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Analysis of structure and function of an agroecological beacon: The case of the Agroecological Educational Center Los Álamos

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ABSTRACT

Objective: To determine whether the Agroecological Educational Center Los Álamos (*Centro Educativo Agroecológico Los Álamos*, CEA), located in the state of Tlaxcala, Mexico, fulfills the elements of structure and function to be identified as an agroecological beacon.

Design/Methodology/Approach: A mixed approach was used (quantitative and qualitative). A study case of the CEA was constructed to understand both the context and the structural and functional characteristics that currently configure it. First, an exhaustive review of secondary information related to the structure and functioning of agroecological beacons in other regions or countries was made. In a second stage, a comparative analysis of the structural and functional characteristics of agroecological beacons was conducted with the data generated in the study case. In the third stage, factors were analyzed that make possible or limit the CEA to develop as an agroecological beacon.

Results: The CEA performs and fulfills with participant youth the function of agroecological beacon, since it is an efficient tool for education, training, knowledge exchange and promotion of agroecology. This favors its dissemination and scaling in the peasant communities where the young people who participate in the CEA are from.

Study Limitations/Implications: The results are only applicable to the study case due to the limitations present in this methodology in terms of its results not allowing to elaborate general explanations.

Findings/Conclusions: The CEA complies with sufficient elements to catalog it as a sectorial agroecological beacon, which is contributing a methodological and strategic light to respond to the challenge of inter-generational transmission of understanding, knowledge and agroecological projects in the peasant indigenous youth sphere.

Keywords: Agroecology, agroecological beacon, indigenous youth.

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INTRODUCTION

Currently, there are two challenges that threaten the welfare of people and the population; one is global warming with all its repercussions in the deterioration of natural resources and the environment; the other challenge, as important, is the one related with food insecurity within a context of climate change and greater resource scarcity, especially land and water (Pérez *et al.*, 2018).

In face of these great challenges, proposals have been made to revert, evade, mitigate and/or adapt to climate change and to contribute to the production of nutritional, innocuous, sufficient and quality foods. One of these proposals is agroecological production systems in their diverse modalities and hierarchical levels; one of the modalities of these systems is agroecological beacons. An agroecological beacon is a unit for training and demonstration in agroecological methods, techniques and practices, within the rural sphere, which guides interested people in developing more sustainable productive systems.

In this context, agroecological beacons exert the function of being "a potent tool for change and scaling of agroecology required in the rural world" (Infante, 2015). They are the answer to the question of: "How to put it into practice?" In this sense, Altieri and Yurjevic (1992) recognize that the dissemination and scaling of agroecology will be possible "only if its proposals are 'a good business' for the small-scale producer, and in addition, if they take into account their rationality". For this reason, they emphasize the importance of demonstrative farms, where there are successful experiences of incorporation of both traditional peasant techniques and also new viable alternatives (Muñoz, 2003). In this way, the environmental knowledge and perceptions of peasant farmers are integrated into agricultural innovation schemes that link resource conservation and rural development, in search for a sustainability approach.

In this sense, agroecological beacons develop and consolidate a demonstrative and educational function in the generation and exchange of knowledge, emphasizing participatory principles, processes and methodologies (Espinoza, 2016). The principle of teaching not being simply to transfer knowledge is fundamental; rather, it is creating possibilities for its construction. Therefore, agroecological beacons help for technical-productive and sustainable rural development aspects to advance thanks to the exchange in knowledge that is constructed and shared in the relationship between the beacons and the plots of peasant families that are connected to them (Infante, 2015).

From this perspective, the research study was focused on the analysis of structural and functional elements with which agroecological beacons are characterized, to be able to determine, through a study case, the characteristics factors that make the CEA possible in order to develop under the identity and functioning of an agroecological beacon. This, highlighting its mission of benefiting young peasant and indigenous people who approach it, with the interest of exchanging and building agroecological understanding and new knowledge to apply in their communities of origin.

MATERIALS AND METHODS

Location of the CEA

The CEA works based on a farm in the locality called Rancho Los Álamos, located in the municipality of Muñoz de Domingo Arenas, Tlaxcala, Mexico. The farm is situated in a plain of 50 hectares, in the high plateau of the northeast zone of the state of Tlaxcala.

The research was carried out with a mixed approach, using quantitative and qualitative methods. The techniques used to gather information were: survey through the questionnaire; semi-structured interview with qualified informants; participant observation with discourse analysis; and documentation of official data such as texts, specialized

publications and research related with the structure and the function of agroecological beacons. To determine the characteristic factors that allow the identification of the CEA as an agroecological beacon, a study case was built based on the contribution by Coller (2000).

From an agroecological perspective, the study was approached with the General Systems Theory (GST; Von Bertalanffy, 1976), considering the CEA from the category of agroecosystem (Altieri, 1999). Under this approach, the CEA was analyzed as a functional totality with the set of sub-systems and their interrelations and form of organization (García, 2006). Finally, the study turned to the theory offered by Infante (2015) to characterize agroecological beacons and, then, to make the comparative analysis of the CEA's structure and function.

RESULTS AND DISCUSSION

Structure and functioning of the CEA

Based on the General Systems Theory (GST) and the suggestions by García (2006), the CEA was analyzed as a "complex system" since it is the seat of a set of environmental, productive, educational, economic and social phenomena that can be grouped as sub-systems. These sub-systems are related between one another to carry out one or several functions.

The system that makes up the CEA is based on the description of the interrelations that are established between the sub-systems, whose functions within each are not independent. From this analytical perspective, the following suggestion by García (2006) can be corroborated and taken advantage of: "the combination of relationships constitutes the structure that gives the system the form of *organization* which makes it *function as a totality*". The sub-systems and the relationships that shape the structure of the CEA and its organization can be modelled and represented (Figure 1).

The CEA, in addition to being described as a complex system, can be characterized by the specific intention of becoming organized and functioning as an "agroecosystem" (Altieri, 1983), with a single and multiple finality at the same time, namely: "to build an agroecological educational community that develops a strategy for education with the aim of integration, rootedness and innovative participation of young people in their communities of origin" (CEA, 2018).

Therefore, the CEA can be characterized as a complex, dynamic and multifunctional system which, in addition to performing agrosilvopastoral activity, conserves biodiversity, guarantees healthy and varied foods, and serves as an educational center for peasant and indigenous youth, with which it contributes to the reconstitution of indigenous communities in the country.

Application of the agroecological paradigm in the CEA

To reach the structural and functional configuration of an agroecosystem with an educational function, the implementation of an integral project for agroecological redesign and transition can be observed in the CEA. With this project, assuming the proposals of the "agroecological paradigm" (Altieri and Nicholls, 2000; Gliessman, 2001), a historical and

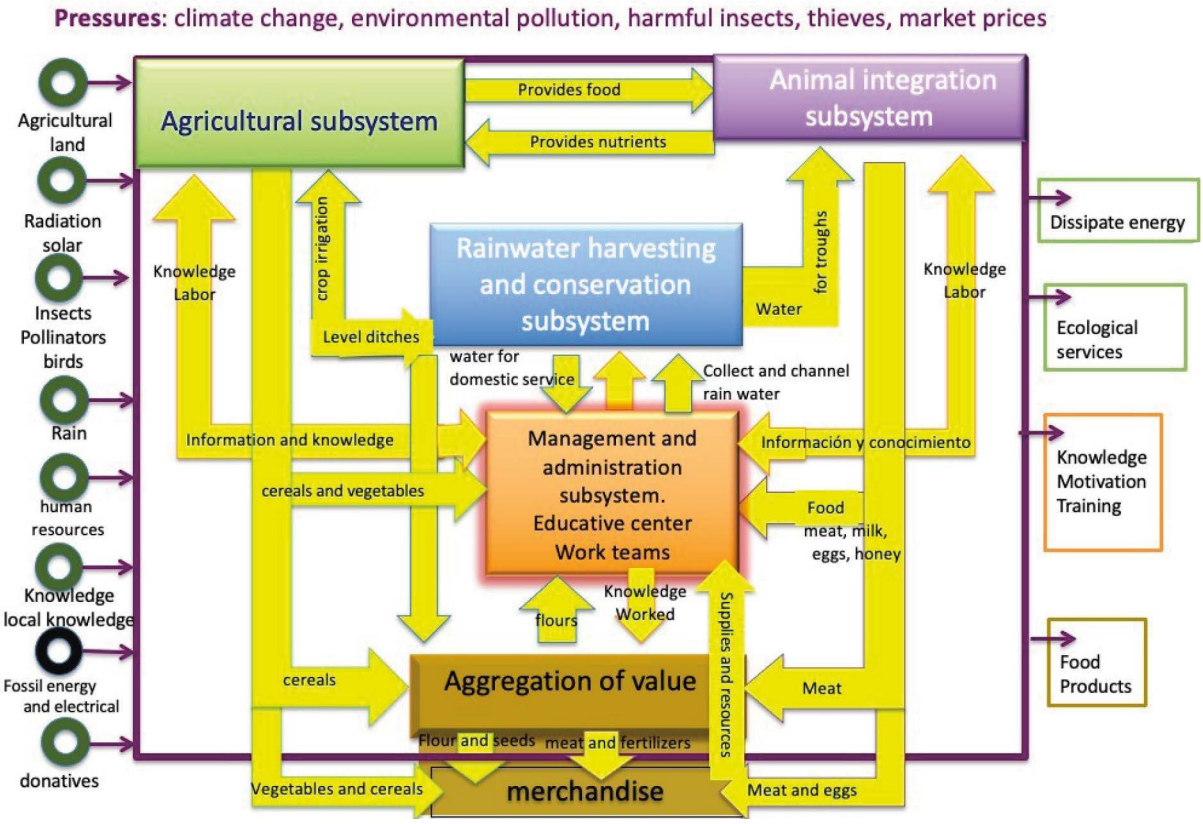

Figure 1. Model of structure and function of the Agroecological Educational Center Los Álamos (CEA).

dynamic transition has taken place. For the CEA, the so-called Agroecological Transition Master Project, with a projection and historical trajectory of 20 years of implementation (CEA, 2019a), has allowed the strategic planning and integration of what Nicholls et al. (2015) describe as agroecological principles, processes and techniques.

In its functioning, the CEA agroecosystem presents the emerging property of serving as a demonstrative field for the generation and exchange of knowledge and the application of agroecological technologies. Table 1 presents the agroecological practices suggested in the CEA.

The emerging possibility of the CEA serving as experimental and demonstrative field is strengthened with the work and function of the educational team by planning and developing a strategy that focuses primarily on making the CEA a space for the exchange of local understandings and new knowledge that help young people in the process of integration and service in their communities of origin. The following testimony from a student exemplifies this experimental, demonstrative and educational function of the CEA:

> "For me, the part of agricultural practices has been interesting about the CEA, where there is a fusion of the theory and the knowledge that we bring from our places of origin. This has been very satisfying and is what I find most interesting, seems to

Table 1. Agroecological practices suggested in the CEA.

Soil and water conservation	**Suggested Practice**
The paths of water Soil and water conservation techniques Soil water management practices	In any part of the farm, erosion can be measured or soil conservation practices can be carried out
Agricultural diversity and biodiversity	**Suggested Practice**
Concepts, laws, challenges	Crop diversity systems can be practiced from June to September
Agricultural tillage y conservation tillage practices	**Suggested Practice**
Tillage systems Conventional tillage Conservation tillage Zero tillage	Students can experiment on a small plot with the milpa system
Planting systems and cultivation systems	**Suggested Practice**
Traditional planting systems Crop polycultures Crop rotations Agroforestry Secondary vegetation (acahual), itinerant agriculture	Crop diversity systems can be practiced from June to September
Crop nutrition and fertilization	**Suggested Practice**
Fertilization without agrochemicals Crop nutrition Organic fertilizers	In the farm you can practice the elaboration of biols and different organic fertilizers
Integrated management of insects and diseases	**Suggested Practice**
Integrated insect management Veterinary homeopathy Biological control of insects	In the farm you can practice any crop
Production, protection and conservation of seeds	**Suggested Practice**
Seed types Save techniques seeds Traditional systems	Safeguard the seeds at home and *in situ* in the milpa and cultivation vegetables
Management of weeds and stubble in postharvest	**Suggested Practice**
	Stubble management on the farm
Organic cattle	**Suggested Practice**
Animal integration Reproduction and fattening of chickens and rabbits Breeding and production of laying hens. Egg production Breeding and fattening of ruminants Apiculture and fish farming	It can be practiced with chickens, broiler chickens, cows and sheep With the beekeeping course at the farm apiary In the management of carp and axolotls of the jagüey

Source: Reworked by the authors with data from the CEA (2019b).

me, and where I have been spending time without even noticing. I feel that when we practice we learn much more, we reaffirm the theoretical knowledge that we already have and we make it come alive" Elizabeth G. (CEA, 2019c).

Different testimonies from students reaffirm this emerging property of the CEA of serving as a demonstrative and educational experience of sustainable agriculture, even in a surface of 50 hectares, as is the case of Rancho Los Álamos:

"I see in the CEA that sustainable agriculture is implemented, which, although there are few workers, is maintained because they integrate the animals through the elaboration and application of compost, with which they substitute the conventional application of urea that we do in my town. Here they have a wide variety and rotation of crops. Insecticides are no longer applied, there is biological insect control right here. And I find it very interesting when hens and sheep are included, because then you have eggs and meat. The watering pools are a great way of capturing water. Thus, with these ways of managing the ranch they don't have to spend so much, but rather this becomes more affordable" Antonio S. (CEA, 2019c).

"In the CEA I learn what an agroecosystem is, because it has both entries and exits and there is the intention of generating synergy for everything to be supported. For example, capturing rain water that is stored in the watering pools and which are meant to be used for the orchards; rotation and diversification of crops; having and sowing different variety of seeds; the nursery that allows having the inputs there for sowing; and the important role that bees play here in this plot, in this land and also in the world. Thus, I can learn about it in a small scale and visualize it in a larger scale". Denisse E. (CEA, 2019c).

Configuration of the educational strategy of the CEA

As medullar part of the educational strategy, the CEA offers young people an integral training proposal that is structured and operates based on four educational areas: academic, sociocultural, human and spiritual. This program is in function of the young people recovering, valuing and appropriating their peasant identity. On the other hand, it has the aim of appropriating more knowledge, tools, values and abilities that allows them to be integrated and to participate economically, socially and culturally in their community, representing at the same time a new contribution in their locality (CEA, 2018a).

The identification of the CEA with the mission of responding to the needs of young peasants and its own identity of Agrocological Educational Center has led it to design and implement a strategic proposal that includes the following:

1. Shaping a demonstrative agroecological community with young people that reaches a high degree of food sufficiency, health, information and communication management, satisfaction of energy (water, heat and housing), based on its educational work and practice, as testimony of learning.

2. Achieving inter- and pluri- cultural coexistence. This coexistence implicates the organization to develop a life in common, community self-diagnoses, and inter-cultural dialogue workshops, where valuing and appropriation of their own cultural identity are favored.
3. Elaborating a training program with integral and pluri-cultural curricular map, with participatory operation. The program can offer visits to example experiences, workshops, courses, talks, encounters and consulting.
4. Relating young people with communities and teachers that can share their knowledge and experiences, with the intention of responding to more than two problems, at least, from their communities of origin.
5. Learning and participating in productive practices for food elaboration, household improvement, and water and energy management; favoring with all this the exchange of local understandings, organization and teamwork, as well as the reutilization and recycling of water.
6. Learning and participating in the elaboration and execution of productive projects with added value, by producing and exchanging products.

Comparative analysis between the proposal by Infante (2015) and the case of the CEA

The characteristic factors of structure and function of agroecological beacons can be determined through a comparative analysis, the academic approach by Infante (2015) about the conceptualization and characterization of agroecological beacons, as well as the emerging factors that result from the efficient interrelation between the structure and its function.

Regarding the comparative analysis of the current reality of the CEA with the elements that constitute the proposal by Infante (2015), it can be observed that the CEA has all the necessary elements at the structural level, except the one of not working with peasant communities of the area where it is established. However, the relationship and the collaborative work developed by the CEA are rescued, with more than 20 peasant organizations or experiences with agroecological approach.

Concerning the functional elements that characterize an agroecological beacon, it is observed that it is not supporting local producers to develop more sustainable agrarian systems, and it is also not achieving a scaling of agroecology in the municipality of Muñoz de Domingo Arenas, Tlaxcala. However, something to rescue is that, it does have the structure and the function of being a guide, a support and a reference for indigenous and peasant youth to set forth on productive projects directed at the construction of more sustainable agrarian systems, and for the propagation and implementation of agroecological knowledge and practices in the communities of origin of the youth that attend the CEA.

The discussion about the comparative analysis between the current reality of the CEA and the function of agroecological beacons established by Infante (2015) could not be concluded without rescuing and valuing the work by the CEA focused on and concentrated in having as main indigenous and peasant youth recipients. The specific contributions that

add to Infante's (2015) concern for implementing strategies to respond to the significant absence of young people in agroecological beacons are listed next. In this regard, it can be seen that in the CEA the following has been achieved:

1. The revaluation achieved in the youth for their identity and mission as peasants.
2. The motivation and theoretical and practical backing with which young people emerge from the CEA to undertake local rural development strategies or projects based on their own youth leadership.
3. The drive and desire promoted in young people to construct a generational transition of peasant labor, revaluing in the students the importance of protecting their identity and biocultural heritage as indigenous peoples.
4. The detonation of a youthful revolutionary impulse promoting resources and strategies to attain food sovereignty, self-management of productive projects, implementation of agroecology, and formulation of cooperative projects from an approach of solidary social economy.
5. The rescue of traditions and spiritual values present in the young people and in the rural communities that have ethical, social and cultural capital which favors strengthening of the social fabric, respect and care for Mother Earth, as well as resilience in face of injustice, violence or periods of crisis.
6. The correlation of institutions, professors, associations, individuals and enterprises to drive the empowerment of indigenous and peasant youth through an autonomous educational strategy that promotes rural and peasant development.

With the consideration and discussion of previous contributions, in the end it is evidenced that in the application of Infante's (2015) theoretical approach to the current reality of the CEA, it does not have all the elements of structure and function to be able to catalog it 100% as a local agroecological beacon, because it is not structured in function of promoting the scaling of agroecology in the peasant family production units of the zone. However, the CEA does have sufficient elements and evidence to qualify it as a sectorial agroecological beacon, which is contributing a methodological and strategic light to respond to the challenge of inter-generational transmission of understanding, knowledge and agroecological projects in the youth scope.

Contributions to the debate and model of agroecological beacons

The CEA is presented as a case that can contribute to the possibility of modelling a type of agroecological beacon, whose function is not linked to the scaling of agroecology at the level of a geographic zone, but rather to a level of population sector or profile of participants. In this sense, in the case of the CEA, it can contribute to the debate of the characterization, function and promotion of specific agroecological beacons for peasant indigenous youth.

In this debate, the CEA can contribute the idea that it is not convenient to offer education and technical training in agroecology only as a series of courses, workshops and short activities, but rather as an encompassing, integral and intensive proposal, which

addresses the human, cultural, community, social and spiritual dimension that are lacking in order to make the following possible:

1. Agroecology takes root in young people as a desired lifestyle and in it they have been able to see and confirm the goodness, importance and profitability of this lifestyle as real testimonies, with which they break the stereotypes that being a peasant is not important for society and for the contemporary world.
2. The agroecological approach can be proven to be a possible, urgent and pertinent paradigm in face of the global crisis, profitable for its community. This importance is rooted by having compared, tested and proven several successful rural projects inside it, in which they have been able to practice, contribute and learn. In this sense, leaving their rural communities and knowing several projects is a significant strategy to open their mind, broaden their relational world, and root a conviction about the possibilities and integral goodness of agroecology.
3. Developing the necessary inner strength, at the emotional, volitional and spiritual level, which favors the capacity of rootedness and resilience to face some problems and temptations of rural youth such as hopelessness, addictions, lack of opportunities to undertake projects by age, the temptation to obtain fast money in activities linked to criminal groups, or the social stereotype that migrating from the communities is the best option.

Therefore, the CEA provides the need to take on the issue of generational transition of agroecologist youth decisively. This issue, from the experience and the model of the CEA, implies placing emphasis not on the amount of people who go through the agroecological beacon or on the number of courses or publications, and also not on the size of the property, but in the training proposal and quality; in the methodology and the accompaniment that is more pertinent to develop convictions and to validate the knowledge and the peasant identity; in the deep impact in the lives of young people that detonates their empowerment and resilience, their sense of community and the desire to conserve their cultural heritage; in the type of accompaniment and methodology that makes it possible to develop the capacity for leadership, negotiation and social communication for them to assume the challenge of making demonstrable and profitable the goodness of the agroecological approach applied from and with their community.

The educational option and proposal of the CEA contributes to the reflection about agroecological beacons by young peasants, a whole complex system where many elements and relationships are at stake. For that reason, to cultivate in them the agroecological approach they must be understood and work with them should be done integrally, considering their family relationships, their wishes and beliefs, their life history, their desire to learn, but also for fun, understanding and valuation.

CONCLUSIONS

The conclusion is a favorable appreciatory opinion, confirming that the CEA does have the elements to be catalogued as a sectorial agroecological beacon, which is contributing

methodological and strategic light to respond to the challenge of inter-generational transmission of agroecological understandings, knowledge and projects in the peasant indigenous youth sphere. The exception is that it is not being focused on the working relationship with peasant communities at the local level.

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