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Background paper prepared for the 2016 Global Education Monitoring Report

Education for people and planet: Creating sustainable futures for all

Indigenous knowledge and implications for the sustainable development agenda

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Abstract¹

This paper attempts to explore how indigenous peoples respond to ecological and development challenges and how their cultures and knowledge systems can contribute to the sustainable development agenda. At first, it will look at the characteristics of indigenous knowledge and at indigenous peoples' notions of development to understand the concepts in which traditional knowledge is rooted. Then, it will analyse the means of knowledge maintenance and transmission, with a particular focus on the importance of women and elders and on the ambivalent role played by formal education. After that, it will explore the relationship between indigenous knowledge, sustainable practices and land and resource management, looking at the role of community and women as well as at new alternative strategies for sustainable development implemented by some indigenous groups. The paper will then look at the contribution of indigenous knowledge to climate change adaptation and to disaster risk reduction. This will be followed by an analysis of the impact of mitigation strategies on indigenous populations and on the necessity of guaranteeing full access to land and justice to allow indigenous peoples to fully realise their rights. The paper will conclude with a reflection on the importance of having an integrated system of knowledge, in which indigenous peoples will have the opportunity not only to share their experiences to overcome future challenges, but also to become active agents of change by being involved in the decision making processes.

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Introduction

Indigenous communities around the world are constantly struggling to maintain their rights, their traditions and their knowledge, in a system still dominated by a western worldview. They face the challenge of living in two worlds, the indigenous and the non-indigenous one, in constant tension with each other, with the latter having more power in shaping the former. For centuries, indigenous populations have suffered from invasion and oppression, and oftentimes they have seen their knowledge eclipsed by western knowledge, imposed on them through western institutions. Yet, indigenous populations have managed to survive for centuries adapting in many different ways to adverse climate conditions and managing to create sustainable livelihood systems. Their diverse forms of knowledge, deeply rooted in their relationships with the environment as well as in cultural cohesion, have allowed many of these communities to maintain a sustainable use and management of natural resources, to protect their environment and to enhance their resilience; their ability to observe, adapt and mitigate has helped many indigenous communities face new and complex circumstances that have often severely impacted their way of living and their territories.

In the report *Realizing the Future We Want*, the UN System Task Team on the Post 2015 UN Development Agenda acknowledges the importance of indigenous knowledge for environmental sustainability stating that “traditional and indigenous knowledge, adaptation and coping strategies can be major assets for local response strategies” (2012, p.28). Therefore, in light of the new post-2015 sustainability agenda, it is essential to explore the linkages between sustainable development and indigenous knowledge, intended here as local knowledge of indigenous communities having its own epistemology and scientific validity and not as opposite to western knowledge. This exploration will provide an opportunity to understand how indigenous peoples in different regions of the world have been responding to ecological and development challenges and how, because of their knowledge systems deeply rooted in local ecology, they can be valuable agents in maintaining global biodiversity and building resilience to climate change.

Through an extensive literature review, this paper aims to understand how indigenous cultures and their knowledge systems can contribute to global challenges. In order to do so, the paper will attempt first to conceptualize indigenous peoples’ notions of development; then, to explore the relationship between indigenous knowledge and sustainable practices and land and resource management. After that, there will be a discussion on the implications of indigenous knowledge in climate change adaptation strategies as well as in disaster risk reduction. This will be followed by a critical reflection of the impact of mitigation strategies on indigenous populations and territories and on the necessity of guaranteeing full access to lands and justice to allow indigenous peoples to realise their rights. Central to this understanding will be a discussion of the characteristics of indigenous knowledge as well as a reflection of its transmission and the benefits of integrating it within the broader sustainable development agenda. Because of the vast body of literature, the examples proposed in this research have been selected by the author to represent the experiences of some indigenous communities around the world relevant to the arguments of the paper. Despite the existence of common experiences and adaptation strategies, the author acknowledges the diversity and uniqueness of indigenous communities around the world. The examples used are therefore not exhaustive nor do they pretend to be universally representative of all indigenous groups.

Indigenous peoples' definition

For decades, finding a common international and universal definition of “indigenous peoples” able to encompass all the different local realities of indigenous groups around the world as well as their cultural diversity has been problematic. Often, the two definitions most frequently used are the one that José Martínez Cobo, Special Rapporteur of the Sub-Commission on Prevention of Discrimination and Protection of Minorities, provided in the document “Study of the Problem of Discrimination against Indigenous Populations” from 1986 and the one of the International Labour Organization (ILO) Convention no.169 from 1989². Besides the similarity between the two definitions, for the scope of this study we use the former one as it includes a component on inter-generational knowledge transmission, essential to this paper. Thus, according to Martínez Cobo,

“Indigenous communities, peoples and nations are those which, having a **historical continuity**³ with **pre-invasion and pre-colonial societies that developed on their territories**, consider themselves distinct from other sectors of the societies now prevailing in those territories, or parts of them. They **form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity**, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal systems” (UNDESA, 2004).

“On an individual basis, an indigenous person is one who belongs to these indigenous populations through **self-identification as indigenous** (group consciousness) and is **recognized and accepted by these populations** as one of its members (acceptance by the group). This preserves for these communities the **sovereign right and power to decide who belongs to them**, without external interference” (UNDESA, 2004).

One important aspect worthy to note in this definition is the high connotation of empowerment embedded within the term “indigenous”. In fact, if once the term “indigenous” was used with a negative connotation as synonym of “outsider” (Maurial, 2002), nowadays, this term has become a symbol of the self-identification, self-determination, sovereignty and resilience of indigenous peoples worldwide. Indigenous peoples have, indeed, demonstrated an increasingly active involvement in advocating and lobbying for their rights to access their lands and preserve and transmit their knowledge and traditions as well as to have their voices heard at national and international levels. It is under this optic of legitimization of “the indigenous” that this paper has been conceived.

² “Indigenous peoples are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonisation or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions.” (ILO n.169, 1989)

³ With historical continuity referring to factors such as ancestral land occupation, culture and language.

Indigenous knowledge: definition and conceptualizations in the academic and development discourse

Indigenous, traditional or local⁴ knowledge refers to the knowledge and know-how unique to a given society or culture, which encompasses “the cultural traditions, values, beliefs, and worldviews of local people” (Dei, 1993, in Agrawal, 1995, p.418), including specific beliefs, rules and taboos that are part of the customary law of a specific group (AIPP et al., 2012; Mu Xiuping and Kissya, 2010). Indigenous knowledge is therefore vital for the survival of the historical and cultural heritage of a particular group as it “forms [its] backbone of social, economic, scientific and technological identity” (Odora Hoppers, 2001, p.76).

As acknowledged in the *Principles and Guidelines for the Protection of the Heritage of Indigenous peoples*⁵, indigenous knowledge is a “complete knowledge system with its own concepts of epistemology, and its own scientific and logical validity” (Battiste, 2002, p.7). Among its characteristics there is its practicality and dynamicity, derived mainly from contextual and cultural changes, which requires indigenous peoples to constantly renegotiate with their environment (Sillitoe, 1998), maintaining their knowledge system in constant evolution (Bates, 2009). Indigenous knowledge “represents [therefore] generations of creative thought and action within each individual community, as it struggles with an ever-changing set of conditions and problems” (Warren, 1996). Because of these strong contextual and cultural connections indigenous knowledge becomes an essential part of indigenous peoples’ lives as it provides the necessary means of survival. Indeed, it is usually “driven by the pragmatic, utilitarian and everyday demands of life” (Briggs, 2005, p. 10), which are influenced also by non-indigenous elements, such as indigenous response to innovation (Maurial, 2002). Indigenous peoples are actors of their knowledge; therefore, separating indigenous knowledge from its socio-cultural context is very dangerous for its understanding as it becomes meaningless and may lead to misleading interpretations (UNESCO, 2009; McCall, 1995 in Sillitoe, 1998). Another aspect that is important to specify is that, besides the close link with the local reality, similar features of indigenous knowledge have been observed in different regions of the world, especially in relation to resource management practices and climate change adaptation strategies, as it will be explained in other sections of this paper.

According to Sillitoe (1998), in the past, the interests related to the studying of indigenous knowledge could be divided into two kinds of areas: the academic one and the development one. The former, including research works from the field of anthropology and ethnography and the latter, more related to land management and participatory development (Agrawal, 2002; Sillitoe, 1998). Many studies carried out in the 80s stress the importance of indigenous knowledge for development. For instance, Brokensha, Warren and Werner (1980, in Agrawal, 1995) talk about the idea of “development from below”. Indigenous knowledge becomes an essential element to this idea as it allows for the increase of the relevance and the

⁴ For the scope of this paper the term “traditional” and “local” are used as a synonym of “indigenous”.

⁵ ECOSOC.(June, 1995). E/CN.4/Sub.2/1995/26. *Principles and Guidelines for the Protection of the Heritage of Indigenous People*. United Nation Sub-Commission on Prevention of Discrimination and Protection of Minorities, Commission on Human Rights. New York: United States.

adaptation of technology to the local needs, the preservation of valuable local knowledge and the use of local skills in monitoring and early warning systems and emphasises human needs and resources. Through their research illustrating the utility of indigenous knowledge, these scholars attempted to raise awareness among policy makers and neoliberal economists of the importance of bottom-up perspectives to create more locally appropriate and environmentally sustainable solutions (Agrawal, 2002; Sillitoe, 1998).

In recent years, the increasing awareness of the sustainable way of living of indigenous populations as well as the deterioration of the conditions of the planet have impacted even more the field of indigenous knowledge studies, with an intensification of studies related to the use of indigenous knowledge in areas such as ecology, biodiversity and environmental conservation, land, natural resources and wildlife management, health and education (Agrawal, 2002; Warren et al., 1993, in Agrawal, 1995); and more recently about adaptation and mitigation strategies to combat climate change and environmental hazards (Nakashima et al., 2012). Indigenous knowledge has been therefore used increasingly to “remedy many of the problems [caused] by development strategies during the past five decades” (Agrawal, 1995, p.420).

In this optic of “development from below” and “indigenous knowledge as a remedy” are also situated some of the concepts related to indigenous knowledge that have emerged recently, which are often critiques of development or, as Briggs (2005) mentions, can be seen as “possible alternative[s] for progress” (p.3). This is the case, for instance, of the idea of *buen vivir* discussed below, which has arisen as a reaction to the negative impact of development strategies on indigenous territories and indigenous groups and can be considered as a new conceptualization of development (Gudynas, 2011a; UNPFII, 2010). In relation to this, it is important to point out that the conception of development, intended as an increase of productivity, modernization, technology and possession of goods and financial capital, is neither part of indigenous knowledge nor of the cosmovisions and languages of indigenous groups (Gudynas, 2011a; Cunningham, 2010a; UNPFII, 2010; Walsh, 2010). In fact, as Aikman (2010) points out, the use of western indicators of development such as consumer goods, purchasing power, and access to services to assess the state of indigenous population fails to take into account specific aspects that indigenous communities worldwide consider essential for their survival. Among these specific aspects there are, for instance, the rights to land and resources, culture and identity and self-determination (Tauli-Corpuz, 2005), which have increasingly become the basis of indigenous peoples’ resistance against all sorts of development policies and projects that have negatively impacted their populations. Other notions embedded in indigenous peoples’ ways of living will be mentioned as followed.

Indigenous knowledge: notions of living well

Central to indigenous peoples' livelihood is the notion of living well, which is based on a set of norms and values shared by different indigenous groups across the world. Fundamental to these values are aspects such as the community, the harmonious relationship between human-nature-universe and notions of equality and complementarity (Ibañez, 2010; Gudynas, 2011b). Among the fundamental conditions of well-being are sufficient food, strong family and community values of caring, reciprocity and solidarity, freedom to express identity and to practice one's culture and safe and non-polluted environment (UNPFII, 2010).

Several efforts have been made among indigenous populations around the world to promote and legitimize their notions of living well. Because of the different experiences and lifestyles of indigenous communities, indigenous groups across the world have adopted different approaches towards the concept of well-being, which differ slightly among each other, despite sharing some common principles and values (Gudynas, 2011a; Mollo, 2011; Thompson, 2011; Cunningham, 2010a; 2010b, UNPFII, 2010). Of the different perspectives of well-being that will be mentioned as follows, some have been adopted at regional levels, some at national levels, some others at local levels only, and some that are proper to a particular group have been extended to other indigenous communities.

Regional notions of living well

For instance, in Latin America, the idea of *buen vivir* has been considered by academics, indigenous leaders, communities and politicians as a guiding principle for a new regimen of development that incorporates the vision of indigenous peoples as well as their traditional knowledge and must be carried out in a collective way (Gudynas, 2011a; Gudynas and Acosta, 2011; Thomson, 2011; Cunningham, 2010a; Walsh, 2010). According to the same indigenous leaders of the region, *buen vivir* can be considered as “a contribution from indigenous populations to the world” (Ibañez, 2010, p.187). Among the principles of *buen vivir* common to indigenous groups across the region is the relationship between human, nature and universe, where nature is considered a “living being” and it has an indissoluble, interdependent, balanced and complementary relationship with the universe and with human beings (Gudynas, 2011a; Mollo, 2011; Cunningham, 2010b, Walsh, 2010). The idea of community and communitarianism are also very important aspects of *buen vivir* (Gudynas, 2011a; Ibañez, 2010; Cunningham, 2010b). The community, rather than the individual, is the main reference for natural and cultural property. Harmony within indigenous communities is reached through a system of equality and respect. Equality and respect for all the members of the community is emphasised and, in particular for women and elders, both groups being the primary holders and transmitters of traditional knowledge.

National and local notions of living well

Two of the most well-known national-level approaches are those in Bolivia and Ecuador. The Kichwa concept of *sumak kawsay* was adopted by the Ecuadorian Constitution of 2008, and the Aymara concept of *suma qamaña* was adopted by the Bolivian Constitution of 2009. Both concepts mean living well; in harmony with the nature and the universe, with the latter having more emphasis on the communitarian life: living well together (Choque, 2006, in Gudynas, 2011b; Gudynas, 2011b).

At local level, in Panama, the Ngobe people use the expression *ti nûle kûin*, which means be happy, live well with good health, free from concerns and in harmony with nature (Mollo, 2011). Similarly, in Chile, the Mapuche indigenous group uses the expression *kûme mongen*, which refers to a good life resulting from a balanced relationship among a person, the environment and the supernatural (Hasen-Narváez and Cortez-López, 2012). While Guarani people use the term *ñande reko* among others to refer to the harmonious living that is maintained since the grandparents' time; *teko kavi* to refer to good life, which implies a respect for life; and *ivi maraei* to indicate the land without evil (Gudynas, 2011a; Mamani, 2010; Mollo, 2011). In Nicaragua, the Miskitu group uses the concept *laman laka*, defined as common good, to refer to the set of norms that regulate aspects of the communal living, such as use of the land, interaction and exchange among people, and that are created to maintain harmony within the family and the community regardless of gender or age (Cunningham, 2010a; 2010b). Outside Latin America, other indigenous groups also use concepts referring to well-being. In the Philippines, for instance, the Kankanaey Igorot, from the Cordillera region talk about *gawis ay biag*, which means good life, and it refers to the systems or rules and taboos that are part of the concept of *inmayan*, which means “do not do it” (UNPFII, 2010).

As for a concept, particular to a specific culture that has been expanded to others, is the concept of *balu wala*, a concept of the indigenous group from Panamá, Kuna. This refers to the relationship between the motherland and the human being, and it is used to establish different kinds of relationships characterized by respect and equity as well as the organizational systems related to the indigenous economic institutions (COONAPIP, 2009). The *Consejo Indígena de Centroamérica* (CICA) used it as methodological instrument to develop the *Plan Indígena de Desarrollo Comunitario* (PIDCO), with the aim of directing the indigenous communities of the Central American countries towards *buen vivir* (Caudillo-Félix, 2012).

Limitations in implementation and empowerment of the living well notions

The notions of *buen vivir* abovementioned offer a great contribution to today's world in crucial aspects such as social organization and economic structure. The harmony between human-nature-universe, for instance, is a key factor in carrying out activities related to resource production and management. Nevertheless, the discourse still remains at a philosophical level, far from having its principles applied concretely in the way of living of the whole society, even in countries such as Bolivia or Ecuador where the idea has been constitutionalized. Alberto Acosta, in a reflection about the actual application of *buen vivir* in both countries, highlights, in the case of Ecuador, the need for a pluralistic transition process consisting of a deeper understanding among the whole population of the real meaning of *buen vivir*, as in his opinion the concept is currently used for *political marketing* rather than to indicate a transformative process. On the other hand, in Bolivia, there is a more widespread, better understanding of the concept but still a failure in the real implementation of the ideas related to it at a country level and among the whole population (Fernández, Pardo and Salamanca, 2014).

Indigenous knowledge maintenance and transmission

Research shows evidence that indigenous groups conceive education as a learning for life experience, which is not confined to formal schooling or a fixed curriculum (Kanstrup-Jensen, 2006). Through a life-long learning approach based on learning by doing (Preston 1975, 1982 in Ohmagari and Berkes, 1997) through observations, actions, and interactions with both adults and environment (UNESCO, 2009)

indigenous peoples ensure the preparation of the individual to fully become a member of their community. Indigenous knowledge is a “living process to be absorbed and understood” (Battiste, 2002), and it is not therefore based on reading books or following a course (Köhler-Rollefson, 1996).

Indigenous knowledge is transmitted from generation to generation. The same community, together with the family, which includes parents, grandparents and older siblings, is responsible for transmitting skills and values to the individual. Sometimes this happens through word of mouth (Warren, 1991), for instance, by the use of storytelling, myths narration (van der Ploeg, 1989, in Sillitoe, 1998), metaphors (Marika et al., 2009), or songs (Battiste, 2002). This explains why the preservation of indigenous languages is also vital to the survival of indigenous knowledge; and sometimes it happens by traditions learned through informed experiences and practical demonstrations, such as rituals and ceremonies (Sillitoe, 1998) or symbols and artworks (Battiste, 2002).

Experiential learning, therefore, plays an essential part in the transmission of indigenous knowledge, which also allows indigenous peoples to adapt to changes overtime (Bates, 2009). As Maurial (2002) points out, oral and experiential traditions are ways for indigenous peoples to foster relationships not only among humans but also between humans and nature, maintaining in this way indigenous well-being. Nevertheless, it is important to point out that knowledge transfer is not a homogenous process and it is influenced by factors such as age, gender, experience, political power, and occupation which may generate different knowledge systems within the same community as well as affecting the quality and quantity of indigenous knowledge possessed by a person (Briggs, 2005; Grenier, 1998; Scones and Thompson, 1994, in Sillitoe, 1998).

Gender knowledge transmission

Knowledge transmission and acquisition can be gender differentiated. Men and women throughout their lives have access to and specialize in different aspects of traditional knowledge (Gururani, 2002). Thus, even though men and women share knowledge on some aspects of their lives, they also possess different, but complementary, knowledge on similar things and have different forms to communicate their knowledge (Schmink and Gómez-García, 2015; Gemedo-Dalle et al., 2006; Grenier, 1998). This issue is mainly related to the different role that they have in their communities as well as to the different tasks and duties that both groups carry out on a daily basis. For instance, men of the Arakmbut group in the Peruvian Amazon develop an understanding of the forest more related to their hunting activities, while women develop a different understanding linked to activities such as plant gathering and fruit picking (Aikman, 2003). Nevertheless, despite the fact that both men and women are responsible for transmitting traditional knowledge to future generations, it is important to point out that within indigenous communities, women and elders have a special role (Tebtebba, 2009; Ramphela, 2004).

Women are generally identified with the motherland because, just as the land, they also “produce” life (Caudillo-Félix, 2012). Indigenous women are seen within their communities not only as the main caregivers but also as custodians of traditional knowledge, culture and biological diversity as indicated in the Indigenous Peoples’ Plan of Implementation on Sustainable Development (2002). Therefore, part of the informal learning process consists of the transmission of traditional knowledge and cultural wisdom from women to their children (Cunningham, 2010b; Howell, 2003). This knowledge can span from methods of conservation and sustainable use of resources to warning signs deriving from natural phenomena.

Examples from Africa show the ability of indigenous women to develop coping strategies, such as relying on plants and crops more tolerant to droughts to secure food for the household during drought periods (Ramphela, 2004). Examples from India demonstrate the importance of indigenous women's knowledge in maintaining traditional habits. For instance, Adivasi women's knowledge is very important for forest conservation, as these women know exactly which type of product to collect depending on the season and the time of the day in order not to overexploit the forest (Pradhan, et al., 2011); while, the knowledge of women from the Bhotiya tribal community is essential to the making of natural dyes, as they are in charge of a great share of the production which goes from the plant collection to the preparation of woollen products and their marketing (Kala, 2002).

Because of this important role attributed to women by indigenous societies, one may think that women within indigenous communities do not suffer from discrimination. Unfortunately, this is not always the case. In fact, despite their importance, indigenous women most of the time find themselves in a vulnerable position. For instance, their knowledge is invisible (Rocheleau, 1991), their work is undervalued (Ramphela, 2004; Gururani, 2002), and their voices are generally silenced in public arenas and international forums (Schmink and Gómez-García, 2015; Caudillo-Félix, 2012). Some of the argumentations in relation to the underestimation of indigenous women have been attributed to the lack of access to citizenship rights and services. An example can be the formal educational system, where women's participations has been limited until recently (Schmink and Gómez-García, 2015) and which has been responsible for transmitting values that are contrasting with the ones of indigenous communities, especially the one of respect and equality between men and women (Caudillo-Félix, 2012). One of the main risks related to indigenous women's invisibility is the substantial loss of indigenous knowledge. In order to arrest this knowledge loss, there is the need to implement initiatives aiming to increase the national and international visibility and participation of indigenous women.

Intergenerational knowledge transmission

As previously mentioned, together with women, elderly people are the custodians of indigenous knowledge and, consequently, the most valuable source of transmission (Dweba and Mearns, 2011). The role of elders' knowledge transmission can be understood, for instance, by the metaphor of the *Yambirra* employed by Yolngu, an indigenous population from northeast Arnhem Land in the Northern Territory of Australia. The *Yambirra* is literally a fish trap made by a collection of rocks positioned in a circular shape where, through a system of small holes, the fish get trapped during high tide. Metaphorically, the rocks represent the elders and the fish represent the children and the grandchildren, who within the *Yambirra* are protected by the elders who come together to guide them into the foundations of learning of the community (Marika et al., 2009). Successful education initiatives, such as the Alaska Rural Systemic Initiative, foster the ongoing interactions of the students with indigenous elders through different means. For instance, elders play a central role in instructional planning, curriculum design and program implementation in culturally responsive schools and are responsible for carrying out knowledge transmission related activities in cultural camps (Barnhardt, 2008; Barnhardt and Kawagley, 2005).

Nevertheless, despite the importance attributed to elders, studies on indigenous knowledge transmission have revealed a growing inter-generational gap between older and younger generations, culminating often in the resistance of the latter towards the acquisition of traditional practices. Already in the early 1990s, Posey (1990) was mentioning the strong influence of the "industrialized world" on young generations as

the main cause of this resistance. Similarly, Ohmagari and Berkes (1997), in their study of knowledge transmission among women of the Omushkego Cree group in Canada, highlight how social changes caused by sedentarization, formal schooling and the introduction of television have brought changes also in the value system of younger generations who do not attribute the same value to indigenous knowledge as their parents or grandparents. Interestingly, it is also the study of Rocheleau (1991), who, in her work in Kenya, noticed a difference in the amount of knowledge loss between young men and young women. The knowledge gap among generations of women was less pronounced than that of men.

This increasing trend, acknowledged also by the same indigenous peoples in international conferences⁶, shows how, despite the increasingly active involvement of indigenous peoples, the lower status that is still attributed to indigenous knowledge and societies. Additionally, the persistent stigma related to everything that is “indigenous”, keeps influencing the ways in which younger generations perceive traditional knowledge and, consequently, decide whether to acquire it or not. For instance, among the Xhosa people in the Eastern Cape Province in South Africa, because of the association of traditional vegetables with poverty and primitiveness, younger generations have stopped learning about these vegetables and using them in their diet, as they do not want to be associated with a lower social status or backwardness more generally. These types of choices made by indigenous youth have brought the loss of important resources, such as traditional vegetables in this specific case, which are a very important source of nutrition especially in poor rural communities (Dweba and Mearns, 2011). As Ford et al. (2010, in Nakashima et al., 2012) point out, the loss of indigenous knowledge has severe consequences for younger generations as it weakens their social capital, which may reduce their ability to respond to ecological and socioeconomic challenges.

As it has been mentioned in the case of indigenous women’s knowledge, formal schooling has been one of the main factors responsible for weakening the relationships between young and old generations with dramatic consequences for indigenous knowledge transmission (AIPP et al., 2014; UNESCO, 2009; Odora Hoppers, 2001; Rocheleau, 1991). For instance, Wongbusarakum (2009) in his research in the Adang Archipelago with the Urak Lawoi group, highlights how in this remote corner of the globe formal schooling has become “a primary instrument of cultural modification and [the] primary source of knowledge about the outside world”, having negative consequences on the maintenance of indigenous knowledge in younger generations.

The role of formal education

The role of formal schooling in the transmission of indigenous knowledge is contrasting. Education can be seen both as the cause of the loss of indigenous knowledge, as well as a potential cure to restore this loss (UNESCO, 2009). Research has indeed documented the negative impact of formal schooling systems on the significant background knowledge about nature, culture and values that indigenous children have previously acquired in their communities. Because education has been serving as a means of transmission of ideologies of the people in power, indigenous knowledge has been denied and destroyed for centuries through formal education systems conceptualized under western or national norms (depending on the country), which were promoting homogenization rather than plurality (Mato, 2015; Stavenhagen, 2015). Examples from countries such as Canada, the United States and Australia show the unquantifiable amount

⁶ Resilience in a Time of Uncertainty: Indigenous Peoples and Climate change, 26-27 November 2015, Paris, France.

of indigenous knowledge loss from the beginning of the 20th century, when indigenous children were sent to residential schools (Ohmagari and Berkes, 1997), boarding schools (Reyhner and Eder, 2015) or dormitories (Armitage, 1995) in an attempt to assimilate them within the mainstream society. As Stavenhagen (2015) points out, the separation of indigenous children from their families and, consequently, from their cultural roots caused “irreparable harm to the survival of indigenous cultures and societies” (p. 255).

Currently, the strong western focus of education systems and institutions around the world keeps preventing a meaningful inclusion of the indigenous populations and their knowledge and practices within the formal schooling system. Among the factors involved in the westernization of the education system, there are the curricula, which usually lack contextual relevance and devalue indigenous knowledge (UNESCO, 2009; Barnhardt and Kawagley, 2005; Maurial, 2002); the teaching methodologies, such as the language of instruction, which is generally the dominant one (Batibo, 2009; Wongbusarakum, 2009); the assessment strategies (Barnhardt and Kawagley, 2005); the faculty attitude (Radoll, 2015); and the values promoted, which often clash with traditional teachings (Nakashima et al., 2012). Additionally, because of the time spent in school, indigenous children spend less time in community settings and participating in traditional activities (Nakashima et al., 2012; Batibo, 2009; Ohmagari and Berkes, 1997). This, combined with the strong focus on acculturation, assimilation and the consequent underestimation of indigenous knowledge, means that “every time a child enters the gates of the school, the spontaneous process of that symbolic fumigation, cosmological cleansing, and mandated acculturation begins” (Odora Hoppers, 2001, p.75). A situation illustrated by Kratli and Dyer (2006, in Aikman, 2010, p.18), shows how, in the case of pastoralist communities in Africa, formal education initiatives implemented by people with no or little knowledge of pastoralists’ traditional ways of living, have become instruments to transform pastoralists into settled farmers, waged labourers or 'modern' livestock producers.

Together with the loss of indigenous knowledge, indigenous students have higher degrees of illiteracy, poor school attendance and poor academic achievement compared to the rest of the population (Stavenhagen, 2015). Indeed, in relation to this last aspect, research on indigenous students’ performance in formal education systems around the world shows that the acculturation process promoted by formal schooling widens the achievement gap between indigenous and non-indigenous students at different education levels; the former the ones who are usually left behind and have fewer opportunities to reach higher education levels. For instance, in Australia, the analysis of the 2009 and the 2012 PISA results indicate that indigenous students remain two and half years behind their non-indigenous peers in mathematics, science and reading literacy (Dreise and Thomson, 2014; Song et al., 2014). Analyses carried out at national levels, for instance in Peru, show that over the first three years of formal schooling, indigenous children lose substantial ground in math and vocabulary, widening their achievement gap with non-indigenous children (Arteaga, and Glewwe, 2014). As the authors suggest, in the long-term if these results keep being ignored by policymakers, there may be a negative impact on aspects such as educational attainment and poverty in the country (Arteaga, and Glewwe, 2014).

Attempts to include or restore indigenous knowledge and practices through formal schooling have been made in many regions of the world. Some of them have led to negative outcomes, while others have led to more successful ones. An example of an unsuccessful initiative, for instance, is the one related to an educational project aimed at addressing issues of school attendance, achievement and wellbeing of Yolngu

youth in Australia, while maintaining their cultural integrity (Marika et al. 2009). The imposition of school staff by the Northern Territory Department of Education and Training (DET) without first consulting the Yolngu elders, as in the agreement, created tensions between the Government and the Yolngu community, who was defending the right to choose its own school staff, in order to be sure to employ people with good attitudes towards the Yolngu. Because of these tensions, the project was never implemented. This example shows, once again, the negative effect of the lack of involvement of indigenous communities in the decision making process. In order to have a meaningful and relevant education for indigenous children and youth, it is therefore necessary that indigenous communities participate in the formulation of education policies. Their participation is the key for the successful implementation of education initiatives, as it will be discussed in the following examples.

Among the regions that have adopted forms of indigenous education, recognized and praised also by the same indigenous peoples (UNPFII, 2008), Latin America and the Caribbean have been in the vanguard with the implementation of intercultural bilingual education models, the creation of indigenous universities and other higher education institutions, and the development of degrees and programs with the objective of increasing indigenous populations' inclusion. The approach for the creation of these institutions and programs varies across countries. In some cases, they have been established by the States; in others, through partnerships among indigenous organizations, higher education institutions, civil societies, private foundations, and development and cooperation agencies; and in some others, by indigenous movements of the region, which for years have been pushing for the rights of indigenous peoples to have an appropriate education (Mato, 2015). This idea translated into the intercultural education approach, which recognizes the linguistic and cultural diversity, in terms of values, worldviews, knowledge (acquired and produced) and learning systems of indigenous, afro-descendants and non-indigenous groups and promotes dialogue among these groups (Gallardo Gutiérrez, 2004, in Rehaag, 2010; Mato, 2008a). Mato (2008a) points out that the innovation of intercultural universities lies in their curricula, which are created with the idea of learning both traditional and non-traditional knowledge. In some countries of Latin America, such as in Mexico, intercultural universities have served as the designated spaces not only to promote this intercultural dialogue, but also to train professionals interested in carrying out research on indigenous languages, cultures and worldviews and committed to the development of their own communities (Schmelkels, 2004). Indeed, intercultural universities have become centres that train professionals and technicians to work mainly in their communities or regions in the health and education sectors, organizations, community projects, small businesses and cooperatives. These types of jobs aim at helping the communities to improve people's quality of life through the creation of better services and the protection and enhancement of their rights (Mato, 2008b).

The importance and positive impact of the two-way learning process implemented in indigenous universities in Latin America is also highlighted in other studies analysing the educational systems in Alaska Native communities (Barnhardt, 2008; Barnhardt and Kawagley, 2005). The Alaska Rural Systemic Initiative (AKRSI), is a network of 176 rural schools serving around 20 thousand students, predominantly indigenous. The main objective of the initiative has been integrating indigenous knowledge and pedagogy within the mainstream education system, through activities such as parents' and elders' involvement, experiential learning, cultural camps, standards for culturally responsive schools and native educator associations. The initiatives promoted through the AKRSI, such as the Old Minto Cultural Camp held by the elders of Minto, brought a pedagogical shift "from teaching about local culture to teaching through

culture” (Barnhardt, 2008, p.113). Additionally, the program has successfully set the basis for the creation of research initiatives and opportunities to partner with other indigenous communities across the United States and around the world, focusing on the intersection of indigenous knowledge systems and formal education in a variety of disciplines, such as indigenous epistemologies, culturally responsive pedagogy, and ethnomathematics. According to Barnhardt (2008), the success of AKRSI lies the ability of indigenous communities from Alaska to “accommodate the differences between their ways of life and those of the outside world while at the same time strengthening critical features of their own diverse cultural history and traditions” (p.114).

Intercultural universities and the Alaska Rural Systemic Initiative are two successful examples that demonstrate the positive impact of education initiatives characterized by dialogue, power balance in the decision making process and mutual respect between the different parties involved. These two initiatives represent in a way what indigenous peoples are now asking in terms of formal schooling reform; it is to say, a culturally-appropriate education with a school curriculum that reflects cultural diversity, includes indigenous languages, recognizes and contemplates the use of alternative educational practices and teaching methods that are based on different knowledge systems and different worldviews (Stavenhagen, 2015; Aikman, 2010); a curriculum that is not only contextually relevant, but also open to the whole national society in general. Within the new sustainable development agenda, the development and implementation of education initiatives aiming at integrating knowledge systems and finding a balance between them is crucial. Indeed, these initiatives will provide precious “insights into ways by which we can extend the scope of our education systems to prepare all students [...] to make a fulfilling and sustainable life for themselves” (Barnhardt, 2008, p.114) and, consequently, for their communities. More joint efforts from governments, educational institutions and indigenous communities are therefore required to develop and implement suitable education policies, to create more intercultural education systems and to empower indigenous peoples to uphold and realise their rights.

Indigenous knowledge in sustainable practices, land and resource management and ecotourism

As it was previously mentioned, indigenous groups have their own visions of development, which differ from the idea of development attached to modern societies. Respect for nature and its conservation as well as community-based management of lands and natural resources are central to the indigenous ideas of well-being. Natural resources are not marketable and the community is the pillar around which indigenous peoples organise their lives (Cunningham, 2010a). Territories are vital for indigenous populations, as it is in these spaces that indigenous communities can carry out social, economic, cultural and environmental activities, which include sustainable production and consumption practices, as well as resource conservation and management techniques, the majority of which are based on traditional knowledge and customary systems of governance (Hiwasaki et al., 2014; Cunningham, 2010a). Thus, “[b]ecause indigenous knowledge has permitted its holders to exist in “harmony” with nature [for centuries], it is seen as especially pivotal in discussions of sustainable resource use” (Agrawal, 1995, p.1).

For centuries, to keep the harmony with the environment leading to a sustainable livelihood, indigenous populations have been carrying out practices adapted to their lands (Aluma, 2004). González et al. (2010) highlight that indigenous populations have been favouring and strengthening sustainable agricultural practices as far back as thousands of years ago. For instance, in the case of the Andes, these practices go

back as far as 8 to 10 thousand years. Among the activities recognized by indigenous peoples as viable and sustainable economic practices there are rotational farming, shifting cultivation (sometimes called also swidden agriculture), pastoralism, fishing, agroforestry, hunting and gathering (Kimberly Declaration, 2002). Additionally, indigenous populations rely on multiple resources and on a high diversity of crops to carry out more sustainable and resilient ways of living. Through the centuries, in fact, indigenous populations have developed specific techniques and technologies to carry out their activities in environmentally friendly and cost-effective ways that “ensure food security while conserving the diversity of wild and domestic plant” (Nakashima et al. 2012, p.57).

Among the technologies used by indigenous farmers in South and Southeast Asia, there is for, instance, shifting cultivation, which is a form of agriculture characterized by 1) an alternation of short span of cultivation and a long span of fallow; 2) the cyclical shifting of the fields; 3) the removal of natural vegetation normally by use of fire (AIPP et al., 2014; Erni, 2005). Like other forms of resource management, this farming technique brings together important aspects of indigenous ways of living, such as community-based management strategies and customary institutions and rituals (Erni, 2005). Additionally, this form of agriculture is very important, as it allows farmers to rely on rich biodiversity and enhance their food security, as different varieties of plants and crops are harvested together (AIPP et al., 2012; Nakashima et al., 2012; Laungaramsri, 2005). Unfortunately, this practice has been misunderstood and considered by national and international organizations as one of the main causes of land degradation and carbon emissions in tropical regions of the world. As a consequence, many policies limiting access to land have been created (AIPP et al., 2014; Erni, 2005). In order to cope with the issues related to shifting cultivation, indigenous populations in South and Southeast Asia have started to combine this practice with other activities. For instance, in northern Thailand some Karen communities have started to rely on ethnic tourism due to their proximity with unique landscapes; other Karen communities have started to compensate the loss of swidden fields by focusing on the cultivation of other plants, such as tea and bamboo (Laungaramsri, 2005). Research has also shown that, in the worst cases, indigenous groups affected by anti-shifting cultivation policies have been forced to abandon this traditional practice and move towards the market economy (AIPP et al., 2014; Laungaramsri, 2005).

Other central aspects of indigenous sustainable livelihood are indigenous cosmovision and spiritual practices. Studies carried out in Amazonia, for instance, have highlighted the importance of shamans and healers to provide guidance on hunting and agricultural activities as well as on resource use (Luzar and Frago, 2012). Another example of spiritual practices influencing resource management is the one of the Naxi people from the northeast of China, whose systems of beliefs and taboos is based on the “Su” spirits. In order not to offend the spirits when they manage natural resources, community members have to follow specific rules, such as “no logging of trees around the ground for ritual ceremony, at water source area, and in the graveyard” or “no hunting of pregnant animals” (Mu Xiuping and Kissya, 2010). The cosmovision of indigenous populations has also been a very important element to ensure biological diversity, ecological equilibrium and a healthy environment (González et al., 2010). For example, in the Andean cultures, the *Pachamama* (mother-earth in Quechua and Aymara) is considered sacred and alive. Human beings throughout their lives need to find the harmony with mother-nature and agricultural practices, based on specific calendars linked to the indigenous cosmovision, which are fundamental to this purpose. A good and sustainable labour in the field nurtures the mother-earth and produces its fertility. The nurturing

activities carried out by indigenous farmers correspond to the different rituals and festivities that are realised following the rhythm of the cycles of nature (González et al., 2010).

Community-based land and resource management

Concepts such as reciprocity, the collectivity of the economic subject, indigenous economic institutions and cosmology and spiritual practices are central to indigenous peoples' ways of living. Indigenous peoples' way of living is communitarian and, generally, it goes beyond a single community with the creation of local and even global alliances based on reciprocity and exchanges, such as informal exchanges related to work issues, symbolic exchanges for rituals and ceremonies and formal exchanges for manufactured articles (Azevedo Luíndia, 2008). Indigenous territories are therefore collective spaces where fauna, flora and human beings live all together in harmony. In order to keep this harmony, indigenous groups have rules for the good functioning of relationships and land management. Indeed, as Nakashima et al. (2012) highlight "in managing territory and resources, indigenous peoples use social mechanism and customary governance structures to ensure equitable access to resources" (p. 49). Some examples of these social mechanisms and customary governance structures that have helped indigenous peoples to improve their level of sustainability are the *balu wala* in Central America (Caudillo-Félix, 2012), the *ug-ugbo* in the Philippines (AIPP et al., 2012; UNPFII, 2010), the *kaitiakitanga* in New Zealand (Dodson, 2015; Kahui and Richards, 2014), the *minga* or *minka* and *ranti ranti* in the Andean Region (Maldonado, 2009 in Cunningham, 2010b) and the *pana pana* in Nicaragua (Cunningham, 2010b). Among these forms of organization there are forms of labour exchange, common property management practices and water and food protection and conservation techniques.

Within the first group, there is, for instance, the *minga* or *minka*, which is the term used to refer to the collective labour for a common project that requires the participation of the entire community. Evidence from Ecuador, for instance, mentions among the examples of *minga* practices, the case of one of the parents who organises a *minga* with all the parents of the community to cultivate a plot belonging to the school in order to have products that will be used to feed the students during the school year (Ferraro, 2004). The Kankana-ey Igorot group in the Philippines also practices a form of mutual labour exchange called *ug-ugbo*, in which they carry out activities such as planting, harvesting, house building, taking care of sick and elders and burials (UNPFII, 2010).

In terms of common property management practices, in New Zealand, Maori use the practice of *kaitiakitanga*, which refers to a form of common property management used to ensure the guardianship of natural environment and resources, as well as its sustainable use for the survival of the community (Dodson, 2015; Kahui and Richards, 2014). Examples from the Southern Island show the importance of this practice to provide tools to manage the local environment, such as the proclaiming of permanent areas, *rahui*, to set aside a resource for a period of time, for instance animals during breeding season, or of the permanent conservation of resources, *owheo*, such as rivers, to avoid their contamination (Kahui and Richards, 2014). Another example is the classification of land made by the Borana pastoralists in Ethiopia, which is based on their knowledge of plant-animal interaction and ecological distribution of the species, as well as on the location of water sources. This knowledge has allowed them to manage water and livestock resources and the settlements' order for centuries in an environment characterized by drought and erratic rainfalls. The division of the land is made through an agreement among the members of the community, and customary rules are applied, for instance, in the use of water. A water manager, *Abba Herrega*, is elected

for each water point to ensure a sustainable use of this vital resource; water points are closed during wet season when livestock are also taken away from water points and brought back during dry season (Gemedo-Dalle et al., 2006).

The protection of freshwater sources using different management and conservation techniques is also a very important aspect to secure water and food in the communities, especially the ones affected more by climate change (UNESCO, 2006). For instance, in the Marshall Islands, coral blocks are placed around freshwater lenses to protect them from salinization (Salick and Byg, 2007). Rainwater harvesting is another technique that has been used among South Asian indigenous groups for centuries (AIPP et al., 2012; Macchi and Oviedo, 2008). Some examples of these practices are the *godha* and *thagalok* systems used by the Jumma groups in Bangladesh, which are based on the use of bamboo to hold rainwater and seepage water for agricultural and household use (Tebtebba Foundation, 2009). Other techniques include water management and distribution systems, such as the *lampisa* system practiced by the Pidlisan-Kankanaeys people in the Cordillera region in the Philippines to maintain the rice production. The system is based on a maintenance and management system of irrigation canals, known as *chetchet*, and on the participation of all the field owners, in cooperative labours, known as *Ob-obbo*, to rehabilitate the irrigation system and guarantee an equal share of irrigation all the time, especially in times of drought (AIPP et al., 2012; Nakashima et al., 2012; Tebtebba Foundation, 2009).

Women's role in land and resource management

As previously mentioned, indigenous men and women perform different tasks, which are often linked to the domains where the activities are carried out. In the Amazon, for instance, since men are usually working in the forest and have greater access to public arenas, men's labour is more related to hunting, agricultural clearing and logging activities, while women, because of their proximity to the domestic and private sphere, engage more in production and management activities in community and household gardens and in non-timber forests (Schmink and Gómez-García, 2015). Similarly, Shiva (1992) points out that due to their role as custodians of biodiversity, indigenous women have a very important role in production, management, preservation and consumption practices as well as in environmental sustainability. Particularly, they have a special role in food security and sustainable resource management. For instance, in shifting cultivation practices, women are responsible for the 70% of the work: from the initial selection of seeds, to weeding the fields, gathering, processing, and selling the surplus products (AIPP et al., 2014). Studies carried out in Laos and India have demonstrated that because of these practices, indigenous women possess a great knowledge in relation to seeds, crop and plants varieties; this knowledge is then transferred to younger generations, which once again highlights the importance of women in the preservation of biodiversity (AIPP et al., 2014).

Women also have a key role in including soil and water management (Rocheleau, 1991). An example of this can be found in the Ikalahan indigenous groups in the Philippines, where women are in charge of agroforestry management through an ancient practice of contour composting known as *gen-gen* (organic fertilizers), employed to prevent soil erosion (AIPP et al., 2012; Tebtebba Foundation, 2009). Household gardening, which can refer to both home and kitchen gardens, is also an important activity in which women are involved. Indeed, the variety of crops cultivated in these gardens has a significant impact on household nutrition and food security, as they are consumed on a daily basis and are also used in difficult times, such as drought periods (Tebtebba Foundation, 2009; Rubaihayo, 2002).

New livelihood strategies: ecotourism as alternative for sustainable development

An aspect that has been highlighted several times in this document is the fact that for indigenous populations, natural resources are not marketable. What indigenous peoples produce is generally used for self-consumption, while the surplus is redistributed equally among the community or used in exchanges with other communities (Cunningham, 2010b). Recently, however, the possibility to access markets in order to sell products and buy goods has changed the way of living of many indigenous groups by providing them with more opportunities for cash income (AIPP et al. 2014; Tauli-Corpuz, 2005). This has brought many economic issues, among which are the rising inequalities and the risk of going into debt, and has also affected indigenous populations' traditional livelihood, with the increase of changes in people's behaviour, from community-oriented to individualized, and the abandonment of traditional sustainable practices (AIPP et al., 2014; Ford, Smit and Wandel, 2006, in Nakashima et al., 2012; Barkin, 2001). In order to avoid these risks, in some countries, indigenous communities have started to look at alternatives within their own context in which they could combine modern practices with their traditional practices without being affected too much by the former. Some of these communities have indeed begun to introduce some complementary activities in the context of non-commercial production and ecosystem management, two main elements of indigenous cultural and social systems, in order to increase their life opportunities (Barkin, 2001).

An example of these activities are the ones related to ecotourism, which, if done appropriately, encompass activities aiming at respecting the environment and the cultural diversity of the region where they are carried out (Azevedo Luíndia, 2008). Research on ecotourism in indigenous communities in Latin America highlights how this aspect has become a viable strategy to reaffirm and promote indigenous cultural values, to enhance the conservation of biodiversity in indigenous territories and to generate additional income for the communities (Azevedo Luíndia, 2008; Gamboa, 2015). The benefits brought by ecotourism practices have been acknowledged also by the same members of indigenous communities. For instance, in Bolivia, indigenous communities from the area of Qaqachaca in the region of Oruro have pushed to include in the curriculum of the Indigenous and Intercultural University of Kawsay notions of eco-tourism alongside the ones of land production and management, as they found the former very beneficial for the implementation of practices related to *buen vivir* as well as to resource management (Saveedra, 2008).

Nevertheless, in some cases, indigenous communities have been impacted negatively by the implementation of ecotourism related activities. For instance, in the indigenous community of La Ventanilla, on the coast of the Mexican State of Oaxaca, since the introduction of projects related to ecotourism, the social structures have become more fragmented and unequal, with parts of the population having lost their rights to use natural resources and having found themselves displaced, physically and economically (Vargas del Río and Brenner, 2013). One of the main risks occurs when eco-tourism activities are created by paying more attention to the economic aspect rather than to the social and environmental aspects (Martínez Corona, 2003). Among some of the problems identified by the literature and summarized by Vargas del Río and Brenner (2013), are the negative impacts that these projects have on indigenous peoples' daily lives, such as the social and environmental costs and the consequent growth of inequalities and the socio-political complexity of managing participatory and community projects.

It is therefore important to address issues of legitimacy and equity as well as sustainability in the development of ecotourism activities. It is essential to help local communities to develop management skills to administer and create income opportunities as well as to create incentives for the conservation of the environment, the development of economic opportunities and other activities, and the development of partnerships with relevant actors (Martínez Corona, 2003). In relation to this, Wallace (1992) identifies six principles that need to be respected in order to have an ecological and ethical tourism: 1) favouring the use of natural resources that minimize the negative impact to the environment and local people; 2) increasing the awareness and understanding of the natural and cultural system of particular areas; 3) contributing to the conservation and management of legally protected areas; 4) maximising the participation of local people in the decision making process; 5) supporting and complementing traditional practices that will create economic and social benefits for the local population; 6) promoting the interaction between the local population and visitors, giving the opportunity to local people to use the natural areas and take part in the activities proposed. A positive example encompassing these principles is, for instance, the one carried out in the Chimalapas Biosphere Reserve, in Southern Mexico where the Zoque community manages and redistributes its own resources. It is in charge of training its own professionals in biology, water and forest management by sending them to technical schools. This has allowed them to work with foreign researchers and environmentalists and develop successful projects, such as the implementation of a greenhouse with plants of the region in danger of extinction and the creation of an ecotourism related program (Barkin and Rosas, 2006). Thus, “if indigenous communities can incorporate modern practices, such as ecotourism, within their own way of life and use them to become economically, politically and culturally empowered, there will be long-term benefits for the entire community” (Azevedo Luíndia, 2008, p.6).

Indigenous knowledge and climate change

Indigenous peoples live in the most vulnerable ecosystems. Ranging from circumpolar Arctic, high-mountains zones, floodplains, tropical rainforests, desert margins, small islands and low-coastal areas, indigenous territories are directly affected by the current ecological crisis responsible for issues such as climate change and loss of biodiversity. Among the climate change threats, indigenous peoples from Asia identify the intensification of typhoons, monsoons and flooding, sea-level rise and salinization of freshwater (Tebtebba Foundation, 2009). In Africa, indigenous populations have suffered from the consequences of desertification, extensive drought and rainfall declines (Conway, 2009; Nyong et al. 2007), while the life of indigenous peoples' in the Arctic is threatened by the melting of the stable ice, necessary to carry out hunting and fishing activities (Salick and Byg, 2007). Similarly, Kronik and Verner (2010) identified in the case of indigenous groups from Latin America and the Caribbean, phenomena such as the melting of glaciers, the intensification of hurricanes, the rise of the sea-level and changes in the rainfall patterns.

The adverse climate conditions have been negatively affecting many aspects of indigenous peoples' lives. In indigenous territories, there has been a great loss of faunas and floras, important not only for food supply but also for carrying out rituals and traditional practices (LEAD, 2013; Kronik and Verner, 2010; Salick and Byg, 2007). The increasing shortage of freshwater and food has been leading also to the increase of health issues, ranging from malnutrition in children under 5 years old and lack of vitamin A, in the case of indigenous groups living in the Chittagong Hill Tracts, to different gastro-intestinal diseases (Tebtebba Foundation, 2009). Similar issues have been observed in the Amazon, where there has been an increase of the incidence of intestinal diseases linked to water (Kronik and Verner, 2010). Climate change has also forced indigenous groups to change drastically their social and cultural practices. For instance, research carried out in desert areas of Africa, such as the Kalahari and Sahel, showed that the desertification has forced indigenous groups to change their way of living, going from nomadic to sedentary lifestyles (Nyong et al., 2007; Salick and Byg, 2007). Additionally, in different Latin American and Asian countries, because of the modification of the planting and harvesting season, changes in ceremonies, rituals and cultural practices linked to these aspects have also been noticed (AIPP et al, 2012; Araujo, 2009; Kronik and Verner, 2010; Tebtebba Foundation, 2009).

Despite these hostile life conditions, indigenous peoples have managed to survive in these circumstances, always finding ways to resist and adapt to environmental changes, mainly due to their deep knowledge of and relationship with the environment (Nakashima et al, 2012). As previously mentioned, the practice of sustainable traditional livelihood is a testimony of the resilience of indigenous peoples and their contribution to mitigate the impact of climate change (UNPFII, 2008). As pointed out during the Asia Summit on Climate Change, indigenous groups have used and applied their traditional knowledge to "agriculture, agroforestry, coastal and river management, use of medicinal plants, water management and harvesting, and disaster management, among others" (Tebtebba Foundation, 2009, p.15). For instance, in British Columbia, Canada, indigenous peoples use their knowledge of weather patterns, ocean currents and tides to stay safe in the water while they are carrying out fishing activities (Turner and Clifton, 2009).

The importance of indigenous peoples' contribution in the adaptation for climate change is also acknowledged in the latest Assessment Report (AR5) of the Intergovernmental Panel on Climate Change

(IPCC), which identifies indigenous and traditional knowledge as a “major resource for adapting to climate change” and highlights the need for “[i]ntegrating such forms of knowledge with existing practices [to] increases the effectiveness of adaptation” (2014, p.19). This is an issue that was re-affirmed in the International Indigenous Peoples’ Forum on Climate Change (IIPFCC), where the importance of indigenous knowledge and cultural practices in the “[contribution] to a climate-friendly livelihood system and biodiversity conservation as well as [their] role in adaptation and mitigation” was highlighted (2014, p. 2). However, besides this recognition, very little has been done by the international community to integrate indigenous peoples in decision making processes and, consequently, indigenous knowledge into climate change strategies.

The UNFCCC defines adaptation as the ability of “finding and implementing ways of adjusting to climate change and responding to climate changes risk and vulnerability,” and it refers to any action that “1) moderates or reduces the negative consequences of climate changes or 2) exploits beneficial opportunities in response to climate-related changes” (AIPP et al., 2012, p.2). Adaptation mechanisms are influenced by “cultural features, social capital, productive practices, and socioeconomic and political situations” (Verner, 2010, p.46 in Kronik and Verner, 2010). Therefore, adaptation and coping strategies vary according to indigenous group livelihoods, ecosystems, climate change impacts and threats. Nevertheless, similarities can be found in the adaptation strategies used by indigenous groups living in different regions of the world, but subject to similar weather conditions.

Studies on climate change adaptation mechanisms in indigenous communities across the world have shown attempts of categorisation of these strategies. For instance, while analysing the adaptive capacity of the Inuvialuit in Canada’s western Arctic, Berkes and Jolly (2001) distinguish between two types of strategies: short- and long-term responses. The former are defined as coping mechanisms, usually seen as an actual response to change, a sort of emergency response to threats to indigenous livelihood systems. The latter are considered as adaptations for life strategies and bring large-scale changes affecting issues, such as cultural values. As stated by the authors, “coping mechanisms can develop into adaptive strategies” (2001, p. 2). Similarly, Salick and Byg (2007) consider coping mechanisms as strategies to deal with short-term changes in the climatic conditions and add that the more these conditions become critical, the more the responses intensify.

According to the Asia Indigenous Peoples Pact, adaptation strategies can be also classified as planned or autonomous, usually developing as a fast response to an emergency (AIPP et al., 2012). Among the traditional responses to adverse climate change conditions adopted by indigenous peoples around the world, Salick and Byg (2007) have identified eight adaptation strategies: 1) diversification of resources; 2) change in the varieties and species; 3) change in the timing of activities; 4) change of technique; 5) change of location; 6) change in resources and/or life styles; 7) exchange; 8) resource management. Normally, these strategies are not used in isolation, and indigenous communities may use more than one of these adaptation strategies at once.


Some significant examples of climate change adaptation strategies are multi-cropping systems. This technique helps in minimizing the risk of harvest failure, since the crops that are cultivated have a different susceptibility to the consequences of climate change (AIPP et al., 2012). Multi-cropping systems have been adopted by different indigenous groups around the world. For instance, in Bolivia, research in different

Aymara indigenous communities in the Altopiano and in the Titicaca region has demonstrated the importance of using a diversified system of crops planted at different altitudes and locations, as well as during different periods of the year, to ensure food security in case some crops suffer damages because of the cold weather (Araujo, 2009; Kronik and Verner, 2010). Similarly, in north-east India, the maintenance of more than 40 crops in a shifting cultivation landscape of different varieties has allowed indigenous communities to survive the difficult weather conditions (Trakansuphakon, 2010; in Nakashima et al., 2012). The harvest of different varieties of crops has been observed also among the Inuvialuit in the northern territories of Canada. They have also had to modify their hunting season calendar and the location of fishing-related activities because of the melting of the glaciers (Berkes and Jolly, 2001).

Together with multi-cropping, another adaptation strategy used by indigenous populations around the world is “multi-activity”. In their observation of adaptation strategies and climate change in Latin America and the Caribbean, Kronik and Verner (2010) indicate “multiactivity” as the ability of indigenous peoples to use a different array of strategies and learn new adaptation techniques to cope with the environmental variations. The Topnaar community, who live in the hyper-arid western part of the central Namib Desert, have diversified their livelihood strategies, combining livestock and *Inara* harvesting among other practices in order to survive the extreme weather conditions (LEAD, 2013). In the Kalahari Desert, because of a change in the rain patterns, to ensure their food resources, pastoralists have modified their agricultural practices, from rain-fed agriculture to watered homestead gardening, and shifted the variety of herd, from cattle to goats, which are more resistant to the drought season (Salick and Byg, 2007). Similar adaptation strategies were also observed in other African indigenous communities, such as the Masaai, the Turkana and the Ogiek in Kenya.⁷

Inuvialuit have also adopted long-term response options to climate change, such as the flexibility of resource use, local environmental knowledge and skills, and intercommunity trade. These have been identified by scholars such as Balikci, Krupnik and Freeman as “adaptive responses to the arctic environment” (Berkes and Jolly, 2001, p. 8), which were observed in the study other indigenous groups in other areas of the Arctic. Similarly, Pearce et al. (2015), in their study on the use of Inuit traditional ecological knowledge in hunting and climate change adaptation, identify three main categories of adaptive capacity: flexibility, hazard avoidance and emergency preparedness. For instance, within the category of flexibility, they include the adaptive capacity of Inuit to respond to changing ice and snow conditions by hunting in different locations, by using different hunting techniques, by adjusting the hunting calendar and by understanding and responding to animals’ behaviour. In this last case, for example, if hunters notice that animals are less abundant, they shift to hunting other species, such as muskox instead of caribou. As Pearce et al. (2015) point out, this change is feasible for the hunters as they just transfer the knowledge and skills they have for hunting caribou to hunting muskox. Additionally, the good knowledge of the local environment helps these populations to avoid hazards. For example, before leaving their villages, hunters consult with elders to determine when it is safe to travel and avoid, in this way, finding themselves in

⁷ Adapted from the presentation 'Traditional Knowledge and Climate Adaptation Strategies: A case Study of Three Communities in Kenya' by Stephen Santamo Moiko, at the international conference *Resilience in a Time of Uncertainty: Indigenous Peoples and Climate change*, 26-27 November 2015, Paris, France.



dangerous situations. In relation to that, hunters have also started to combine their traditional knowledge with new technologies, such as GPS, satellite images and Very High Frequency (VHF) radios. The combination of both traditional and modern technologies has been very important to help hunters facing the rapid pace of climate change. This shows that the complementary use of these two knowledge systems, if applied adequately, can bring about successful results.

Indigenous knowledge and disaster risk reduction

The integration of indigenous knowledge in disaster risk reduction has been slow compared to other disciplines (McAdoo et al., 2009). Indeed, only recently, research on disaster risk reduction has not only demonstrated the high value of indigenous traditional knowledge in preventing and mitigating the effects of natural disasters, but also in relation to early warning, preparedness, response and post-disaster recovery (Rautela and Karki, 2015). Indigenous groups around the world adopt different strategies depending on the natural hazards to which they are more subject. For this reason, sometimes indigenous groups from different countries, but who live in areas with similar weather conditions, use similar strategies. Among the strategies that have been observed by researchers, there are prevention strategies based on weather forecasting and the modification of agricultural practices to limit damages to crops and other interventions to prevent the population and the livestock from all sorts of harm. Mercer et al. (2007) in their analysis of indigenous groups living in Small Island Developing States in the Pacific, point out that some of the territories that, in recent years, have been the most affected by natural hazards, grouped these strategies into general categories that include 1) land use planning; 2) building methods; 3) food resilience; 4) social resilience; 5) and environmental resilience.

Among some of the strategies employed by indigenous groups, there are some that are more related to agricultural or construction practices. For instance, in Honduras, the Quezungal traditional farming system, which entails that crops are planted beneath trees, protected the crops from the effect of Hurricane Mitch in 1998, and only 10% of them were lost (Macchi and Oviedo, 2008). In Vietnam, indigenous peoples living in coastal areas have been planting windbreaks all along the coasts in order to break the waves of tropical storms (AIPP et al., 2012); in Bangladesh, indigenous peoples have adapted their agricultural calendar in order to take advantage of the waters of the floods (Tebtebba Foundation, 2009). In the Philippines, the Ivatans people, because of the high frequency of typhoons happening in the Batanes Islands, have adapted their entire lives around the weather. From their traditional houses, built with limestone and thick wood for the walls, to the techniques to build their boats and to their social dynamics, based mainly on mutual help, Ivatans have developed a system that has allowed them to become the only indigenous group in the Philippines to have successfully mastered a complete resistance to the typhoons (Uy and Shaw, 2008).

Furthermore, the close relationship of indigenous groups with their territories has helped indigenous populations to use their traditional knowledge to interpret the behaviour of nature and forecast weather conditions in this way. In her analysis of early warning indicators of cyclones in Coastal Bangladesh, Howell (2003) classified early warning indicators into 4 categories: 1) weather patterns; 2) sea/river patterns; 3) animal behaviour; 4) other patterns, which included the bending of the tree and the fall of new leaves from trees. Some indigenous groups also use the appearance of Pleiades as an indicator. For instance, the Pitjantjatara Aboriginals in Australia use this indicator as a sign of animal breeding season, while other Australian Aboriginal groups use the Pleiades around September as a sign of fair weather and, therefore, as the right time for sailing (Green et al., 2010); Quechua and Aymara farmers in the central Andes, use Pleiades around the southern winter solstice in late June to forecast the variations in summer rainfall and autumn harvests (Orlove et al., 2000). Thus, from extended observations of animals' and plants' behaviours, as well as water and sea movement and changes in the celestial bodies, many indigenous groups have been able to survive and prevent the worst destruction from tsunamis and

hurricanes. For instance, indigenous peoples in the Solomon Islands managed to survive the tsunami of 2007 by moving to higher ground as soon as they saw the sea withdrawing after an earthquake (McAdoo et al., 2009). This exact same situation occurred a year earlier in the indigenous communities of the Andaman and Nicobar Islands in India, who also managed to survive the tsunami by moving to higher grounds (Tebtebba Foundation, 2009).

The findings of a study about weather forecasting in the Bhotya tribe in the Indian state of Uttarakhand reveal that local people usually rely on several indicators, each one of them indicating a specific condition (Rautela and Karki, 2015). Among them there are floral indicators, such as the dropping of fruit or drying of flowers before maturity, indicating that a very dry season is approaching; animal indicators, such as ground-nesting bird species making their nest on higher grounds, meaning a rise in the water level of streams and rivers; or burrowing animals like rats starting to dig in the ground after coming out of their burrows, indicating some natural calamities. Additionally, animals and birds are also indicators of earthquakes, as they hear the earthquake waves much in advance and usually leave a place two days before a major earthquake happens. Roncoli et al. (2001), in their study of weather forecasting in indigenous communities of Burkina Faso, found that ethnic groups, such as the Mossi and the Fulani, use similar indicators to predict seasonal rainfall and make decisions related to harvesting, such as preparing the soil or planting crops varieties.

Mitigation strategies, land rights and access to justice

To deal with the negative effects of climate change, some mitigation strategies, such as the reduction of greenhouse gas emissions, have been agreed upon at the international level, like in the Kyoto Protocol and the Bali Action Plan or at national and local levels, like in the National Adaptation Programme of Actions (NAPAs) or National Adaptation Plans (NAPs). Indigenous peoples have also committed to minimize the emission of greenhouse gases through the use of their traditional practices as stated in the Indigenous Peoples' Plan of Implementation on Sustainable Development of 2002 and in the Declaration of Indigenous Peoples of Africa on Sustainable Development, which focused mainly on green economy.

Among the contributions of indigenous peoples to climate-change, mitigation is the ability of indigenous peoples to protect natural resources and biodiversity. For instance, Green et al. (2010) highlight the importance of traditional techniques of mosaic burning, which consist of the "burning of small patches of land to enable greater control of the fire front" (p. 340) to maintain the ecosystem and mitigate carbon dioxide emissions, contributing in this way to the effort of the country in reducing the emission of greenhouse gas. Another example is the one mentioned by Kronik and Verner (2010), who refer to Brazil as a successful case where indigenous peoples have inhibited deforestation practice, as well as managed to preserve a rich biodiversity (half of the world biodiversity is in the Brazilian Amazon). However, the exclusion of indigenous peoples from the decision-making process of programs such as the one to Reduce Emissions from Deforestation and Degradation (REDD) not only has put at risk indigenous peoples' ability to help in the climate change mitigation process, but has also undermined indigenous peoples' adaptive capacity. In his analysis of the adoption of national REDD strategies in Africa, for instance, Sena (2009) points out that unless it is done right, REDD puts indigenous peoples in a very difficult position. In fact, on the one hand, if REDD projects are carried out in indigenous territories, there will be negative consequences in terms of land rights, culture and livelihood adjustments; on the other hand, even if REDD projects are not undertaken in indigenous territories, governments may change their regulations on land access and use other ways in order to have a more homogenous national REDD scenario (Sena, 2009).

Some of the abovementioned consequences caused by this exclusion are already visible in many indigenous territories around the world. For instance, in different part of Asia, some of the mitigation measures put in place to reduce the greenhouse gas emissions, such as the use of indigenous land in Indonesia and Malaysia to plant oil palm for bio-diesel production or the construction of dams in Northeast India and Nepal, have severely damaged indigenous territories (Tebtebba Foundation, 2009). In Africa, most of the mitigation strategies used to combat climate change focus on reforestation and forest protection (Mbow et al., 2014; Pemunta, 2013). Nevertheless, the creation of natural reserves in indigenous areas, as part of environmental policies to protect and preserve the fauna and flora, has deprived indigenous peoples from their land, reducing the possibility of using it not only for agricultural purposes, but also for social and cultural practices (Mollo, 2011; Thomas, 2003). In Cameroon, for instance, Pygmies have been struggling since 1950, the year of the creation of the Djia Wildlife and Hunting Reserve that subsequently became part of the UNESCO World Heritage Site Scheme in 1987. These conservation measures, together with the country's land tenure law that does not consider traditional land titles as land ownerships, have caused the loss of Pygmies' ancestral lands and natural resources, excluding them from any benefit deriving from forest exploitation and biodiversity conservation. This has led to a further impoverishment and

marginalization of Pygmy communities who cannot perform their traditional activities without violating the law (Pemunta, 2013). Due to the fact that these mitigation strategies are in contrast with the need of increasing agricultural production to feed the population, Mbow et al. (2014) suggest looking at agroforestry practices to both combat climate change and secure food for the growing population.

The negative effects of old and new mitigation strategies have added a further layer to indigenous peoples' battles for their rights. This layer has to be added to the exploitation of natural resources, the implementation of development initiatives and the pressure of climate change, which for years have been the bases of the struggle on indigenous territories (Mollo, 2011). As previously mentioned, one of the most important bases for the persistence of *buen vivir* is the respect of nature, as well as the access to lands and territories. It is around these issues that indigenous peoples organised their lives, not only in terms of economic resources but also in terms of social and cultural practices (Mollo, 2011). For this reason, indigenous peoples perceive the fight for the preservation of these elements as vital. In relation to this, different authors point out that indigenous knowledge preservation cannot succeed without indigenous peoples regaining control over the use of their territories and resources (Thomas, 2003; Agrawal, 1995). Therefore, there is a need to reorient state policies not only to increase indigenous communities' participation in land management, but also to enhance their participation in decision making processes and to make indigenous peoples obtain free, prior informed consent on issues related to their lands and territories⁸.

Indigenous peoples have ancestral dominion and property rights over their territories. However, as it could be noticed in the abovementioned example of the Pygmies living in Cameroon, where there is an overlap between customary and country law (Pemunta, 2013), having the ancestral dominion of the land does not guarantee indigenous communities the access to it and its use. For this reason, it is important that States all over the world facilitate to indigenous populations the access to their land by supporting and recognizing their customary rights to land and resources (AIPP, & Norag, 2015). For instance, in the Philippines, indigenous rights are constitutionally guaranteed and also enabled through the Indigenous Peoples' Right Act (IPRA), which, among others, protects and promotes indigenous peoples' right to own and develop their ancestral lands/domains. However, "the recognition of ancestral land and ancestral domains has been very problematic, resulting in conflicts and gross violations of land rights" (AIPP, & Norag, 2015, p. 3). As a matter of fact, the legal recognition of indigenous peoples' rights is not always enough. Therefore, in those countries where laws on land and property rights exist, the State needs also to find ways to enable indigenous people to actually use existing laws to defend their rights and interests, guaranteeing in this way their full enjoyment of individual and collective rights.

In relation to this, Sena (2009), in his study of the African context, identifies illiteracy and ignorance of the law among some of the main obstacles in the inability of indigenous peoples to enforce the existing laws in their favour. Because "education has an important role to play in supporting and enabling greater decision making and indigenous self-determination" (Aikman, 2010, p.21), educational initiatives aiming at informing indigenous populations on their property rights become, therefore, essential empowering tools.

⁸ Adapted from the presentation 'New perspectives for IPCC's 6AR: focus on the local' by Valerie Masson-Delmotte, at the international conference *Resilience in a Time of Uncertainty: Indigenous Peoples and Climate change*, 26-27 November 2015, Paris, France.

A successful example, for instance, is the Communal Justice Program offered by the *Universidad Mayor de San Andrés* in Bolivia. This three-year program aims at training representatives of indigenous communities and contributing, in this way, to “the establishment of a complementary relationship between Communal Justice and Customary Law in order to defend and promote Human and Indigenous Rights” (Mallea Rada, 2008, p. 107). Since its establishment in 2001, the program formed 300 specialists in Communal Justice and 8000 promoters, specialized in Human and Fundamental Rights, Communal Justice, land remediation and gender equality. Additionally, the program helped increase the participation of women within the Bolivian justice system. Three students of the program participated as delegates in the Bolivian Constituent Assembly of 2007, while others have been elected as councillors in their municipalities. Because of its achievements, the program has been internationally recognized in 2004 by the *Convenio Andrés Bello*, and in 2008 within the context of the Dubai International Award for Best Practices to Improve the Living Environment, where it was categorized as good practice. Besides its great results and international recognition, the success of this program lies also in the fact that by connecting Communal Justice and Customary Law, it has been tackling one of the main issues identified as cause of the lack of recognition of indigenous rights: the problem of defining and understanding “customary law” (Bustamante, 2006). More programs, such as the one just described, will therefore be necessary to increase the opportunities for indigenous populations to uphold and realise their rights.

Integration of knowledge systems and implication for the 2015 sustainable development agenda

For decades, traditional knowledge has been compared and contrasted with scientific knowledge, putting the latter always in a position of privilege compared to the former. However, since the development of knowledge systems rarely occur in isolation, seeing indigenous knowledge and scientific knowledge as two separate and isolated entities does not describe the real situation (Agrawal, 1995, Anderson, 1990; Bravo, 2000, Ellen and Harris, 2000, in Bates, 2009). Additionally, literature on the topic has widely highlighted the fact that there is not a clear divide between the two, but on the contrary, the integration of indigenous and scientific knowledge is a very important issue to consider, as one knowledge system may be used to fill in the gaps of the other, creating in this way what Thompson (2011) defines as “new pluralist paradigms” leading to a more sustainable way of living (Agrawal, 1995).

Among the benefits of the integration of indigenous and scientific knowledge, Krupnik et al. (2007) highlight the increase of “understanding of local to regional biological and ecological conditions and transition into more powerful decision-making on the part of indigenous peoples” (p. 2954). Some of the areas in which the combination of indigenous and scientific knowledge has become a very important tool have been in climate change adaptation strategies (Kronik and Verner, 2010;), in the prevention and reduction of the risks caused by natural hazards (Mercer et al., 2010), and in the maintenance of biodiversity conservation (Prakash, 2002). For instance, among the integrative strategies that indigenous groups in Asia have used, there is the combination of indigenous knowledge with modern technologies (AIPP et al., 2012). In relation to this, initiatives of the World Bank have demonstrated how the integration of environmentally friendly and cost-effective techniques derived from indigenous knowledge, such as the building of contour bunds, leaching the soil, green manuring and natural compost with operations carried out by the Bank and NGOs in the Indian state of the Uttar Pradesh, helped in increasing the cropping intensity from 37% to 200% and the income of farmers by 60% after 5 years, reducing in this way also the migration of local farmers (Prakash, 2002). This example shows the existing complementarity between indigenous knowledge and scientific knowledge systems. In order to increase the benefits of this complementarity, as well as the knowledge over a certain practice, there is the need for a cross-cultural understanding of these knowledge systems (Sillitoe, 1998).

In terms of ways in which indigenous knowledge can be integrated to strengthen adaptation and mitigation mechanisms, there seems to be a consensus in the literature related to use of participatory approaches. Participatory approaches are, in fact, essential to ensure the right and balanced representation of both knowledge systems. For instance, Mercer et al. (2010) developed a participatory framework for integrating indigenous knowledge with scientific knowledge, which consists of the combination of four specific steps: 1) community engagement, 2) identification of vulnerability factors within the community, 3) identification of both indigenous and scientific strategies to cope with factors affecting the vulnerability of indigenous peoples, 4) development of an integrated strategy. This framework aims at reducing the vulnerability to natural hazards of rural communities in Papua New Guinea, as well as increasing the collaboration among stakeholders to improve organised disaster risk reduction planning. Another example using a participatory approach is the project of Hiwasaki, et al. (2014) about the integration of indigenous and scientific knowledge for hydro-meteorological hazards in Indonesia, the Philippines and Timor-Leste. This

framework highlights the involvement of the community from the very beginning of the process. Indigenous community members participated in the observation and recording of indigenous knowledge practices, in the data analysis as well as in the validation of the documented knowledge through focus groups. Scientists were also involved in the process, where they looked at the data analysed and made suggestions on how to deal with both knowledge systems. These results were brought back to the community for further discussion and indigenous knowledge was finally categorized into different groups. This final categorization is the one used to determine which knowledge could be integrated with science and further used to inform not only policy-makers but also practitioners. One last important point mentioned by Hiwasaki, et al. (2014), in fact, is that because of the categorization of knowledge, this framework can help identify transferable indigenous knowledge that can be applied to other regions of the world or in other circumstances, for instance by local farmers.

One of the main advantages of having a participatory methodology is to keep indigenous knowledge within the community, avoiding in this way its loss. Research on climate change in Latin America and the Caribbean for instance, has highlighted how the loss of knowledge by indigenous elders and the population in general translated into the loss of the ability of predicting and controlling natural cycles. This jeopardizes indigenous peoples' ability to adapt, prevent and reduce natural disasters in time, increasing in this way their vulnerability and risk (Kronik and Verner, 2010). Similar concerns have been raised also in the recent international conference *Resilience in a Time of Uncertainty: Indigenous Peoples and Climate change* held the 27-28 November in Paris, France, where indigenous people and scholars from all over the world mentioned the tragic implications of indigenous knowledge loss for indigenous communities. Therefore, it is essential to foster dialogue and create partnerships between indigenous populations, civil societies, governments, development partners, management agencies as well as scholars from different disciplines, to promote the conservation of indigenous knowledge as well as its integration in different initiatives (Krupnik et al., 2007; Gorjestani, 2004; Sillitoe, 1998).

In relation to this, it is important to point out that knowledge exchange has to happen by bearing in mind that both knowledge systems have the same validity and value. Indeed, unfortunately, research has pointed out that even in participatory approaches power relations are still an issue, with non-indigenous populations having the tendency to present themselves as experts in the field, while presenting indigenous populations as lacking in knowledge (Cockburn, 2015). Therefore, efforts should be made to ensure that the knowledge of all the stakeholders involved is treated as equally valid, important and useful. As Gorjestani (2004) highlights, including indigenous voices in the future development agenda will validate indigenous peoples' knowledge system, empowering in this way indigenous communities and promoting a relationship of equity when it comes to their interactions with different stakeholders. As Pemunta (2013) points out, if indigenous peoples "are regarded as dialogic partners and powered, they will become their own change agents through participatory and sustainable development" (p.23).

In her paper on indigenous peoples and Millennium Development Goals (MDG), Tauli-Corpuz (2005) reflected on poverty issues and challenges experienced by indigenous peoples in relation to the MDGs targets. She attributed these problems mainly to the invisibility of indigenous populations at national and international levels, identifying as one of the main causes of this invisibility the mismatch between the western notions of development and the ones of indigenous peoples. Indeed, as previously mentioned, the indicators used to measure the MDGs were not appropriate to provide a complete picture of indigenous

peoples' experiences, whose situation was often omitted in the MDG country reports. To find solutions to these issues and face in this way their invisibility, indigenous peoples started to advocate for aspects, such as the adaptation of indicators, approaches and methods to their realities; the increase of their participation in international forums; and the reform of education initiatives with a better focus on quality issues, such as language of instruction, teachers and curriculum relevance. Ten years later, in international forums⁹ indigenous peoples keep advocating for similar aspects.

Conclusion

The new sustainable development agenda encompasses many issues that are directly affecting indigenous peoples' lives. Education, poverty, access to justice and climate change are only a few of the challenges that indigenous people have been and are currently facing. Their knowledge and know-how, deeply rooted in the relationship of indigenous peoples with nature and community, has proven to be efficient to respond to some of these challenges; however, it is not enough. Caught between environmental hazards on one side and development initiatives on the other, if some solutions are not taken rapidly there will be negative consequences for the survival of these populations as well as for their knowledge systems. Knowledge loss has been already responsible for increasing the vulnerability and risk for indigenous populations. It is, therefore, important that the national and international community starts recognizing indigenous peoples and their knowledge as valuable allies in the fight against climate change and sustainable development challenges and in maintaining global biodiversity. In light of the new post-2015 sustainability agenda, joint efforts are urgently required to develop and implement suitable initiatives to empower indigenous peoples to uphold and realise their rights and be involved in the decision making process, becoming in this way active agents of change.

⁹ Resilience in a Time of Uncertainty: Indigenous Peoples and Climate change, 26-27 November 2015, Paris, France.

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