1
Nonprofitable	–1	–1
Ae	1	1
Be	0	0
Ce	–1	–1

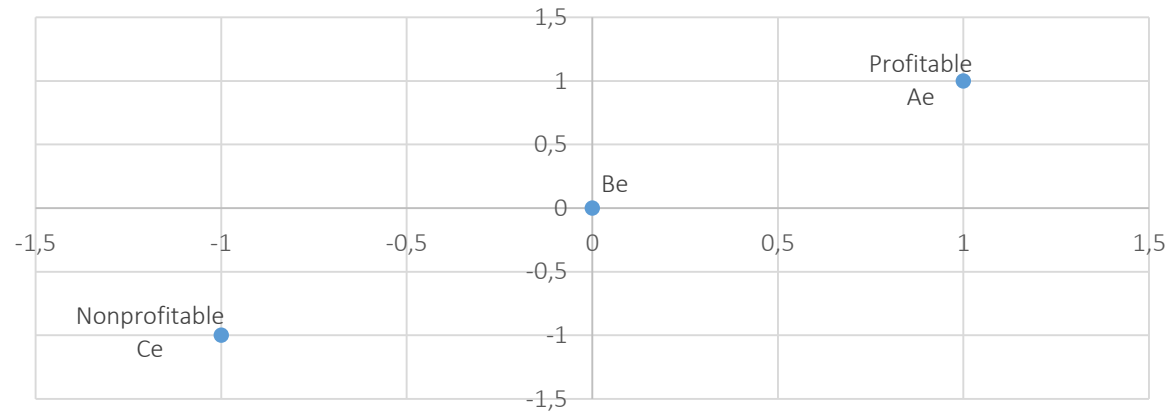


Figure 2. Representation of the environmental factorial correspondence analysis

4. DISCUSSION, LIMITATIONS AND FUTURE STUDIES

Profitable organizations seem to conduct more social and environmental actions in an agro-ecology context. Even if the management of recycling operations is not very easy in most cases, this new method of agriculture seems to be considered viable. At least, profitable organizations put in place more actions than those who have no profitable aims. How can those results be explained? One reason may be the time and investment available for these activities. Nonprofitable organizations rely on volunteers and their available budgets are limited to donations. Another reason lies in the values that drive all the Oasis projects. Farmers in agro-ecology are motivated by environmental reasons. The high grades achieved by profitable organizations may be explained by the mix of profit and nonprofit driven values in these organizations: they do not replace nonprofit values with profit values, but they pursue both. As underlined by D. Semenda and O. Semenda (2018), environmental *and* economic mechanisms of rational land use are essential for the agricultural land preservation. This double motivation also increases the number of actions they put in place.

To synthetize this exploration of the environmental Oasis projects, it is suggested that a holistic and agro-ecological approach to local farming is profitable: alternative practices make it possible to obtain outputs at least equivalent to those of conventional agriculture. Indeed, the triple R approach is a complex process in the industry and the agriculture, which depends on materials being reused, recycled and recovered. When the triple R approach occurs within one organization, each instance of reduction, reuse or recycling has a direct impact on the number of new raw materials bought and directly affects costs. This may explain why those who are driven by earning money are more active than those for whom it is not the priority. In the case of the current exploratory investigation, the environmental impact is summarized in Figure 3.

As highlighted in Figure 3, most environmental dimensions have a direct economic impact.

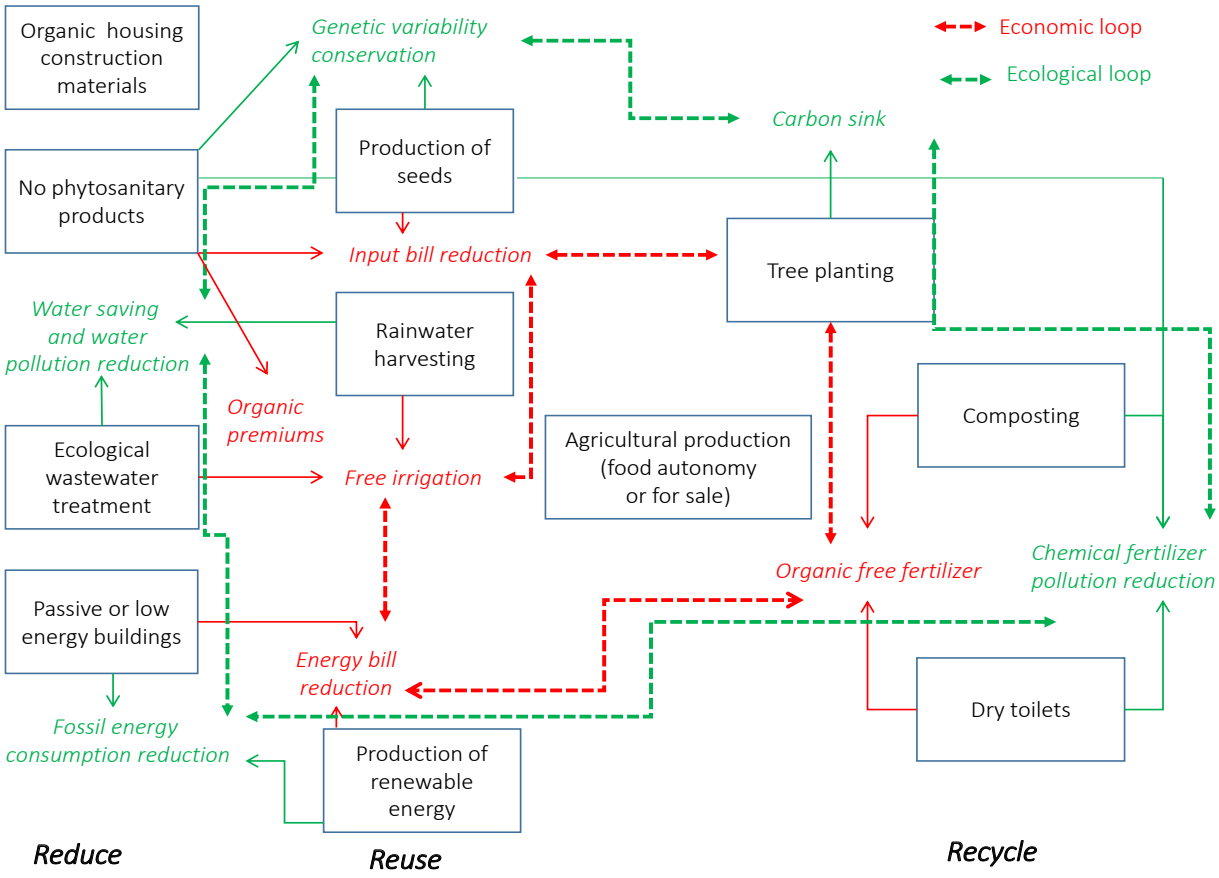


Figure 3. Economic and ecological loops

http://dx.doi.org/10.21511/ee.10(1).2019.05

Waste is a source of degradation of the environment and for the people. But pollution is also a source of loss of raw materials. This is why environmental actions need to reduce costs in terms of energy, water, and fertilizers. Furthermore, the absence of phytosanitary products and the agro-ecological principles offer organic benefits for consumers. Some studies have found the impact on yields to be higher, while other studies have found them to be lower. In line with Schmitt and Renken's (2012) results, for-profit organizations in the current sample lead on actions that are socially just, economically feasible, and environmentally sustainable. This is extremely promising for the development of agro-ecology, which is positive for both environmental protection and food security. However, it is possible to identify two main limitations to this investigation on the environmental Oasis projects:

- The first limitation is due to the data collection methodology. The data collected are general, and do not provide in-depth details on environmental actions. For example, if a website indicates that renewable energy is used in a project, the reader ignores the proportion of renewable energy consumption in relation to the total energy consumption of this project. Thus, the absence of direct contacts and exchanges with decision makers prevents to put the results obtained into perspective.
- The second limitation is linked to the lack of sensitivity analysis in the grade construction (e.g., the impact of the variability of the model's input factors on the output variable). Sensitivity analysis would make it possible to understand the weighted and differentiated effects of the different environmental actions, for example, the ecological wastewater treatment or the production of seeds, on the environment according to different dimensions of the triple R approach.

Many research avenues are possible, especially to determine whether environmental Oasis projects are generalizable (or not). Depending on their characteristics, crop, livestock and agrarian production systems can respond to the requirements of agro-ecology. To this end, it is important to analyze the specific use of agricultural milieu in different contexts. The objective is to understand the reasons for choosing an agro-ecological system by some farmers, and the rejection of an agro-ecological system by other farmers. Using a comparative approach, it will be important to identify in future works the factors that favor or hinder the development of agro-ecological systems (structure of the farm, farmer's relationship with his/her socio-economic environment, strategic vision of the activity, etc.). This should result in academic knowledge that is useful for the development of agro-ecology while intensive agriculture (farming), which transgresses many "planetary boundaries," is threatening the Earth's resilience capacities.

CONCLUSION

The industrial (or "productivist") agricultural model, based on intensive use of natural resources, is increasingly being called into question for its anti-environmental nature, particularly through the excessive use of chemicals. An alternative model, called agro-ecology, is now being discussed and studied to show that it is possible to design an efficient and environmentally friendly agricultural system. Agro-ecology is an impact-oriented approach to biological phenomena that combines agricultural development and the protection/regeneration of the natural environment, adopting circular principles. The agro-ecological approach is the basis of a global management system for sustainable agriculture, which values agro-ecosystems, optimizes production and minimizes inputs. This paper analyzed the French environmental Oasis projects, part of the "Hummingbird movement" initiated by Pierre Rabhi, which represent a successful agro-ecology experience, in both economic, social and environmental terms. This investigation is a first step in a research project whose objective is to indicate that agro-ecology is an efficient option, and not just the dream of ecologists and activists disconnected from economic reality.

ACKNOWLEDGMENTS

The authors sincerely thank Professors Pierre Batteau, Leslie Carnoye and John P. Conley as well as anonymous reviewers of *Environmental Economics* for their insightful comments on previous versions of the paper.

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