



## Methodological and Ideological Options

## Strong sustainability, critical natural capital and the capability approach

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## ABSTRACT

This article is an attempt to conceptually improve the notion of strong sustainability by creating a rapprochement between its core concept, critical natural capital, and the capability approach. We first demonstrate that the capability approach constitutes a relevant framework for analysing the multiple links between human well-being and critical natural capital. Second, we demonstrate that the rapprochement between critical natural capital and the capability approach can form both the normative basis and the informational basis for a deliberative approach to human development which embraces a strong sustainability perspective. This conceptual rapprochement, as illustrated in our case study, opens up avenues of research towards the practical implementation of human development projects from a strong sustainability perspective.

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## 1. Introduction

In recent years, a number of articles have examined the pros and cons of a rapprochement between sustainability and the capability approach (CA) (see among others Ballet et al., 2011, 2013; Rauschmayer and Leßmann, 2011; Martins, 2011; Polishchuk and Rauschmayer, 2012; Scerri, 2012; Griewald and Rauschmayer, 2014). However, none of these articles has established a connection to the notion of critical natural capital (CNC), a notion that lies at the heart of strong sustainability (Ekins et al., 2003; De Groot et al., 2003; Neumayer, 2003). The role of CNC is to highlight the very limited substitutability of the functions and services provided by natural capital as concerns their unique contribution to human existence and well-being (Ekins et al., 2003). Identifying the critical aspects of natural capital implies that we are in a position to address the issue of the multiple links that exist between the natural environment and human well-being. Duraiappah (2004), along with Polishchuk and Rauschmayer (2012) have started to show that the CA can help resolve this issue.

Authors working on strong sustainability (Ekins et al., 2003; De Groot et al., 2003; Chiesura and de Groot, 2003; Brand, 2009; Dedeurwaerdere, 2014) note that in addition to “objective” ecological criteria (safe minimum

standards, minimum ecosystem size, maximum sustainable yield, ecological footprint, etc.), societal values and perceptions, and ethics and attitude to risk also play a decisive part in determining what aspects of natural capital should be considered “critical”. So the definition of CNC relies not only on our capacity to supply factual knowledge about socio-ecological systems, but also on discussions about the values that underline our use of natural capital (Dedeurwaerdere, 2014). Therefore, the identification of the critical elements of natural capital requires both the relevant factual knowledge about the interactions between natural capital and human well-being, and a normative basis for the assessment of the sustainability of these interactions. As long as there are multiple value judgments involved in the definition of the critical elements of natural capital, and given the irreducible uncertainties of complex socio-ecological systems, public deliberation and stakeholder participation (Van den Hove, 2000) would appear to have an input to make towards the definition of the criticality of natural capital (De Groot et al., 2003; Dedeurwaerdere, 2014).

The goal of this paper is twofold: (i) it demonstrates that the CA represents a relevant framework for analysing the multiple links between human well-being and natural capital, and so for specifying the elements of natural capital that could be critical for generating well-being and (ii) it demonstrates that the combination of the CA and CNC can form both a normative basis and informational basis for a deliberative approach to human development which embraces a strong sustainability perspective.

This paper is structured as follows: Section 2 first describes the differences between weak and strong sustainability. It then presents the concept of CNC, links it to ecosystem services and concludes by examining how public deliberation contributes to the definition of criticality. Section 3

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presents the main features of the CA with an emphasis on the role this approach confers to public deliberation when dealing with the assessment of well-being. Section 4 addresses the multidimensionality of the interconnectedness that exists between human well-being and natural capital through the lens of the CA. The last section (Section 5) demonstrates, through a case study, how a combination of the CA and CNC can form both a normative basis and an informational basis for a deliberative approach to human development which embraces a strong sustainability perspective.

## 2. Strong Sustainability and Critical Natural Capital

This section first presents and characterises the two main types of sustainability: weak sustainability and strong sustainability. It then goes on to identify the relationship between CNC and ecosystem services before investigating how public deliberation contributes to the definition of criticality of natural capital.

### 2.1. Weak Sustainability Versus Strong Sustainability

The notion of natural capital was introduced by a number of ecological economists at the beginning of the nineties (Ekins and Max-Neef, 1992; Costanza and Daly, 1992; De Groot, 1992). Given the suitability of natural capital for depicting the socio-economic uses of the environment and for pushing environmental issues into economic thinking and decision-making, it was rapidly adopted for sustainability studies (Arias-Maldonado, 2013).<sup>1</sup> In the field of ecological economics, natural capital is defined as a set of complex systems, consisting of evolving biotic and abiotic elements, that interact to determine the capacity of an ecosystem to directly and/or indirectly provide human society with a wide array of functions and services (Noël and O'Connor, 1998; Ekins et al., 2003; De Groot et al., 2003; Brand, 2009).<sup>2</sup> This emphasis on natural capital allows us to make a distinction between weak sustainability and strong sustainability.

The weak sustainability approach assumes that natural capital and manufactured capital are essentially substitutable and that there are no essential differences between the kinds of well-being they produce (Ekins et al., 2003; Neumayer, 2003, 2012). The only thing that matters is the total value of the aggregate stock of capital, which should be at least maintained, or ideally added to, for the sake of future generations (Solow, 1993; Neumayer, 2012). From this standpoint: *"it does not matter whether the current generation uses up non-renewable resources or dumps CO<sub>2</sub> in the atmosphere as long as enough machineries, roads and ports are built in compensation"* (Neumayer, 2003, :1). With this type of approach we can logically compensate the degradation of natural capital by the estimated equivalent amount of manufactured or financial capital. In weak sustainability, technological progress is assumed to constantly generate technical solutions to the environmental problems that are caused by the increased production of goods and services (Ekins et al., 2003; Sébastien and Brodhag, 2004).

In contrast to weak sustainability, some authors have formulated a strong conception of sustainability (see among others Noël and O'Connor, 1998; Ekins et al., 2003; Chiesura and de Groot, 2003; De Groot et al., 2003; Neumayer, 2003). For the proponents of this strong

sustainability approach, a distinction must be made between natural capital<sup>3</sup> and manufactured capital. First, natural capital is characterised by the phenomenon of irreversibly (for example, the extinction of a species is irreversible) and the threshold phenomenon (for example, above a certain threshold of concentration of pollutants, the auto-depuration process of water of aquatic ecosystems is overloaded: if the concentration of pollutants continues to increase, the functioning of the ecosystem is disrupted). Moreover, the amount of manufactured capital can be increased or decreased, whereas natural capital can disappear if the prior deterioration and continued diminution of this capital have been too excessive to enable it to replenish itself and hence supply essential services for human well-being. Finally, manufactured capital requires natural capital for its production, so manufactured capital cannot be a complete substitute for natural capital. To sum up, there is a qualitative difference between manufactured capital and natural capital (Ekins et al., 2003). Second, natural capital is multifunctional i.e. in certain situations it can provide several services simultaneously. For example, the flow of water in a river can provide biological services (the reproduction of fish), economic services (the fish can be caught or the flow can be used to produce hydro-electricity), and recreational services (bathing in the river). This multidimensional aspect of natural capital means that it is unlikely for manufactured capital to act as an appropriate substitute. Natural capital, manufactured capital and other forms of capital (for example, human and social capital) instead have to be seen as complementary in producing human well-being (Brand, 2009). Third, due to our lack of knowledge about how natural systems function, we cannot know for certain what the effects of destroying natural capital will be on human well-being (Dietz and Neumayer, 2007). This uncertainty adds to the irreversibility phenomenon and should theoretically ensure that we adopt a precautionary principle in our use of natural capital (Jonas, 1984). Fourth, as is stated by several authors (see among others Toman, 1992; Dedeurwaerdere, 2014), an increase in future consumption is not an appropriate substitute for the loss of natural capital. The following quote illustrates this argument: *"Today's generation cannot ask future generations to breathe polluted air in exchange for a greater capacity to produce goods and services. That would restrict the freedom of future generations to choose clean air over more goods and services"* (UNDP, 2011: 17). And consequently the fundamental issue of intergenerational justice enters the debate.

To sum up, by building on these four arguments, the strong sustainability approach assumes that the substitutability between natural capital and other forms of capital should be strictly limited to the circumstances where the use of the services provided by natural capital does not lead to the irreversible destruction of this capital because its depletion cannot be compensated for by investing in other forms of capital (Neumayer, 2012). Therefore, the strong sustainability approach holds that certain elements of natural capital are "critical" due to their unique contribution to human well-being (Ekins et al., 2003; Dedeurwaerdere, 2014). These potentially "critical" elements to human existence and well-being can be conceptualised as ecosystem services provided by natural capital (Brand, 2009). We will now explain the notion of ecosystem services and explore their relations with CNC.

### 2.2. Critical Natural Capital and Ecosystem Services

The Millennium Ecosystem Assessment (MEA) (2005) broadly defines the concept of ecosystem services as the benefits people obtain from ecosystems. It identifies two main types of ecosystem services:

<sup>1</sup> Nevertheless, we acknowledge that this interpretation of "natural capital" is questionable and that it has been faulted for being too anthropocentric. Even if we acknowledge that the concept of natural capital cannot be considered as an absolute category and is open to criticism, the point of our paper is not to develop this aspect. For further information, see Foster and Gough (2005).

<sup>2</sup> The word "function" is used, namely to indicate some capacity of the ecosystem to do something that is potentially useful to people (Haines-Young and Potschin, 2010), and "ecosystem services" are understood here as aspects of ecosystems that are utilized (actively or passively) to produce human well-being (Fisher et al., 2009). For the sake of simplicity we will focus on ecosystem services, which means that we will address natural capital through its role as a provider of services that enhance human well-being.

<sup>3</sup> We must acknowledge that the use of the term "natural capital" should reflect the fact that naturalness is not an absolute category and therefore we need to take into account the general process of hybridization between society and nature in the production of human well-being (Arias-Maldonado, 2013). Consequently, natural processes do not need to remain untouched to provide key services for human well-being. They can be altered, amended and brought into play, thereby remaining critical without remaining fully natural (Arias-Maldonado, 2013). We will not develop this point further. For more information, see (Arias-Maldonado, 2013).

“supporting” and “direct”.<sup>4</sup> Supporting services represent the internal functioning of natural systems (nutrient cycling, primary production, evolving processes, soil formation, water cycling, production of atmospheric oxygen, etc.). These services supply the essential biological support system for life on Earth, thus generating a viable habitat for all living organisms, including human beings. They are necessary for the provision of direct ecosystem services. The MEA acknowledges three categories of direct services: provisioning services (food production, provision of drinking water, wood for fuel, fibre for textiles and rope, etc.), regulating services (water and air quality regulation, climate and pest regulation, pollination, regulation of erosion, etc.) and cultural services (recreation, tourism, aesthetic inspiration, etc.).

According to the literature on strong sustainability (Ekins et al., 2003; Chiesura and de Groot, 2003; De Groot et al., 2003; Dietz and Neumayer, 2007; Brand, 2009), the criticality of ecosystem services depends on i) the essential role of these services for human existence and well-being, ii) the non-substitutability of the services with regard to their unique contribution to human well-being, and iii) the risk of the services becoming irreversibly extinct if the natural capital that provides them is degraded beyond critical thresholds. This leads us to a definition of critical natural capital or CNC. CNC highlights the need to maintain the ecological functioning of natural systems above certain thresholds of degradation in order to conserve the capacity of natural capital to provide the services which are critical for human existence and well-being (Ekins et al., 2003; Chiesura and de Groot, 2003; De Groot et al., 2003; Dietz and Neumayer, 2007; Brand, 2009). Therefore CNC corresponds to a particular configuration of natural capital that provides a set of critical ecosystem services. Consequently, this “critical” configuration of natural capital depends on the identification of critical ecosystem services.

The strong sustainability approach nevertheless does not state that ecosystem services everywhere have to be sustained exactly as they are. An assessment must be made of those services that play a key role in supporting life and producing human well-being in a given context (Ekins et al., 2003; Dedeurwaerdere, 2014). However, proponents of strong sustainability recognize that the uncertain state of knowledge about ecosystems, and ecosystem services, renders it very difficult to judge which services are critical and which are not.

### 2.3. Public Deliberation and Critical Natural Capital

It is important to point out that the criticality of the ecosystem services provided by CNC is dependent not only on ecological criteria, but also on the values espoused by society (Ekins et al., 2003; Chiesura and de Groot, 2003). In many cases the decision of what counts as an “unsustainable effect” is a matter of judgement, which can only be partially resolved by science. Ethics and attitudes to risk-taking play a significant bearing here. Moreover, many environmental problems are characterised by the unstable and incomplete nature of scientific knowledge, accompanied by the inherent unpredictability of complex systems (Noël and O’connor, 1998; Ekins et al., 2003). Consequently, the criticality of ecosystem services depends on ecological criteria (for example, species richness, ecological integrity of the ecosystems that constitute natural capital in a given context), as well as economic criteria (for example, productive activities directly using or affecting natural capital), political criteria (for example, the relative influence of a particular group on the management of natural capital) and social criteria (for example, relative importance of natural capital for standards of living and quality of life) (De Groot et al., 2003). And so, criticality cannot be considered as an absolute category (Arias-Maldonado, 2013).

<sup>4</sup> Authors writing about CNC mainly refer to the ecological functions provided by natural capital; the MEA speaks in terms of ecosystem services. Ekins et al. (2003) distinguish between the function “of” natural capital and the function “for” human beings. The concept of the “supporting service” used in the MEA clearly reflects the function “of” natural capital, and the concept of “direct services” popularised by the MEA directly echoes the “function for” human beings. For the sake of simplicity, we will not go any further into the distinction between functions and services here, and will only refer to ecosystem services.

In short, the definition of the criticality of ecosystem services and so of natural capital, requires both a scientific understanding of the functioning of a particular socio-ecological system and a wide-ranging debate about the values, goals and objectives of the various groups of stakeholders belonging to this system. This entails a complex interrelationship between normative values on one side and factual knowledge on the other (Dedeurwaerdere, 2014). As long as there are multiple value judgments involved in the definition of critical ecosystem services, and given the irreducible uncertainties that characterise complex socio-ecological systems, public deliberation and stakeholder participation (Van den Hove, 2000) seem to be required if we are to define the criticality of natural capital (De Groot et al., 2003; Dedeurwaerdere, 2014). The CA, with its emphasis on the multidimensionality of human well-being and its focus on public deliberation for dealing with issues concerning the assessment of well-being, appears to be a good candidate for addressing these complex interrelationships between human well-being and natural capital and between normative values and factual knowledge. The next section will present the main features of the CA before establishing the connection between the CA and CNC.

### 3. The Capability Approach and Human Development

This section first presents the main features of the CA. It then discusses the particular role public deliberation plays in this approach when defining and assessing human well-being.

#### 3.1. The Main Features of the Capability Approach

The CA is an attempt to renew the assessment of human well-being in a manner that can stand up to utilitarian and resourcist approaches. Indeed, in the CA, well-being has to be assessed in terms of the freedoms and opportunities “to be” and “to do” what people have reason to value (Sen, 1999). Thus, human development is defined as the process of extending the real freedoms that people enjoy i.e. enhancing people’s capabilities (ibid). Capabilities correspond to the various options that a person can choose, according to his or her values, in order to achieve expected life-styles. Capabilities are composed of a bundle of achievable functionings. Functionings can be elementary i.e. related to nutrition, health, life expectancy, or more complex, such as taking part in the life of a community and having self-respect (Sen, 1999). Hence the CA, and more generally, human development, is multidimensional, with a focus on the intrinsic importance of various aspects of quality of life rather than the accumulation of goods (see among others Sen, 1999; Alkire, 2002; Robeyns, 2005).

A person’s capability set depends on his or her access to resources (here resources should be understood as endowments, such as manufactured goods and services, but also non-material goods, such as human and social capital) and on his or her conversion factors. A person’s capacity to convert resources into functionings relies on personal conversion factors (physical and psychological characteristics, etc.), social conversion factors (institutions, customs, public goods, gender, role, etc.) and environmental conditions (changes affecting climate, river flow, etc.) (Robeyns, 2005). Therefore, the CA does not only take into account the resources people have access to, but the broader context that allows them to transform these resources into well-being achievements. It is important to note that the capability concept operates via a notion of freedom (i.e. positive freedom) that encompasses both potential choices (i.e. the set of achievable functionings) and realized choices (the set of chosen and achieved functionings). The CA makes it possible not only to drive the concept of well-being toward a more multidimensional conception, but also to distinguish between well-being achievement and well-being freedom. Freedom of choice therefore takes centre stage in the definition and improvement of human well-being. The next paragraph explores the role that the CA assigns to public deliberation in dealing with issues concerning the assessment of well-being.

### 3.2. The Role of Public Deliberation in the Definition and Assessment of Well-being

In the assessment of well-being, Sen advocates a purely deliberative approach for identifying the list of capabilities that should be valued for each context (Sen, 2004). Martha Nussbaum (2000, 2003) however puts forward a list of capabilities which could serve as a universal reference for assessing human well-being. Her list includes ten central capabilities: life, bodily health, bodily integrity, senses, imagination and thought, emotions, practical reason, affiliation, other species, play and control over one's environment (Nussbaum, 2000, 2003, see Appendix 1 for an overview of Nussbaum's list). Sen's objection to Nussbaum's position is that a philosophically based capability list is illegitimate because such lists should be the outcome of a public deliberation process (Claassen, 2011). However, Nussbaum does not rank the capabilities on her list and the value placed on capabilities may differ according to the context. The list is not hierarchical; it is open-ended and it is subject to ongoing revision. The question of establishing priorities is left up to deliberation processes. As explained by Alkire (2010), the CA does not specify who decides what people "have reason to value" for any given context, but it sets out to create a space where this issue can be discussed. Indeed, according to Alkire (2006: 135–136): "*the selection and prioritization and distribution of valuable capabilities draw on collective deliberation, and current priorities should be able to be influenced in some way by it*".

So, even if Sen and Nussbaum hold differing views, we can say that in general the CA clearly supports the active participation and empowerment of people in choice-making processes which concern the definition and assessment of well-being (see among others Alkire, 2006; Crocker, 2007). This emphasis by human development scholars on public deliberation and the involvement of people in decision-making processes illustrates the close relationship of the CA with what has been referred to as "deliberative democracy"<sup>5</sup> (see especially Crocker, 2006, 2009).

To sum up, the CA offers a framework for addressing the multidimensionality of human well-being and it gives a central role to freedom of choice and public deliberation in the definition and assessment of well-being. In the next section we will consider the interrelated multidimensionality of natural capital and human well-being via the CA.

## 4. The Multidimensionality of Natural Capital and Human Well-being

In this section we will explore the multidimensionality of both human well-being and natural capital in more depth by focusing on their connectedness. We will show how the CA constitutes a relevant framework for analysing the multiple links between human well-being and the ecosystem services that emanate from natural capital.

### 4.1. The Multidimensionality of Natural Capital in Its Provision of Services That Contribute to Human Well-being

Natural capital is multidimensional in two respects. First, it is defined by its provision of services that are essential for human well-being, which in itself is multidimensional. This multidimensionality is completely dependent on the multidimensionality of human well-being. Second, the intrinsic multidimensionality of natural capital also renders the assessment of its criticality multidimensional.

With regards to the first point, by providing ecosystem services, natural capital caters for basic human physiological needs, and also performs economic and social functions that contribute to both personal

<sup>5</sup> Deliberative democracy emphasizes the deliberative or discursive aspects of democratic decision-making rather than the institutionalized norms (e.g. electoral systems, branches of government, parliamentary arrangements, bureaucratic functions) that are frequently defined as being the essence of democracy (Sneddon et al., 2006). Hence, public deliberation is centre stage in this conception of democracy. Deliberative democracy is embodied in the assumption that individuals can change their minds during deliberative processes to reach a consensus on particular collective issues (see Habermas, 1984; Fishkin, 2009).

and collective well-being (Chiesura and de Groot, 2003). At a personal level, ecosystem services promote freedom, self-development, recreation, and psychological and physical health, while at a collective level they contribute to social relationships, standards and values, ethics, ideals, cultural identity, etc. (ibid.). The MEA (2005) captures these multiple links in its categorization of four types of contributions that ecosystem services make to human well-being: health, security, basic materials for a good life and good social relations. Therefore, ecosystem services play an important role in determining the freedom of choice and action for human beings (ibid.). The MEA conception of well-being is very close to that of the CA, even if it does not refer explicitly to it. Indeed, the foregoing examples of the contributions ecosystem services make to human well-being echo Sen's definition of functionings (to be well nourished, to take part in the community, etc.) and some of the dimensions of human well-being that can be found on Nussbaum's list (bodily health, affiliation, etc.). Therefore, according to Polishchuk and Rauschmayer (2012), ecosystem services can be effectively viewed as contributing – in a variety of ways – to people's capabilities. In other words, ecosystem services are essential inputs for many of the capabilities required for human development (e.g. life, bodily health, play, and affiliation, ...). The challenge is to establish a list of ecosystem services, and identify how these ecosystem services relate to capabilities people value in different contexts.<sup>6</sup> Duraipapp (2004) proposed the first conceptualization of the relationship between ecosystem services and the CA. With its focus on poverty, Duraipapp's framework<sup>7</sup> does not give sufficient importance to the specific contribution of cultural services to human well-being (Polishchuk and Rauschmayer, 2012). Nevertheless, it helps us explore the contribution of provisioning and regulating services to some of the dimensions listed by Nussbaum, such as bodily health. In turn the Nussbaum list is useful for assessing the contribution of cultural ecosystem services to well-being (Polishchuk and Rauschmayer, 2012). Therefore, as will be demonstrated in our example in the next section (Section 5.3), these two lists can be used in complementary fashion to highlight the multiple links between ecosystem services and human well-being. In sum, whichever standpoint we choose, whether it be the development of a predefined non-hierarchical list of capabilities as proposed by Nussbaum, or a purely deliberative procedure as proposed by Sen, the CA supplies us with a multidimensional framework for analysing and comparing the impact of ecosystem services on human well-being.

### 4.2. The Multidimensionality of Natural Capital and the Assessment of Its Criticality

According to Brand (2009), defining a measure which can reflect criticality is a major challenge. After reviewing the literature, he identified six domains in which natural capital, and hence the ecosystem services it provides, can potentially be critical; (i) the socio-cultural domain, when ecosystem services are critical for a particular social group, as they create a socio-cultural context in terms of non-materialistic needs; (ii) the ecological domain, when ecosystem services are ecologically valued for their significance in terms of naturalness, biodiversity, uniqueness etc.; (iii) the sustainability domain which refers to

<sup>6</sup> This challenge is particularly difficult to overcome because an ecosystem service can affect several dimensions of well-being; and in turn, a dimension of well-being can be simultaneously affected by several categories of ecosystem service (Duraipapp, 2004). It has to be noted that it is also possible to start with a list of capabilities and then to investigate how they are related to ecosystem services.

<sup>7</sup> According to Duraipapp (2004), the 10 elements of well-being are 1) being able to be adequately nourished; 2) being able to be free from avoidable disease; 3) being able to live in an environmentally clean and safe shelter; 4) being able to have adequate and clean drinking water; 5) being able to have clean air; 6) being able to have energy to keep warm and to cook; 7) being able to use traditional medicine; 8) being able to continue using natural elements found in ecosystems for traditional cultural and spiritual practices; 9) being able to cope with extreme natural events including floods, tropical storms and landslides; and 10) being able to make sustainable management decisions that respect natural resources and enable the achievement of a sustainable income stream.

the debate between weak and strong sustainability; (iv) the ethical domain, when the loss of ecosystem services can be morally disadvantageous, in that moral values are being violated; (v) the economic domain, when the loss of ecosystem services brings with it very high economic costs in monetary terms, and (vi) the human survival domain; ecosystem services become critical when without them human life would not be possible.

This intrinsic multidimensionality makes it very difficult to assess the level of criticality and substitutability of natural capital and of the ecosystem services it provides.<sup>8</sup> Indeed, by acknowledging that natural capital and human well-being are both complex and multidimensional, we have to deal with multiple meanings and values and with measurements that are not necessarily comparable or commensurable (Scheidel, 2013). Consequently, and from a strong sustainability perspective, there are situations in which improvements in one dimension of well-being (e.g. increased income) cannot replace deteriorations in another dimension (e.g. degradation in the quality of the environment) (Martinez-Alier et al., 1998; Scheidel, 2013). We must set priorities as to the choice of ecosystem services that need to be maintained in line with the kinds of related capabilities people value. Here, public deliberation and stakeholder participation come across as being relevant courses of action in the identification of a list of ecosystem services and related capabilities.

The next section, the last in this paper, further explores the role of public deliberation in tackling the interplay between factual knowledge and normative values which is centre-stage in the definition of criticality of ecosystem services and natural capital. This interplay is a central issue in the implementation of a strong sustainability approach.

## 5. A Deliberative Approach to Human Development From a Strong Sustainability Perspective

This final section first gives a rapid overview of the main characteristics of participatory planning, which is one of the methods used to implement the deliberative aspects of the CA. Second, it presents how the CA and CNC can form both the normative basis and informational basis for a deliberative approach to human development which embraces a strong sustainability perspective. Third, it concludes with an example that illustrates our argument.

### 5.1. Implementing the Deliberative Aspects of the Capability Approach

Alkire, 2006 demonstrates the relevance of “participatory planning” methods (a particular method used in deliberative democracy) in the practical implementation of the deliberative aspects of the CA, notably with regard to local development and poverty reduction issues. According to the former, “Participatory planning techniques purport to offer a form of informed and deliberate decision making in which prospective value judgments may be made explicitly by the group(s) concerned, rather than relegating these judgments to a market mechanism, formal democracy, or leadership by committee by NGO staff or by dictator” (Alkire, 2006: 138). She notes that if adequately implemented, participatory planning can both empower people and use deliberation to identify valuable capabilities and generate plans to expand them. This kind of participatory methods is also being used in land-planning (see especially community planning methods, Wates, 2014).

It is necessary to point out however that careful attention must be paid to the quality of the democratic process, particularly the inclusion of all stakeholders in public deliberation (Deneulin, 2009). Indeed, as Sébastien (2011) shows, some stakeholders are systematically left out of “participatory” processes, such as local negotiations about sustainable

development and discussions about its implementation. She notes that a consensus obtained by omitting certain stakeholders from the process may lead to environmental degradation (for further details on power imbalances, see Alkire, 2006).

### 5.2. Critical Natural Capital, the Capability Approach and Public Deliberation

Our goal here is not to propose a methodology for deliberation, but simply to demonstrate that combining CNC and CA approaches can form the relevant informational basis and normative basis to enhance strong sustainability implementation.

#### 5.2.1. Investigating the Normative Basis

With regard to the normative basis, the CA highlights the fact that the aim of development is to improve people’s capabilities (Sen, 1999). However, this conception of development is questionable because of the risk that freedoms will be used for unsustainable actions (Lessmann and Rauschmayer, 2013).<sup>9</sup> Among others, Lessmann and Rauschmayer (2013) assert that some freedoms and lifestyles can have detrimental consequences for the capabilities of present and future generations. However, the 2011 Human Development Report (HDR) recognized that the human development field should align with the strong sustainability approach. Indeed, the report points out that “Given the principles underlying the human development approach, the inclination to give equal weight to the well-being of all generations and the centrality of risk and uncertainty, our position leans towards that of strong sustainability” (HDR, 2011: 17). This is an invitation for relating the normative goal of the CA with CNC. Indeed, CNC highlights the severely limited substitutability of natural capital, and hence the importance of taking into account the impact that the improvement and achievement of capabilities have on natural capital (Schultz et al., 2013).<sup>10</sup> Therefore, there is a need to conserve critical services of natural capital to secure both an intragenerational equitable distribution of ecosystem services related capabilities (Ballet et al., 2013) and a fair transmission of freedom of choice across generations (Dedeurwaerdere, 2014).<sup>11</sup> This implies, as noted by Peeters et al. (2013: 59), that “the social goal of enhancing people’s capabilities and well-being should be situated within the biophysical constraints of the ecosystem”. It does not mean that we must reject the moral imperative of expanding human freedoms, but that we must fully accept the biophysical constraints of the ecosystem when dealing with human development (Peeters et al., 2013), especially from a strong sustainability perspective. When considering the sustainability of human development for a particular socio-ecological system, these constraints can be addressed in the definition of CNC. Finally, this leads us on to a definition of sustainable human development which embraces a strong sustainability perspective: “The preservation, and when possible expansion, of the capabilities of the present generation – taking into account the intragenerational equitable distribution of these capabilities – which should occur without compromising the possibility of future generations to develop their own capabilities through an equitable transmission of freedom of choice across generations” (adapted from Sen, 2009: 251–252, Ballet et al., 2005: 9; Dubois, 2009: 291).

#### 5.2.2. Investigating the Informational Basis

With regard to the informational basis, we argue that ecosystem services and capabilities provide the necessary factual knowledge to analyse the multidimensional interface between the natural environment and human well-being. On the one hand, capabilities represent a wide

<sup>9</sup> For further information see the special issue of JHDC, “Capability and Sustainability”, vol 14, 2013.

<sup>10</sup> For further details on integrating the feedback effect of achieving capabilities on natural capital, see Schultz et al. (2013).

<sup>11</sup> According to Dedeurwaerdere (2014), it is an illusion to believe that by transmitting the necessary level of aggregate capital stock, technology will allow us to substitute one or other form of manufactured capital for the destruction of natural capital while preserving the same level of freedom of choice over time.

<sup>8</sup> According to Ekins et al. (2003), multidimensionality may cause insuperable difficulties in performing the necessary monetisation and aggregation across the range of issues involved in the determination of the levels of criticality and substitutability of natural capital. So monetisation methods alone seem to be inadequate when attempting to obtain the full spectrum of criticality to which natural capital may be subjected.

**Table 1**  
Identification of the ecosystem services and of their contribution to local population well-being.

Identified ecosystem services	Contribution of ecosystem services to human well-being (actual contribution required to obtain functionings) <sup>a</sup>	Dimensions of human development (contribution to central human capabilities)	Domains of criticality
Water quality regulation	Being able to have adequate and clean drinking water	Bodily health	Human survival
Local climate regulation	Being able to cope with extreme natural events	Bodily health	Human survival
Air quality regulation	Being able to have clean air	Bodily health	Human survival
Landscape quality	Being able to use the senses, to imagine, think, and reason—and to do these things in a “truly human” way	Senses, imagination and thought	Socio-cultural
Support for recreation	Being able to laugh, to play, to enjoy recreational activities	Play	Socio-cultural
Support for social relationships	Being able to live with and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction	Affiliation	Socio-cultural
Natural heritage	Being able to live with concern for and in relation to animals, plants, and the world of nature	Other Species	Socio-cultural
Soil fertility	n/a	n/a	Ecological
Habitat for biodiversity	n/a	n/a	Ecological

<sup>a</sup> For identifying the contribution of regulating services to well-being we used Duraipappah's list and for cultural services we used Nussbaum's list.

informational basis (wider than preferences or goods) by giving us a general understanding of people's access to resources and their capacity to convert these resources into well-being due to their conversion factors. The CA also allows a space for investigating the freedom of choice and action of people and people's values. On the other hand, ecosystem services indicate the large diversity of contributions made by natural capital to human existence and well-being, especially when they are linked to people's functionings and capabilities. Finally, deliberative democracy acts as a conceptual framework from which methods such as participatory planning could be adapted for the participatory identification of a set of “critical ecosystem services” and related “valuable capabilities”. Attributing a value to ecosystem services is achieved through the identification of the functionings people obtain from a particular ecosystem, such as “being able to enjoy a walk in the forest”, “being able to farm a piece of land for food”, “being able to enjoy good air quality”, “being able to access good quality drinking water” etc. The rapprochement between the CA and CNC makes it possible to precise our definition of criticality of ecosystem services and natural capital. Then it is possible to say that an ecosystem service becomes critical when it helps people obtain a set of functionings that they value and refuse to relinquish, even when compensation or substitution is offered to offset the degradation of the natural capital that produces this service. Thus, CNC corresponds to the particular configuration of natural capital that provides the set of ecosystem services publically identified as critical in a given context. The following example illustrated our argument.

### 5.3. An Example

This last subsection presents an exploratory case study that illustrates the potential of using the rapprochement between CNC and the CA as a normative and informational basis to assess land-planning projects, taking into account the multidimensionality of both human well-being and natural capital from a strong sustainability perspective. We use this rapprochement between CNC and the CA to discuss a controversial land-planning project located in the centre of Fontainebleau, France (40 miles south of Paris).

#### 5.3.1. Context and Methodology

Fontainebleau council plans to convert a remaining “natural space”<sup>12</sup> located in the town centre into an extension to an existing car park which adjoins a several building of a university. This “natural space” represents a certain configuration of natural capital which delivers several ecosystem services. Students and researchers enjoy this “natural capital” for obtaining various functionings. Initially, a researcher from the university and a person representing the Fontainebleau Biosphere Reserve

helped us identify the ecosystem services provided by this “natural space”. We then determined the contribution of these identified ecosystem services to human well-being in terms of functionings and categories of capabilities by using the Duraipappah and Nussbaum lists. We also used Brand's classification of domains of criticality. Next, we examined the potential impacts of the car park extension on the well-being of the local population. Finally, we considered potential alternative scenarios.<sup>13</sup>

#### 5.3.2. Identification of the Ecosystem Services and Their Contribution to the Well-being of the Local Population

The following is a description of the identified ecosystem services provided by the “natural space”. This space plays a role in the regulation of “water quality” through the filtration/infiltration of rainfall and runoff from streets and buildings. It contributes to local “climate regulation” through evapotranspiration and carbon capture, and to “air quality” and temperature regulation for the same reasons. The above regulating services could have held less significance in another context, for example, in a rural area or a more sparsely populated area, but in a town of approximately 30,000 inhabitants (if we also count the population of the adjacent city of Avon), they hold a level of significance that warrants attention.<sup>14</sup> In addition, the space delivers cultural services. According to the researcher we interviewed, it provides a “landscape quality” service (it is pleasant to have some “green” inside the town – university staff and students can see this area of green from their offices and from the refectory), a “recreation” service (e.g. having a walk outside when taking a break, playing football) and a “social relationships” service. Also, an old oak tree is considered by some members of the university as part of the town's “natural heritage”. In addition to these regulating and cultural services, we can say that the vegetation in the space also serves as a “habitat for biodiversity” in an urban environment. And finally, this “natural” land cover could offer a potential “soil fertility” service for developing possible provisioning services through urban agriculture projects.

Table 1 identifies the contribution made by each ecosystem service to human well-being and the domains of criticality which are affected if these services stop once the extension has been built.

Extending the car park by tarmacking the “natural space” will irreversibly destroy the nine identified ecosystem services. In accordance with the strong sustainability approach, the impact on each service of extending the car park should be assessed and the possibility of

<sup>12</sup> This ‘natural space’ covers approximately 3.74 acres. It is mainly compounded of grass surrounded by some trees and hedges.

<sup>13</sup> As far as this study represents a very preliminary exploration of the potential of combining CNC and CA for land planning and scenario assessment it was neither possible nor necessary to establish a proper deliberative process for the identification of ecosystem services and valuable functionings. However, as the basis of this new framework is now set, several research projects will be undertaken to invite the participation of relevant stakeholders to establish the lists for the ‘identification of ecosystem services and related capabilities’ step and the ‘making a choice between the different scenarios’ step.

<sup>14</sup> These regulating services could be quantified by using appropriate ecological measurements.

restoring (not compensating) these services should be identified. The community may also decide that some services can be foregone. Indeed, the strong sustainability approach does not state that all ecosystem services have to be maintained exactly as they are, but that priorities have to be democratically decided for that given context. If we first look at the feasibility of limiting irreversible impacts, it would be possible to limit (or even eliminate) the use of tarmacking by replacing it with a porous pavement system that allows water to infiltrate and vegetation to grow to a certain extent (see Liu et al., 2014). It would also be possible to plant hedges and trees, or at least not cut down those that already exist. This would maintain some regulating services and would partially reduce the impact on the landscape quality and also limit the impact on the “habitat for biodiversity” service. In contrast, it would be difficult to avoid the destruction of the potential “soil fertility” services and the cultural services. Indeed, it will probably not be feasible to play football or enjoy a walk in a car park extension. Lastly, from the perspective of participatory planning we have to envisage the possibility of formulating alternative scenarios.

### 5.3.3. Discussing Alternative Scenarios

Instead of extending the car park, it is possible to envisage creating an urban park (scenario B) or a community vegetable garden in order to have provisioning services (scenario C). Table 2 illustrates how our framework could be useful for characterising the different scenarios.

The car park extension could encourage increased motorized mobility. In terms of capabilities this would improve the ability of a certain sector of the population i.e. those who can afford a vehicle and the car park fees. This solution can still be viewed from a strong sustainability

perspective if the car park extension is part of a general strategy on the sustainability of mobility inside Fontainebleau. For example, will the car park extension significantly improve traffic flow and hence reduce levels of CO<sub>2</sub> emissions? Will the car park extension provide an opportunity to develop pedestrian zones that enable drivers to leave their vehicle and continue their journey by foot or on public transport? However, with the disappearance of the ecosystem services, the original beneficiaries (the students and the researchers at the university) will lose their capabilities. The creation of an urban park or a community vegetable garden would lead to a large diversity of functionings being achieved as it is identified in the above table. If the park or the garden is open to all citizens, the space becomes a public good. Consequently, a greater number of people would benefit from the space (more equitable access) than the car park extension and the natural capital it represents would be conserved for future generations. Finally, the original beneficiaries of the space (the students and the researchers at the university) could continue to benefit from it and thereby maintain their capabilities.

This discussion illustrates the fact that criticality is not an absolute category. As we saw, CNC corresponds to a configuration of natural capital which delivers a set of ecosystem services publically considered critical. This configuration is quite different for the three scenarios. In scenario A the current configuration of natural capital is irreversibly destroyed, along with its capacity to provide ecosystem services. In scenario B the current configuration is modified to improve the delivery of cultural services, and to a certain extent, regulating services. In scenario C the current configuration is also modified to allow provisioning services to be developed, while maintaining some regulating and cultural

**Table 2**  
Discussing the sustainability of the different scenarios.

Scenario	Impacts on ecosystem services	Functionings obtained (contributions to well-being enhancement)	Irreversibility (intergenerational justice)	Accessibility/distribution of benefits (intragenerational justice)
A: using tarmac to extend the car park	All ecosystem services irreversibly destroyed	-Being able to park easier in the town -Being able to save some time if the traffic is more free flowing (it is not easy to pinpoint the kind of human dimension which is affected)	Very high degree of irreversibility, no possible transmission of natural capital to future generations. Transmission of built capital and economic capital with a monetary value	Restricted to people with cars and who can afford the car park fares
B: urban park	Maintenance, and to some extent, improvement in the existing cultural and regulating services	Improvement in the functionings that are linked to the following dimensions: -Bodily health (e.g. being able to walk, run in the park, being able to relax, breathe fresh air) -Senses, imagination and thought (e.g. being able to be inspired, to paint, etc.) -Play (being able to play sports, games with others) -Affiliation (urban parks are meeting places) -Other Species (being able to observe and care for non-human species)	Very low degree of irreversibility. Transmission of natural capital as a potential for ecosystem services delivery. The economic value is hard to calculate, it is probably lower than scenario A	If the park is managed by the council, it becomes a public good which is widely accessible to local citizens
C: community vegetable garden	Use of a new ecosystem service: provisioning services. This use can be achieved through organic practices that help maintain the regulating services and participate in maintaining cultural services	New functionings obtained which relate to the following dimensions -Bodily health (picking local organic products) -Practical reasoning (learning new knowledge, know-how) -Control over one's environment (controlling an element of food production) -Play and affiliation (community vegetable gardens are also recreational and social places)	Very low degree of irreversibility. Transmission of natural capital as a potential for ecosystem services delivery. The economic value is hard to calculate, but it is probably lower than scenario A.	The access is generally restricted to a certain number of participants, but other options can be discussed

services. Therefore, nor the town hall representatives, the researchers or technical experts, neither the original beneficiaries can decide alone which are the critical ecosystem services and which are not and thus what should be the corresponding critical configuration of natural to be conserved, modified or lost. The determination of a set of critical ecosystem services can only occur through a public deliberation process that involves a broad range of representative stakeholders.

In sum, as it is illustrated by our example, ecosystem services, functionings and capabilities form the informational basis in the identification of the multiple links that exist between this “natural space” and the well-being of the local population. But they are not sufficient in themselves to decide which set of ecosystem services should be dispensed with and which set should be maintained. In addition, the normative basis we suggested (expanding human capabilities equitably while taking into account biophysical limits) serves to analyse the sustainability of different scenarios. It helps us discuss and compare the scenarios, but it does not attempt to provide any optimum criteria for the decision-making; and thus it serves to shape the deliberation process that is meant to lead to a decision.

## 6. Conclusion

In this paper we have attempted to conceptually improve the notion of strong sustainability through a rapprochement between its core concept, CNC, and the CA. First we demonstrated that the CA framework acts as a medium for the multidimensional facets of natural capital and therefore addresses the multidimensionality of its criticality in the production of human well-being. We showed that a suitable starting point could be the preparation of a list of ecosystem services and the identification of their impact on a predefined or co-constructed list of valuable capabilities. It is then possible to see which functionings and categories of capability benefit from ecosystem services. This approach would help define the criticality of natural capital because it would highlight the critical role natural capital plays in the generation of functionings and capabilities through ecosystem service delivery.

Second we demonstrated that the rapprochement between CNC and the CA can form both the normative basis and informational basis for a deliberative approach to human development which embraces a strong sustainability perspective. The normative basis concerns the improvement in people’s capabilities, while taking into account the biophysical constraints of the ecosphere. When considering the sustainability of human development for a particular socio-ecological system, these constraints can be addressed in the definition of CNC. The informative basis for tackling issues of human well-being is represented by the actual distribution of ecosystem services and related capabilities. On a final note, deliberative democracy acts as a conceptual framework whose methods could be adapted for a participatory identification of a set of critical ecosystem services and related “valuable” capabilities. These conceptual improvements open up possible avenues of research towards a deliberative approach which would allow to implement human development projects from a strong sustainability perspective.

## Appendix 1. An Overview of Nussbaum's Ten Central Capabilities (adapted from Nussbaum, 2003)

Life	Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
Bodily health	Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
Bodily integrity	Being able to move freely from place to place; having one's bodily boundaries treated as sovereign.
Senses, imagination and thought	Being able to use the senses, to imagine, think, and reason—and to do these things in a “truly human” way.
Emotions	Being able to have attachments to things and persons outside ourselves.

Practical reason	Being able to form a conception of the good and to engage in critical reflection about the planning of one's own life.
Affiliation	A. Being able to live for and towards others, to recognize and show concern for other human beings, to engage in various forms of social interaction; B. Having the social bases of self-respect and non-humiliation.
Other species	Being able to live with concern for and in relation to animals, plants, and the world of nature.
Play	Being able to laugh, to play, to enjoy recreational activities.
Control over one's environment	A. Political. Being able to participate effectively in political choices that govern one's life B. Material. Being able to hold property (both land and movable goods), not just formally but in terms of real opportunity; having the right to seek employment on an equal basis with others. In work, being able to work as a human being, exercising practical reason and entering into relationships of mutual recognition.

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