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NGOs AND PARTICIPATORY CONSERVATION IN DEVELOPING COUNTRIES: WHY ARE THERE INEFFICIENCIES?

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NGOs and participatory conservation in developing countries: why are there inefficiencies?*

Elena Vallino† and Gani Aldashev‡

Abstract

The concept of combination of economic development and nature conservation emerged in NGOs programmes for developing countries, under the label of participatory conservation. This implies the direct involvement of the local communities in conservation. We develop an economic model to explain why participatory conservation has been "invented", why in many situations it does not function, and why environmental NGOs find it difficult to make it functioning. The occurrence of the tragedy of the commons in a given natural area may justify an NGO intervention. Since there is empirical evidence of failure of a top-down approach in conservation, the effort of the local stakeholders is necessary. Given that there is contract incompleteness, the NGO may apply participatory conservation. However, since local farmers live at subsistence level and are strongly risk averse, they may give priority to agricultural income with respect to tourism income, which derives from conservation. They may not collaborate with the NGO for conservation activities if the NGO does not allocate some effort to sustain agriculture. However the NGO is funded by donors with environmental motivations.

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Therefore, it cannot justify an allocation of effort into agriculture rather than into conservation. It faces a trade-off between producing a large conserved area with non-cooperating local communities but with satisfied donors and a smaller conserved area with cooperating local communities but unsatisfied donors.

JEL codes: O13; Q15; Q2; F53.

Keywords: participatory conservation, non-governmental organizations, agriculture, protected areas.

1. Introduction

The concept of combining economic development and nature conservation emerged in international aid programmes a couple of decades ago. One key ingredient of this concept is the direct involvement of local communities in conservation activities. We call this phenomenon "participatory conservation". This paper develops a theoretical model to explain why participatory conservation has been invented, why in many situations it presents inefficiencies in terms of nature conservation and it does not function as intended, and why environmental non-governmental organizations (NGOs) find it difficult to make it functioning. The paper is structured as follows. In section 2 we explain what participatory conservation is. Section 3 presents the setup of the model. Section 4 addresses a situation in which there is only the local farmers community and there is not any NGO or development project. Section 5 introduces the presence of an NGO in an hypothetical situation where information is perfect and full contracts are feasible. Section 6 explains why participatory conservation has been invented from the point of view of contract theory. Section 7 presents economic reasons why participatory conservation has inefficiencies. In section 8 we show the perspective of the NGO and talk about the mechanisms in place that hinder the NGO in finding easy solutions. In section 9 we summarize the main points and conclude.

2. What is participatory conservation?

"Participatory conservation" is a practice in which the community linked to a natural resource that needs to be protected is directly involved in conservation efforts and activities, holding some rights and responsibilities linked to these activities. In the literature this practice is mentioned also as integrated conservation and development projects (ICDPs), community-based natural resource management (CBNRM), or co-management (Hughes and Flintan 2001).

One of the first times that the term "integrated conservation and development project" (ICDP) was used was in the Luangwa Valley Integrated Conservation and Development Project funded by the Food and Agriculture Organization and by the Government of Zambia in the 1960s (Child and Dalal-Clayton 2004). The aim of the project was to make wildlife

management beneficial for the local people. Since then, the term ICDP has been applied to many different types of conservation programmes. By the 1990s the concept had been introduced into the initiatives of many major international organizations (Wells et al. 2004). It is peculiar that "organizations whose primary mission is conservation and those whose mission is development have both adopted the ICDP approach in some form" (Garnett et al. 2007). As a result the definition of the ICDP has expanded, so that projects of this type are now described as "(...) approaches to the management and conservation of natural resources in areas of significant biodiversity value that aim to reconcile the biodiversity conservation and socioeconomic development interests of multiple stakeholders at local, regional, national and international levels" (Franks and Blomley 2004 in Garnett et al. 2007: 2). Very often the concept of "participatory conservation" is applied to the creation of a protected area. The local community becomes therefore a stakeholder of the conserved area. That is to say, it is directly involved in the decision-making process; it takes over many responsibilities concerning the management of the conservation area; it receives the income generated by the conservation area, mainly through tourism. However, the community must be committed to exploit only some quantities of the resources of the conserved area, and to pursue agricultural, grazing and hunting activities outside of it (Hughes & Flintan 2001, Blaikie 2006, Garnett et al. 2007, Galvin & Haller 2008, Murphree 2002).

The reasons for the "invention" of this schema are diverse. The failure, in many situations, of top-down approaches in conservation has been acknowledged. It has been recognized that the cooperation of local people is necessary for effective conservation. There is a need of allowing access rights to natural resources for local people whose livelihood is dependent on those resources (Ostrom 1990, Baland and Platteau 1996, Agrawal 2007, Campbell and Vainio-Mattila 2003).

However, there has been a long history of concern about the effectiveness of ICDPs in meeting either conservation or development objectives. The cases in which there has been actual integration of these two objectives are still the exception, and it seems that synergies do not emerge spontaneously. Failure leads to loss of biodiversity, and successes are rarely linked to substantial improvements in the wealth and well-being of the communities in which the interventions were undertaken. Such successes are typically described in anecdotal case studies and often appear peculiar, temporary, and contingent on local history, society, and

environment (Garnett et al 2007, Murphree 2002). In the literature many participatory conservation projects are object of sharp critiques both from a theoretical point of view and on the basis of empirical findings (Blaikie 2006, Herrold-Menzies 2006, Hsing-Sheng 2007, Galvin and Haller 2008, Vallino 2009). Many authors argue that trade-off between conservation and development goals is still unavoidable (Barrett & Arcese 1995, Hsing-Sheng 2007). Mutual causation processes between conservation and development initiatives are context specific and dynamic (Van Laerhoven and Ostrom 2007, Berkes 2007, Garnett et al. 2007, Platteau 2008). Often the prevailing approach is still top-down and the role of indigenous knowledge is neglected (Fairhead and Leach 1996, Gibson 1999, Blaikie 2006, Zougouri 2006). Local decision-making institutions are fragile and require continuing external support (Balint 2006). The goals of sustainable income generation alternatives based on nature rely too much on earnings from tourist activities, which are volatile and fluctuating (Brown 1998). The goals of wildlife preservation and that of income generation from wildlife-based activities are incompatible: if one is reached, the other is missed (Barret & Arcese 1995, Oates 1999, Wunder 2001, Kideghesho 2008). There may be conflicts between users at different scales. Local users of a forest may favour resource extraction to satisfy livelihood needs while global scale users may instead demand forest preservation for carbon storage (Dolsak & Ostrom, 2003). Given their poverty, indigenous communities in developing countries would like to observe quick economic improvements of their conditions from conservation and tourism activities. At the same time conservation-based NGOs are more interested in diminishing the level of resource extraction within the conservation zone (Coria and Calfucura 2011). Auer (2006: 217) underlines that "these and other potentially confounding problems pose challenges for even the best-managed common pool resources, and some of these factors may be beyond the control of local users, rule-makers, and rule-enforcers".

3. Setup of the model

We present a simple model of the tragedy of the commons (Hardin 1968) with an environmental NGO intervention. For the clarity of exposition, we assume that farmers are unable to construct cooperative solutions, so in the absence of an outside intervention, an

excessive use of the natural resource occurs. We model the relation between the farmers and the NGO as a principal-agent one, with the NGO being the principal and the farmers acting as agents. For simplicity, we also abstract away from the internal dynamics of the farmers' community and restrict the sharing of benefits of the project to a simple equal-sharing rule.[1] We thus assume the simplest possible community, consisting of two identical farmers (*A* and *B*).

The community is surrounded by a natural area (e.g. a forest inhabited by wildlife), that the NGO would like to transform into a protected zone.[2] There are three agents: the NGO, whose main motivation is environmental conservation, and two farmers, whose livelihood is based on agriculture and other subsistence activities. The economy consists of three sectors: agriculture, conservation (in the presence of the NGO), and other subsistence activities of the farmers, which we generically label as "hunting" (but that more broadly can include harvesting of fruits and plants, grazing, fishing, etc.). The farmer divides his time between agriculture and hunting for the following reasons: first, because he simply wants to diversify the risk. Second, because by doing both activities he maximizes the total payoff (Lambin and Meyfroidt 2010).

Each farmer is endowed with units of time and aims to maximize his own utility. The NGO owns instead monetary funds to be allocated and maximizes its mission of conservation. t_a^A and t_h^A represent the time that farmer A allocates respectively to agricultural activity and to the so-called hunting activity. t_a^B and t_h^B indicate the time that farmer B dedicates to agriculture and hunting activity. We have reaction functions of the activity of one farmer with respect to the other. The time that farmer A allocates to hunting activities is positively related with the time allocated by farmer B. The allocations of time for hunting of A and B are perfect complement goods. If A increases hunting, B does it as well, for two reasons. First, the

[1] Clearly, there might be a considerable inequality among the community members and thus elite capture might arise. These issues of interactions between the community members have been widely studied (Platteau 2004, Platteau and Abraham 2002, Platteau and Gaspart 2003, Winkler 2011). However, given that many development practitioners (e.g. Campbell and Vainio-Mattila 2003) point out that studies of interaction between the project beneficiaries and the project designers are very limited, we concentrate on this specific dimension.

[2] For a good review of the literature on interventions of this kind, see Winkler (2011). The principal contributions are also Gordon (1954), Skonhoft (1998, 2007), Smith (2002), Johannesen and Skonhoft (2005), and Fischer et al. (2009).

imitation mechanism is strong; we assume that hunting, besides being a source of income, also represents a social status symbol, like it happens for example in some rural regions of West Africa (Vallino 2009). Second, if one farmer observes that the other augmented his hunting he may suppose that game resources are becoming more abundant and he may decide to hunt more as well.

Concerning the production functions of agriculture and hunting, there is ½ probability that a good and productive year occurs. Regarding agriculture, if a bad year occurs, the production function of farmer A (t_a^A) is equal to 1. Instead, if a good year occurs the production function will have a Cobb-Douglas form and will be

$$1+\beta_0(t_a^A)^\alpha$$

with $0 \lhd \alpha \leq 1$ and where β_0 is agriculture productivity. The same occurs for farmer B.

Regarding the hunting activity, if a bad year occurs the hunting activity will be 1. If a good year happens the hunting activity of farmer A (t_h^A) will be equal to

$$1+Q\frac{t_h^A}{(t_h^A+t_h^B)}$$

where Q is the carrying capacity of the environment in terms of resources different than agriculture, like game or timber and non timber forest products. Since the model is static, I assume that Q is already at its steady state level. Therefore I do not deal with the issue of the re-growth rate of the natural resource.

Regarding the function $Q\frac{t_h^A}{(t_h^A+t_h^B)}$ note that the first derivative with respect to t_h^A is positive. The cross-derivative has an ambiguous sign, which at the symmetric Nash equilibrium is exactly equal to zero.

While regarding agriculture farmer A decides on his own, his time allocation to hunting is influenced by the time that farmer B dedicates to hunting. The same happens for farmer B. This functional form means that the amount of game hunted by farmer A will be determined

by the quantity of game available (Q) and by the time that farmer A spends in hunting (t_h^A) as a fraction of the total time spent in hunting by farmers A and B. As I explained before, the time that farmer A chooses to dedicate to hunting is positively related to the hunting behaviour of farmer B. If B increases this activity, A does it as well. This is the reason why t_h^A is considered as a fraction of the total time devoted to hunting by the two farmers.

4. Two farmers only

I start modelling a situation in which the NGO is absent. Each farmer maximizes his own utility function as it is expressed in the problem (1).

$$\underset{t_h^A}{Max}\ \tfrac{1}{2}(1+\beta_0(t_a^A)^{\alpha})+\tfrac{1}{2}+\tfrac{1}{2}[1+Q\frac{t_h^A}{(t_h^A+t_h^B)}]+\tfrac{1}{2} \qquad \text{s.t. } t_a^A+t_h^A=1 \tag{1}$$

Farmer A faces ½ probability that its production function for agriculture is $1+\beta_0(t_a^A)^{\alpha}$ and ½ probability that it is 1. Regarding hunting, again there is ½ probability that the function is $1+Q\frac{t_h^A}{(t_h^A+t_h^B)}$ and ½ that the function is 1. He has a time constraint: the unit of time at his disposal is divided between agriculture activity and hunting activity.

Given the time constraint, the problem (1) can be reduced to

$$\underset{t_h^A}{Max}\ \beta_0(1-t_h^A)^{\alpha}+Q\frac{t_h^A}{(t_h^A+t_h^B)} \qquad \text{s.t. } t_a^A+t_h^A=1 \tag{2}$$

The first-order-conditions thus become

$$-\beta_0\alpha(1-t_h^A)^{\alpha-1}+Q\frac{t_h^B}{(t_h^A+t_h^B)^2}=0$$

$$\underbrace{\beta_0\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A}=\underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}}_{MBt_h^A} \tag{3}$$

The marginal cost of hunting for farmer A (MCt_h^A) is expressed thus in terms of opportunity costs with respect to his own agricultural activity ($1-t_h^A$) and of the productivity rate of agriculture (β_0). The marginal benefit of hunting for farmer A (MBt_h^A) depends instead on the share of hunting realized by farmer B with respect to the total hunting activity achieved by farmers A and B. It depends of course also on *Q*, the quantity of the natural resource available.

At the end of the maximization process we will have the reaction functions

$$t_h^{A^*} = f(\beta_0, t_h^B) \text{ and } t_h^{B^*} = f(\beta_0, t_h^A) \tag{4}$$

Solving the system of equations in (4), we obtain the Nash equilibrium which indicates the level of hunting of farmer A and farmer B in a situation without any NGO intervention.

In order to observe the shape of the reaction functions we first isolate the net marginal benefit of hunting for farmer A

$$NetMB = Y = Q\frac{t_h^B}{(t_h^A + t_h^B)^2} - \beta_0\alpha(1-t_h^A)^{\alpha-1} = 0 \tag{5}$$

Using the implicit function theorem

$$\underbrace{\underbrace{\frac{\partial t_h^A}{\partial t_h^B}}_{Slope\,Reaction\,Function} = -\frac{\partial Y/\partial t_h^B}{\partial Y/\partial t_h^A}}_{Implicit\,Function\,Theorem} = -\frac{Q(-2)(t_h^A + t_h^B)^{-3}[(t_h^A + t_h^B)^2 + t_h^B 2(t_h^A + t_h^B)]}{Qt_h^B(-2)(t_h^A + t_h^B)^{-3} + \beta_0\alpha(\alpha-1)(1-t_h^A)^{\alpha-2}} \tag{6}$$

The slope of $t_h^{A^*}$ is then

$$\frac{\partial t_h^A}{\partial t_h^B} = -\frac{2Q(t_h^A + t_h^B)^{-3}[(t_h^A)^2 - (t_h^B)^2]}{\beta_0\alpha(1-\alpha)(1-t_h^A)^{\alpha-2} + 2Qt_h^B(t_h^A + t_h^B)^{-3}} \tag{7}$$

The same occurs for $t_h^{B^*}$. As it is possible to observe in Figure 1, the optimization problem is symmetric. Then when t_h^A is equal to t_h^B ,as it is the case, because the game is symmetric, the

slope of t_h^A will be zero. If $t_h^A \lhd t_h^B$, the slope of t_h^A is positive and the contrary occurs with the opposite situation. The reaction functions are parabolas. At the beginning, if t_h^A increases, t_h^B increases as well. The two curves cross at the point where the respective slopes are equal to zero and after this point the joint behaviour of the two farmers ceases: if one farmer increases hunting, the other decreases.[3]

Proposition 1. An increase in agricultural productivity raises the marginal cost of the hunting activity, and both reactions curves $t_h^A\ (\beta_0, t_h^B)$ and $t_h^B\ (\beta_0, t_h^A)$ shift towards the interior; total equilibrium hunting decreases. An increase in carrying capacity of the natural area raises the marginal benefit of hunting and the total equilibrium hunting activity increases.

[3] This mechanism is similar to that presented into the rent-seeking model (Perez-Castrillo and Verdier 1992).

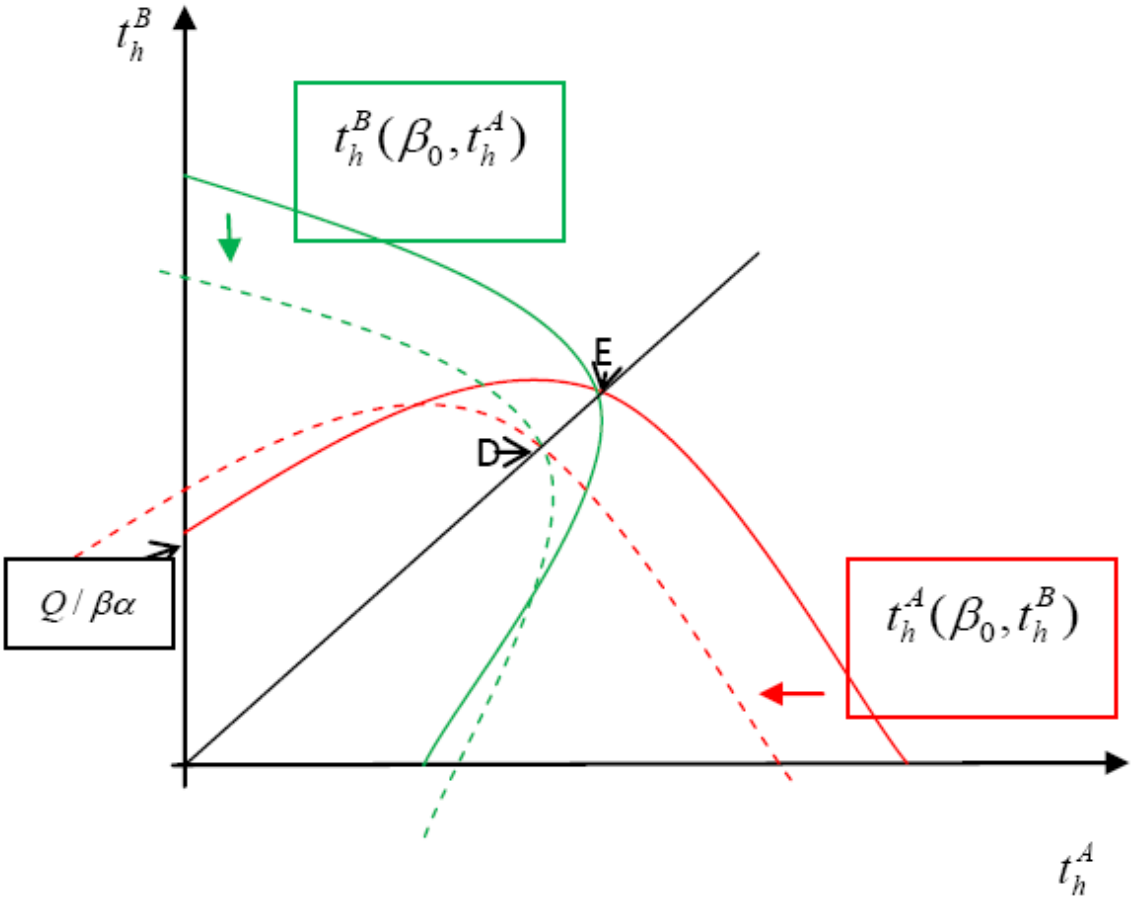

Fig. 1. The reaction functions of farmer A and B regarding hunting activity.

5. NGO intervention in a full contract situation

We assume that the Nash equilibrium played by farmers A and B in terms of time spent in hunting activity causes the depletion of the natural resource, leading to a sort of tragedy of the commons. Since the Nash equilibrium functions as a kind of self-enforcing rule (Mas-Colell et al. 1995), an actor interested in resource preservation may consider an external intervention as necessary in order to modify the farmers' incentives and therefore their behaviour. Let us assume that this actor is an environmental non-governmental organization (NGO) which wishes to establish a protected area and to exclude the farmers from the hunting activities normally pursued within the boundaries of the zone that needs to be preserved.

We proceed now to model a situation in which full contracts are feasible. The NGO maximizes conservation, which means

$$\underset{e}{Max}\, Q - \gamma \sum t_h \tag{8}$$

where *e* is the expenditure of the NGO, γ is a coefficient representing the irreversible damage done to the environment by hunting and harvesting, and again Q is the quantity available of natural resources.[4] Since Q and γ are constant, the same goal is reached with the program

$$\underset{e}{Min} \sum t_h(e) \tag{9}$$

We assume that the NGO can contract, which means that it is able to observe the behaviour and to implement enforcement on the level of hunting (Laffont and Martimort 2002). Therefore it proposes a payment scheme to the farmer in order to give him incentives not to hunt. The NGO intends to transfer a lump sum to the farmer, which I call *w*, with an approach that may recall the one of "payment for environmental services" (PES) (Engel and Palmer 2008). Therefore the payment scheme will be w^{high} if $t_h = 0$, w^{low} if $t_h > 0$.

The next step is to find values of *w* such that the farmer accepts or rejects the payment scheme.[5] The timing of the game proceeds as follows. First, the NGO offers the payment scheme to the farmer. If the farmer rejects the payment scheme (Engel and Palmer 2008), he plays the Nash equilibrium t_h^* and, based on his utility function (1), he gets the following payoff

$$\tfrac{1}{2}[(1+\beta_0(t_a^A)^\alpha) + Q\frac{t_h^*}{\sum t_h^*}] + \tfrac{3}{2} \tag{10}$$

If the farmer accepts the payment and chooses $t_h = 0$, his payoff will be instead

[4] I consider *Q* to be at its steady state, it is therefore a constant.

[5] Here there is only the "individual rationality constraint" also called "participation constraint" (Laffont and Martimort 2002). The "incentive compatibility constraint" is not necessary, since the behavior is observable. If this would not be the case, the NGO should give incentives on the base of results, not of behavior.

$$\tfrac{1}{2}[(1+\beta_0)+0]+\tfrac{3}{2}=2+\tfrac{\beta_0}{2}$$

(11)

Therefore he will gain $2+\tfrac{\beta_0}{2}+w^{high}$

Consequently, in order that the farmer accepts the payment scheme, it must hold

$$w^{high} \triangleright \tfrac{1}{2}[(1+\beta_0(t_a^A)^{\alpha})+Q\frac{t_h^*}{\sum t_h^*}]+\tfrac{3}{2}$$

(12)

Since the maximum of t_h is 1 and the maximum of $\sum t_h^*$ is 2, because there are two farmers, the maximum of the term in square brackets is $[\beta_0+Q\tfrac{1}{2}]$. Therefore the funds of the NGO (F) together with the income derived from the park (R) must be higher than this term, as it is expressed in (13).

$$QR+F \geq [\beta_0+Q\tfrac{1}{2}]$$

(13)

I suppose that the creation of the protected area will bring revenue (R), for example through tourism, and that, at this stage, this revenue will go entirely to the NGO itself, since still we do not have a participatory conservation project.

6. A rationale for participatory conservation

According to the theory, if contracts are incomplete, it matters who the owner is (Besley and Ghatak 2001). In fact, the owner has the right on the residual benefit (Tirole 1999). Even if in general we can observe that contracts are rarely complete (Bowles 2008), specifically

contracts between NGO from the North and local beneficiaries in the South are always incomplete, because of strong information asymmetries (Werker and Ahmed 2008).

The rationale of participatory conservation is the following. If the NGO is the only owner of the conserved area and keeps for itself the income derived from it, local farmers have no interest in putting effort into the project outcome. But local effort is necessary, for three main reasons. First, a theoretical one: as Aghion and Tirole (1997: 27) argue, "in an organization, the delegation of formal authority to a subordinate will both facilitate the agent's participation in the organization and foster his incentive to acquire relevant information about the corresponding activities". Second, there is empirical evidence about failure of pure top-down and "fortress" approaches in the management of protected areas, given the difficulty of effective monitoring and enforcement, especially in developing countries (Galvin and Haller 2008, Garnett et al. 2007). Third, it exists a general trend in development initiatives worldwide based on the assumption that direct participation of project beneficiaries improve project performance (Ishamn et al. 1995). It has been recognized that the project output, in this case the conservation of a natural area, depends on the effort put by the NGO together with the effort allocated by the local indigenous community whose livelihood is strongly linked to the resources of the natural area itself (Brosius et al. 2005). For these reasons the NGO transfers a property right (although without selling rights) to the local community, in order that it has an incentive to put this effort which has been recognized as necessary. This is an in-kind transfer, which has been considered appropriate for economic reasons under some circumstances: in particular, if the poor receiving the transfer from the altruistic rich face the risk of a loss and are risk-averse "it may be efficient to provide them with in-kind transfers of insurance and self-insurance" (Coate 1995: 56), like for example providing a rural development project instead of an open grant.

7. Inefficient participatory conservation

The presence of an NGO and the initiative of a participatory conservation project in which the revenue from tourism in the newly created protected area is channelled to the local community create expectations (Werker and Ahmed 2008). Local people take for granted that

the NGO has resources and expect them to be invested into conservation but also in agriculture, which I assume is the major source of income for rural indigenous people (Gibson and Marks 1995, Campbell and Vainio-Mattila 2003, Muchapondwa et al. 2006). Our model is strongly based on the assumption that the effort of the farmer into the conservation sector is *inversely* related with the effort that the NGO puts into the same sector. The effort of the farmer for the protected area is here interpreted as "do-not", as commitment to conservation by avoiding to exploit the resources inside the park. The reasons behind this assumption are essentially based on two intuitions: first, if the productivity of agriculture is low, the farmer will not commit to conservation, almost independently from the income earned with the conservation project. Second, if the productivity in the agricultural sector increases, the farmer will commit more to conservation.

We will now motivate these intuitions, beginning with the first one. In the short run the income coming from tourism in participatory conservation projects may not exceed the opportunity cost of land. This is extensively documented by single case studies and by reviews of participatory conservation initiatives worldwide (Galvin and Haller 2008, Garnett et al 2007). In areas in which the naturalistic tourism potential is actually low, like for example in West Africa, while the innovation of sharing the benefits derived from natural parks and wildlife with local project beneficiaries has improved benefit flows, the available evidence still indicates that rural population lose out in economic terms when protected areas are established and wildlife is protected (Emerton 2001, Muchapondwa et al. 2006, Vallino 2009, Smith et al. 2009, Coria and Calfucura 2011). Brown (1998: 4) states that "while one cannot entirely exclude tourism from the range of options open to governments wishing to promote conservation with development, its role can be easily overrated, and it is unlikely to provide the panacea for biodiversity conservation in many parts of Africa". In West and West-Central Africa there are a number of structural shortcomings regarding nature and wildlife-based tourism: severe lack of infrastructures, lack of game comparatively with East and Southern Africa, impossibility of national and local governments to make significant investments in the tourism industry (Brown 1998, Vallino 2009). Moreover, there is evidence that only a small fraction of PC projects' income actually reaches the community, therefore incentives for the rural population to change habitual behavior are low (Winkler 2011, Barrett and Arcese 1995, Bookbinder et al. 1998, Gibson and Marks 1995, Wells et al. 1992).

If we consider perspectives in the long run, we have various reflections. First, one may suppose that, if the project is successful, income from tourism may increase. However, if the local people live in subsistence conditions, they may not afford the possibility of deferring the satisfaction of basic needs to the future. "(…) Agents who live close to their subsistence level and have no alternative income-earning opportunities, are concerned that the income they derive from exploitation of the resource meets their subsistence requirement *in each period*. If the conservation of the resource involves costly investments that have a long gestation period, it may happen that they are not able to bear such a sacrifice" (Baland and Platteau 1996: 19).[6] This issue is linked to the land management matter. Vermeulen (2004) brings the example of the periphery of the Parc W in West Africa, where extreme land disputes exist and food crops in agriculture already compete with cotton cash crops, grazing, hunting and harvesting activities. He wonders if it is cautious adding a further land consuming activity like safari hunting for tourism, even if conducted in a participatory way.

Second, PC projects may give the wrong incentives to the local people. Local farmers do not spontaneously avoid poaching if they receive lumpsum transfers, because they consider tourism income as a complement rather than a substitute to existing income sources (Winkler 2011, Wells et al. 1992, Ferraro 2001, Ferraro and Kiss 2002, Angelsen and Kaimowitz 2001: 408-409).

Third, we have to remember that agricultural income is individual while tourism income would be channeled to the community as a whole and collective incentives may not be automatically effective. This kind of incentives may not be concretely perceived by the locals and the gains can hardly be harnessed individually (Gibson 1999, Hulme and Murphree 2001, Galvin and Haller 2008: 21, Smith et al 2009). The creation of a community forest whose intent is the commercial and touristic valorisation for the benefit of the community, implies the delimitation of the new village land on spaces that up to this point have been exploited and managed by individual households. Through a PC project community members must associate among themselves in order to manage collectively new streams of resources. This

[6] "Note that there are two conditions for this proposition to be true. First capital markets must be imperfect: agents are not able to obtain loans. Second, the market for the resource would also be imperfect since, otherwise, the agents under a binding subsistence constraint would be better off by selling immediately their resource to a new owner who would make a better use of it" (Baland and Platteau 1996: 19). These conditions hold of course in rural areas of developing countries.

may have two consequences: they may face a reduction of individual income sources and they may face very high transaction costs, if not sufficiently equipped with institutional instruments for decentralization and participation (Joiris and Bigombé Logo 2008: 28, Borrini-Feyerabend 2000).

Fourth, in most of the participatory conservation projects no formal and explicit procedure is organized for the allocation of land and resources of the buffer zones and of the zones surrounding the conservation zone to the community households, after the prohibition of access into the park. Therefore the creation of the protected area may lead to land tenure insecurity, which represents quite a paradox for initiatives that are intended to be participatory (Joiris and Bigombé Logo 2008: 25).

Fifth, farmers of rural settings in developing countries are strongly risk averse. Therefore, they may prefer to cultivate itself food, rather than buying it on the market with the income earned from the conserved area (Vermeulen 2004). In remote rural areas of developing countries the market is highly imperfect and transaction costs are dramatically high. This may mean very strong difficulty for the access to the food market (Bromley 2008, Vallino 2009). Moreover, tourism is more volatile than agriculture, since it is subject to the international fluctuations of the recreation industry (Barrett and Arcese 1995, Brown 1998, Dansero 2010: 434, Coria and Calfucura 2011). Finally, the issue of entitlements is relevant (Sen 1981). It is not only important how much money it is earned with conservation sector or agricultural sector. It is rather more about which kind of entitlements each sector gives (Smith et al 2010). In the agricultural sector there are probably different ways of access to food, which is the crucial issue, there are social security and redistribution mechanisms which reduce the vulnerability. Conservation sector with tourism may not have these mechanisms (Brown 1998).

We turn now to the second intuition, that is to say, if the productivity in the agricultural sector increases, the farmer will commit more to conservation. First, the farmer gives priority to the income coming from agriculture. If this reaches a satisfying level, the farmer decides to enjoy the income coming from the natural park as well, because he wants to diversify its sources of income (Lambin and Meyfroidt 2010). But in order to do, he must avoid to exploit the resources inside the park (Mueller et al 2008). As I mentioned before, Winkler (2011: 56) argues that, for the indigenous community, “new income sources are complements to existing

activities rather than substitutes". One may wonder why the farmer does not diversify his income from the very beginning, if there is the opportunity. We argue that is because first he must reach a *subsistence level* in terms of agricultural income, which may be in money of in food. After this is reached, he is ready to diversify and cooperate with the NGO for tourism, which means not-to-exploit resources of the park. The issue of subsistence is mentioned by many in the literature, but it is rarely considered as the *main* cause of failure of participatory conservation projects.

Second, I rediscover the "Borlaug hypothesis". Normann Borlaug continually advocated increasing crop yields as a means to curb deforestation. The large role he played in both increasing crop yields and promoting this view has led to this methodology being called by agricultural economists the "Borlaug hypothesis", namely that increasing the productivity of agriculture on the best farmland can help control deforestation by reducing the demand for new farmland (Angelsen and Kaimowitz 2001, Angelsen and Kaimowitz 2001a). Apart from the sharp debate arose in the last decades around Borlaug's propensity for fertilizers and biotechnology utilize in agriculture (Borlaug 2000, Borlaug 2007), I think there is still space for the serious consideration of the link between improvements in agricultural techniques and lower deforestation rates. Theoretically, agricultural intensification triggers two countervailing forces, one that increases and another that reduces cultivated surfaces (Rubel et al 2009). Initially, intensified production allows farmers to have higher yields per hectare and an increased gross income. This situation may induce them to expand the cultivated area. If demand for the food products is relatively inelastic, the increase in supply will result in a decline in crop prices. This fact may stop the increase of cultivated surface. The increased yields that set these processes in motion may have origins from changes in technology, but also from the knowledge that farmers accumulate about a place, since they would abandon their less-productive fields. The lands abandoned by farmers have the potential to become places that provide enhanced environmental services and face an increase in forest cover (Walker 1993, Mather and Needle1998, Waggoner and Ausubel 2001, Matson and Vitousek 2006, Borlaug 2007). However it is possible, particularly if demand for one product is elastic, that the increase in supply does not lead to a price decline and the overall incentive for higher production by using more land remains in place (Rudel et al 2009). Empirical studies provide evidence for both land-consuming and land-sparing effects (Tachibana and Nguyen 2001) from intensification (Shively and Martinez 2001, Kaimowitz and Smith 2001, Coxhead et al

2001, Meyfroidt and Lambin 2007). In particular Angelsen and Kaimowitz (2001: 404-407) identify the following situations in which conjugation of agricultural intensification and conservation objectives is feasible: agricultural technologies suited specifically for forest-poor areas; labour-intensive technologies where labour is scarce and migration limited; promotion of intensive systems where farmers are also involved in low-yielding extensive farming practices; agricultural technologies that substantially raise the aggregate supply of products with inelastic demand; technologies that promote agricultural systems that provide environmental services similar to those of natural forests.[7] From a political point of view, Rudel et al (2009) underlines that "both reducing emissions from deforestation (…) and payments for environmental services on abandoned agricultural lands only become politically acceptable policy options when crop yields rise on the remaining lands".

The third reason why the farmer will decrease his consumption of the park resources after the agriculture become more productive, is a pure economic one. The farmer puts its effort where the marginal productivity is higher. Therefore if agricultural productivity increases, he has no effort left for "hunting" inside the park.

Let us consider now these issues in analytical terms. We assume that the NGO has resources equal to 1, where *e* is the expenses for agricultural support and 1-*e* the expenses for park conservation.

The park size is equal to $(1-e)(Q-\gamma\sum t_h)$,which is linear. Again, γ is a coefficient representing the irreversible damage done to the environment and Q is the carrying capacity of the environment.

Agriculture productivity for the farmer is now influenced by the NGO expenses and it becomes $\beta(e)=\beta_0+\beta_1(e)$ with $\beta_1^{'} \triangleright 0 \triangleright \beta_1^{''}$ which indicates the concavity of the production function.

The NGO maximizes conservation, therefore its program is $\underset{e}{Min}\sum t_h(e)$.

The utility maximization program of the farmer with the NGO is thus the following:

[7] The book "Agricultural technologies and tropical deforestation" (Angelsen and Kaimowitz 2001a) offers an excellent and detailed study on the links between improvements in agricultural techniques and consequent impact on the environment, on land management and on forest cover, both in developed and developing countries. For issues on land use transition and deforestation see also Lambin and Meyfroidt (2009).

$$\underset{t_h^A}{Max}\ \tfrac{1}{2}(1+\beta(e)(t_a^A)^{\alpha})+\tfrac{1}{2}+\tfrac{1}{2}[1+Q\frac{t_h^A}{(t_h^A+t_h^B)}]+\tfrac{1}{2}(1-e)(Q-\gamma\sum t_h)R$$

$$\text{s.t. } t_a^A+t_h^A=1 \qquad (14)$$

where R is tourism revenue and $(1-e)(Q-\gamma\sum t_h)R$ is the total tourism income. Here ½ means that we assume that farmer A and farmer B split the total tourism income in two. The former ½ means instead the probability of having a good or bad year.

The First-Order-Conditions become:

$$\underbrace{\beta(e)\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A}=\underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}-(1-e)R\gamma/2}_{MBt_h^A}$$

(15)

As it is possible to see in Figure 2, when *e* is equal to zero, which means that the NGO does not spend anything in agriculture and devotes the whole amount of resources to conservation, the marginal benefit of hunting is higher than its marginal cost. Therefore the farmer decides that it is worth to hunt and the total hunting will be very high.

If *e* increases, the marginal benefit will increase linearly. When the marginal cost of hunting overcomes its marginal benefit, hunting will reduce. e^* corresponds to the point where the marginal cost of hunting is at its lowest level, it equals the marginal benefit, and total hunting is thus at its maximum. e^{opt} corresponds to the point where hunting is at its lowest level therefore I consider it the most efficient level of expenses in agriculture.

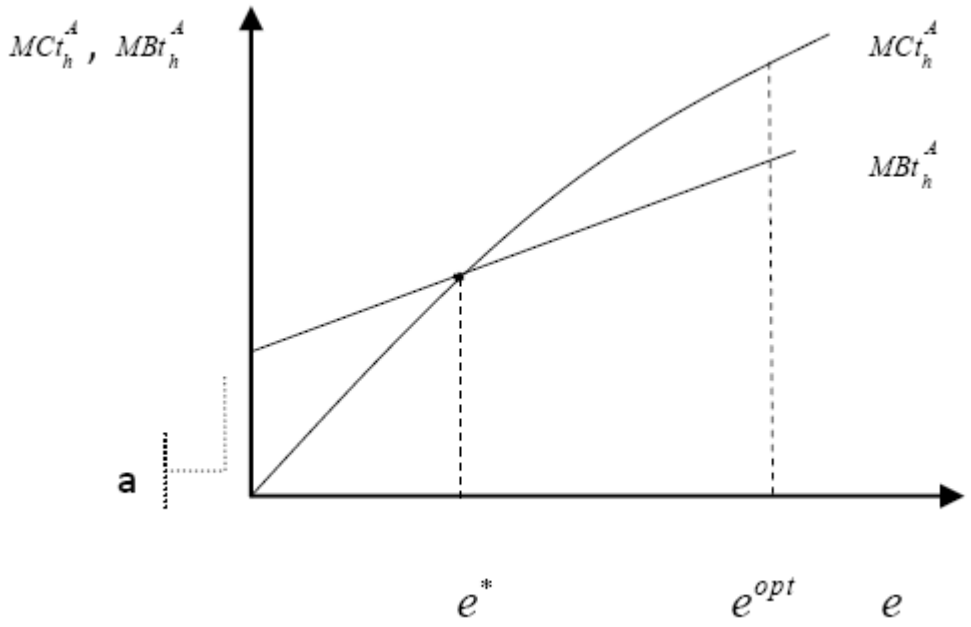

Fig. 2. Marginal cost and marginal benefit of hunting for farmer A in relation to the NGO expenses in agricultural support. The marginal cost of t_h^A is concavely increasing in *e*, while the marginal benefit of t_h^A is linearly increasing in *e* starting from β_0. The value of e is between zero and one.

The mechanism can also be viewed in the following way. Since I explained that with the NGO intervention $\beta(e) = \beta_0 + \beta_1(e)$, the First-Order Conditions expressed in (15) become

$$\underbrace{(\beta_0 + \beta_1(e))\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A + t_h^B)^2} - (R\gamma/2) + e(R\gamma/2)}_{MBt_h^A} \quad (16)$$

I transfer all the terms with *e* to the left-hand side

$$\underbrace{\beta_0\alpha(1-t_h^A)^{\alpha-1} + \beta_1(e)\alpha(1-t_h^A)^{\alpha-1} - e(R\gamma/2)}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A + t_h^B)^2} - (R\gamma/2)}_{MBt_h^A} \quad (17)$$

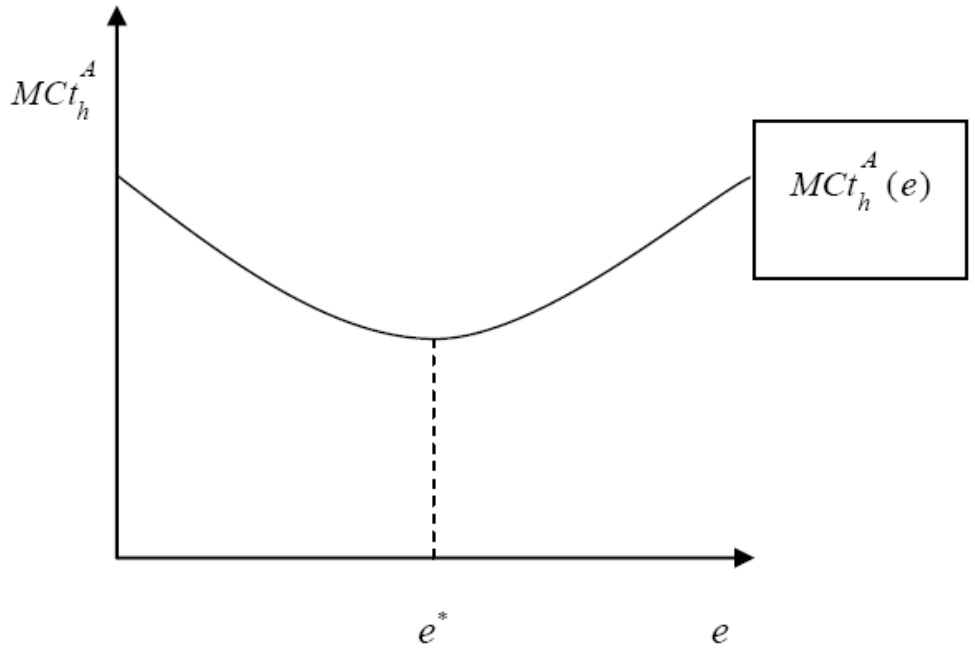

Fig. 3 The marginal cost of hunting for farmer A in relation to the NGO expenses in agricultural support.

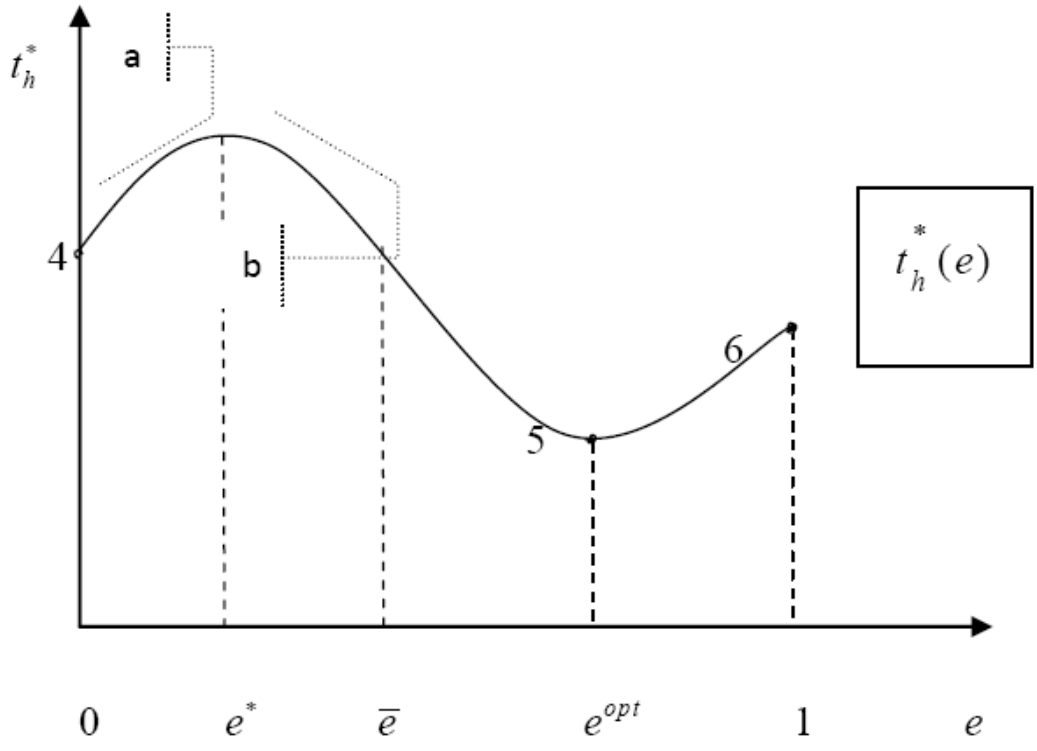

Fig. 4 Total hunting in relation to the NGO expenses in agricultural support.

When the NGO expense in agriculture is equal to zero, we are in the situation of participatory conservation with transfer of property rights, but no NGO expenses in agriculture (in Figure 4 and Figure 5 this will correspond to point 4). The part "a" of the curve (which we indicated also in Figure 2) indicates the moment in which the NGO starts to increase *e*: first the total hunting increases as well. In fact, because of the term $-e(R\gamma/2)$ the income from tourism decreases linearly when *e* increases. Until e^* is reached this effect dominates and let the marginal cost of hunting decrease. Therefore total hunting diminishes. e^* is the point where the marginal cost of hunting is at minimum, and total hunting at maximum. In the part "b" of the curve it is showed that after e^* the concave part of the marginal cost expression, with the term ($\beta_1(e)\alpha(1-t_h^A)^{\alpha-1}$), dominates. When *e* increases further, the marginal cost of hunting increases and hunting decreases. This continues until $\bar{e}$, where the level of hunting is the same as when *e* was equal to zero. Only if the NGO goes further and increases expenses in agriculture until e_{opt}, hunting will reach a lower point, which in Figure 4 and in Figure 5 will correspond to point 5, that is to say participatory conservation with expenses in agriculture. The shape of the curve may be such that if the whole NGO expense is dedicated to agriculture (*e*=1), the hunting increases again until a hypothetical point 6 in Figure 4. I find this phenomenon interesting and thanks to the modelling process it is possible to observe it. Therefore, the NGO should invest *a lot* in agricultural support since only a few investments in this sector may not be sufficient (Garnett et al 2007). For example the GEPRENAF Project in southern Burkina Faso had planned some activities for support to the agriculture but it has not been sufficiently followed and implemented, it created unfulfilled expectations in the local population and had indeed counter-productive effects (Vallino 2009). Brown (1998) also advices that by increasing the level of local investment in the zone to be preserved, rather than reducing it, may limit the external costs of conservation area management.

7.1 Comparison of the First-Order Conditions (FOCs) of the situations without and with NGO.

I start considering the case in which *e* = 0, which constitutes one extreme with no NGO expenses in agriculture. Recalling (15) and (3) I compare the following FOCs.

With NGO: $\underbrace{\beta(e)\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}-(R\gamma/2)}_{MBt_h^A}$

Without NGO: $\underbrace{\beta_0\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}}_{MBt_h^A}$

It is possible to observe that the two marginal costs coincide, while the marginal benefit is lower in the situation with the NGO. Consequently the total level of hunting (t_h^*) in the situation with the NGO but without expenses in agriculture (e = 0) is lower than the total hunting in the situation without NGO.

If we consider the opposite extreme, with the whole NGO expenses in agriculture and zero in the park (e = 1), recalling (17) and (3) we have:

With NGO $\underbrace{\beta_0\alpha(1-t_h^A)^{\alpha-1}+\beta_1(1)\alpha(1-t_h^A)^{\alpha-1}-1(R\gamma/2)}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}-(R\gamma/2)}_{MBt_h^A}$

Without NGO $\underbrace{\beta_0\alpha(1-t_h^A)^{\alpha-1}}_{MCt_h^A} = \underbrace{Q\frac{t_h^B}{(t_h^A+t_h^B)^2}}_{MBt_h^A}$

The marginal benefit of hunting is the same in the two situations, while the marginal cost is higher in the situation with the NGO.[8] Consequently the total hunting in the situation with the NGO is lower than in the situation without the NGO.

Finally, if we compare the FOCs with e = 0 and with e = 1 we observe that the term $\beta_1(1)\alpha(1-t_h^A)^{\alpha-1}$ may be higher or lower than $(R\gamma/2)$. Therefore it depends on R, the tourism revenue: if R is sufficiently low, it may exist a level of total hunting lower than the one of participatory conservation with no expenses in agriculture (but still higher than the one of participatory conservation with expenses in agriculture).

[8] Note that the terms $(R\gamma/2)$ cancel on both sides of the equations.

8. The perspective of the NGO

After this analysis one may wonder why the environmental NGO does not invest in agricultural support in order to create further incentives for the local community to collaborate and commit for conservation by reducing the resource extraction inside the park. The answer is that the NGO is strictly tied to its mission (Garnett et al. 2007, Werker and Ahmed 2008). It faces therefore a trade-off: if it invests in both the park and the agricultural sector, it will receive more effort by the local farmers, but it will produce a smaller park. If it invests more into the park sector, it will produce a larger park, but with less effort by local farmers, indeed with more probability of failure in the long run.

In the last decades environmental concerns increased dramatically and conservation oriented organizations increased their size and power worldwide, bringing politics into nature-caring issues (Alcorn 2005, Adams and Hutton 2007).[9] Therefore NGOs and governmental organizations (GOs) initiatives about local development, rural development, community participation had to broaden their focus and to take the environment into account in order to obtain funding (Garnett et al 2007, Campbell and Vainio-Mattila 2003, Giannini 2011). Angelsen and Kaimowitz (2001a: 403-404) write that "another reason why policy-makers should understand how technological change affects forests is that research managers and development agencies increasingly seek to justify their budgets by claiming that their projects help conserve forests. As the world becomes increasingly urban and past scientific breakthroughs allow us to produce more food than markets demand, political support for agricultural research and technology transfer has declined. In contrast, public concern about the environment, and tropical forests in particular, has never been stronger".

If the approach of the NGO is conservation oriented it is likely that its donors and sponsors have environmental motivations. Therefore as projects' output they want to see large parks with relatively lower concern for the degree of collaboration and well being of the indigenous community (Garnett et al 2007). Consequently the NGO has a strong incentive to invest more into the park than into agriculture. The use of participatory techniques for conservation in order to motivate local people easily became in many situations, fortunately not in all of them,

[9] For a very interesting historical perspective on conservation movements and participatory conservation initiatives see Alcorn (2005) and Brosius et al. (2005).

a rhetoric, which "upon occasion served to help shift resource away from local strategies for livelihood and empowerment toward resource management that serves more powerful institutional interests (…)" and triggered "processes of expropriation, reallocation, and management in which political and economic inequalities are (…) reinforced by programs legitimized through the language of participatory resource" (Brosius and Lowenhaupt-Tsing 1998: 6, Blaikie 2006, Adams and Hutton 2007). One further consideration needs to be done: if the competition among NGOs in the North increases, as it is more and more the case (Aldashev and Verdier 2010), this incentive for investing more into the park than into agriculture will become higher, with negative consequences on the outcome of the participatory conservation project (Campbell and Vainio-Mattila 2003, Tisdell 2007, Werker and Ahmed 2008).

Proposition 2. An institutional constraint forbidding the NGO to spend on agriculture ($e = 0$) implies a sub-optimal level of conservation (i.e. inefficiently high level of total hunting).

9. A recapitulation: five possible scenarios

Summarizing, I identified five kinds of scenarios, represented in Figure 5, regarding conditions that influences the behaviour of the local farmers in hunting activities.

1. Local farmer community without any NGO presence: the farmers reach Nash equilibria that may lead to the overexploitation of the resource.
2. Full contract situation. The NGO is willing to reduce the exploitation of the resources. It creates a protected area and it pays lumpsums to the farmers in order to induce them not to exploit the resource within the conservation area. It is able to enforce the contract. Hunting levels reduce.
3. Incomplete contract situation. Due to information asymmetries and high transaction costs, the NGO is not able to enforce the rules. The farmers will behave like in the situation without the NGO. The level of hunting is very high and the resource will deteriorate.
4. Incomplete contract situation with property transfer (participatory conservation). The NGO invests full effort in conservation. Due to incompleteness of contracts, the NGO

transfers property rights on the income deriving from the park to the local farmers. The aim is to give to the farmers an incentive to collaborate in preserving the resources. The hunting level decrease and the state of the resource improves.

5. Incomplete contract situation with property transfer and support to agricultural sector. The NGO invests part of its resources in conservation and another part in agriculture. The result will be a second best solution from the perspective of the utility of the NGO. However, from the point of view of the hunting level which damages the park, this point is the best one so far, if compared to the points 1, 3 and 4. Solution 2 is indeed not feasible. The inefficiency is the distance between point 4 and 5.[10]

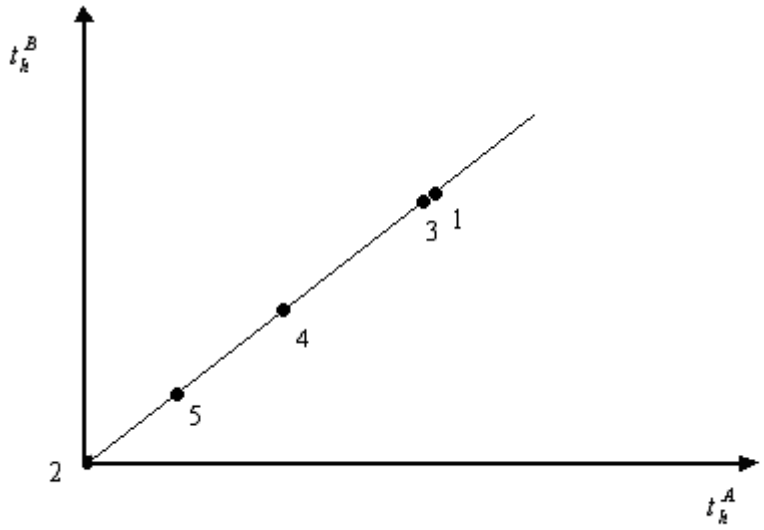

Fig. 5 Five possible levels of hunting by farmer A and farmer B (own elaboration).

[10] The same mechanism is explained in Angelsen and Kaimowitz (2001: 408-409): "Governments play a central role in agricultural research and technology transfer and could potentially offer farmers subsidized technologies and inputs. In return, farmers might restrict their forest clearing. Access to specific farm programme benefits would be contingent on certain conservation practices. For this to work, however, would require the government to strictly enforce the agreement, which often proves quite difficult. Otherwise, farmers would have strong incentives to receive the subsidized technologies and encroach into forests. This has been a major problem in Integrated Conservation and Development Projects. In principle, these are designed to create win–win packages but they have often been based on naïve assumptions about farmers' behaviour."

Point 5 is what a social planner would do, which can not control on behaviour directly (t_h), but has the control on expenses (*e*). The inefficiency comes from the fact that an NGO is not a social planner. It has resources, but it can not use them freely.

Of course *R* (tourism revenue) is crucial. An increase if *R* reduces the distance between points 4 and 5. However, this paper shows how and why this may not completely solve the problem and smooth the mechanism. In a wider sense, the project should invest in "enhance, rather than replace, existing livelihoods" (Brown 1998: 4). This view is called by Brown (1998) "enhanced livelihood" approach and it is an option instead of the "alternative income-generating" approach, based mainly on tourism income. Since tourism may not be profitable in some contexts, due to a combination of factors such as lack of valuable natural features and species, lack of infrastructure, political instability, it should not be considered as the main source of socio-economic development of indigenous communities. Tourism should not be a substitute for broader commitment by NGOs, government agencies to address more basic problems and demands faced by local communities (Garnett et al 2007, Berkes 2007, Coria and Calfucura 2011). Deiniger and Minten (1999) investigated the relation between deforestation and agricultural intensification in Mexico. They discovered that existing forms of communal agricultural land are not associated to high deforestation rates, that there is apparently no incompatibility between agricultural support policies and conservation objectives in the medium to long term, and that poverty influences negatively the forest cover. Therefore they argue that "to the degree that they can be confirmed in other settings, these findings would imply that policies that focus on natural resource conservation without concern for the socioeconomic well-being of the affected population may be seriously misguided" (ibid.: 336).

Regarding lines of future research, at a theoretical level we would like to improve the model by endogenizing *R*, that it to say, how much property rights, in terms of tourism revenue, the NGO decides to devolve to the local community, since here we assumed that the NGO transfers either the whole share of revenues or none. It would be interesting to observe how different shares of transfers influence farmers behaviour and levels of hunting. Regarding policy-oriented research, instead, it would be crucial to investigate more deeply which kind of agricultural intensification should be pursued and on which part of the community territory, based on the specific features of each context.

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