DIFFERENCES WITHIN SIMILARITIES: TYPOLOGY OF FARMING STRATEGIES AND NATURAL RESOURCE MANAGEMENT IN TWO *EJIDOS* OF JALISCO, MEXICO

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Abstract

In the Mexican countryside, communally organised institutions called *ejidos* are a very important for the management of natural resources. This study develops a typology through social and ecological data to characterize farm management strategies and the agroforestry systems in two ecologically contrasting *ejidos* within a highly biodiverse region on the southern coast of Jalisco, Mexico. Taking the household as the unit of analysis, we conducted 55 structured interviews collecting data of 50 different socio-ecological variables. We found 4 consistently groups associated mainly with land tenure differences inside the ejido and the surrounding ecosystems in the farm. Also, diversification of strategies appears to be an inherent response of the social-ecological system to uncertainty and instability. These results have important public policy implications as they can boost specific strategies while diminish others with their environmental outcomes.

Keywords: household strategies; livelihoods; social-ecological systems; Mexico

Introduction

In the Mexican countryside, *ejidos* are a very important institutions in the management of natural resources (Alcorn and Toledo 1998). These peasant communities formally emerged as an outcome of the land redistribution policies which followed the Mexican Revolution. About 54% of all land in Mexico, and 60% of all forests, fall within these territories or similar land holding systems (Skutsch et al. 2015); *ejidos* represent around 90% of all these communally managed lands. The rural areas not communally organized are held by private landowners who may be large or small. An interesting feature is that sometimes these private owners may live in an *ejido*, although their property is external to it.

The analysis of management strategies in these institutions is relevant for conservation and [illegible] and ecological [illegible] stems in two communities within a highly biodiverse region on the southern coast of Jalisco, Mexico. We hypothesize that the land tenure institution that is present (the *ejido* system), creates differential access to resources inside the communities, leading to different social groups adopting different strategies and, consequently causing different impacts on the surrounding ecosystems and environment.

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Materials and methods

We choose two ecologically contrasting *ejidos* in the same region (Chamela-Cuixmala) (Figure 1), one with mainly tropical dry forest (*ejido* Ranchitos) (Schroeder and Castillo 2012) and one with temperate forests (*ejido* Pabelo) (Monroy et al. 2016) to observe differences in their land-management strategies. Taking the household as the unit of analysis, we conducted 55 structured interviews (29 in Ranchitos and 26 in Pabelo) relating to their productive activities and natural resource management. We collected information on 50 different socio-ecological variables on the: a) family unit, b) productive activities, c) natural resource management, and d) other financial activities, (Table 1). From this information, we performed first a cluster analysis of farm household types and then with the groups formed we displayed the ordination analysis to observe the most important variables in the ordination of the data. Both analyses were done using basic routines in the software R. In addition, field observations of plots were performed with some interviewees to identify specific characteristics of the agroforestry systems and management practices.

Figure 1: Chamela-Cuixmala región

Table 1: Social and ecological variables on which data was coded and the type of variable.

Family unit	Productive activities	Other capitals
Age of interviewee (d)	Farming (b)	Extra labor for ranching (b)
Figure within the *ejido* (c)	Cattle ranching (b)	Extra labor for crops (b)
Place of origin (b)	Agriculture (b)	Family labor (b)
Family in the U.S. (b)	Forest activities (b)	Daily wage labor (b)
Family members (d)	Business and services (b)	Reciprocal labor (b)
Adults (d)	Day laborer (b)	Receives government support (b)
Minors (d)	Reciprocal labor (b)	Amount of supports received (d)
Students (b)	Salaried work (b)	Communal areas benefit (b)
Housekeeping (b)	Total of activities (d)	Remittances (b)
Management of resources		
Hectares of plots (d)	Heads of cattle (d)	Farm crops (b)
Hectares of pasture (d)	Perform occasional sale (b)	Self-consumption crops (b)
Hectares of crops (d)	Perform specific season sale (b)	Market crops (b)
Hectares of forest (d)	Minimum annual sale of livestock (d)	Orchard cultivation (b)
Provision services (b)	Maximum annual sale of livestock (d)	Cultivation of useful plant (b)
Regulation services (b)	Produce milk and cheese (b)	Number of useful plants (d)
Cultural services (b)	Sale milk and cheese (b)	Backyard animals (b)
Perform clearcutting (b)		
Use firewood and poles (b)		

(b): binary variable, (c): categorical variable, (d) discrete variable

Results

Cluster analysis suggests the existence of four groups of household farming strategies (numbered 1 to 4 in Figure 2). From their characteristics we name them as: Group 1 ‘farmers with cattle specialization’; Group 2 ‘day laborers or off-farm workers’; Group 3 ‘private landowners’; Group 4 ‘diversified community farmers’. Of the 50 variables analyzed within the groups, 34 proved to be significantly different between at least two of the four groups. Ordination analysis shows these groups were also strongly associated with different land tenure characteristics or different status (Table 2). The first axis of the Principal Coordinate Analysis

(PCoA) shows a main differentiation between those households without cattle, without access to provision services, and commonly having small plots or no land at all (on the left in Figure 2, mostly from Group 2); and those who practice cattle ranching, use provisioning services, and have land and pasture (on the right in Figure 2, mostly from Groups 3 and 4). The second PCoA axis reveals a striking differentiation between the two *ejidos*. Other variables that are relevant, but that have less discriminating power, include: the presence of crops in the plots, crops designated for self-consumption, milk and cheese production and the payment of daily wages to laborers. The average amount of forest was greater in Group 3 (77.5 ha), followed by Group 1 and 4 that had similar amounts (17.3 to 15.2 ha), finally the group with the less forest was Group 2 (4. 8).

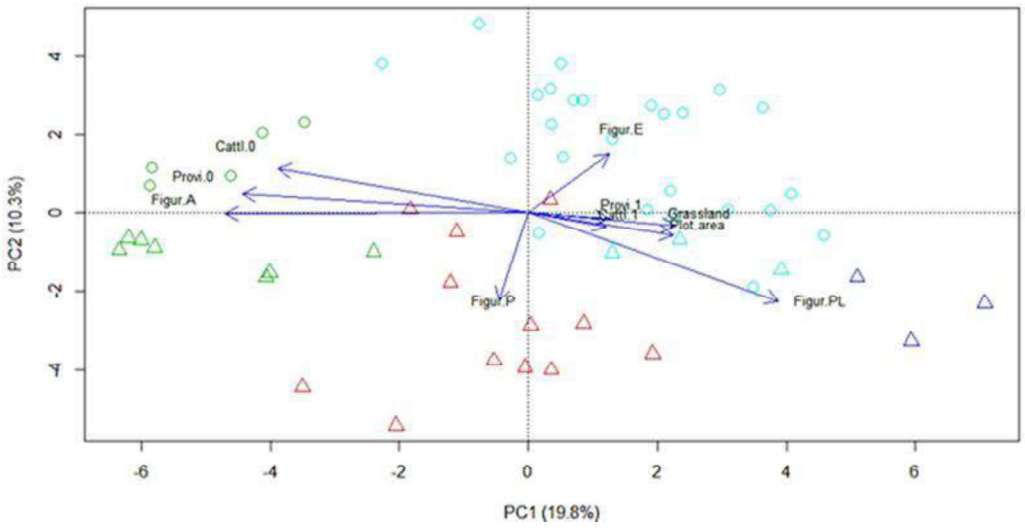

Figure 2: Ordination analysis, differentiating the groups from the cluster analysis. Group 1 in red, Group 2 in green, Group 3 in blue and Group 4 in turquoise. The triangles represent households in the ejido Pabelo and the circles in Ranchitos. The main variables are also observed on the two axes, these are: Figur.A: landless people (avecindados); Figur.E: people with community land rights (ejidatarios); Figur.PL: private landowners; Figur.P: partial land rights (posesionarios); Cattl.0: without cattle; Cattl.1: with cattle; Provi.0: provision services not used in plots; Provi.1: Provision services used in plots; Plot.area: total hectares of plot; Grassland: total hectares of grasslands in the plot.

Table 2: Different land tenure status among the four groups of strategies.

		Group1	Group2	Group3	Group4	Total
Ejido	Ranchitos	0	5	0	24	29
	Pabelo	12	7	3	4	26
Figure	*Avecindados**	0	10	0	0	10
	Private landowners*	1	0	3	1	5
	*Ejidatarios**	2	2	0	23	27
	*Posesionarios**	9	0	0	4	13

*Variable different between groups with significance at p <0.05

According to the main characteristics occurring in landscapes and plots, we schematized the typical agroforestry systems in both *ejidos* (Figure 3). There are some elements shared, like: vegetation patches, sources of water, grasslands and forage and useful trees scattered. Also, plots are divided into paddocks that farmers use to keep the cattle for a certain time (between 15 days to 1 month) depending on the area available to them and the season. The typical agroforestry system in Pabelo (Figure 3a) has certain features like perennial rivers or streams and riparian forest alongside to protect river flow. Also, patches of oak forest are common, because oaks are very useful species for fences and firewood. Agroforestry systems in Ranchitos (Figure 3b) are differentiated by having bigger patches of tropical deciduous forest in

various successional stages due to the rapid regrowth of this forest type. Also, by having hydraulic infrastructure, mainly watering holes, because of the low availability of natural water sources, in addition to maize cultivation to feed the cattle.

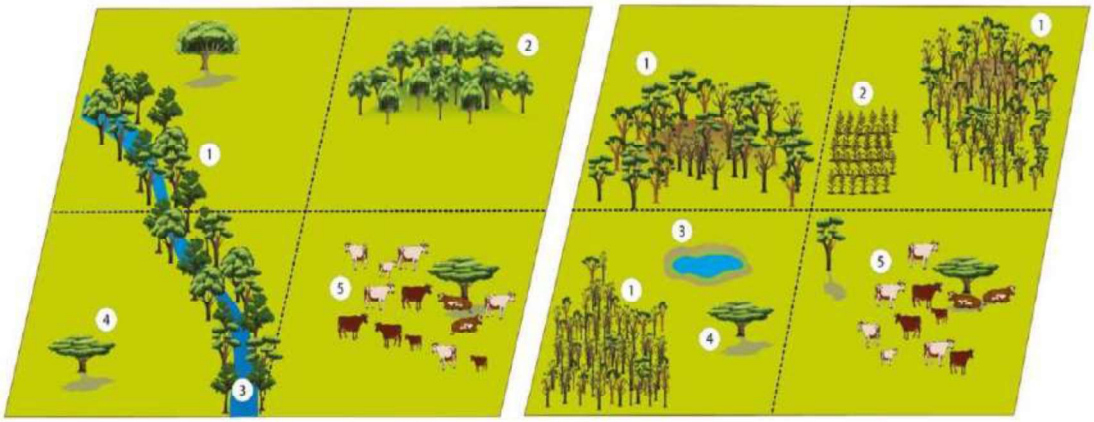

Figure 3a (left). The typical agroforestry system in Pabelo. 1: Riparian forest. 2: Oak forest remnants. 3: Permanent rivers or streams. 4: Useful trees. 5: Cattle. Figure 3b (right). The typical agroforestry system in Ranchitos. 1: Tropical deciduous forest in different successional stages. 2: Maize cultivation. 3: Watering hole. 4: Useful trees. 5: Cattle.

Discussion and conclusion

This study focused on understanding the land management strategies of two *ejidos* in a highly biodiverse region of Jalisco, Mexico. Based on the characterization of different socio-ecological attributes, we establish four different farming types. The recognition of these typologies has social, economic and ecological implications beyond the study region. According to our research, the farming typologies are directly related to access to land and the social position of the head of household as regards rights within the *ejido* institution, suggesting that this constitutes one of the main drivers of the farming strategy. Also, in our analysis diversification of strategies appears to be an inherent response of the social-ecological system to uncertainty and instability. Another result from the classification of strategies is the particular ecosystem in with each household is embedded. We suggest that differentiation of strategies is at least partially due to differences in the biophysical and ecological conditions between the two *ejidos*, which may condition the productive activities that can be implemented. This has been indicated by some authors as the 'system of strategies' or the 'farming style', which refers to the relationship between the human groups in a specific region and their surroundings, creating a spatial identity (Cochet 2015; Gerritsen 2004; van der Ploeg 1990).

The empirical evidence shows that the 'ideal' or theoretical paradigm of modern agriculture under which there is only one type of agrarian logic (i.e. productive specialization), does not materialize on our study site. In this sense, public policies can play a very important role in pushing farmers towards a more diversified strategy or towards a more specialized one.

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