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**Panel Session - Rethinking Capabilities: Sustainability and Social Innovation**

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**Innovating in the Link between Strong Sustainability and the Capability Approach:  
The role of Critical Natural Capital in Human Development**

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**ABSTRACT**

Sen's Capability Approach has radically re-oriented the vision of development, from the obsession of an aggregate, ill-defined level of wealth towards a rigorously defined notion of freedom that builds on the ideals of social justice and human dignity. His recent book on the *Idea of Justice* (2009) opens new insight on how to integrate environmental concern in the Capability Approach, going further than his previous writings and speeches (Sen 2000). However, it still suffers from several weaknesses related to the definition of sustainability. Sustainability is usually considered in two ways by making a distinction between “weak” and “strong” sustainability. Weak sustainability is built on the assumption that the various forms of capital whether financial, physical, natural, social, etc., are substitutable. Strong sustainability rejects this substitutability holding that there are dimensions of natural capital which are critical and their depletion cannot be compensated, therefore jeopardizing growth. In his writings, A.Sen is quite ambiguous, oscillating between weak and strong sustainability, making it hard to think about human development in a truly sustainable way.

This paper is a proposal to fill this gap and build a clear concern regarding the integration of the ecological dimension within the Capability Approach. It aims at crossing the Capability Approach (and more largely Human Development) with the Critical Natural Capital theory (CNC) based on strong sustainability. CNC theory stemmed from Ecological Economics and advocates for a social definition of “criticality” based on relevant thresholds. CNC is a subset of natural capital which, at a prescribed geographical scale, performs the ecosystem services that are essential for human well-being and for which there are no substitute possible. Therefore, the loss of dimension of such capital would conduct to irreversible situation. However, the criticality of natural capital is related to the standards of living and relative affluence of particular group,

region or nation. Therefore, what is felt to be an intolerable loss of capital has to be decided through social and political consensus. In that way, the Capability Approach could provide an innovative frame to the CNC theory in order to ensure consistency with the objective of strong sustainability.

The paper discusses four points. First, capability can be considered as the hybrid result of nature (natural resources submitted to critical constraints) and society (social and economic opportunities). The use of relevant conversion factor could contribute to the setting up of a balance co-evolution between human dimensions and natural or living organisms

Second, CNC determines those ecosystem services which are essential for the people's functionings. Therefore, it has to be taken into account when addressing the range of human freedoms required for human development.

Third, through the achievement of their functionings, people have an impact, positive or negative, on the habitat. Non-sustainable achievements would gradually jeopardise natural capital. Some minimum thresholds have to be set up to delineate the critical range of natural capital. If not there is a risk for a socio-ecological crisis that will generate harmful consequences on the people's freedoms.

Fourth, the Capability Approach, and through it Human Development, can help to better delineate for whom and for what use natural capital would become critical. By this way, providing a definition of strong sustainability where the crossing of Sen's Capability Approach with the Critical Natural Capital theory would constitute the foundations for research on sustainable human development.

**Keywords:** Sustainable Human Development, Capability Approach, Strong Sustainability, Critical Natural Capital, Ecosystem Services.

## INTRODUCTION

More than twenty years after the Brundtland report (WCED 1987) and the Rio Earth Summit (1992), Ecological economics scarcely addresses the global issue of Human Development, while, in the meantime, Sen himself does not fully address ecological and environmental issues in his view of the Capability Approach and Human Development (Sen 2009). The literatures of these two streams of thought have long been disconnected (Neumayer 2010).

However, scholars from both Ecological Economics (Dodds 1997, Lethonen 2004, Sneddon et al. 2006) and Human Development (Neumayer 2010) have claimed to establish a dialogue. According to Lethonen (2004, p.204) *"A marriage between the capability approach and the one based on environmental functions might hence provide ideas for analysing the environmental-social interface"*. On the one hand, the Capability

Approach (CA) provides, according to Dodds (1997), a comprehensive philosophical view of human well-being. *"In Sen, one can see a way to radically alter the global orientation of development, away from its obsession of an aggregate, ill-defined wealth, towards a rigorously defined notion of freedom that builds on ideals of social justice and human dignity"* (Sneddon et al. 2006, p.262). However, if Sen provides a sophisticated explanation of the role of resources, goods and services, in achieving well-being, his approach suffers a lack of concern with ecological constraints and environmental sustainability (Lessman, 2011).

On the other hand, ecological economics, through its Critical Natural Capital (CNC) theory, provides the foundations for considering sustainability in a "strong" perspective (see *Ecological Economics* No. 44, 2003). In ecological economics, the economic dimension is considered as embedded in the ecosystem. This is the case when dealing with a structure of property rights on environmental resources and services, with the social distribution of power and income, with gender issues and social class or caste (Martinez-Alier 2001). Ecological economics, differently from mainstream economics, influenced by the neoclassical school, is interested in the human-nature interaction, and in justice over time (Faber 2008). Some scholars prefer to speak of sustainability economics (Baumgartner and Quaas 2010). They have noted that ecological economics still continues to use the tools inherited from mainstream economics (like rational model of behaviour, marginal cost and benefit analysis, self-ruled markets, contingent valuation, etc.) which may lead to an inappropriate vision of well-being inconsistent with the goal of ecological economics (Gowdy and Erikson 2005).

When analyzing the benefits and limits of the two approaches, it appears that an appropriate combination of CA and CNC could bring new insights for the analysis of human-environment interacting system. It will help addressing questions on how and to what extent is human being free, how one could conceptualize the instrumental and intrinsic role of nature, how can human beings preserve and protect nature, etc. (Baumgartner and Quaas 2010). On the one hand, CNC could be related to the CA to make it more consistent with environmental sustainability, particularly "strong" sustainability. On the other hand, CA, which offers a pragmatic and contextual approach for well-being and justice related to social choice, could be linked to the CNC theory in order to provide a social and contextual definition of criticality. The paper debates of the consequences of relating the CA to the CNC theory, and, more generally, bridging Human development and Ecological economics.

It discusses four points. First, capability can be considered as the hybrid result of nature (natural resources submitted to critical constraints) and society (social and economic opportunities). The use of relevant conversion factor could contribute to the setting up of a balance co-evolution between human dimensions and natural or living organisms. Second, CNC determines those ecosystem services which are essential for the people's functionings. Therefore, it has to be taken into account when addressing the range of human freedoms required for human development.

Third, through the achievement of their functionings, people have an impact, positive or negative, on the habitat. Non-sustainable achievements would gradually jeopardise natural capital. Some minimum thresholds have to be set up to delineate the critical range of natural capital. If not there is a risk for a socio-ecological crisis that will generate harmful consequences on the people's freedoms. Fourth, the Capability Approach, and through it Human Development, can help to better delineate for whom and for what use natural capital would become critical. By this way, providing a definition of strong sustainability where the crossing of Sen's Capability Approach with the Critical Natural Capital theory would constitute the foundations for research on sustainable human development.

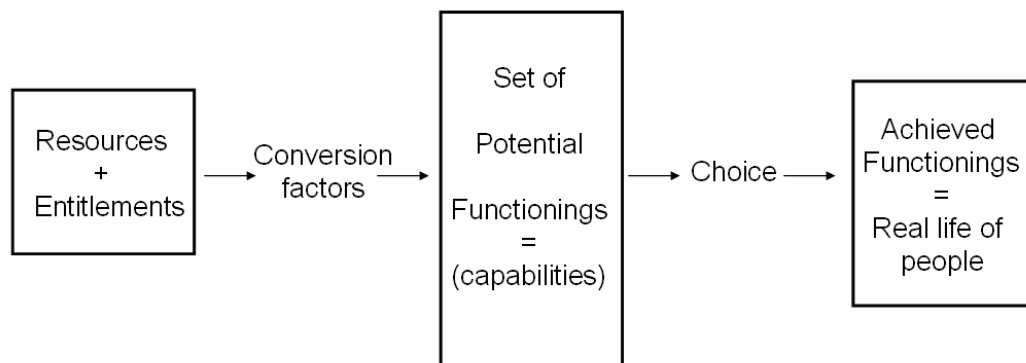
## **1. The Capability Approach and the Critical Natural Capital Theory: Insights and Limits**

### **1.1. The Capability Approach**

#### **1.1.1. Presentation**

*"Usually, the progress of societies is measured mainly by the Gross Domestic Product per capita and the growth of the economy, not by improvements in people's well-being"* (Alkire 2010, p.38). In order to shift from this reductionist view of welfare, Sen has proposed the "capability approach" which is based on the freedoms to choose in order to ensure well-being. Well-being is less a matter of accumulating goods than what a person is able (or free) to do or to become, with the use of these goods. Development can be seen as *"a process of expending the real freedom that people enjoy"* (Sen 1999, p.3). These freedoms are considered as both the "ends" and the "means" of development (Sen 1999, preface XII). They allow individuals to become the main drivers of their 'human development' by becoming an 'agent' capable to change their situation, and the situation of others, then expressing their capability. Indeed, capabilities express the various possibilities (i.e the potential functionings) a person can choose, according to his/her values, to achieve expected life-styles (Sen 1992, 1999). Functionings are the actual achievements of a person, i.e. *"what a person is succeeding in doing or being"* (Sen 1987, p.19). The set of achieved functionings represents the real life of people. Functionings can be elementary, and related to nutrition, health, life expectancy, or more complex such as *"taking part in the life of the community and having self-respect"* (Sen 1999 p.75). The following figure, adapted from Robeyns 2005, Bonvin and Farvaque 2008, illustrates the logical pattern of the Capability Approach.

**Figure 1: The logical pattern of the capability approach**



As the figure shows, the CA puts the light on the ontological roots of the well-being, i.e. resources, entitlements and conversion factors, which are needed by the people to build their capabilities. Resources include endowment (assets, commodities, income...), entitlements as rights (i.e. a granted access to resources that could be converted into capability and a real possibility of using rights)<sup>1</sup>. In addition, Sen noticed that people and societies typically differ in their capacity to convert resources into functionings. The people's capacity to convert is relying on internal conversion factors, referring to personal characteristics (i.e. physical and psychological characteristics, human capital, experience...) and external conversion factors referring to the social context (institutions, customs, public goods,...) and environmental conditions (climate variations, river flow variations,...). It is important to note that, while capability is related to the freedom of choice, functionings are related to well-being achievement. Thus, the capability concept is operated through a notion of freedom (i.e. positive freedom) which enables to encompass both potential and achieved choices (Reboud 2008). Indeed, by making the difference between potential and achieved functionings, it is possible to highlight a person's true range of choice (e.g. making the difference between having unsustainable use of natural resources because of no other option, or because of a deliberate choice)<sup>2</sup>. By this way it is possible to understand the capability limits the people encounter when trying to improve their well-being. For instance, a person who values the functioning "rapid mobility" needs: first, resources like a bike or a car, or income for public transportation; second, to be entitled to use it by having a granted access to this resource (through valid driving licence, not being discriminated as a woman...); third, to know how to use this resource (it concerns human capital, i.e. to know how to drive a bike or a car, how to take

<sup>1</sup> Sen observed that the famines, which occurred in India during the 70's, were not the result of insufficient food production but a problem of access to this food: formal rights like selling his working force, or selling his own production on markets, or buying food on market, were not operating anymore.

<sup>2</sup> According to Levrel (2003), poor do not have the opportunity to choose a sustainable use of their resources: they don't have the capability. Therefore, extreme poverty makes it difficult for a person to choose sustainable strategies to protect biodiversity, even if implies functionings that he/she values the most (Duraiappah 1998).

public transportation); fourth, to be in good physical condition (an internal conversion factors), and, at least, some external conversion factors like available roads or usable tracks, indicated pathways... It is, only if the functioning could be achievable, that it will be considered as a potential functioning. Then the person will choose among a set of potential functionings (i.e. a vector) those which could be achieved (taking a bus or a car) according to his values, means and opportunities. All the potential functionings a person could achieve constitutes his/her set of capabilities. Therefore, the feasibility of functionings of a person depends on: (a) resources and entitlements, (b) the set of (individual) conversion functions, (c) social and economic opportunities, (d) the person's values.

### **1.1.2. From Capability Approach to Human Development**

Human development does not specify who decides what people 'have reason to value' in each context but it does create the space to discuss this issue. For example, if people do not value an outcome, then human development has not occurred (Alkire 2010). So, finally capabilities and functionings are beings and doings people have reason to value. Functionings are related to well-being achievement and capability is related to the freedom of choice to achieve well-being. In this view acting freely and being able to choose are directly conducive to well-being (Sen 1992). Thus poverty can be defined as a lack of choice (and not anymore in monetary terms), when achieved functionings are equal to potential functionings. Poverty understood as a lack of choice can be relevant for human development assessment both in northern and southern countries (see PNUD).

The capabilities set give information about the vectors of functionings reachable by a given person and this information is important whatever the definition of the social well-being. According to Sen (1999 p.253) *"through informational broadening-- by shifting from individual preferences to capabilities -- it is possible to have consistent and coherent criteria for social and economic assessment"*. Therefore, agreed social concerns can emerge and partial agreements are sufficient to identify alternatives accepted by every stakeholder without requiring complete ranking of all individual preferences<sup>3</sup>. In *The Idea of Justice* Sen (2009, chap. 4 and 15) goes further advocating for a pragmatic, contextual approach of justice based on public reasoning and capabilities as informational basis, taking into account pluralities of values, and operated through democracy<sup>4</sup> understood as "government by discussion".

To sum up, the CA gives a more sophisticated explanation of the role of resources, goods and services, in achieving well-being and relates it to general theory of social choice. However, Sen's approach suffers of a lack of environmental concerns like any

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<sup>3</sup> In other words, it is much more relevant to conceive building of collective preference through a process of interaction between heterogeneous preferences rather than by their aggregation (Levrel 2006).

<sup>4</sup> Sen (2009) adds that democracy must also be seen more generally in terms of the capacity to enrich reasoned engagement by enhancing informational availability and the feasibility of interactive discussions.

other traditional economic approaches. He has not seen the particular features of ecosystem services (Sneddon et al. 2005, Lessman 2011) and the consequences on sustainability. The next paragraph will be dedicated to the presentation of strong sustainability and its core component CNC, which constitutes, as we will see in the second part, the framework in which Sen's approach, and more broadly, human development should be embedded.

## **1.2. Critical Natural Capital Theory and Strong Sustainability**

### **1.2.1. Reference to Strong Sustainability**

In a neo-classical economic approach, the sustainability debate is reduced to a mere question of substitutability between natural and man-made capitals; there is no concern for the complex interplay between economic, socio-cultural and ecological systems (Chiesura and De Groot 2003). On the contrary strong sustainability approach, which derives from a different perception that substitutability of manufactured for natural capital is seriously limited by such environmental characteristics as irreversibility, uncertainty and the existence of 'critical' components of natural capital, which make a unique contribution to welfare (Ekins et al 2003). In this view, natural capital is more as complementary to man made capital rather than substitutable. Natural capital has to be understood as a metaphor to indicate the importance of elements of nature (e.g. minerals, ecosystems and ecosystem processes) to human society. CN should not be considered as a simple stock of natural resources but as a set of complex systems compounded of biotic and abiotic evolving elements of which interactions determine the ecosystems' capacity to provide directly or/and indirectly a wide array of functions and services to human society (De Groot et al. 2003, Brand 2009). In this respect, Critical Natural Capital is in fact considered as a subset of natural capital which, at a prescribed geographical scale, performs essential ecosystem functions and services for well being of present and future generations, for which no substitute in terms of other type of capital currently exist and the loss of which would be irreversible (entailing very large costs) provoking socio-ecological crisis (Dodds 1997, Noel and O'Connor 1998, Ekins 2003, Ekins et al 2003, Chiesura and De Groot 2003, De Groot et al 2003, Levrel 2006, Brand 2009). Some authors talk about environmental functions other of ecosystem services (ES). The word 'function' is being used, namely to indicate some capacity or capability of the ecosystem to do something that is potentially useful to people (Haines-Young and Potschin 2010) and ecosystem services as are understood here as aspects of ecosystems utilized (actively or passively) to produce human well-being (Fisher et al. 2009). The functions or processes become services if there are humans that benefit from them. Without human beneficiaries they are not services (Fisher et al. 2009). Defining what constitutes an ecosystem function or service, an understanding of spatial context (geographical location), societal choices and values (both monetary and non-monetary) is as important, as knowledge about the structure and dynamics of ecological systems themselves (Haines-Young and Potschin 2010). We will not going into details here in the distinction between functions and services and we will talk only about ecosystem services



for simplification. However, it is necessary to distinguish supporting service (corresponding to function “of” natural capital, or “indirect services”) from the other ones. They correspond to the basic processes and cycles in the internal functioning of natural systems, which are responsible for sustaining and maintaining the stability and resilience of ecosystems and which provide a habitat for all living organisms including human being (Ekins et al 2003). Three category of direct services are acknowledged by MEA as provisioning services (food, drinking water, fuel wood, fiber, etc.), regulation services (water and air quality, climate and pest regulation, pollination, regulation of erosion etc..) and cultural services (recreation, tourism, aesthetic inspiration...). Therefore, ecological services (ES) range from the very sustenance of basic biophysical conditions (supporting, regulation, provisioning services or source, production functions) to the provision of opportunities to recreate, learn and experience ‘higher’ feelings (cultural services or information and scenery functions) (Noel and O’Connor 1998, De Groot 1992, De Groot et al. 2002 and 2006, Douguet and O’Connor 2003, Chiesura and De Groot 2003, MEA 2003 and 2005, Ekins et al. 2003). In terms of scientific methodology, strong sustainability is to be greatly preferred as the a priori position of full substitutability of natural capital which for two reasons appears improbable (Ekins et al. 2003). First, the destruction of manufactured capital is very rarely irreversible whereas irreversibility, with such effects as species extinction, climate change or even the combustion of fossil fuels, is common in the consumption of natural capital. Second, moreover, to the extent that manufactured capital requires natural capital for its production, it can never be a complete substitute for biophysical elements and structures of natural capital.

### **1.2.2. Criticality as a Social Consensus**

According to Brand (2009) there is immense conceptual confusion around the CNC because it is controversial which measure would be appropriate to reflect or mirror ‘criticality’ (e.g. ecological importance, economic value, socio-cultural landscape...). Nevertheless, criticality of natural capital is dependent on the level of technology and values put forward by the society (Ekins et al. 2003, Chiesura and De Groot 2003). Then no need it be assumed that all environmental functions are so important for human welfare that they must be maintained. Some assessment must be made of those functions that play a particularly important role in life support and human welfare, and policy for sustainability must be geared towards these. Indeed, in many cases, what counts as an ‘unsustainable effect’ rather than a sustainable economic cost is a matter of judgement which can only partially be resolved by science. Ethics and the attitude to risk also play a significant role here. Moreover many environmental problems are characterized by fluid and incomplete state of scientific knowledge, accompanied by the inherent unpredictabilities of complex systems (Noel and O’Connor 1998, Ekins et al. 2003). Consequently, determination of criticality depends on ecological, as well as economic, political and social criteria and critical levels depend not only on ecological standards, but are also related to standards of living and relative affluence of a particular group, region or nation (De Groot et al. 2003). Therefore, what constitutes an intolerable loss hence, what is critical, is to be decided by social or political consensus. Although strong

sustainability recognizes nature as a distinct, even critical, sort of capital (which makes it already more consistent with sustainability requirements) it remains somehow abstract and difficult to operationalize. Concepts such as 'non-substitutable' or 'irreplaceable' raise fundamental questions like: Irreplaceable for what? And for whom? (Chiesura and De Groot 2003).

Ekins et al. (2003) give as a conclusion of the European CRITINK project, that is not possible to identify CNC as particular elements of natural capital but that it has to be identified through environmental functions i.e. ecosystem services it provides. Therefore, methods for identifying who benefits from ecosystem services are needed. Without this information, we risk creating or exacerbating existing social inequities with policy incentives (Daily et al. 2009). In addition, to build the credibility of ecosystem service approaches a grasp of the decision-making processes of individual stakeholders is needed (ibid). According to Carpenter et al. (2008) the fundamental challenge to go beyond MA is to understand the dynamics of ecosystem services and human well-being raising, among others, emblematic questions such as: How changing flows of ecosystem services affect the most vulnerable members of society? What mixes of ecosystem services do people prefer? How do human choices and actions affect local flows of ecosystem services? However, only a few publications exist that link sustainability and personal decision making (Rauchmayer et al. 2011) and, as we saw in the introduction, ecological economics still largely operates with inherited tools (homo economicus behaviour, self-ruled markets, marginal cost and benefit analysis, etc.) from mainstream economics (Gowdy and Mayumi 2001, Gowdy and Erikson 2005). That constitutes a major break to CNC definition and operationalization not allowing to well understand for what and whom natural capital could critical neither the dynamics of ecosystem services and human well-being. We assume that crossing CNC theory and Sen's capability approach could help addressing these questions but it is first necessary to integrate an ecological dimension in the Sen's approach. We will see in the next part how it is possible to do so, thanks to the CNC framework.

## **2. Integrating the Ecological Dimension within the Capability Approach**

### **2.1. Capability Approach, Human Development and Sustainability**

If the CA provide sound based underpinnings for "human development" by reconciling the economic and social dimensions, it does not make a space for environment as defined in the the CNC theory. Sneddon et al. (2006, p.262) note *"If there is one noticeable gap in Sen's analysis, it is a lack of concern with the environment and ecological changes"*. According to Flippo (2005), in his approach, Sen conceives the Nature in the same way as neoclassical economics does i.e. passive, inert, stable, guaranteed. Hence, in the Sen's perspective, human beings are the only "agent" of freedom expansion or restriction. Therefore, freedom expansion is only blocked by a lack of ingeniousness or cooperation of Human beings. The absence of a clear ecological concern in the Sen's approach does not enable to assess well-being in a fully sustainable

way. Sen has never pronounced it self clearly on the style of sustainability should be promote staying ambiguous in his writings oscillating between on strong and weak sustainability (Neumayer 2010). In his last book, Sen still advocates for Solow<sup>5</sup> formulation of sustainability (i.e. a “weak” perspective) but with an important modification saying that *“in particular , sustaining living standards is not the same thing as sustaining people's freedom and capability to have –and safeguard-what they value and have reason to attach importance to”* (Sen 2009, p.250). He gives the example of preservation of the spotted owl for reasons that have nothing much to do with human living standards but he did not explain those reasons.

For the first time in twenty years of existence the 2010 definition of human development recognized the ecological dimension defining human development as *“the expansion of people's freedoms – the worthwhile capabilities people value – and to empower people to engage actively in development processes, on a shared planet”* (Alkire 2010, p.40). It is noted, under the above cited definition, that *“Human Development is development by the people of the people and for the people.”* The first phrase could be very useful, as we will see in part 5, for the CNC social definition, but the second sentence corroborate Flipo's above statement (in thought of human development scholars people are the only means of capabilities). To our mind it would be necessary in order to make human development sustainable to add “human development is development by the people of the people and for the people with and within Nature”. As we saw natural capital is not fully substitutable by another type of capital and provides many ES. As many studies showed (MA the most acknowledge) *“all people—rich and poor; living in developing or developed countries—depend on ecosystem services for their well-being”* (UNEP 2005, p.10).

## **2.2. The Capability Approach and Ecosystem Services**

According to Lessman (2011), the CA offers some possibilities to take ES into account. Provisioning service could be taken into account by the world “resource” (production of food, collection of food or fuel wood medicine plants etc... for consumption or income). Regulation services could be both “conversion factor” (climate regulation, water regulation for irrigation etc) and “resource” as public good (air quality, public good). Cultural service could be eluded by the CA (e.g. through “being” functioning when achieved confers “identity”) but not in a uniform and systematic way. In brief the “production” of capability and the role of ecosystem services has yet to be explored.

As we already saw in the CNC presentation part, ES range from the very sustenance of basic biophysical conditions (supporting, regulation, provisioning services) to the provision of opportunities to recreate, learn and experience ‘higher’ feelings (cultural services). If the first provide the basic requirements for the very existence of human life, the second

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<sup>5</sup> Solow's sees sustainability as the required resources that must be left to the next generation in order to achieve a standard of living at least as good as our own generation and to look similarly for the generation after next (Sen, *The Idea of Justice* 2009, p.250).

contributes to making it worthy to be lived (Chiesura and De Groot 2003). From the above, it is clear that ES fulfil not only the basic physiological needs (clean air, water, food etc.), but also economic and social functions, through their critical contribution to human well-being both at the personal (freedom, self-development, recreation, psycho/physical health, etc.) and at the collective (social contacts, norms and values, ethics, ideals, cultural identity, etc.) levels. *"It is interesting to note the resemblance of Sen's approach with the function-based approach used by some ecological economists to define what is often called critical natural capital"* (Lethonen 2004, p. 204). Indeed, the above examples of ES contribution to human well being echo Sen's definition of functionings (to be well nourished, to take part in the community etc...). Therefore, it can be state that ES constitute essential inputs for many functionings required by human development. Clearly some minimum configuration of structure and process is required for 'healthy' functioning and service provision (Fisher et al. 2009). This 'infrastructure' has value in the sense that its prior existence and maintenance is necessary for service provision, and is therefore a service in itself (ibid). *Humanity's primary dependence on the 'functions of' "life support" functions or "supporting" services of natural capital reflects the fact that, however they may perceive themselves, humans are a part of, and not apart from, nature* (Ekins et al. 2003 p.170). But there is no space in Sen's approach to reflect this idea. It is, hence, necessary to do so framing the CA into the CNC theory.

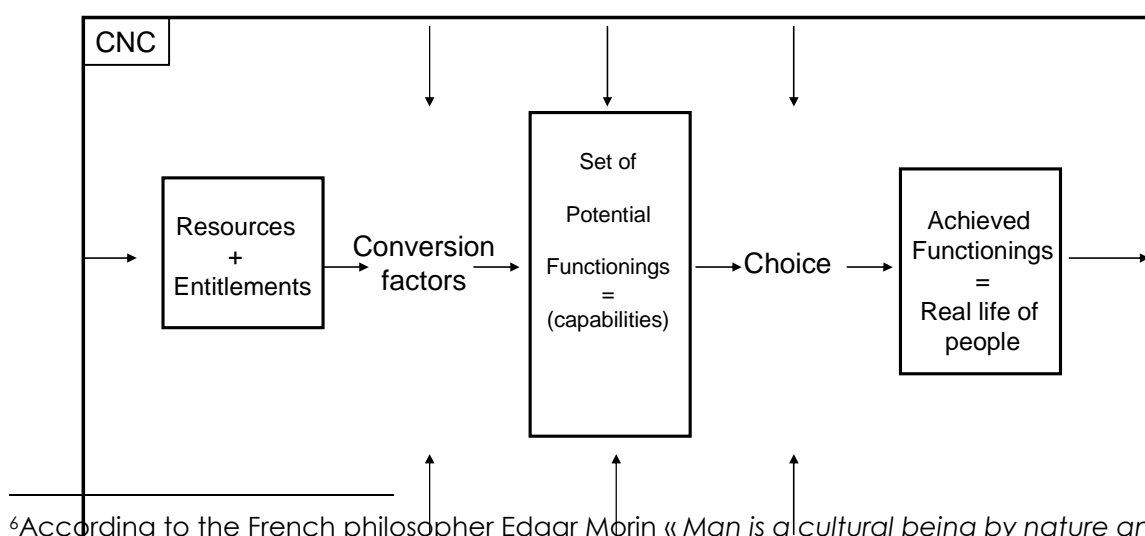
### **2.3. Critical Natural Capital as an Arena for Human Development**

Sen made a move forward the environment in his last book recognising for the first time that it also provides opportunities to people. For Sen, the environment is not only a matter of passive conservation of pre existing natural conditions since it can also include the results of human creation. For him development is fundamentally an empowering process and this power can be used to preserve and enrich the environment and not only to decimate it. However, Sen does not specify that human activity cannot be viewed as external to ecosystems and that human creation at the end depend on nature as it is showed by the CNC theory. Drawing on this basis we will go further in the integration of an ecological dimension in the CA. According to D. Harvey *"Human beings, like all other organisms, are 'active subjects transforming nature according to its laws' and are always in the course of adapting to the ecosystems they themselves construct* (p28, 1993). Human societies produce nature as much as nature shapes human societies. Therefore, it is much more relevant thinking the transformation of a particular ecosystem in terms of changing forms of social organizations that produced it rather than defend the rights of a hypothetical mother earth (Harvey, 1993) or preserving particular species *for reason that go beyond living standards* as in Sen given example of spotted owl. *It is, in practice, hard to see where 'society' begins and 'nature' ends* (Harvey 1993, p.33) because *"human beings are part of Nature from which they draw a part of their being and their effective capacities of action"* (Flippo 2005, p.73, Morin 1973, p.100). This sentence could also be a definition of what is a "capability" and illustrates the fact that "capability" could be

considered as a hybrid product of Nature and Society<sup>6</sup>. But the existence of capability requires the existence and the maintenance of natural activity about which, in order to avoid provoking harmful consequences on people's freedom, human must pay attention (Flipo 2005, Ekins 2003). The CNC (identified through the ES it provides) thus constitutes the ecological foundations of capabilities. The size and quality of the CNC is hence directly related to the real freedom that people enjoy. That is why capability achievement or improvement can not be done, to some extent (defining CNC through an open and participatory process), without taking into account this ecological dimension. Furthermore, a just social order includes the stipulation that it preserves itself and the natural foundations of its existence (Faber 2008). Going further than minimum thresholds which delineate the critical facet of natural capital would involve socio-ecological crisis provoking harmful consequences on people freedom. Considering CNC as human society's habitats and as a source of crucial elements (ES) for essential capabilities involves that conservation and enhancement of the availability and quality of the CNC (and ES) should also be regarded as a goal for a "development as freedom". The degree of sustainability of conversion of the CNC elements (i.e. ES) into achieved functionings becomes a major issue for human development.

The pattern bellow tries to catch up the three following ideas. First, there is the fact that the CNC provides ES which are essential elements for those functionings required by human development and, consequently, have to be considered when determining people's capabilities. Second, when a person achieves a functioning, this will have an impact on the CNC, structuring or modelling by this way his habitat. Third, it reflects the primary dependency of human beings on the CNC as an arena for action and co-evolution with other living organisms. By this way, we integrate the ecological dimension within Sen's capability approach.

**Figure 2: Sen's equation of well-being framed within critical natural capital**



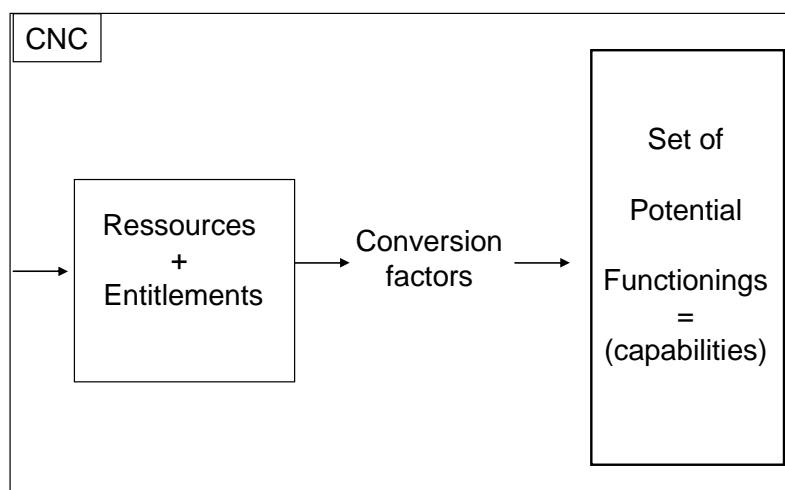
<sup>6</sup>According to the French philosopher Edgar Morin « Man is a cultural being by nature and a natural being by culture (Morin *The Paradigm Lost* 1973, p. 100).

### 3. Making the CNC Theory more Consistent with Social and Individual Concerns through the Capability Approach

#### 3.1. Well-being and Ecosystem Services

We have demonstrated in the previous part how the environment provides essential elements for capability production. This part is dedicated to the illustration of how applying the CA reasoning to ES could help to better comprehend individual well being concerns in the CNC theory. As it was noted by several authors (De Groot et al 2003, Ballet et al. 2005, Dubois 2009), it is essential to address not only the ecological, but also the socio-cultural and the economic dimensions if we are to achieve sustainable use of our (critical) natural capital. In addition, Carpenter et al (2008) claimed that research is needed to understand the effect of changes in ecosystem services on wealth and poverty. Well being is often measured in terms of income and poverty is frequently quantified by using the poverty line expressing the minimum income required to purchase a person's basic nutritional needs. However, ES are often outside the market economy, affecting human well-being in multidimensional ways (Carpenter et al 2008). As we saw, the CA gives a more complex explanation of the role of goods and services in achieving well-being. So we could apply it to the CNC in order to better explore links between ES and well being i.e. to which limits people are exposed to draw functioning from CNC. If the Millennium Ecosystem Assessment defines Ecosystem Services as "the benefits that people obtain from ecosystems", we can see on the light of Capability Approach, that these benefits are not direct or automatic. The following figure highlights the fact that to draw capabilities from ES (or CNC) people need resources, entitlement and finally conversion factors (internal and external). Applying CA reasoning to CNC provides an interesting lens to address inequalities of opportunities drawn from ecosystems as it is detailed in paragraph c, but first we illustrate the above reasoning through three examples.

**Figure 3:  
approach  
to critical**



**The capability  
reasoning applied  
natural capital**

### 3.2. Some Instances

Living nearby a forest is not sufficient to truly derive well being from it. For a person who values the functioning "walking into the forest for recreation", the existence of a forest which can deliver the recreation services is an absolute pre requisite but it is not sufficient to derive well being from it. Indeed, this person needs some **resources** e.g. means of transportation to get there like a car or bike, sufficient income to take public transportation, sufficient income to pay the forest entrance fees, appropriate clothes, some free time to envisage this walk... He also needs to be **entitled** to these resources and to the forest (to have a granted access to it ...). If we are now looking at **internal conversion factors** it is necessary to be educated, informed or have already experienced the well being which could be derived from a walk, to be good health condition... At the end people need **external conversion factors** as roads and tracks, existence of public transportation, signs and indicated pathway to do not get lost in the forest, favourable cultural context ....For example in Fontainebleau which is the biggest forest area of Paris region, one of the richest in terms of biodiversity in France and now recognised as biosphere reserve by the Unesco, Poor people won't go into in the forest even if they live at the edge because enjoying the forest according to them is not a type of leisure for their social class (Kalaora 1993) . We don't want them to go into the forest because people have their reasons but it is just to highlight that living within a rich natural capital area does not mean you can benefit from it.

We now take the air quality regulation service as an example which appears as a free public good. To breath, people do not need resources neither to be entitled, but depending on one's internal factors, an asthmatic person will not be able to draw the same capabilities from low air quality that a non asthmatic person could.

If we take the example of a person who would like to derive some well being from provisioning service through food production for consumption or income his capability will depend on his resources, entitlements and conversion factors. At first is coming the issue of entitlements, i.e. distribution of property rights, possibility of distributorship on particular

land which could deliver the service. As it is already well acknowledged by several studies entitlements to land for agriculture constitute often a strong limiting factor, both in Northern and Southern countries, for new people who want to start developing agricultural livelihoods. Then the issue of resources comes as appropriate agricultural tools and entitlements to the resources such as access to capital and loans.... Regarding internal factors specific knowledge are necessary for agriculture. Of course good physical condition is also required in the box of internal factor for drawing capabilities from provisioning services. The last but not the least, the box of external factor includes many of the regulation services (regulation of climate, water, soil erosion, pollination etc...) and some parameters such as market existence, distribution supply facilities, regulative norms, customs etc...

Those instances teach us that the following parameters: resources, entitlements, internal and external conversion factors describe people limits (constraints) to obtain capabilities from nature.

### **3.3. Addressing Inequalities**

As we saw natural capital provides to people ES required by essential human development functionings (food, health, recreation, inspiration etc.). Considering ES as elements of people's real freedom (through capabilities) means, in terms of social justice, that individuals or communities should have a granted access to the services they value. However, the access to ecosystem services is often a source of well-being inequalities for the following reasons:

- Entitlements: Poor or marginalised social groups are always suffering of entitlement problems that do not enable them to draw functionings (even less sustainable) from ES (e.g. farmer communities are excluded from many protected area without negotiations, property rights, high prices of land in Northern countries, etc.).

- Accumulation: Many scholars have shown that economic inequalities and ecological ones are often cumulated (Laigle and Oehler 2004, Laigle and Tual 2007). Poor people are often living in low quality environment which does not provide them the ES needed to have all the functionings required by human development.

- Competition between ES: Situations where the use of one ES is at the expense of some other services valued by others stakeholders (e.g. provisioning VS recreation...) (Noel and O'Connor 1998). Since ES are in competition to ensure well-being of different social groups, the choice of the ES to be maintained or the way of maintaining it, will depend to some extent on the political capacities of these groups.

- Conversion capacity: Regulation services can be taken into account by conversion factors in the Sen's approach. But as far as Sen created this category observing that people differ in their capacity to convert resources into capability, regulation services as conversion factor could therefore also constitute a factor of



inequalities (e.g. distribution of rivers flow, distribution of precipitation along watershed, desertification, flooding, climate variation....).

As a preliminary conclusion we can say that applying the CA to the CNC puts the light on people's limits to draw opportunities from ecosystems services in terms of conversion factors, entitlements and resources. The distribution of the former parameters is not equitable among groups of societies so not everyone can draw the same capabilities from the same quantity and quality of ES (i.e. of the CNC). Consequently, comparisons, measures, indicators or public policies based on ratio of natural capital *per capita* is not sufficient to assess the interactions between people's well being and the environment. Nevertheless, the goal is not to reach a strict equality of capability all over the world, but to promote an equitable distribution of capability regarding the socio-environmental characteristics of a given territory.

In addition, introducing ES in a well established framework of well being assessment help to overcome some limits of this concept. Indeed, it helps to frame it in structure of distribution of entitlements, distribution of resources, to link it with personal features and within a socio-cultural and economic context through conversion factors.

## **4. Human Beings as “Agent” of Sustainable Human Development**

### **4.1. The Characteristics of the “Agent”**

According to Neumayer (2010, p3), *“human development serves to remind sustainability proponents that people are real people with freedoms and choices, not social welfare state clients who are allocated a certain amount of utility by the omnipotent social welfare planner”*. If Sen has based his approach on positive freedom, it is because acting freely and being able to choose make people agent of change. For him, if individuals evolve in a democratic environment, they use their capabilities to take part in decision-making process, in order to increase their opportunities (Sen 1999). Thus the ‘patient’ whose well-being commands attention becomes the ‘agent’<sup>7</sup> who can transform the society (Dreze and Sen 1989). By considering the results of the previous part, we can state that the people's capacity to be an “agent” of human development depends on a series of parameters, which are: first, the availability and quality of the CNC; second, the availability of adequate resources; third, the distribution of the entitlements; fourth, the degrees of the conversion factors, and ultimately the set of reference values, personal ethics and responsibility, which guides the selection of the

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<sup>7</sup> Sen adds in *The Idea of Justice* (2009, p.252): *“... people as “agent”, whose freedom to decide what to value and how to pursue what they value, can extend far beyond their own interest and needs”*. According to UNDP (2002, p. 53): *“People are not only the beneficiaries of economic and social progress, they are also its agents, both as individuals and by making common causes with others”*. Alkire (2010, p.39) defines agency as: *“Supporting people and groups as actors; helping them to help themselves”*. For more detail see agency freedom.

potential functionings to be achieved. The table below presents as a summary of these parameters which contribute to make people be agent of human development and provides some instances of such parameters.

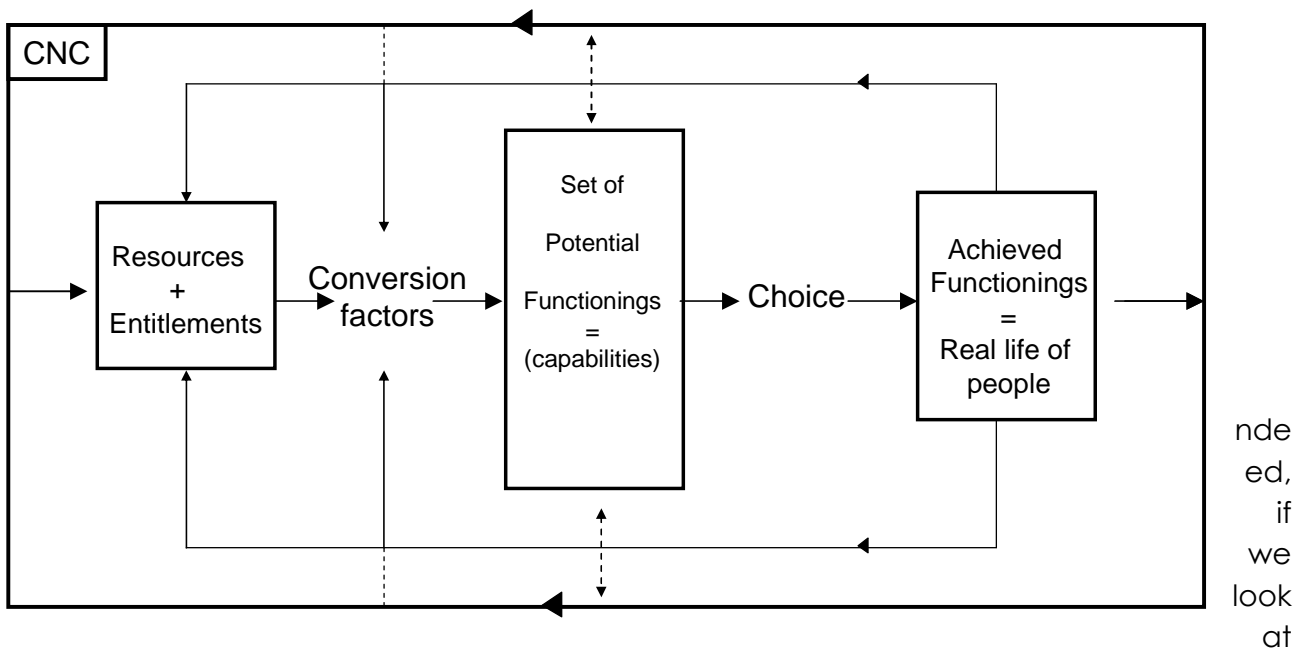
**Table 1: Parameters for the capacity of being a human development agent**

Parameters	Instances
CNC (socially and collectively defined)	Critical Natural Capital which could deliver ecosystem services which constitute essential input for many capabilities
Resources	Commodities, income, free time, tools, manufactured and financial capital, loans...
Entitlements	Property rights, institutional arrangements, rules and rights (operating and laws)...
Internal conversion factors	Human capital, Health condition, psychological condition, social capital, experience.....
External conversion factors	Public infrastructures, institutions, markets, social norms and customs, some regulation ecosystem services...
Ethical reference	Ethics, values, responsibility, recognition...

#### **4.2. Assessing the Sustainability of Human Development**

Chiesura and De Groot (2003, p.224) state that “*Criticality can be considered as an ‘emergent property’ arising out of the interaction of ecological and human value systems.*” As it is demonstrated all along the paper crossing the CA and the CNC theory could help to address this statement. The scheme bellow try to catches up this idea providing a framework to better understand the dynamics of ecosystem services and human well-being showing the positive or negative feedback an achieved functioning could have on the CNC.

**Figure 4: Framework for the analysis of sustainable human development**



the scheme we see that capabilities drawn from the CNC depend on people's resources, entitlements, conversion factors, and ultimately on "the values" which guide the choice among potential functionings. Therefore the sustainability of a chosen functioning will depend on these parameters. As long as poverty is defined as a lack of choice (and not in monetary terms) many people can not have the opportunity (regarding their conversion factors, entitlements and resources) to obtain a sustainable functioning from the CNC. Some other people could have the required resources, entitlement and conversion factors to achieve sustainable functionings from the CNC but they do not because of their values. Converting resources and ES into unsustainable achievements gradually nibble the natural capital. According to the nature of the functioning the set of capabilities will increase or decrease. The first corresponds to sustainability and the second one to the exact opposite. Here, we understand sustainability as it is formulated by Sen (2000 p.5) "*Development that promotes the capabilities of present people without compromising capabilities of future generations*". If availability and quality of CNC decreases, the capability set will do so. Exceeding critical minimum thresholds of natural capital will lead the system in a non sustainable dynamic (or pathway) accompanied by irreversible effects. In economics, irreversibility occurs when the current choices are constrained by the previous ones. Degradation of natural capital by its unsustainable use over critical thresholds involves that people will lose the possibility of achieving essential functionings (enjoying good air quality, enjoy healthy agricultural product, enjoy landscape etc...) leading to a net loss of capabilities for present and to some extent to future generations. Making the difference between achieved functionings and capabilities enable the assessment of a person true range of choice. That's very interesting to assess interaction between societies and Nature notably, in the developed countries where the income of a major part of the population is not depending directly on natural resources. Indeed, making the difference between achieved and potential

functionings could reveal the constraints (time allocation, information lack, conversion factors etc.) that people endure. It could also reveal the adequacy between people's values, behaviour regarding use of ES and the opportunities they really have to function sustainably (e.g. going to supermarket as deliberate choice or going there because there is no others alternatives due to a lack of resources (money, time..), *internal conversion factor* (education, information ..), *external conversion factors* (absence of organic shops and markets, social norms...). The innermost feedback loop corresponds to the socio-economics realm and the circumstancing one to the environmental realm, illustrating that individual and societies are embedded in Nature.

### 4.3. People as Agent of Sustainable Human Development

As far as people could be considered as agent they could be the core unit for sustainable human development construction. Therefore, human development goal should be that each person<sup>8</sup> could participate, through his functionings, to the CNC definition and maintenance through time. We assume that promoting an equitable distribution of resources entitlements and a strong attention to the person's characteristics (conversion factors), regarding the socio-environmental characteristics of a given territory, constitutes a prerequisite to reach this goal.

As long as capabilities and functionings are beings and doings that people have reason to value Human development can help improve the CNC definition because it does not specify who decides what people 'have reason to value' in each context. But it does create the space to discuss this issue thanks to the informational broadening enabled by shifting from preferences to capabilities. Agreed social concerns can emerge and partial agreements are sufficient to identify equitable alternatives accepted by every stakeholder. That constitutes a major contribution of the CA to the CNC by contributing, at least theoretically, to make more feasible the social definition of criticality.

So all this reasoning leads us to improve the definition of human development toward Sustainable Human Development defined as "*a Development that promotes the capabilities of present people without compromising capabilities of future generations through the democratic definition and conservation of ther CNC*". We accompanied this definition by the one of "*sustainable functioning*" which is the most basic element of sustainable human development. We define this notion as "*an appropriate combination of elements of the CNC (or ES), resources, entitlements and conversion factors that the people have reason to value, and which do not compromise capabilities of present and*

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<sup>8</sup>According to Sen: "*The presence of individuals who think, choose and act – a manifest reality in the world – does not make an approach methodologically individualistic*" (Idea of Justice 2009, p.245). According to Alkire (2010, p.34) "*Sen's capability approach embraces ethical individualism but does not defend methodological or ontological individualism. Ethical individualism "postulates that individuals are the ultimate units of moral concern ... This, of course, does not imply that we should not evaluate social structures and societal properties, but ethical individualism implies that these structures and institutions will be evaluated in virtue of the causal importance that they have for individuals' well-being."*

*to some extent (according to actual state of knowledge) of future generations".* The research goal to foster sustainable human development research is to bring to light the gap that exists between potential functionings and achieved functionings in order to highlight the capability space (related to the CNC, resources, entitlements, conversion factors) on which public policies must act and values which should be debated in order to improve people's opportunities of sustainable functionings.

## CONCLUSION

On the one hand, framing the CA into the CNC adds to the former the ecological dimension of sustainability. On the other hand, framing the CNC into the CA strengthens the theoretical background of the former by providing a social definition of criticality leading to concrete operations. By inter-relating the CNC theory and Sen's CA the paper brings to the forefront some interesting elements to help defining for "what" and for "whom" natural capital could be critical. As demonstrated in section 2, natural capital could be critical because it provides a habitat for human beings and a flow of ecosystem services which take part in the building of people's capabilities. Therefore the conservation of the CNC becomes an important goal for human development. Framing the CNC into the CA enables to think the democratic definition of criticality. Indeed, applying the capability approach to ecosystem services reveals "why" people "have reason" to value a particular set of functionings. It is because drawn from the choice of a particular set of ecosystem services, e.g. organic farming vs. intensive farming, buying a four wheel drive car vs. hybrid one, etc. Therefore, it could be argued that the crossing the CA and the CNC theory brings relevant data on what are the mixes of ecosystem services that people do prefer for the CNC.

This crossing also helps defining for whom natural capital would be critical. As we saw in section 3, applying the CA to the CNC offers an informational broadening on relationship between human well being and environment. Indeed, the CA put the light on the person, his characteristics and the environment in it broader sense (including natural, social, political, cultural and economical dimension) within he evolves and his values. Applying the CA reasoning to the CNC highlighted that on its own ES are not sufficient to provide people capability and put the light on people's inequalities to draw opportunities from ecosystems in terms of resources, entitlements and conversion factors. That will allow a better understanding of how changing flows of ecosystem services affect the most vulnerable members of the society.

Through this integrated approach of human development, human beings are not any more reduced to rational "homo economicus", but understand as a person with values (that allow a space of investigation of "why" people act in a particular way), with particular characteristics (resources, entitlements and conversion factors) and who can be considered as an "agent" of sustainable human development through democratic definition and conservation of the CNC. It can be argued that our crossing will help to

better understand how criticality emerge from social–environment interactions, giving a framework to investigate how do human individual choices and actions affect local flows of ecosystem services. As the ultimate result, the integrated definition of sustainability drawn out of the crossing constitutes with the notion of sustainable functioning, theoretical integrated underpinnings to foster sustainable human development research and sustainability economics! An operationalization of this theoretical paper is on going and we hope to be a source of inspiration for plenty others.

## REFERENCES

- Alkire S., 2010, "Human development: definitions, critiques and related concepts", Research Paper 2010/01, Human Development Report, United Nations Development Program, New York.
- Ballet J., Dubois J.-L. and Mahieu F.-R., 2005, *L'autre développement, le développement socialement soutenable*, L'Harmattan, Paris.
- Baumgartner S. and Quaas M., 2010, "What is sustainability economics", *Ecological Economics* 69, pp. 445-450.
- Bonvin J.-M. and Farvaque N., 2008, *Amartya Sen : Une politique de la liberté*, Michalon, Paris.
- Brand F., 2009, "Critical natural capital revisited: Ecological resilience and sustainable development", *Ecological Economics* 68, pp.605-612.
- Carpenter, Mooney, Agard, Capistrano, DeFries, Díaz, Dietz, Duraiappah, Oteng-Yeboah, Pereira H.M., Perrings Ch., Reid W.V., Sarukhan J., Scholes R.J. and Whyte A., 2008, *Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment*, PNAS, vol.106 No.5, pp.1305–1312
- Chiesura A. and De Groot R., 2003, "Critical natural capital: a socio-cultural perspective", *Ecological Economics* 44, pp. 219–231.
- Daily G. C., Polasky S., Goldstein J., Kareiva P.M., Mooney H.A., Pejchar L., Ricketts T.H., Salzman J. and Shallenberger R., 2009, "Ecosystem services in decision making: Time to deliver". *Front Ecol Environ* 7(1), pp. 21–28.
- De Groot R., Van der Perk J., Chiesura A. and van Vliet A., 2003, "Importance and threat as determining factors for criticality of natural capital," *Ecological Economics* 44, pp. 187–204.
- Dodds S., 1997, "Towards a 'science of sustainability': Improving the way ecological economics understands human well-being", *Ecological Economics* 23, pp. 95-111.

- Dreze J. and Sen A.K., 1989, *Hunger and public action wider studies in development economics*, Oxford Clarendon Press, Oxford.
- Dubois J.-L., 2009, "Searching for a Socially Sustainable Development: Conceptual and Methodological Issues" in R. Gotoh and P. Dumouchel (eds), *Against Injustice: The New Economics of Amartya Sen*, Cambridge University Press, Cambridge, pp.275 - 294.
- Duraiappah A.K., 1998, "Poverty and Environmental Degradation: A Review and Analysis of the Nexus", *World Development*, Vol.26 No.12, pp. 2169-2179.
- Ekins P., 2003, "Identifying critical natural capital: conclusions about critical natural capital", *Ecological Economics* 44, pp. 277-292.
- Ekins P., Simon S., Deutsch L., Folke C. and De Groot, R., 2003, "A framework for the practical application of the concepts of critical natural capital and strong sustainability", *Ecological Economics* 44, pp.165-185.
- Faber M., 2008, "How to be an ecological economist", *Ecological Economics* 66, pp. 1-7.
- Fisher B, Kerry Turner R. and Morling P., 2009, "Defining and classifying ecosystem services for decision making", *Ecological Economics* 68, pp.643-653
- Flipo F., 2005, « Pour une écologisation du concept de capabilité d'Amartya Sen », *Nature Sciences Sociétés* n°13 pp.68-75.
- Gowdy J.M. and Mayumi K., 2001, "Reformulating the foundations of consumer choice theory and environmental valuation". *Ecological Economics* 39, pp. 223-237
- Gowdy J. and Erickson J., 2005, "Ecological economics at a crossroads", *Ecological Economics* 53, pp. 17-20.
- Haines-Young R. and Potschin M., 2010, "The links between biodiversity, ecosystem services and human well-being", in Raffaelli D. & Frid C. (eds.): *Ecosystem Ecology: a new synthesis*, BES Ecological Reviews Series, CUP, Cambridge
- Harvey D., 1993, "The Nature of Environment: Dialectics of Social and Environmental Change", *Socialist Register* Vol.29, pp. 1-51.  
<http://socialistregister.com/index.php/srv/article/view/5621>
- Kalaora B., 1993, *Le musée vert : radiographie du loisir en forêt*. Collection environnement, L'Harmattan, Paris.
- Laigle L. and Oehler V., 2004, *Les enjeux sociaux et environnementaux du développement urbain : la question des inégalités écologiques* », Recherche exploratoire, PUCA/MELT.

- Laigle L. et Tual M., 2007, « Conceptions des inégalités écologiques dans cinq pays européens : quelle place dans les politiques de développement urbain durable ? », *Développement durable et territoire*, Dossier 9 : Inégalités écologiques, inégalités sociales.  
<http://developpementdurable.revues.org/document4262.html>.
- Lehtonen M., 2004, "The environmental-social interface of sustainable development: capabilities, social capital, institutions", *Ecological Economics* 49, pp. 199– 214.
- Lessman O., 2011, "Sustainability as a challenge to capability approach" in Rauchmayer F, Omann I. and Frühmanet J., 2011 (eds) *Sustainable development: Capabilities, needs and well-being*, Routledge Studies in Ecological Economics, pp. 43-62.
- Levrel H., 2003, "Poverty, vulnerability and renewable resources", *From Sustainable Development to Sustainable Freedom*, HDCA annual conference, 6-10 Septembre 2003, University of Pavia.
- Levrel H., 2006, *Biodiversité et développement durable : quels indicateurs ?* PhD tesis, EHESS Recherches Comparatives sur le Développement, UMR 51-73, Département Ecologie et Gestion de la Biodiversité Museum National d'Histoire Naturelle.
- Martinez-Alier J., 2001, « Ecological economics », article 4.9 No.9, *International Encyclopaedia of the Social and Behavioural Sciences*, pp. 4016-4023.
- MEA [Millennium Ecosystem Assessment], 2003, *Ecosystem and Human Well-Being: A Framework for Assessment*, Island Press.
- MEA [Millennium Ecosystem Assessment], 2005, *Ecosystem and Human Well-Being: a synthesis*, Island Press.
- Morin E., 1973, *Le paradigme perdu*, Seuil, Paris 1979. Translated in English, *The Paradigm Lost: A cultural and systems theoretical critique of political economy*, Kenneth Michael Stokes, 1995
- Neumayer E., 2010, "Human development and sustainability", Research Paper 2010/05, Human Development Report, United Nations Development Programme, New York.
- Noël J. and O'Connor M., 1998, "Strong Sustainability and Critical Natural Capital", in Faucheux S. and O'Connor M., (Eds.), *Valuation for Sustainable Development: Methods and Policy Indicators*, Edward Elgar Publisher, Cheltenham, pp. 75-98.
- Rauchmayer F, Omann I., Frühmanet J. (eds), 2011, *Sustainable development : Capabilities, needs and well-being*. Routledge Studies in Ecological Economics, London.
- Reboud V. (dir), 2008, *Sen : un économiste du développement ?* Notes et documents 30, AFD, Paris.



Robeyns I., 2005, "The Capability Approach: a theoretical survey", *Journal of Human Development and Capabilities*, 6: 1, pp. 93-117.

Sen A.K., 1987, *The Standard of living*, Tanner lecture, Cambridge University Press, Cambridge.

Sen A.K., 1992, *Inequality Reexamined*, Oxford University Press, Oxford.

Sen A.K., 1999, *Development as Freedom*, Alfred Knopf. Inc., New York.

Sen A.K., 2000, "Ends and means of sustainability", Keynote speech at the international conference *Transition to sustainability*, May 2000, Kyoto.

Sen A K., 2009, *The Idea of Justice*, Belknap Press, Cambridge, Mass.

Sneddon C., Howarth R. B. and Norgaard R. B., 2006, "Sustainable development in a post-Brundtland world", *Ecological Economics* 57, pp. 253– 265.

UNEP, 2005, "Exploring the links between Human Well-being, Poverty and Ecosystem Services", Nairobi.

WCED [World Commission on Environment and Development], 1987, *Our Common Future*, Oxford University Press, Oxford.

## BIOGRAPHIES

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