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Economic, Ecological, and Social Valuing of the Cuniculus Paca under the Ecuadorian Model of Good Living (“Buen vivir”)

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Abstract. Departing from the current development and Ecuadorian strategy, this paper assesses the wildlife species named *Cuniculus Paca* as a source of bush meat for local rural communities settled along the Pacific coast. At the outset, two premises are set up: on the one hand, a distinction is made between *Cuniculus Paca* as a positional good and as a relational good and, on the other hand, custom is assumed lying behind in its chasing process. Thereby, it proposes a methodology to value the aforementioned specie from both economic and ecological standpoints, but also incorporating in the later the variable Good Living (“*Buen vivir*”), which is measured by the level of satisfaction of the relational good that is co-produced along hunting. It is also assumed that this supplementary activity carried out by local people is largely a tradition passed on from one generation to another. The paper also calculates the abundance average relative index to place the *Cuniculus paca* population in the wild. An econometric model is then specified to estimate the effect of Good Living (“*Buen vivir*”) on its social value of the *Cuniculus Paca*. Based upon the estimated results some right policies to ensure a sustainable management of such resource are brought to the fore to ensure the bush meat consumption among local peasants, in line with the Good Living (“*Buen vivir*”) convocation.

Keywords. Economic value, cultural value, ecological value, Good Living or “*Buen vivir*”, *Cuniculus paca*, public policy.

JEL. D12, O12, Q28, Q57.

1. Introduction

Hunting and consuming cynegetic species is a common practice of the forest-dwelling people both in tropical and neo-tropical areas worldwide. The bushmeat consumption has been broadly documented in the literature specialised (Golden et al., 2014; Rentsch & Damon, 2013; Gardner & Davies, 2013; Morra et al., 2009; Albrechtsen et al., 2006; de Merode et al., 2003). In Latin America, the use of wild-life in general and mammals in particular spreads over the region. One of the favourite mammals is the *Cuniculus Paca*, which is widely consumed from Mexico to Argentina. Gallina et al. (2012) state that in Lacandon Jungle, Chiapas, Mexico, the 80% of those households interviewed capture *Cuniculus Paca* for food and Naranjo et al. (2004) demonstrated that in the Lacandon Jungle, Chiapas, Mexico, the annual extraction of biomass from species

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reached 8160 kg with higher rates of extraction corresponding to the *Cuniculus Paca*. Its attractiveness not only obeys being a complementary protein source of rural local population (Aquino et al., 2009), but also its major role fulfilled in the ecosystem (Robinson & Redford, 1991; Santos-Fita et al., 2012).

In Ecuador, according to the Wildlife Conservation Society (2010), 85% of bush meat sold in the Pompeya's market in the Eastern jungle of Ecuador is explained for mammals, such as *Cuniculus Paca* but some parts of the Ecuadorian Amazon, the animal protein demand is satisfied at 100% through hunting (Robinson & Redford, 1991). The relevance of bushmeat in Ecuador is revealed by studies that analyse hunting relationships and others factors that influence the hunter's behaviour in the Ecuadorian Amazon (Sirén et al., 2006; De la Montaña et al., 2015); and the assessment the sustainability of hunting in various indigenous communities in Ecuadorian Amazon (Zapata-Rios et al., 2009).

In this view, this study aims to evaluate *Cuniculus Paca* by implementing a methodology which combines economical, ecological and social aspects so as to provide tangible elements to the Good Living model. Hence, our working hypothesis states that the social economic value it is an efficient way of valuing wildlife species like *Cuniculus Paca* if we are determined to go beyond theoretical tenets invoked by the model of Good Living and thus to set up the right policies to manage it.

The *Cuniculus Paca* is identified by local hunters themselves as their preferred pick among others surrounding wildlife species because tasteful meat provided. Its hunting is carried out by night when moon illumination level is low (Martins et al., 2007; Harmsen et al., 2011). In addition to its delicious meat, it plays a fundamental role in the neo-tropical ecosystems for its key position in the food chain, allowing the presence of species at higher levels and moreover for its important role as a seeds spreader, which ensuring the survival of some plant species (Eisenberg & Redford, 1999). As is easily grasped, the services delivered by *Cuniculus Paca*, like that of any other wild-life species, do not get across formal markets so they do not have an explicit price as happening in the case of conventional goods and services.

Before starting analysis is necessary to grasp the essence of the Ecuadorian model of Good Living ("*Buen vivir*"). This development model was instituted in 2008 with the approval of Ecuador's new constitution. From this, the Good Living is translated into regulatory principles and is constituted with a guaranteed transverse axis by the development scheme (Constitution, 2008, Chapter VI, art. 275) through countless declared constitutional rights (Title II, Chapter II). Theoretically, this new paradigm should be able to achieve both the Good Living of people and economic development. It demands a comprehensive vision of a multidimensional development system, which highlights an economic, social and welfare system and a regime of Good Living, which happens to be a combination of equity and economic systems and social inclusion, in addition to the recognition of constitutional rights granted to nature.

The Good Living ("*Buen vivir*") is a community-based paradigm that the life is supported in the complementarity, reciprocity and relationally. It considers the nature as an ecosystem of life (Garcia, 2013). Under this biocentrism perspective, the Ecuadorian Good Living postulates the frugal use of nature, without opulence and without accumulation (Gudynas, 2009).

The Good Living also holds in a solidary social and economic system (Constitution, 2008, Chap. VII, Section I, art. 283) consisting of a mixed economy that includes as forms of public economic organization and private business like popular and solidary economies. The private economics is concerned about the balance market, on the contrary, the public economy one in conjunction looks for a

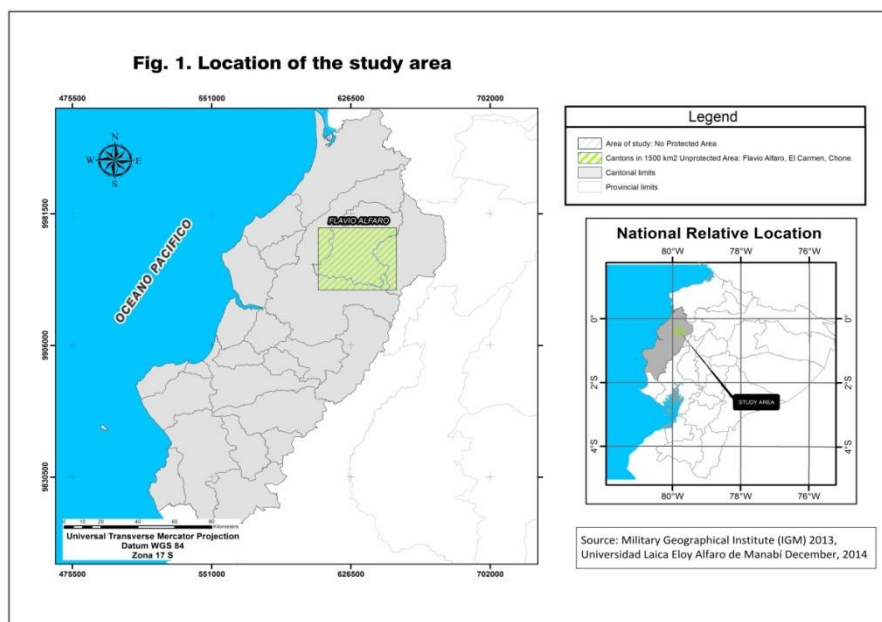
popular economy both social and political equilibrium as well as the ecological, and it is achieved with self-organized labor according to the expanded reproduction of everyone's lives, where the real saver is the nature (Coraggio, 2009).

According the Ecuadorian Good Living ("*Buen Vivir*") development level is determined by either the income or consumption of the people as their satisfaction with life. The satisfaction level is measure through how many time devoted to relationship with others people (friends, the sons, and the family). It is also considers the time dedicated to contemplation to nature (SENPLADES, 2011). This demands to consider the right to the relationship with nature (Huanacuni Mamani, 2010), which is recovered as a life principle that is recognized by Social Solidarity Economy in coexistence with the right to the property and the market.

2. Materials and Methods

2.1. Location of the study area

Flavio Alfaro is located in the northwest part of Manabí province, Ecuador (see Fig. 1). It encompasses 1.343.1 Km² and the surrounding areas of the Carmen y Chone, it contains 156.9 Km². The population is 37422 inhabitants according to 2010 (National Institute of Statistics and Censuses, 2011), distributed 51.8% male and 48.2% female, 16.6% urban and 83.4% of the population is rural.



Almost all the study area is embraced by vegetation of tropical dry forest and very dry tropical forest that is not a protected area. It is located between the coordinates: Northwest Point: 00° 17'03"S and 80°01'24"W. Northeast Point: 00°17'03 "S and 79°38'31"W. South West Point: 00°26'45"S and 80°01'24"W. Southeast Point: 00°26'45"S and 79°38'31"W. It is an area characterized by the presence of coastal mountain ranges that reach an altitude between 350 and 500 meters above sea level and with coastal valleys. The rainy season lasts from January to May and it drizzles in the dry season from June to December. Annual rainfall in this area ranges from 1000 to 2000 mm; the temperature varies between 22° C and 26° C. The core economic activities in Flavio Alfaro are agriculture, livestock and forestry, so they make up the principal sources of earnings (Decentralized Autonomous Municipal Government Flavio Alfaro, 2011). As

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aforementioned, subsistence hunting is a complementary activity; it is a legal activity under current Ecuadorian legislation. However, economic or social regulation is weak, at its best.

2.2. Data collection and empirical analysis

Raw data was collected by a socioeconomic survey conducted in February 2014 in the middle of the rainy season and having a statistical sample of 806 households. At one first stage, the units selected are those included in censuses sectors, which are the primary sampling units (United Nations, 2005) constructed from enumeration areas identified and used in seventh national population census and sixth housing census 2010 in Ecuador (National Institute of Statistics and Censuses, 2011), whereas in a second stage the houses are chosen to comply with the stylised facts put forward by the same census: firstly, over 95% of the population living in the study area there is a single household living in (National Institute of Statistics and Censuses, 2011), and secondly that such kind of housing unit is a stable living place and easily identifiable in the area rural. Hence, the distribution of second stage units were determined from numbers of houses (it is assumed each house is ruled by a household) in the Primary Sample Units based on the seventh population census Ecuador (National Institute of Statistics and Censuses, 2011).

The variables used in the regression model are described as follows (see table 1):

Table 1. Variable description and expected sign.

Variable	Notation	Description	Expected sign	Unit of value	Source
Social Economic Value	Sev	Social benefit obtained by Pev correction pondering it with the ecological factor, the factor of relational goods and the cultural factor. This is calculated: private economic value minus the discount rate for utilization for wildlife (from price the hunting license in Nuevo Leon state, Mexico. It is obtained S/. 481 Mexican pesos in 2013 exchange rate US\$ 1=S/.13.14).	Positive	US\$	household survey
Private Economic Value	Pev	Private economic value or hunter profit $[(Pq) - (IOC, rf, inp)]$: gross income (price times quantity) minus three types of cost (opportunity cost personal income, fixed capital costs and other inputs, respectively). Pev is realized in the bush meat consumption process by the hunters and their families.	Positive	US\$	household survey
Good-Living or "Buen vivir"	Bv	It is structured from three factors of Good Living ("Buen vivir"): relative abundance of game species (Ra), relational goods (Rg) and the cultural factor (Cu). This variable "Buen vivir" is an index that we obtain by the following formula: $[1 + ((Ra + Cu + Rg)/3)]$	Positive	Index	Calculus
Relative abundance	Ra	The relative <i>Cuniculus Paca</i> abundance index (based on estimates obtained according to the methodology proposed by Beck – King and Von Helversen (1999).	Positive	Index	Calculus
Relational Good	Rg	The relational Good produced at the hunting process which by the hunter is related to nature in the act of hunting.	Positive	0-1	household survey

Custom	<i>Cu</i>	The ancestral custom of hunting for subsistence that comes from years ago.	Positive	0-1	household survey
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In the valuing process of the *Cuniculus Paca* we recur to the method of indirect opportunity cost of labour (*IOC*) to value, in monetary terms, the time devoted properly to the ritual of stalking implied but also including the assigned time to go back and forth the forest. The cost of hunting tools and instruments (*fc*) is transferred to the bushmeat by linear depreciation over their useful life established in five years and the cost of ammunitions and cost of food and drink (*inp*) used for hunting are valued at market retail price.

Bushmeat production (*q*) and price (*P*) variables result from observation. The fixed capital (*fc*), labour cost (*IOC*) variable, supplies (*inp*), total cost (*TC*), and income (*I*) variables were constructed from observed variables such as: invested time in hunting events in the period of study, amount and types of inputs and the number and type of hunting tools and instruments, and so on. This input is used to construct the vector of the variable private economic value (*Pev*). Furthermore, secondary sources of information were used: unified monthly wage in Ecuador legislated in 2013 (US\$318), retail-market price of inputs and tools and instruments, and International Accounting Standards (IASs). It should be noted that along with socio-economic information provided by the household survey, the data available on the relative abundance (*Ra*) of the species *Cuniculus paca* were analyzed too.

3. Valuing of the *Cuniculus Paca*

The *Sev* is the net benefit accrued by society from the consumption of the *Cuniculus Paca* meat. Hence, this *Sev* is a function of the private economic value and the externalities measured by the index of Good Living (“*Buen vivir*”). This index was constructed based upon the relative *Cuniculus Paca* abundance, the relational good produced at the hunting time, and custom of the ancestral practicing of hunting for subsistence reasons. So that, social economic value is expressed as follow:

$$Sev = f(pev, Ra, Rg, Cu) \tag{1}$$

To obtain *Sev* a log-linear model is specified in the grounds proposed by Rodriguez-Rios (2015):

$$\ln Sev = \delta_1 pev + \delta_2 Bv_i + \varepsilon_i \tag{2}$$

Where: *Sev* = Social economic value, *Pev* = Private economic value and *Bv* = the dummy variable “*Buen vivir*”. $\delta_1, \dots, \delta_2$ are parameters to be estimated.

The model specification (2) is based on positive economic theory and empirical evidence on hunting of the *Cuniculus Paca*. This is a single-equation model that has been estimated by Ordinary Least Squares (OLS) in Stata v13, basing on 43 observations.

4. Results and conclusions

The overall estimation procedure of the Social economic value of *Cuniculus Paca* goes through two broad stages. The first one defines each of the factors of the Good Living (“*Buen vivir*”): Relative abundance of the *Cuniculus Paca* local population (*Ra*), the relational good (*Rg*), and the cultural factor (*Cu*), while in the second stage the regression equation specified (2) is estimated.

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Being a key variable the Good Living (“*Buen vivir*”), it is worthy to say that the relative abundance (*Ra*) of the *Cuniculus Paca* in Flavio Alfaro and neighbouring villages is calculated in 0.3*Paca* number per hectare or 30 individual per Km². This index is an average of the abundance relative of the *Cuniculus Paca* of 30 sampled sites in the study area (Eloy Alfaro University technical report, 2014), using methodology by Beck-King & Von Helversen (1999). As a whole, the sub-variables above mentioned become a sort of a benchmark to calculate the index Good Living (“*Buen vivir*”), using the formula specified above (Table 1) and the following scaling (Table 2).

Table 2. Good Living (*Bv*) variable classification

Good Living (“ <i>Buen vivir</i> ”) Factors ^a	Good Living (“ <i>Buen vivir</i> ”) Index	Dummy Good Living (“ <i>Buen vivir</i> ”) (<i>Bv</i>) ^b
It fulfils all factors of the good living (<i>Rg</i> , <i>Cu</i> y <i>Ra</i>)	1.75	1
It fulfils at least with two of the factors of the good living.	1.42	0
It fulfils at least with one factor of the good living.	1.08	0

Notes: a = The Good Living (“*Buen vivir*”) factors: *Ra*, *Rg*, *Cu* and b= Buen Vivir (*Bv*) categorical variable.

After estimation, the results obtained are as follow:

$$\ln Sev = 2.873 + 0.0054Pev + 0.906Bv$$

s.e.: (0.193) (0.00109) (0.183)

Estimate findings show that the coefficients linked to the regressor variables *Pev* and *Bv* representing the good life, are statistically significant at 0.05 level. Overall significance the model is acceptable ($F_{(2,40)} = 38.78$; $p = 0.000$). The private economic value and Good Living (“*Buen vivir*”) explains, on average, 79.2% of variation in the *Sev* of the *Cuniculus Paca* ($R^2 = 0.792$). The results also show that throughout the hunting period 2013, when the *Pev* increased in one dollar, *ceteris paribus*, the *Sev* grows 0.54%. The impact of the “*Buen vivir*” variable on the *Sev* is 90.6%. This situation corresponds when hunters show a higher level of satisfaction by the effect of the index of relative abundance of *Cuniculus paca*, the cultural factor and the satisfaction that hunters had felt when they were hunting in the forest. The magnitude of the impact of variable *Bv*, 0.91 explains the difference between the social average value of households that hunted the *Cuniculus Paca* and those who did not. The impact of the *Bv* variable is illustrated in Figure 2.

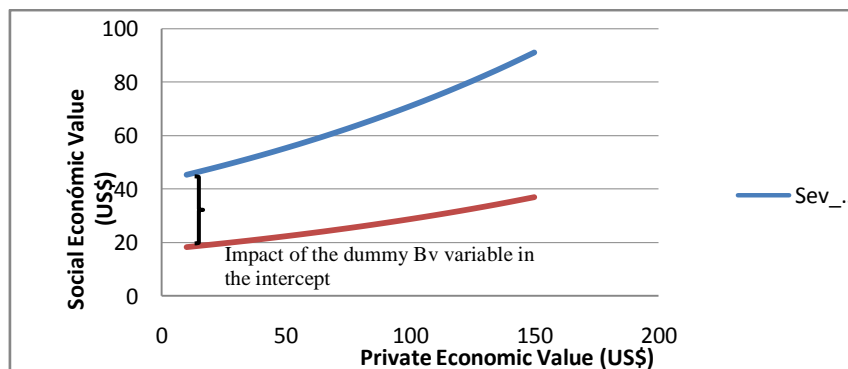


Figure 2. The effect of variable “*Buen vivir*” (*Bv*) on the social economic value (*Sev*)

In a nutshell, a) the main motivation for *Cuniculus Paca*'s hunting and consumption is the custom of tasting by the exquisite flavor of its meat, b) In accordance to 2013 data, monthly consumption of *Cuniculus paca* ranks fifth (1.6%) after the chicken meat (32.7%), the fish meat (31.3%), the pork (20.5%) and beef (13.4%) (Rodríguez-Ríos, 2015). Undoubtedly, the consumption of bush meat not only *Cuniculus Paca*, but also other species such as agouti (*Dasyprocta Punctata*), nine-banded armadillo (*Dasybus Novemcinctus*), Peccary (*Pecari Tajacu*), among others is a relevant issue as it is a factor that supports the achievement of Good Living ("*Buen vivir*") of the inhabitants of rural local communities in the Ecuadorian coast that in the case of Ecuador is a challenge seen from the need to achieve the earthly realm of Good Living ("*Buen vivir*") and, c) in the short term, the opportunity cost for rural people in the process of stepping in a more sustainable hunting is not so high (Bodmer & Lozano, 2001).

The findings also indicate that meat of wild *Cuniculus Paca* plays a small relative role in household earnings in comparison to the spiritual gain obtained by local inhabitants.¹

5. Discussion and policy options

Although the consumption of meat of wild-species *Cuniculus Paca* is a vital part of the diet of dwelling households in the study area, the research results drawn suggest that underlying hunting motivations such as incidence of its relative abundance index, its relational value and the custom to consume bushmeat, as a whole, weight the hunter's decision of hunting it. In other words, not only technical factors intervene in such a decision. In this view, public policy for a sustainable use management must include the following strategic elements:

1) Given that the social appreciation of wild-life stocks includes the enjoyment of property and relational expression using species like the *Cuniculus Paca* in a sustainable manner and custom, this assessment proposal should be taken as a benchmark for making public policy to ensure the dual objective: achieving a degree of Good Living ("*Buen vivir*") of communities while natural endowment is preserved.

2) Inducement of extraction levels of *Cuniculus Paca* compatible to that the suggested social value amount of US\$ 4451.51 in the hunting period 2013 (the coefficients estimated for each independent variable was used to predict economic, ecological and social value of *Cuniculus Paca*).

3) Promote the organization of hunters into communities capable of interpreting the new relationship between nature and humans proposed by the "*Buen Vivir*" paradigmas as a means to ensure natural reproduction of the species as attempts to "overcome the fence built by the anthropocentrism characteristic of Modernity" (Gudynas, 2010a, p.47). It will dedicate to sustainable management the hunting subsistence to ensure the self-consumption the bush meat of the local households.

4) Recognition of the fact that hunters are basically motivated by social benefits associated with *Cuniculus Paca* and others cynegetic species rather than purely economic motives may assist in making of appropriate local management. As shown, the 97.8% of total households surveyed declares to devote the bushmeat produced to self-consumption and only the remaining, 2.2%, is for sale (Rodríguez-Ríos, 2015).

¹In fact, the sale of *Cuniculus Paca* meat contributes only 5% of the overall household budget surveyed (Rodríguez-Ríos, 2015).

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5) Explicitly admit that efficient economic and non-economic mechanisms to regulate the consumption of bushmeat, are needed to address many other aspects, implications and relevant relationships which, in turn, require further analysis and specific studies, for instance: future research emphasizing de-forestation as a major factor in the decline of populations of species of wildlife; studies analyzing the nutritional, cultural and gastronomic importance of the *Cuniculus Paca* and related close species. Research to determine the stock of the species in the wild and on the various ecosystem services.

Apart of that, our results corroborate the conclusions of Gallina et al. (2012) who have assessed the use of the wild *Cuniculus Paca* for the Sierra de Tabasco State Park in Mexico, highlighting its consumption for the subsistence of the local inhabitants and those obtained by Valsecchi et al. (2014) for the case of the consumption of the wild *Cuniculus Paca* in Brazil. Likewise, Altrichter & Almeida (2002) demonstrated that *Cuniculus Paca* is the main species consumed in 15 communities on the Osa Peninsula, Costa Rica. Also our results are related with conclusions of Sirén (2012) that focus on the consumption of bushmeat in the communities of the Ecuadorian Amazon.

Our proposals for public policy action look for the addition of a set of social policies of Good Living ("*Buen vivir*") designed and based on the development of human capabilities (Sen, 1999) to "*Buen vivir*" of forest-dwelling peoples.

The evaluation of the *Cuniculus Paca* considered the abundance of this cynegetic species in an attempt combining ecological and social aspects with economic valuation of wild *Cuniculus Paca* (Admiraal et al., 2013; Costanza et al., 2015). The economic evaluation is only one dimension of the overall value of nature indicates Turner (1999). Hence, it would not be adequate if it is not taken into account other dimensions of the value embodying fully ecosystem sustainability (Admiraal et al., 2013). Also, Gudynas (2010b) indicates that the environment must be assessed through other methods besides economic, considering other values as cultural, social and ecological. However, methods as contingent valuation have been used widely in environmental evaluation. There is a set of studies over the economic valuation of natural resources both marketed and non-marketed that have used this method of contingent valuation (Piran et al., 1997; Loomis & White, 1996; Tietenberg & Lewis, 2015; Gelo & Koch, 2015), and others such as the travel cost method (Badola et al., 2010), Hedonic Property Values and so on.

Our method combines both the tangible good (hunted prey) and the non-material hunter's consumption (Kasser, 2003) in accordance with the Ecuadorian model for the Good Living ("*Buen vivir*"). Therefore, we included not only the monetary costs and benefits, but also include the non-marketed contribution as the human-nature relations, which give satisfaction felt by the hunter. It is part of an integrative definition of well-being and quality of life (Costanza et al., 2015). Estimate the contribution of these two goods on the Good Living ("*Buen vivir*") of the local population is the major advantage of our methodological approach. Moreover, the results agree with similar studies and can be applied to other close cynegetic species.

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