Economic Growth, Biodiversity and Conservation Policies in Africa: an Overview

Iritie, Jean-Jacques

LADEG, Department GCEA, INP-HB Yamoussoukro

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B. G. Jean-Jacques Iritié*

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Abstract

From the economic literature on the relationship between economic growth and environment pioneered by Grossman and Krueger (1991) and Shafik and Bandyopadhyay (1992) we first conduct a theoretical and critical reflection on the existence of a Kuznets curve for biodiversity. It appears that results are strongly contrasted. Then, we focus on the main biodiversity conservation policies implemented in Africa, i.e. protected areas and we discuss its effectiveness in achieving the dual objective of conservation and economic development for local communities.

Keywords: Economic growth; environmental Kuznets curve; biodiversity conservations policies; proteced areas; Africa.

JEL classification: Q01, Q50, Q57.

1 Introduction

The Convention on biological diversity (1992) defined biodiversity as :

> the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.

*LADEG, GCEA, INP-HB, B.P. 1093 Yamoussoukro, Côte d'Ivoire - jeanjacques.iritie@gmail.com (⊠). I am grateful to Joel Korahiré (University of Ouaga 2) and Joseph Koula (INP-HB) for their valuable advice. I also thank Germaine Bah-lou, Madoussou Diomandé, Germain Houkponou and Nassita Soro, students in agricultural economics at INP-HB, for helpful comments and suggestions. Of course, I am solely responsible for all imperfections that may remain.

We distinguish genetic biodiversity related to the diversity of genetic information stored in each species, species biodiversity related to the richness and abundance of species and ecosystem biodiversity related to the ecosystem variability; in the literature, biodiversity of species retains more attention (Dietz and Adger, 2003; McPherson and Nieswiadomy, 2005). Biodiversity has huge economic, ecological and scientific interrelated contributions. In an economic perspective, biodiversity improves productivity of natural ecosystems[1] and agricultural activities (Heal, 2004). It enables humanity to be protected against risks of disease and other problems that could destabilize agricultural systems (e.g. phenomenona of resistance). Biodiversity is also a source of genetic knowledge; it helps medical scientists to understand life and the role of each species in maintaining ecosystems. Biodiversity is also essential to intrinsic ecological functions (i.e. the ecological balance) and ecosystem services. For example, the removal of keystones species[2] produces irreversible consequences for the entire ecosystem. (Batabyal, 2002; Heal, 2004). Ecosystem services can be merchants (timber production, ecotourism, pharmaceutical uses.) or non-merchants such as watershed protection, carbon sequestration, soil fertilization (Norton-Griffiths and Southey, 1995; Edwards and Abivardi, 1998; Batabyal, 2002; Heal, 2004; Pearce, 2007). Biological diversity is undoubtedly an essential resource for human beings and for the preservation of natural ecosystems; only a joint ecological and economic management of ecosystem can allow humans to continue to benefit from its services.

One estimates total number of species between 3 and 100 million (Armsworth et al., 2004); but unfortunately one observes increasing loss of species as well as transformation and disappearance of many ecosystems (Mills and Waite, 2009). Estimates of extinction rates are uncertain; however today, many ecologists argue that the annual rate of extinction is between 20 to 200 extinctions per million species, higher than past extinction rates (Pearce, 2007). The main causes of biodiversity loss are human activities (Edwards and Abivardi, 1998; McPherson and Nieswiadomy, 2005; Pearce, 2007): destruction of habitats, exploitation of resources, introduction of new species and climate change, etc. According to Batabyal (2002), biodiversity preservation requires establishment of a resilient management system which deals with a threshold of use and an acceptable disturbance allowing system to regain its ecological balance. Some authors such as Roberts and Grimes (1997), Margules and Pressey (2000), Heal (2004) and Pearce (2007) rather suggest establishment of worldwide protected areas. The biodiversity conservation effort also results through several agreements or conventions includ-

[1] According to Heal (2004), the research shows that a more diverse ecosystem has more ability to withstand stress and becomes productive; thereby the loss of biodiversity has a high probability to decrease ability of the system to maintain or recover from damage or disturbance.

[2] The keystones species provide unique key services for the functioning of ecosystem (Batabyal, 2002); his determination often leads to better actions in favor of biodiversity protection.

ing the "big five", i.e. the Convention on wetlands of international importance especially as waterfowl habitat (or Ramsar 1971), the Convention concerning the protection of the world cultural and natural heritage (1972), the Convention on international trade in endangered species of wild fauna and flora (or CITES 1973), the Convention on the conservation of the migratory species of wild animals (or CMS 1979) and the Convetion on biological diversity (or CBD 1992)[3].

Africa is not on the sidelines of the global commitment for conservation. The continent is rich in biodiversity; and so, african countries have been considered as strategic areas for scientific investigations on choices, means and opportunities to conservation. Biodiversity conservation policies in Africa presents a major challenge for sustainable development. However, Lightfoot (1994), Roe and Elliot (2005) show that other factors act indirectly and create favorable conditions for biodiversity loss: population growth, distribution and migration of population structure, poor governance, poverty and inequality, inefficient macro-economic policies. But as a rule, most of african countries presente these characteristics. So, the question to provide or not biodiversity conservation efforts in Africa is relevant.

Fortunately, the extensive economic literature on relationship between economic growth and environmental quality initiated by Grossman and Krueger (1991, 1995) leaves us optimistic. Indeed, it appears an hypothesis that long-run economic growth would solve the environmental degradation problem (Grossman and Krueger, 1995; Shafik, 1994; Selden and Song, 1994; Cropper and Griffiths, 1994; Barbier, 1997; Stern et al., 1996). This hypothesis, so-called environmental Kuznets curve (henceforth EKC), is inspired by the work of Kuznets (1955) about the existence of an inverted-U-shaped relationship between per capita income and income inequalities. Kuznets points out two stages in the growth of social inequality in developed economies: first a phase of increase over time with income up to a peak and then a phase of decline. So, based on empirical observations related to several developed countries (including United States, United Kingdom and Germany) Kuznets (1955) established a profile of income disparities in economic development process. In a similar way, the EKC-concept states that nation pressure on environment ends up decreasing when a high level of economic growth is achieved (Grossman and Krueger, 1991, 1995). It implies for example that african countries will give more interest to the preservation of environment with economic growth.

In this study the main question is to know whether the EKC hypothesis may be applied if the variable of environment is a biodiversity index. In other words, is there a direct relationship between economic growth and biodiversity conservation

[3] We can quote other more specialized conventions such as the International convention for the regulation of whaling (1946), the International convention for the protection of birds (1950), the African convention on the conservation of nature and natural ressources (1968) and the Convention on the conservation of European wildlife and natural habitats (1979).

at long run term? If not, what conservation policies implemented in Africa to address biodiversity loss? From an general economic literature on bidiversity, we conduct a theoretical and critical reflection on the existence of a Kuznets curve for biodiversity and discuss the efficiency of biodiversity conservation policies implemented in african countries; but in a first part we briefly review the economic literature on the EKC concept.

2 Environmental Kuznets curve hypothesis

2.1 Theoretical arguments

The Shafik and Bandyopadhyay (1992), Grossman and Krueger (1991, 1995) and Selden and Song (1994) seminal works mark the beginning of thinking about relationship between development and environment. They use various indicators of pollution - sulfur dioxide (SO_2), carbon oxides (CO_x), nitrous oxides (NO_x), heavy and fine suspended particulates, pathogenic contamination, heavy metals, deforestation, etc., in relation with the level of economic development. The EKC hypothesis states that the level of development, expressed as per capita gross domestic product (GDP), has positive effect on environment[4]. The low income countries have little concern for environment degradation at the first stage of economic development characterized by subsistence economic activities and industrialization (Stern et al., 1996); but after satisfying primary needs and improving living standard, one reaches a threshold of economic development for which awareness of environment increases. In other words, the use of natural resources to create one unit of wealth decreases gradually; the efficiency gains are expected to be large enough to reverse the direction of relationship between economic growth and degradation (Meunié, 2004).

The theoretical existence of EKC would be an outcome of the both economic growth and rising of individual incomes; indeed revenue act through changes in production structures, changes in demand or individual preferences and finally depend on the institutional and policy framework that prevails in the country (Grossman and Krueger, 1991, 1995; Plassmann and Khanna, 2006; Nourry, 2007; Kaika and Zervas, 2013).

The evolution of productive structures following the increase of wealth can have three effects highlighted by Grossman and Krueger (1991, 1995): scale effect,

[4]EKC hypothesis can be qualified as "econo-centric" vision and therefore is close to “weak sustainability” concept; in other words, environment is not the support of socio-economic development, but rather is simply an common external factor; so there exists possibility of total substitution between natural capital and manmade capital. For a typology of sustainability approaches, see Faucheux and Noel (1995, pp. 239-325.)

composition effect and technology effect.

- Scale effect: is the fact that an increase of goods and services production leads to more pressure on environment and causes greater pollution as by-product.
- Composition effect is due to the change in economy towards cleaner production systems; the idea is that the economy tends to change through three stages of development: rural economy, industrial and urban economy and finally a more "tertiarized" economy, which is intensive in human capital and eco-friendly.
- Technological effect occurs when, from a certain threshold of wealth, the nation massively invests in R&D for more efficient and cleaner production techniques. The existence of an EKC presupposes that above an income threshold, the scale effect is more than offset by the other two.

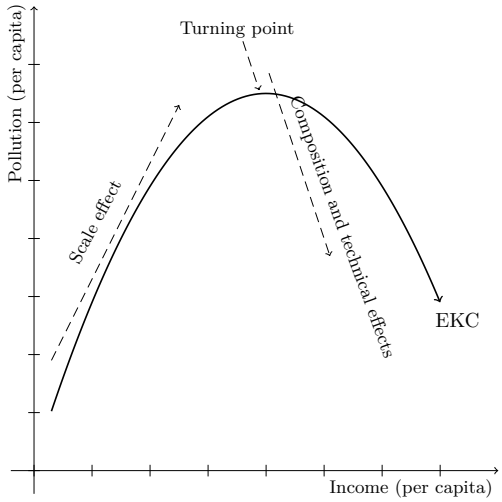

Figure 1: Environmental Kuznets curve

An EKC occurs also owing to changes in demand or consumers preferences vis-à-vis environmental goods. For instance, Fuentes (2011) focuses on human preferences and inefficiency of social coordination as the main causes of loss of biodiversity. According to Plassmann and Khanna (2006), if consumers show any reduction effort when they are rich, no sophisticated technology can reduce degradation. In fact with an improvement of their living conditions, individuals give

more value to environmental amenities (Selden and Song, 1994). So the perception of the quality of environment plays a role in the declin stage of EKC; ecological variable becomes an argument of consumers utility function, influences the market and encourages productive structures to move towards clean processes (Plassmann and Khanna, 2006; Ranjan and Shortle, 2007). The quality of environment is analyzed as a luxury good: $\varepsilon_R > 1$ or income-elasticity of demand for "green" goods exceeds the unity (Yandle et al., 2002; Dinda, 2004).

The political aspect of EKC is explained by the negative effects of corrupt and less effective political system on economic growth (Acemoglu et al., 2001). Indeed, efficient institutions which are capable to impose enforceable and strict regulation to protect environment of market failures may partly explain pollution mitigation (Kaika and Zervas, 2013); moreover, with increase of income and information access, people put pressure on governments to take measures of environment protection (Nourry, 2007).

Apart from the above classical factors, the theoretical literature gives other reasons - such as international trade - as an explanation of observation of EKC; here, the underlying idea is that trade liberalization and mobility of capital allow economic expansion; however an increase of export goods production generates pollution and affects environment quality. Therefore the EKC comes from the specialization of countries. Indeed, due to the strict costly environmental regulation in force in rich countries, these ones relocate their polluting industries toward developing countries. And unfortunately, developing countries with low environmental standards accept such polluting industries in the aim to promote foreign direct investment, employment and production. In other words, low income economies specialize in polluting industries and become "pollution havens" while rich countries specialize in clean industries (Birdsall and Wheeler, 1993; Neumayer, 2001). However the hypothesis of pollution havens is challenged by another one called "race to the bottom"; in fact the relocation of industries and the exits of capital to developing countries will lead to job losses in rich economies, otherwise they will be forced to relax their regulation and this leads to a race to the bottom until reaching a low level of protection. This will result in a sharp environmental deterioration in both rich and developing countries (Porter, 1999; Wheeler, 2001)[5].

2.2 Contradictions and criticisms

Several empirical studies incorporating all or part of data used by the pioneers show contradictions about EKC-concept. For example Shafik (1994) shows that the EKC hypothesis is not automatic; Harbaugh et al. (2002) rather shows

[5]The validity of the two hypothesis, "pollution havens" and "race to the bottom", has been questioned in the empirical EKC literature.

a inverted-N shaped relationship, De Bruyn et al. (1998) detects monotonically increasing relationship between economic growth and emissions, Shafik (1994) and Holtz-Eakin and Selden (1995) show that turning points are higher than maximum income of sample used. It is generally accepted that the inverted U relationship is checked for local pollutants such as SO_2 and NO_x (Stern and Common, 2001; Stern et al., 1996; Yandle et al., 2002). Emissions of pollutants that have a more diffuse impact, such as CO_2, continue to increase with growth; thus, here economic growth contradicts the fight against global warming.

There is also methodological limitations to the existence of an EKC, e.g. impacts of panel composition (Stern and Common, 2001), choice of dependent variable and specification of the econometric model (Bulte and van Soest, 2001), negligence of irreversibility of envionmental damages (Arrow et al., 1995) and phenomenon of simultaneity (Stern et al., 1996). In addition, according to Roberts and Grimes (1997) the inverted U-shaped could be the result of two divergent and juxtaposed trends and not the path of individual countries following various stages of development. The irreversibility means there is no return to the old balance once ecosystem's carrying capacity is exceeded; the simultaneity means there is potential feedback effects of pollution on economic growth; in other words, pollution affects health, labor productivity and natural resources (Nourry, 2007). Therefore a search for a rapid economic expansion at the expense of natural resources may be counterproductive; the idea of an EKC is not a systematic and general result.

3 Kuznets curve for biodiversity

Few empirical works really analyze the existence of a Kuznets curve for biodiversity. When they do it, most of them are specifically interested in deforestation rates as indicator of biodiversity loss. Cropper and Griffiths (1994) examine the effect of demographic pressure on deforestation in 64 countries in Africa, Latin America and Asia over the period 1961-1991. They use a quadratic panel model and show the existence of an EKC only for Africa and Latin America with respective turning points at 4,760 $US and 5,420 $US; the authors also find that the average income of these countries are below these peaks; they deduce that countries are on the first part of the Kuznets curve. These results were confirmed by the work of Bhattarai and Hammig (2001), but here the turning points are much higher than those of Cropper and Griffiths (1994). Similarly, Culas (2007) highlights the existence of an EKC for deforestation in Latin America countries and the key role played by institutional factors in mitigating deforestation. In contrast, other works on deforestation contradict the existence of an EKC for biodiversity; for example, Shafik (1994) and Koop and Tole (1999) use other estimation methods and invalid the existence of Kuznets curve for deforestation; Nguyen and Azomahou (2003)

use a panel model in which they focus on spatial interactions of indicators of deforestation; with a sample of 85 developing countries (Africa, Latin America and Asia-Oceania) over the period 1961 to 1994, they show that per capita income growth rate has no relevant effect for all groups; the relationship between GDP and deforestation is "anti-Kuznets" i.e. U-shaped. In another study, the same authors introduce new variables such as access to information, political institutions and trade, use semiparametric models and invalide the hypothesis of Kuznets curve for biodiversity.

In addition to studies on forest biodiversity, literature is interested in biodiversity of animal species. Naidoo and Adamowicz (2001), McPherson and Nieswiadomy (2005) and Kerr and Currie (1995) analyze the relationship between economic growth and the number of endangered species; results are very mixed; while Naidoo and Adamowicz (2001) and McPherson and Nieswiadomy (2005) find evidence of EKC for mammals and birds threatened, Kerr and Currie (1995) identify a monotonic relationship where the rate of mammals and endangered birds decreases with economic growth. Dietz and Adger (2003) emphasize the disadvantage of using the number of threatened species as a measure of biodiversity loss; for them, the number of threatened species is a pressure indicator on biodiversity and not of biodiversity loss. Then they built a biodiversity proxy (species richness) using Arrhenius law[6] to estimate biodiversity loss. Their results show that there is no Kuznets curve for biodiversity; indeed the mechanism of species extinction is much faster than the renewal mechanism or creation of new species; there is no turning point in the relationship between biodiversity and per capita income. Biodiversity loss is essentially irreversible and monotonous. These results point in the same direction as those of Asafu-Adjaye (2003). Finally more recently, Mills and Waite (2009) re-analyze the data used by Dietz and Adger (2003) by using a quantile regression and a spatial filtering; their results argue the presence or absence of a proof of a Kuznets curve is an insubstantial and simplistic information to draw conclusions about income-biodiversity relationship. Therefore, they advocate further exploration to understand mechanisms by which income affects biodiversity; they discourage also the use of the hypothesis of a Kuznets curve for biodiversity in defining public policies for biodiversity conservation.

As it is clear from the literature review, results about Kuznets curve for biodiversity are mixed. Economic growth does not seem to be necessarily the solution of biodiversity loss. Also, note that the Kuznets curve for biodiversity is subject to the same criticism as environment: irreversibility, model specification, selection of indicators, simultaneity, etc. Otherwise environmental Kuznets curve hypothesis

[6] $S = cA^z$ with S: number of species, A forest area, c: constant reflecting the density of species per unit of area, z: slope of the relationship between S and A expressed in logarithm and its value range is 0.15 and 0.35.

assumes a perfect knowledge of "environmental good" or enough information to consumers to express their preferences; it is not the case for the good "biodiversity"; indeed, biodiversity remains somewhat appropriate and a distant concept of people's concerns. Besides, the scientific community has been really aware of the benefits of biodiversity and ecosystem services recently. Even though various regional and international agreements promote biodiversity protection, it still takes a lot of time for this to be apparent to many people. Today, biodiversity conservation is mainly through management of protected areas policy. We will describe the principles of this policy and discuss its effectiveness in Africa.

4 Biodiversity conservation policies in Africa

Protected areas are key elements of any strategy for biodiversity conservation of a country or region (Margules and Pressey, 2000; Doumenge et al., 2001); this is particularly true in Africa which is rich in biodiversity. According to the International Union for Conservation of Nature and Natural Resources (IUCN)[7], a protected area is:

> a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008).

It shows that a protected area (national parks, monuments, nature reserves, etc.) globally aims conservation of species and their genetic variability and thus first maintaining natural processes and ecosystems that sustain life. The "2014 United Nations List of Protected Areas" contains just over 209,000 protected areas with a total 3.4% of the world's marine area and 14% of the world's terrestrial, covering a total area of 32,8 million Km^2. On African continent in particular, protected areas represent 14 % of terrestrial areas and 2.4 % of marine areas; sites are generally very large and cover 15 % of the world's area protected (Deguignet et al., 2014). Biodiversity conservation in Africa is a priority[8]. Indeed the continent is a unique heritage for the future and many communities still rely on today. Africa remains one of the most important continents in experimentation of management models of conservation policies and wildlife; this has prompted creation of national

[7] Also, note that the IUCN brings together all protected areas into six management categories; these categories provide a kind of common language and framework for creation, planning and regulation of protected areas. The guidelines for applying protected area management categories are reported in Dudley (2008).

[8] For example, to enhance conservation in Africa, it was adopted in 2010, with the support of the Convention on diversity, a strategic plan on biological diversity 2011-2020 accompanied by 20 ambitious goals called "Aichi Targets".

parks and protected areas during and after colonization (Korahiré, 2009). In terms of planning, in the last two decades, biodiversity conservation policies in Africa have moved from "fortress conservation" approach to "new conservation" approach (Mengué-Medou, 2002; Guéneau and Jacobée, 2005; Hoon, 2008).

The "fortress conservation" was characterized by a monopoly control of central government, exclusion of local populations and prohibition of traditional uses of fauna and flora. Exclusion is done without subsidies, nor reciprocities or assistances to local people who derive most of their livelihoods from nature; local populations are considered a direct threat to maintaining biodiversity. So, they felt threatened and expropriation victims of their lands and rights (Nelson, 2004). The fortress approach is qualified "green imperialism" or "top-down" conservation; it resulted in a rift between environmentalists and local communities (Igoe, 2004); i.e. the creation of protected areas was done in pain. However, this approach was vigorously fought because he did not consider costs of damage caused to local communities (Hoon, 2008); restrictions aroused misunderstandings, revolts and predatory behaviors opposed to conservation (infiltration for farming, poaching, grazing of livestock.). There was a real conflict between conservation programs and the needs of local people. Tanzania's Tarangire National Park created in 1970 by central government in disregard of needs and culture of local Maasai people is an example; they are prohibited from accessing water sources and pasture land in game reserves. We can also mention the Djoudj National Bird Sanctuary in Senegal created in 1971 after evacuation of entire villages, the National Park Omo, one of the nine national parks Ethiopia whose boundaries and recovery in 2005 by private sector still threatens local populations (Triplet, 2009).

The "new conservation" or "community-based conservation", initiated in the late 80s and widely adopted in the 90s, is based on participation and strengthening capacity of local people in conservation objectives. According to Hulme and Murphree (1999), it involves transition from a centralized governance to a local participatory governance, a revision of the concept of conservation by taking into account the concept of sustainable development and finally the incorporation of liberal ideas and the use of market forces to finance conservation. It also emphasizes recognition of the rights of local communities without which achieving biodiversity conservation objectives would be difficult (Nelson, 2004). The participation of local communities through co-management becomes an institutional way of reconciling on one hand, people with environmentalists and on the other hand, conservation and development (Haller et al., 2008). Thus, many donors such as USAID, GTZ, World Bank and NGOs have funded integrated projects of conservation and development (or IPCDs) - such as ecotourism, exploration of biodiversity, extraction of non-timber forest products - initiated by local populations (Ferraro and Simpson, 2003). The Tafi Atome Monkey Sanctuary created in

Ghana in 1996 is a good example; the local communities work as tourist guides, shops owners, etc; many other projects IPCDs[9] were introduced in the early 1990s in Southern Africa, including Zimbabwe, Zambia, Namibia and Botswana[10]. However, although praised by ecologists and social scientists as the most accurate of the two conservation approaches, "community-based conservation" is severely criticized: low added value for local people, short-term vision, IPCDs worsen conservation problems because they generate new inhabitants and therefore population pressure and over-exploitation of resources, persistence of competition problems between hunting and agriculture, ambiguous effects on incentives for conservation, etc (Ferraro and Simpson, 2003; Guéneau and Jacobée, 2005).

In the 2000s, these criticisms have led to a resurgence of strict protectionist paradigm, similar to the fortress approach but specially an emergence of a new approach extending the new conservation concept and considering biodiversity as a merchant good (Conrad and Ferraro, 2001; Ferraro and Simpson, 2002, 2003); the idea is to offset the relative costs of conservation through direct aid to local people rather than encourage, through subsidies, alternative activities such as ecotourism (Guéneau and Jacobée, 2005). According to Ferraro and Simpson (2003), it is simply to encourage conservation by paying directly for "conservation performance"; direct payments have already been successfully tested in high-income countries. Obviously to be effective, direct transfers will exceed the benefits derived from the destruction of biodiversity; there would be a kind of "commodification" of biodiversity. In the literature, one talks about "market-oriented" conservation approach. Crook and Clapp (1998, 2002) emphasize that biodiversity loss is due to market failures problems; for them, effective conservation must be done through formalization and expansion of markets for biodiversity. Although the idea of direct payments is still hypothetical for protected areas planning in Africa, according to ICEM (2003) soon we'll see its implementation.

5 Concluding discussions

"Protected area" does not always mean "effective protection"; many protected areas are ineffective (Triplet, 2009); however, measuring the effectiveness of protected areas, especially in Africa, can be a quite complex task because of many factors

[9]Some agencies or authors prefer speaking more generally about projects or programs Community based-natural resources management (CBNRM) or Wildlife community management (WCM) (Hughes and Flintan, 2001). IPCDs projects must be financially attractive to local communities, economically viable for nations and reasonable for donors (Barnes et al., 2002).

[10]The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe, the Luangwa Integradted Resources Development Project (LIRDP) in Zambia, the Tribal Grazing Land Policy (TGLP) in Botswana (Hoon, 2008) and CBNRM initiatives in Namibia.

that may be taken into account. In our view, three essential points to be taken into account to improve their effectiveness: integration of economic aspects of conservation, increased financial incentives and operationalization of the institutional and legal framework of conservation plans.

Recent literature explicitly states that the economic aspects often have been ignored in the methods for identifying priorities of diversity conservation (Naidoo et al., 2006; Adams et al., 2010; Chiozza et al., 2010). Indeed, systematic conservation planning has long been the preserve of biologists and ecologists; they often ignore the trade-off between costs and benefits of conservation in the analysis of effectiveness of policy (Hauer et al., 2010). Furthermore, most of African countries suffer from lack of spatial economic informations for the analysis. Yet, integration of conservation costs including opportunity cost[11] are important and affect conservation policies results. For example Chiozza et al. (2010) show that integrate opportunity costs in conservation planning allow to identify sites to be added to existing sites in achieving objective of protecting mammals and amphibians in Uganda and also to reduce conflicts between economic development and conservation. The analysis of effectiveness of conservation policies needs a monetary valuation of benefits and costs; the quantification task is not always easy despite several methods developed in environmental economics. Then, authors such as Norton-Griffiths and Southey (1995), Ferraro and Simpson (2002), Barnes et al. (2002), Lindsey et al. (2005), Siikamäki and Layton (2006) and Chiozza et al. (2010) use a cost-effectiveness analysis instead a cost-benefit analysis. For example Norton-Griffiths and Southey (1995) use approximations and show that the net profit of conservation in Kenya is below its opportunity cost; in other words, there is a competition between alternative activities and biodiversity conservation, and when demand for alternative uses is very high, it raises questions about relevance of creation mechanisms for protected areas. Thus it is clear that costs of conservation should be integrated early in planning process.

At the institutional and legal level, most African countries have a satisfactory framework[12] for protected areas. However, despite abundance of laws and institutions, the framework is often ineffective and less strictly enforced for management of protected areas, and especially when there are economic interests. Pearce (2007) rightly points that the most biodiversity-rich countries are the same which have poor governance and high levels of corruption; for example, a study

[11] When you decide to create protected area, you exclude and restrict immediately the use of the site for profitable alternative economic activities. The net profits of the most cost-effective alternative activity represent the opportunity cost of the conservation project (Barton et al., 2013); in addition to opportunity costs, one includes acquisition costs, management costs, transaction costs, damage costs.

[12] Some countries like Ghana and Burkina Faso have even registered conservation priorities of nature in their Constitution.

of UICN/PACO (2012) on actors and governances of protected areas in West Africa shows that the types of "official" governance[13] formalized by laws and regulations are really in inadequacy with daily practice. While we strongly advocates involvement of local communities in management and decision-making, we find that the management is still centralized by public authorities with insufficient resources. It also requires that creation mechanisms for protected areas, taking into account the dual objective of conservation and local socio-economic development, are supervised by laws and regulations[14] to avoid past mistakes[15]. Moreover, the institutional framework must favor environmental collective awareness of African people and their policy-makers; it must also support public-private collaboration and political stability for biodiversity conservation.

The last aspect of our thinking is related to the funding of conservation. Funding opportunities provided by law in each African country remain below the real needs for protected areas. According to Nelson (2004), many countries spend less than 20% of annual investment needed for efficient conservation. The lack of funding to cover the costs of biodiversity conservation is one of the main factors limiting efficiency. The use of markets of environmental services to improve private sector contribution to conservation and the establishment of permanent funds may be ways to remedy this problem; a depth reflection on direct payments should be seriously considered.

To conclude, note that the literature does neither invalidate nor confirm the existence of a Kuznets curve for biodiversity. Thus, economic growth is far from being systematic solution to biodiversity loss. However, the effort of conservation is not zero but is characterized by proactive conservation policies such as protection of areas around the world and especially in Africa, a continent rich in biodiversity. Although the effectiveness of protected areas in Africa is often questioned, they continue to play a key role in biodiversity conservation; considering the above reflections will undoubtedly help improve their efficiency. Moreover, further research on the determinants of conservation effort will provide essential informations to analyze the sustainability of protected areas and local economic development.

[13]IUCN recognizes four types of governance or structures of management of decision power about protected area: governance by government, by cooperative arrangements, by private entities and finally by local communities (Dudley, 2008). These four "official" types of governance are represented in Africa.

[14]Increasingly, one favors legislation when creation of protected areas is for nations; it is the case in Burkina Faso and Ivory Coast (UICN/PACO, 2010)

[15]Indeed, Mengué-Medou (2002) and Guéneau and Jacobée (2005) argued that some protected areas in Africa are created not on ecological considerations but economic and political or simply because lands consist only of little interest for other uses (i.e. landlocked areas or areas serving as refuges for emblematic species). Also, there are protected areas that are only created on paper but not physically (Triplet, 2009).

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