TERRITORIAL DEVELOPMENT AND LOCAL KNOWLEDGE SYSTEMS

Engaging local farming knowledge through a right-based approach to agricultural development

Food and Agriculture Organization of the United Nations

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Acronyms

CGIAR - Consultative Group on International Agricultural Research

CFS - Committee on World Food Security

CSOs - Civil Society Organizations

FAO – United Nation's Food and Agriculture Organization

FAO NRL – Land and Water Division of the Food and Agriculture Organization

FFS – Farmer Field Schools

GFAR - Global Forum on Agricultural Research

IAASTD - International Assessment of Agricultural Knowledge, Science and Technology for Development

ICARRD - International Conference on Agrarian Reform and Rural Development

IK - Indigenous Knowledge

ILC - International Land Coalition

KS – Knowledge System

JFFLS – Junior Farmer Field and Life Schools

LKS – Local Knowledge System

NGO - Non-governmental Organization

PNTD – Participatory Negotiated Territorial Development

STA - Social Territorial Agreement

UNFPII – United Nations Permanent Forum on Indigenous Issues

VGGT – Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security

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1. Introduction and Key Concepts

Over the last two decades, indigenous and traditional knowledge and local knowledge systems have received increasing public attention. Building on growing international support for rights-based approaches to development, and with the recognition of people's right to self-determine their own cultural values, local knowledge systems have also received legal recognition within politically and economically dominant legal systems. However, going from recognition to practical realization or support for such local knowledge systems still requires considerable efforts.

> "Modern science can and must build on indigenous knowledge systems to develop agriculture while at the same time safeguarding an embattled environment and enabling fragile and threatened ecosystems to survive."
>
> Address by FAO Director-General Jacques Diouf, World Food Day Ceremony, FAO Rome 16 October 2005

Statements from previous and current Director Generals of FAO, recommendations in the IAASTD report,[1] and findings in several recent high profile publications of various international organizations[2] emphasize the enormous contribution that local knowledge systems contribute to all facets and phases of food security and sustainability.[3] These sources call for enabling the potential force of over two billion small-scale famers with agro-ecological production methods to ensure the future food supplies of a growing world population, in particular marginalized groups. While the concrete pathways to this goal may differ, one important factor is common: the need to dynamically include local knowledge and knowledge systems and their users in the process of development for food security in a just and sustainable way.

The purpose of this paper is to argue that agricultural development efforts should support the practical integration of different knowledge systems in various areas and sectors of agriculture to reach the sustainable development goals of a happier and healthier humanity and global environment.

> "We think it's important to revive ancestral knowledge and practices."
>
> Ms Nadine Heredia, First Lady of Peru during the World Food Day symbolic harvest of Quinoa at FAO Rome, 16 October 2013

Beginning with a discussion on some of some basic concepts around knowledge, land and territory, the paper will illustrate some of the different ways of thinking of knowledge system processes as they relate to agricultural stakeholder rights. The paper then aims to emphasize the need for innovative and inclusive participatory processes for engaging local knowledge users in order to diversify knowledge use and support sustainable natural resource management.

[1] IAASTD 2009. "Agriculture at a Crossroads, Global Report."

[2] FAO 2009a. "FAO and traditional knowledge: the linkages with sustainability, food security and climate change impacts."; IIED 1988. "Indigenous Knowledge for Sustainable Agriculture and Rural Development."; IIED 2013. Biocultural Blog http://biocultural.iied.org/, CBD (2013), UNCTAD (2004, 2013a); IIED 2013. Biocultural Heritage Blog: http://biocultural.iied.org/about-biocultural-heritage

[3] Sustainability here refers to environment in the widest sense, thus including not only natural resources, but also the social, economic, industrial, cultural and spiritual environments which influence production and consumption behavior.

1.1 Local Knowledge Systems

"With their wealth of ancestral knowledge", indigenous and tribal peoples make for "key partners in the fight against hunger, malnutrition, and food insecurity"
FAO's Sharon Brennen-Haylock,at the General Assembly's Social, Humanitarian, and Cultural Affairs Committee, Oct 21 2013

The significance and scale of the potential of local knowledge in community-based development may not be immediately obvious until one reflects on the diversity and complexity of local knowledge systems and their importance in agricultural production and the development agenda. A quick review of local knowledge system concepts therefore helps to clarify how a rights-based approach can support these knowledge systems and their far reaching implications for agricultural development in general.

Firstly it should be acknowledged that knowledge and knowledge systems are related but not the same.

Knowledge is the accumulated awareness of facts, processes and their interactive dynamics. The concept of knowledge also often includes the knowledge user's understanding and/or ability to apply that knowledge.

Knowledge Systems (KS) include the different facets of knowledge and all the realms and interactive processes, including also the knowledge holders and their technologies and institutions, which contribute to the formation of knowledge. The greater one's awareness of life, the more complex such a knowledge system becomes. Thus knowledge systems range from a reductionist scientific view of life as an assembly of mechanical processes, to a holistic view of everything being alive with inherent intelligence and awareness. Knowledge Systems are generally dynamic and evolving and may be of different nuances, strengths and sizes. Furthermore, cultures are strongly influenced by their associated knowledge systems and vice versa.

Thus when we talk about knowledge systems in an agricultural context, local culture (however distinct it may be) is a

The Four Pillars of Food Security and Knowledge Systems: [a]

- Availability
- Access
- Utilization
- Stability

Knowledge systems require the same basic pillars for survival as are necessary to achieve food security. And similar to food security, if one of these basic principles cannot be fulfilled, the whole knowledge system is impacted. The weakening of knowledge systems can lead to a loss of cultural and biological diversity and as well as have economic and even political implications. Thus promoting the prosperity, flexibility, and adaptability of knowledge systems is critical.

Since knowledge systems are essential not only for agriculture but also for the identity and vitality of a culture, the recognition and right to one's own knowledge and cultural self-determination are synonymous. The right to protect the cultural heritage of a people, including knowledge, language, education and other traditions like food, is recognized in Article 31 of the United Nations Declaration on the Rights of Indigenous Peoples adopted on 13 September 2007[b].

[a] FAO 2008. An introduction to the basic concepts of food security: www.fao.org/docrep/013/al936e/al936e00.pdf
[b] UN 2007. UN Declaration on the rights of indigenous people: www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf

very important factor, including language, formal and informal institutions, governance, and relationships with all of its participants and environments.

It is useful to distinguish between indigenous, traditional (or ancestral), local and science-based knowledge systems. Indigenous knowledge systems are those of distinct indigenous peoples and their cultures, who are most recently described, rather than defined, by United Nations Permanent Forum on Indigenous Issus[4] and in the UN Declaration on the Rights of Indigenous Peoples.[5] Traditional knowledge systems here shall mean those that have been transmitted by the preceding generations, which not necessarily are indigenous people. Local knowledge systems (LKS) are those existing in certain geographic or cultural areas that may be a mix of indigenous, traditional, and science-based knowledge systems.

For the discussion of this paper, science-based knowledge systems are treated separate from LKS, although they could be considered a special case of LKS and have influenced many LKS to varying degrees following religious, political and economic globalization.[6] This distinction is important to allow inclusion of knowledge systems that are hybridized or are not originating from a well-recognized indigenous cultural group, especially in areas where different external influences have already significantly modified the LKS that existed prior to colonization or more recent industrial, economic, media or policy development and other influences.

Farming practices follow a similar distinction pattern to the differentiation of science-based knowledge systems and LKS: industrial agricultural production versus localized and community-based production. Most small-scale local farming systems are highly complex as a result of adaptation of natural diversity and social/cultural farming processes supported by LKS. Larger-scale monoculture farming systems tend to use more science-based technologies to simplify human input and compensate or replace natural processes with technical inputs like mechanization and agro-chemicals[7]. The resulting loss in biodiversity and resilience corresponds to similar losses in local knowledge and disempowerment of local social systems. Careful integration of the two systems without these losses are rare, but harbor the potential of great benefits. Some cases are illustrated throughout this paper.

> Food is not a commodity like others. We should go back to a policy of maximum food self-sufficiency. It is crazy for us to think we can develop countries around the world without increasing their ability to feed themselves.
>
> —Former US President Bill Clinton, *Speech at United Nations* World Food Day, *October 16, 2008*

All systems mentioned above of course, are very valid approaches with benefits and drawbacks. Yet the differences between them have profound impacts on understanding and behavior, and therefore impact (through knowledge users) the physical and social environment, culture, and relationships with nature in different ways. It is clear that enormous benefits (to humanity and nature as a whole) could be obtained from developing different systems further yet also joining their tremendous capacities in a fair and respectful approach towards a win-win negotiated process with a common goal. The synergies resulting from a jointly negotiated approach have significant

[4] UNFPII, 2009. "Who are indigenous peoples?"
[5] UN, 2007. Declaration on the Rights of Indigenous Peoples
[6] FAO 2004a. "What is local Knowledge?"
[7] Scott 2009. "Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed."

potential.

1.2 Rights-based Approaches to Rural Development and Food Security

"Land rights are the first building block on the road to achieving food security"
UN Special Rapporteur for the Right to Food

Land and agricultural production is central to the livelihood of hundreds of millions of rural peoples. "2.5 billion people derive their livelihoods from agricultural resources; 900 million poor people live in rural areas and 720 million – 400 million of whom are indigenous peoples – directly depend on agriculture and related activities."[8] These agricultural communities depend on secure access and use of natural resources and land to support their livelihoods, food security, economic prosperity, and cultural traditions.[9] This issue of secure access and use of land and natural resources is particularly significant to smallholders and family farms in the developing world, where there are "500 million smallholder farms… supporting almost 2 billion people who depend on them for their livelihood…"[10] Globally these agricultural communities are faced with mounting challenges such as shrinking natural resources, food insecurity, and climate change, all of which are compounded by insecure tenure. In response to these challenges, in March 2006 a wide range of agricultural development stakeholders (including FAO, civil society, and 91 country representatives) gathered in Porto Alegre, Brazil at the International Conference on Agrarian Reform and Rural Development (ICARRD) with the goal of promoting rural development policies that:

> [C]ontribute to food security and poverty eradication, **based on secure individual, communal and collective rights, and equality**, including, inter alia, employment, especially for the landless, strengthening local and national markets, income generation**, in particular through small and medium sized enterprises, social inclusion and conservation of the environmental and cultural assets** of the rural areas, through a sustainable livelihood perspective and the empowerment of vulnerable rural stakeholder groups. These policies should also be implemented in a context that fully respects the rights and aspirations of rural people, especially marginalized and vulnerable groups, within national legal frameworks and through effective dialogue.[11]

During ICARRD the attendees agreed to a set of Principles to support marginalized and underrepresented groups, with particular focus on land rights, through a "participatory approach based on economic, social and cultural rights."[12] The goals and strategies from ICARRD marked an important milestone for placing human rights and social justice at the centre of the sustainable agricultural agenda.

Following ICARRD, the 2007/2008 spike in global food prices and the emergence of the global land rush has made the challenge of supporting secure land rights all the more challenging. For

[8] FAO 2009. "FAO and traditional knowledge: the linkages with sustainability, food security and climate change impacts."
[9] USAID 2013. "Issue Brief: Land Tenure and Food Security."
[10] CFS High Level Panel of Experts 2013. "Investing in Smallholder Agriculture for Food Security."
[11] ICARRD 2006. "Final Declaration" (emphasis added).
[12] Ibid

example, the International Land Coalition states that large-scale land acquisitions pose significant risks for food security and smallholder land rights, while the Land Matrix reports that over 33 million hectors of land have been involved in large-scale land acquisitions since 2000.[13] Faced with these challenging trends, the centrality of land rights to agricultural communities and sustainable rural development continues to only become more significant. In response, FAO has supported the development of a number of global frameworks and guidelines[14] related to land rights which emphasize human rights and land tenure security, reflecting a growing trend toward the use of rights-based approaches to development.

Broadly, FAO has defined rights-based approaches to development as work that "holds that people have a fundamental right to be free from hunger…[and]…considers the beneficiaries of development not merely as passive recipients, but as active stakeholders."[15] Thus rights-based approaches promote two core components: 1) placing human rights as the foundation of food security and development work; and 2) local actors (i.e. those affected by the development efforts) also have a fundamental right as stakeholders to determine how they achieve food security and are affected by development work, i.e. determine the knowledge system elements they want to use. Rights-based approaches therefore recognize the critical link between human rights and the means (or the how) of achieving food security and development objectives.

Photography Credit: I. de Borhegyi

Capacity-building of marginalized actors plays an important role in a rights-based approach in order to ensure that stakeholders can adequately represent and realize their interest. This requires a bottom-up approach to development activities, where a diverse range of experts and specialists inform rather than dictate the development process and results. These experts' role is one of a facilitator and connector between different knowledge systems, between sustainable strategies, and natural resource visions of the local stakeholders. The revitalization and proper use of Participatory Rural Appraisal techniques and other qualitative methods for training and research (such as FFS and JFFLS[16]) is needed to support capacity development of stakeholders as part of a rights-based approach.

[13]ILC 2011. "Policy Brief: Outlook on Farmland Acquisitions"; ILC GIGA workshop presentation; Land Matrix: http://www.landmatrix.org/

[14]FAO 2012b. "Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, Guideline 8B."

[15]FAO Legal Office. "The Right to Food."

[16] FAO Farmer Field School: http://www.fao.org/nr/land/sustainable-land-management/farmer-field-school/en/; FAO 2007. "Getting Started. Running a Junior Farmer Field and Life School."

Despite the similar terminology, it should be recognized that human-rights approaches and rights-based approaches to development are related but different. A human-rights approach focuses on recognizing the inherent human dignity of all groups and individuals, and promotes various civil, cultural, economic, political and social rights that states have the obligation to respect, protect and fulfill.[17] Alternatively, a rights-based approach to development is a broader concept that promotes secure rights (both formal and customary) over particular resources, such as land, forests or fisheries, on the grounds that this is more fair than arbitrary systems or allocation of access, and that with secure rights, the rights holders will maximize the sustainable (economic, environmental, social) use of the resource. Thus the two concepts are intricately related and complimentary, but approach the issue to rights and resources from different angles.

This concept of a rights-based approach to development is not new and not confined to land and natural resources work at FAO. In fact rights-based approaches to development have received increasing attention in several other of the organization's departments, namely in the Fisheries and Aquaculture, Forestry, and Economic and Social Protection departments and the FAO Legal Office. It is thus clear that approaches which place rights at the core of development strategies are multi-sectoral and build-off of a long history of international dialogue and consensus.

1.3 Self-determination and Sovereignty of Local Communities

One of the foundations of rights-based approaches to development is the right to self-determination. Established in Article One of the International Covenant on Civil and Political Rights, the right to self-determination grants all peoples the right to "freely pursue their economic, social and cultural development."[18] Although broad, this human right treaty emphasizes again the entitlement of communities to determine *how* to pursue economic, social, and cultural development within the greater political context that they participate (i.e. as members/citizens of a State), again linking rights with use and management of natural resources and land.[19]

Within the context of agricultural production and rural livelihoods, the right of self-determination and rights-based approaches to development have contributed to the concept of food sovereignty. For more than a decade civil society and social movements have defined food sovereignty as (in-part) the "right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture system."[20] Like rights-based approaches to development, the food sovereignty concept emphasizes human rights and the right of local actors to determine *how* they pursue agricultural production and food security, which also includes the knowledge systems used in

[17]FAO 2013. "Towards a convergent approach to Land and Rangeland Management." NRL Draft working paper.
[18]International Covenant on Civil and Political Rights 1976: http://www.ohchr.org/en/professionalinterest/pages/ccpr.aspx
[19]In addition to the International Covenant on Civil and Political Rights, there are a number of other international treaties, declarations, standards, and guidelines protecting the right of self-determination, particularly regarding indigenous and tribal peoples, such as: ILO Convention No. 169; UNDRIPS; FPIC
[20]Declaration of Nyeleni 2007; International Planning Committee for Food Sovereignty; La Via Campesina 2013. "The Jakarta Call."

agricultural production.[21] Food sovereignty thus incorporates, but also goes beyond, the concept of food security to more fully recognize the human, economic, and cultural rights dimensions of agricultural systems while specifically promoting environmental sustainability.
Although a specific definition of food sovereignty has never been agreed upon by the FAO Member Countries, this concept is slowly gaining recognition within FAO. Civil society representatives have repeatedly raised the issue of directly supporting efforts toward food sovereignty within the CFS, and in 2012 the 32nd Regional Conference for Latin America and the Caribbean concluded with an agreement to "organize a wide-ranging and dynamic debate with the participation of civil society and academia to discuss the concept of food sovereignty."[22]

The concept of food sovereignty is important because it incorporates the broader social, political, cultural, and economic dimensions of agricultural production, rural livelihoods, and freedom from hunger and advocates for a more bottom-up and multi-sectoral approach to address these complexities. Considering this more holistic understanding of food security and the increasing importance of rights-based development work within FAO, this paper offers a relevant and complimentary approach to rural development that builds-upon and incorporates both perspectives. With the goal of avoiding the ineffectiveness of the most common centralized, supply-driven, "top-down" approaches to development, territorial development[23] (see Section 3.1) offers the theoretical foundation for addressing the overlapping, and sometimes conflicting interests and asymmetries of power among actors in a given geographical space.

1.4 Creation, Loss, and Adaptation of Knowledge and Knowledge Systems

In analyzing rights-based approaches to development and knowledge systems in the context of increasing globalization, it is clear that change occurs at the local level as new actors, resources, ideas, and pressures impact communities and the environment. Thus different knowledge systems adapt, are created, and are lost in different ways and at increasing rates with more global interaction.

Cultures that emphasize industrial and science-based development usually adapt to globalization of knowledge by creating sub-sets of knowledge systems and institutionalizing them, separated by subject area. Then these sub-sets are often further separated (organized) by function, like National Agricultural Research Systems (NARS) or National Extension Services. More recently these sub-sets of knowledge are also centralized at global levels, as exemplified by GFAR and CGIAR. Communication of this science-based knowledge to users is organized again into fairly independent services like publications, radio and extension services. Attempts to integrate these knowledge system sub-sets across disciplines and functions to align with farmer needs has encountered numerous difficulties, in part due to their inherent differences and tendencies to autonomous operation. For similar reasons the repeated call for inclusion of more traditional and indigenous perspectives and knowledge has generally failed.

[21] See "Principals of food sovereignty." International Planning Committee for Food Sovereignty: http://www.foodsovereignty.org/FOOTER/Highlights.aspx.
[22] FAO 2012c. "Thirty-Second FAO Regional Conference for Latin America and the Caribbean Final Report."
[23] FAO 2005. "An approach to rural development: Participatory and Negotiated Territorial Development."

Comparatively, local knowledge systems are generally less institutionalized and therefore more flexible and susceptible to change. In these systems the knowledge producer and user are often both members of the same community, if not the same person, and are connected through a diversity of communication channels and social relations.

Mixing of different cultural knowledge in local knowledge systems often results in something that is not as distinct as an indigenous knowledge system, yet is not a completely science-based system either. But all too often the critical knowledge held and practiced by more marginalized stakeholders in a local knowledge system is lost during the adaptation process. All complex systems change slowly if left to their own devices, but if the change mechanism (particularly in-regard to local/national and formal/informal institutions) is not a participatory, well designed and carefully implemented one, unbalances and tensions are most likely to develop, particularly under the pressures created by the economies and technologies of science-based knowledge systems.

Loss of language and loss of traditional knowledge systems

Languages sustain the knowledge and local practices that communities use to meet their livelihood needs. For example, the loss of language associated with food and agro-ecological systems is considered a proxy indicator for the loss of knowledge associated with agro-biodiversity use in rural areas. This makes it important to invest in efforts to retain indigenous languages and the knowledge they "carry" not only for food security but also sustainable agricultural production in the future.[a]

But languages globally are highly threatened. Over half of the 10,000 estimated languages spoken in 1900 have been lost and today only about 5% of these remaining language are not threatened by extinction.[b]

Recognizing this threat, loss of language is now considered as one of the indicators for obtaining AICHI target 18 of enhanced biodiversity conservation implementation.[c]

[a] FAO 2009a. "FAO and traditional knowledge: the linkages with sustainability, food security and climate change impacts."
[b] Mooney 1999. "The ETC Century: Erosion, Technological Transformation and Corporate Concentration in the 21st Century."
[c] Convention of Biological Diversity 2012. Aichi Biodiversity Targets.

This breakdown of local knowledge systems, and with it the loss of traditional knowledge among rural and urban people, may be the result of a number of external and internal (internal to the knowledge system) influences, but increasing economic, social, and political globalization is a driving factor. Other related factors include: cultural invasion by foreign economic systems, technological conveniences and philosophies, environmental shock, war, loss of language, and changes in traditional education. Significant problems result from these social and environmental shocks (and the resulting impacts to local knowledge) when local or traditional communities do not have adequate access to other knowledge systems, resulting in a form of cultural and intellectual poverty. This poverty, especially in the context of agriculture and rural lifestyles, has led to reduced productivity, economic poverty, environmental and social degradation.

Since both science-based and local knowledge systems have their strengths and weaknesses, the adaptation process of knowledge systems impacted by globalization needs to be slow enough to build mutual understanding of all stakeholders in the knowledge system and to adapt and evolve the best suitable parts of both traditional and science-based knowledge

systems, cultures, languages and behaviors. The critical roles of equitable communication (sharing) and ownership (trusting the source) of knowledge have been recognized for this process of effective adaptation, with participatory and inclusive processes receiving important attention in science-based knowledge systems. But despite this recognition, implementation of platforms to support equitable adaptation of local knowledge systems have experienced inherent difficulties due to the deep institutional separation and disconnectedness of science-based knowledge systems and differences between the knowledge systems of the "producer" of knowledge (researchers), the technical knowledge holder (extensionists) and the knowledge user (agricultural producers). Another reason for growing disconnectedness results from the loss of understanding and/or the lack of accommodating life as a whole i.e. respecting and integrating the dynamic complexity and multi-functionality that nature expresses.

> "Typically all this environmental erosion comes at a time of equally unprecedented erosion of knowledge", which may be difficult to perceive in an age where our science and technology based knowledge continues to increase exponentially.
>
> Mooney, 1999. "The ETC Century: Erosion, Technological Transformation and Corporate Concentration in the 21st Century."

The challenge thus is to recognize the wisdom that very well may be contained in such local knowledge systems and to include all kinds of knowledge holders in the process of this recognition and adaptation. Facilitation, support and careful protection during this adaptation is key to success.

Photography Credit: ©FAO/Daniel Hayduk

Science-based and ancestral knowledge systems

The predominant paradigm in science-based knowledge systems is that through proper experimentation (and learning) one can arrive at completely objective results. The scientific approach though, is only one way of arriving at knowledge and from there at solutions or improvements. In such an approach the results are all determined by the thinking (observation and experience) of the one formulating the hypothesis and by the capacities of evaluation. Simplified, one could say that a science-based approach is dissective and exclusive while, in general, traditional or ancestral knowledge systems are more holistic and inclusive.

Throughout history there have been many other approaches of arriving at knowledge and change. For example, traditional knowledge systems often consider all of nature as alive (i.e. recognizing intelligence, awareness and the right of existence in all its visible and invisible elements), and also have developed and maintained effective communication systems and specialized models of negotiation with various elements of nature. In the context of nature and agriculture, this especially refers to communication with non-human beings of nature, like plants, animals, minerals and nature spirits. Sometimes these actions are taken care of by specialists referred to as elders, shamans, medicine (wo-) men or "priests," and in others they are part of individual or group processes expressed in sharing, reflecting and rituals. Such knowledge systems vary widely by depth, complexity and methods, but they generally have elements in common that distinguishes them from the science-based knowledge systems of industrial cultures.

A very generic summary of these elements includes: the concept of life, the close and direct interaction with nature and its different members, and the humbleness of recognizing the role of humans as part of nature. Most of these concepts have been recognized in social ecological systems, but have not found their way into mainstream agricultural practices. The information used to create knowledge in these traditional systems can be obtained through observations with the common five senses, reading and physical activity, or through "extra-sensorial" perceptions during more or less altered states of mind and awareness. The former had been the only declared source of information of science in the last two centuries and has consequently been developed to unprecedented levels of precision and measurability, whereas the latter was systematically excluded, often even ridiculed. Many indigenous and traditional knowledge systems have formed on the basis of skilled sensorial observations, and also of highly developed "extra-sensorial" perceptions and explored them both for observation, understanding and communication with their external physical world.

The blind eye that science turned to these simple yet significant way of obtaining knowledge for human uses is also, in part, at the base of our environmental problems and even social dysfunctions. Where the societal connection to nature is diminished, the ability of this communication, i.e. to listen and understand the language(s) of nature, has also often disappeared. Unfortunately also the attitude of caring for nature as part of what makes and sustains us has disappeared.

Yet it remains critically important to value this language of nature and integrate the advantages of obtaining knowledge directly from the source so that better decision-making and technology development can result from the marriage of science's capacity with local wisdom, including the wisdom held by nature.

For an in-depth discussion of communication with nature, see Buhner, 2002. "The lost language of plants, The ecological importance of plant medicines to life on earth."

2. Local Knowledge and Energy

2.1 Role of Energy in Local Knowledge Systems

Many stakeholders in indigenous knowledge systems recognize a broader range of forms and qualities of energy in their natural environment than mainstream science does. Many know or perceive that this energy (similar to physics' descriptions of dual existence of matter and wave) has different degrees of intelligence and awareness usually contained in or governed by an open omni-present and omni-scient principle. Due to the perception of intelligence and purpose in some energies, such nature forces are often described as beings or the result of action taken by beings that exist in this realm of subtle energies, still invisible and immeasurable by scientific technology. Purposeful and skilled collaboration with those forces or beings enables greater understanding of mutual needs, more appropriate actions and sometimes leads to results not obtainable with current science-based technologies[24].

Accepting such properties is a needed for potential collaboration with such forces and intelligent beings to be possible. Thousands of years of experience, show repeatedly that certain results and synergies can be obtained which sometimes do not fit current science-based models and

Examples of recognition of subtle energy impacts on agriculture

Arhuaco agricultural knowledge recognizes the impact of specific timing during production on food quality. Therefore, food produced for participants in important ceremonies and rituals is sown at auspicious moon phases with special rituals adapted for each crop species. As almost secondary results, these special plantings are avoided by or are free of pests and diseases.[a]

Biodynamic practices emphasize growing rhythms in synchronicity with planetary movements and use homeopathic sprays to avoid crop weaknesses and diseases. Many homeopathic applications have demonstrated effective disease control, overcome ecological imbalances and obstacles and improved production.[b]

Vedic practices in India include the presence of Devas (invisible beings) in their practices as also do many if not most indigenous practices in Africa and Central and South America. [c]

And traditional pranic agricultural practices use the application of subtle energies to modify plant growth, health and soil conditions.[d]

In applications of local and traditional knowledge that relies only on local resources, sustainability not only increases through replacement of fossil energies in their form of fertilizers and pesticides, i.e. less negative environmental impact, but also by better caring for and meeting the needs of the different elements of the whole system (visible and invisible) and thus creating opportunities for better collaboration between all those forces and beings, including the farmer, whose needs are better met. Creating better collaboration in a system is a pre-condition for the system to create synergies, i.e. benefits derived beyond the capacities of what the separate individuals could produce.

[a] Krell, pers comm. from Mamo Lorenzo, Arhuaco elder, Colombia.
[b] Nastati, 2005, Kaviraj, 2006; Murthy 2010
[c] Narang 2008; Deshpande, 2005

[24] Krell, R., 2014; Krell personal communication

understanding constructed with technically measurable knowledge only.[25] The knowledge and ability to work with these energies is one of the most distinct marks of indigenous and other ancestral knowledge systems, and is particularly noticeable when it comes to working with medicinal and food plants within natural and agricultural environments.

The highly sophisticated medical knowledge of plants has not only been obtained by trial and error, but in some cases has been derived from communication with the plants themselves.[26] Such communication can and is also applied to food plants and to the production of crops. It could very well be applied also on a larger scale for the conservation of biodiversity.

Thus the understanding and use of a holistic energy system is closely tied to local knowledge systems and their very different relationships to nature and all its different living organisms or what science-based knowledge systems refer to as natural resources. However, many traditional cultures are no longer fully in tune with their ancestral local knowledge systems. They have already been exposed to the strong forces of the science-based system and started to relinquish part of their patrimony in rapid adaptation.

2.2 Connectedness and Relationships

The better that the many different actors in any knowledge system are connected (i.e. the more they are recognized, respected, communicate with each other and know each other) the easier and more abundantly their common system (eco-system) will express itself and perform. Except for the added dimension of non-physical actors in ancestral understanding, this is not so different from the multiple interactions considered in social ecological theories.[27] Disconnection, be it from the cultural and social environment or supporting subtle life forces, will lead to weakness and/or non-functional behavior of an organism, human, animal, plant or ecosystem alike.

Indigenous knowledge systems have been aware of this need for connectedness and perceive the lack thereof more clearly, as they often identify with nature as a whole or as a part of the whole organism of nature. Losing part of this system (i.e. part of themselves) affects their whole livelihood and cultural identity. Therefore it is important and is also their recognized right[28] to have that wholeness respected in all its nuances and entirety and that any proposed changes be agreed on first.

Outside of the indigenous context, the importance of being connected to the subtle (mostly non-visible and non-measurable) aspects of the natural environment and its human cultural additions have also been demonstrated by psychologists in the 1950's and 1960's and for the rest of biological organisms by R. Sheldrake[29] and epigeneticists[30] during the last 3 - 4 decades.

[25]Buhner, S.H., 2002. "The lost language of plants, The ecological importance of plant medicines to life on earth."
[26]Ibid
[27]Berkes et al. 2000. "Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience."
[28]UN 2007. Declaration on the Rights of Indigenous Peoples: http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf
[29]Sheldrake, R., 2009. Morphic Resonance: "The Nature of Formative Causation."
[30]Lipton, B.H., 2005. "The biology of belief."

Therefore the importance of a healthy environment at both physical and more subtle levels is of high importance. This includes, of course, the knowledge environment that forms or influences in its own ways the cultural, social, economic, physical and more subtle environmental components.

Destroying the environment (from subtle knowledge to physical structures) by any means, impacts the livelihood of any human being, but especially of those who still live in intimate and direct interdependence with intact natural systems. Ignoring the life in everything disconnects even further from these realities and makes it much more difficult to properly understand and care for nature as a whole which in the end is also the very provider or "resource" that maintains human lives.

Photography Credit: FAO

In such knowledge systems of interrelatedness, neither land nor other natural resources can ever become a tradable commodity as it has become in the industrial societies. They can still be used through exchange and with care, but not become merchandize as any human manufactured product. As a result, access, use and care of these resources take on a very different form that require different measures and attitudes than those resulting from science-based knowledge systems. The latter however is dictating most of the frameworks which often fit and are congruous only with the dominant science-based economic and social culture.

Scientific approaches are not destructive per se by any means. As with other perspectives and forms of thinking, it determines the kind of knowledge that is obtained. Then it is the use of that knowledge and resulting knowledge system processes that determine whether its use results in construction or destruction and which choice and balance between them creates more benefits to all or only a part of the complex system of life on this planet. The same can of course be said about the various types of local knowledge systems. In the end it may boil down to the wisdom of those processes or participants in those processes who guide the development of these knowledge systems.

3. Local Knowledge Systems and Land

> *"… unless biodiversity and cultural knowledge are maintained, they [indigenous people] will be unable to continue meeting their livelihood needs."*[31]

It has been well established that biodiversity and agro-biodiversity (including. medicinal plant diversity,[32] local crop seeds,[33] and food diversity[34]) has a major impact on local knowledge and culture. Similarly land and the use of land according to the local knowledge system is another one of those essential elements, since with certain restrictions the whole local social safety net for livelihood support and adaptability to climatic and other changes is severely hindered (if not eventually eliminated) if the local knowledge system is not intact.

> "Biodiversity is the very core of our existence within our communities. You cannot say how many dollars this is worth because it is our culture and our survival.
> In this context biodiversity is invaluable …
> We value our surroundings as our identity, as who we are and our inheritance that is given to us …"
>
> Ruth Lilongula, Solomon Islands (UNEP/IT, 1999, p.162)

Due to the close relationship between land and local knowledge, differing concepts of land, and in-particular concepts of available or marginalized land, in differing knowledge systems is important to note. Often in a science–based perspective certain lands are considered under-utilized and therefore inefficient i.e. higher productivity can and should be obtained by changing land use. In this perspective land is seen only as a resource to be exploited, and it quickly becomes subject to ownership and therefore also trade. Whereas in many local and traditional views land is an integral thread of the fabric of life. The same under-utilized land may be seen as a food security reserve for years of low crop production, or as a source of medicine for health care or as an area set aside for use by nature in exchange for yielding food for humans from agricultural areas.

Given these diverse and complex views on land, the introduction of new ways of managing access to and ownership of land, if not done through negotiated agreements and in ways congruent with the local knowledge and values will create cultural changes that most likely will lead to a loss of local knowledge as well as other social and environmental consequences. But if the negotiation processes are equitable, fair and well informed, they are more likely to lead to sustainable solutions, the action and results of which still need to be monitored, evaluated (using both types of knowledge systems), and adjusted as necessary. As mentioned above, it is of high significance how the interaction between the two or

> "The scale of foreign land acquisitions (often also termed land grabbing) dwarfs the level of Official Development Assistance, the former being 5 -10 times higher in value than the latter in recent years."
>
> UNCTAD 2013 Trade and Environment report

[31] FAO, 2009b. "Indigenous and tribal peoples: building on biological and cultural diversity for food and livelihood security."

[32] Buhner, S.H., 2002. "The lost language of plants, The ecological importance of plant medicines to life on earth."; Convention of Biological Diversity 2010. Global Biodiversity Outlook 3

[33] FAO, 2009b. Indigenous and tribal people: building on biological and cultural diversity for food and livelihood security.

[34] Kuhnlein et al., 2009. Indigenous peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health. FAO & CINE, Vol. 1, 339 pages. ISBN 978-92-5-106071-1

more knowledge systems or cultures is orchestrated and managed and whether the results lead to knowledge and cultural loss or enrichment. By carefully joining or connecting knowledge systems we can develop understanding and capacities much further to achieve a more equitable co-existence with all that comprises nature, whether we call it resources or partners. The common responsibility for sustainably managing land and knowledge systems therefore requires delegated or joint management, which is why equitable participation by all stakeholders in the land or knowledge system is critical.

3.1 Territorial Development

The concept of territory perceives land not just as a two-dimensional surface area but a multi-dimensional populated space that is simultaneously the environment and the body which, because of its content and quality, provides the opportunities for human development. Specifically the term territory refers to:

> • A geographical space or arena where individuals/groups/communities live and organise themselves socially, and where different actors claim different types of rights (may be viewed from legal, economic, environmental, social and cultural dimensions/contexts);
>
> • An arena for dialogue and negotiation which hosts continuous interactions among and between actors and their physical environment aimed at promoting men and women equitable access to land with a gender perspective.[35]

A territorial approach to development recognizes the complexity of social, political, economic, environmental interactions within a territory and works to empower local stakeholders to find sustainable solutions to natural resource challenges. FAO's work on the territorial development builds upon a long history of strengthening security of tenure, customary land rights, and sustainable use and management of natural resources through rural development initiatives.[36] This territorial work responds to the need to adapt methodologies, instruments, and activities to the new challenges posed by globalization and climate change in the twenty-first century by promoting a different approach to territorial issues and directly involving community stakeholders in project design and implementation.

Increasingly this kind of territorial approach to development is being recognized by both governments and international agencies as an effective method for addressing "issues of land insecurity, inequitable distribution of land, and social conflict,"[37] and offers a strategic entry-point to engage local knowledge systems.

[35]FAO 2012a. "Improving Gender Equity in Territorial Issues (IGETI)."
[36]To explore some programs based on territoriality, see: FAO 2009. "Dialogue, Consensus and Vision – PNTD-more than a methodology." See also: FAO 2012a. "A territorial development vision oriented to indigenous peoples: a possible path."
[37]IAASTD 2009. "Agriculture at a Crossroads, Global Report."

The territoriality concept, presented within the context of sustainable governance, was the keyword of the Global Land Forum 2013: "Inclusive and Sustainable Territorial Governance for Food Security: Sharing Lessons from Around the World" organized by the International Land Coalition (ILC).[38] During the Forum the 273 members of the Coalition, including FAO, committed to promoting land governance based on territoriality, "which brings together power, society, and space,"[39] and endorsed the Antigua Declaration. The Antigua Declaration, stating the ILC members' objective to promote a secure and equitable access to natural resources, specifically refers to the management of natural resources as follows[40]:

> *"We acknowledge the growing international consensus on land governance that includes collective rights and respects territorial visions of development, human rights, gender equality and environmental sustainability..." [...]*
>
> *"1.We will support models of development and environmental stewardship based on respect for* ***territorial governance and local food and natural resource management systems****, which recognise the multiple dimensions of land, including its cultural, social and spiritual functions, as a basis for social inclusion and dignity."*
>
> *"7.We recognise the integral value of the environment and the sustainable management of natural resources to achieve food security, the well-being of our societies and full realisation of the right to food.* ***We will work to recognise and enable the stewardship role of local communities by up-scaling our efforts to secure their customary and diverse tenure rights and by advocating local governance of territories and commonly held land, water and other natural resources.****"[...]*

Additionally the Antigua Declaration contains an Annex named "People-centered Land Governance" which contains two recommendations that refer to rights-based approaches to the management and the use of land and natural resources within a territorial context. With these objectives in mind, FAO's Land and Water Division is increasingly working to support rights-based territorial development within the natural resource management governance context. Thus it is clear that the importance of territorial development, secure land rights, and the socio-cultural dimensions of rural livelihoods in food security have gained significant recognition by the international community.

[38] Content drawn from NRL "Third Document on NR Management and Use," distributed to FAO-NRL 11/9/2013; The International Land Coalition is a global alliance of civil society and intergovernmental organisations working together to promote secure and equitable access to and control over land for poor women and men through advocacy, dialogue, knowledge sharing and capacity building. FAO is part of ILC and collaborates with it through several projects. More information on the ILC website: http://www.landcoalition.org/news/fao-ilc-project-facilitates-access-land-governance-resources

[39] ILC website: "Global Land Forum and Assembly of Members 2013: Inclusive and Sustainable Territorial Governance for Food Security".

[40] Antigua Declaration 2013: http://www.landcoalition.org/sites/default/files/news-files/AntiguaDeclaration_1.pdf

3.2 Framing FAO's work on Territorial Development

Although the Antigua Declaration focuses on the word "land," it should be clear that the territoriality approach, considering natural and human components of a territory as a whole, stresses a holistic view of natural resources. Land, water, forests, air, genetic diversity, grasslands and other natural resources, through their interaction, all must be considered part of a territory and integral to supporting the livelihoods of those living in it. In a territorial approach, the analysis of the depletion of natural resources is not limited to the actions of the people who directly cause resources degradation, but seeks the historical, political and social causes that led the territorial actors to their behaviour. This consideration of the variety of actors and factors of a territory, within the broader context of land and natural resource tenure and use, requires a perspective change; it brings to light the multiplicity of interests and visions on land and natural resources, as well as different sources of information and knowledge available to achieve the goals of local actors.


Photography Credit: A. Odoul

In considering the benefits of this bottom-up approach to development, it must be acknowledged that recognizing and analysing the needs and interests of all stakeholders in a territory, as well as the asymmetries of power between actors, introduces a high level of complexity to any development effort. Balancing issues of self-determination, sovereignty, and social cohesion is not simple and is entirely dependent on the local conditions. For this reason the territorial development approach must be flexible and adaptive to local contexts. This is particularly true in situations of human mobility across borders, such as migration, refugee movement, and pastoralism. Thus territorial development cannot be focused on a specific pre-determined result, but is rather people-centred and process-orientated, with guiding principles to help reach a sustainable stakeholder-driven goal.

This territorial development approach has been tested by FAO in many locations around the world and in a wide variety of projects from land conflict resolution at the local level to land policy and governance at the national level.[41] As FAO formulates its new strategic framework, this territorial approach aligns clearly with Strategic Objective 3: Reduce Rural Poverty[42]:

a) the enabling environment is created or improved so that the rural poor have voice and equitable access to resources, services, institutions and policy processes to move out of poverty;

b) the enabling environment in member countries is created or improved to increase access by the rural poor to decent farm and non-farm employment; and

[41]FAO 2005. "An approach to rural development: Participatory and Negotiated Territorial Development."
[42]FAO Conference 38th Session, Review Strategic Framework: http://www.fao.org/docrep/meeting/027/mg015e.pdf

c) the enabling environment is created or improved for effective social protection to enhance food security and nutrition, and sustainable management of natural resources for the rural poor.

In addition to supporting FAO Strategic Objective 3, the territorial development approach also promotes the framework of the Voluntary Guidelines on the Responsible Governance of Tenure for Land, Fisheries and Forest in the Context of Food Security (VGGTs).[43] The VGGTs recognize the importance of equity and justice for achieving secure tenure and access rights.[44] Most significantly, the VGGTs seek to promote the improvement and development of the policy and legal frameworks regulating the range of tenure rights that exist over land, fishery, and forestry resources. Therefore the territorial approach can be considered as supporting the VGGTs framework by addressing natural resource conflict, stakeholder asymmetries of power, and justice and equity in the land context.

4. Linking Value, Knowledge, Rights and Natural Resource Governance

4.1 Participation, Dialogue and Negotiation for Sustainable Territorial Development

Drawing on extensive field-work experience, FAO developed a methodology based on meaningful stakeholder participation, open dialogue, and fair negotiation to help rural agricultural communities face the growing challenges related to territorial. This territorial approach, Participatory Negotiation Territorial Development (PNTD),[45] responds to the failures of past top-down, large-scale, and centralized development projects which typically do not engage local actors (particularly marginalized stakeholders) and their interests, and in-turn have often proved unsustainable over time.[46] In contrast, PNTD focuses on bottom-up and community-based approaches that focus on conflict prevention and mediation, securing land rights, and sustainable management and use of natural resources. The Core Principles of PNTD are:

[43]FAO 2012. "Voluntary Guidelines on the Responsible Governance of Tenure for Land, Fisheries and Forest in the Context of Food Security."
[44]Ibid
[45]FAO 2005. "An approach to rural development: Participatory and Negotiated Territorial Development."
[46]Ibid

Principles of the PNTD approach:

• Stakeholder-based: recognizes the heterogeneity and equality of stakeholder interests and visions of the territory.

• Territorial: based on territories as spatial units of analysis, shaped by the social, political, economic, cultural and historical relations existing between stakeholders and their territory.

• Dynamic: recognizes the complexity of a changing environment in order to support positive patterns of change, and help to mitigate negative patterns.

• Systemic: takes into account the complexity of a territory and the interdependencies within and between territories.

• Multi-sectorial: integrates environmental, social, economic, political, and cultural dimensions of the stakeholders' visions of their territory.

• Multi-level: promotes integration at different territorial levels and scales in the system of governance.

• Participatory and negotiated: promotes equitable representation by increasing the bargaining power of marginalized actors to strengthen fair dialogue, mutual trust, and consensus-building.

• Modest: recognizes the usefulness of different disciplines, tools, and methods; selects priority areas for intervention; identifies modest territorial projects.

Source:
FAO 2009. "Dialogue, Consensus and Vision – PNTD-more than a methodology."

Based upon the above Principals, the PNTD methodology can be summarized in three phases[47]:

1. **Territorial diagnostic:** Through participatory research with local stakeholders,[48] the social, political, economic, and cultural factors that influence natural resource use and access are identified. Additionally the diagnostic includes participatory mapping of stakeholders and conflicts (current and potential) in the given territory. A critical component of this territorial diagnostic includes a thorough understanding of the local actors' interests and visions for the natural resource use which can be gathered through extensive field interviews and historical analysis of the territory.

[47]Ibid
[48]Including government institutions, local communities, NGOs, and private sector

Challenge: Developing a comprehensive understanding of the local actors' interests can be challenging, particularly in-regards to the interests of marginalized actors who may not have the capacity to adequately represent their opinions.

2. **Initiation of participatory dialogue:** Once the relevant stakeholders have been identified, participatory dialogue is initiated with local actors to determine development objectives, identify and resolve conflicts, and propose tools and approaches to improve tenure security and sustainable natural resource management and use.

   Challenge: Building trust among the different stakeholders is an important first step in the dialogue process but can prove challenging, particularly in areas of protracted conflict. Additionally, engaging powerful stakeholders, such as local authorities who may initially see no benefit to engaging in dialogue, is necessary to allow implementation of any potential territorial agreement.

3. **Fair negotiation and consensus building:** As the different interests, visions, and perspectives of the stakeholders are expressed through the dialogue process, negotiation among the actors is needed in-order to find a mutually acceptable agreement. Negotiation requires actors to both understand each other's positions and be willing to yield some of their own interests in order to reach a common way forward. In order for this negotiation to be considered fair, all stakeholders should be considered equal actors in the negotiation. This requires that asymmetries of power be acknowledged and reduced in order for all actors to have meaningful participation and bargaining power. To accomplish this goal, capacity-building for less-powerful and marginalized actors is needed. The end-goal of the negotiation process is for all actors arrive, through a consensus process, to reach a final agreement that can then be implemented or further developed.

   Challenge: In some circumstance finding consensus through fair negotiation is not possible, and in the worst-case scenario conflict mediation is needed in-order to prevent violence and/or restore open dialogue. To help avoid this outcome PNTD advocates for interest-based collective negotiation techniques to help find common ground among different actors.

It should be stressed that these PNTD steps are process-orientated, rather than results–driven. PNTD is a long-term approach to improving sustainability and reducing conflict in dynamic and complex territories, and there is never a single solution to accomplish these goals. Many of the PNTD steps toward sustainability and reducing conflict over land and natural resources, such as building trust and capacity-development for stakeholders, can be accomplished without creating a final 'product' or single resolution out of the PNTD dialogue process. For example, PNTD can support the gradual strengthening of local institutions, which plays an important role in promoting security and sustainability, but is not realistically achievable in the short-term. Thus

certain issues related to land and natural resource rights, management and use may only be achieved through equitable partnership and dialogue over extended periods of time.

Although PNTD is process-orientated, this approach does have specific overarching goals and strategies. Therefore based upon the Core Principles and the three PNTD methodological phases mentioned above, FAO's Land and Water Division promotes the following strategies for sustainable territorial development:

PNTD strategies for sustainable territorial development:

- Formulate rural development projects and support ongoing field activities;
- Empower disadvantaged actors and their organizations to incorporate their needs and concerns;
- Support bottom-up decision making processes and strategy formulation;
- Promote local development initiatives in the context of national regulations and international norms, with special attention to human rights and the conservation of the environment;
- Foster inter-agency collaboration and partnerships with governments, NGOs and civil society;
- Discuss international strategies for rural development.
- Advise and strengthen institutions for improved natural resource governance

Source:
FAO 2012. "A territorial development vision oriented to indigenous peoples: a possible path."

In situations where stakeholder-based territorial dialogue and negotiation are successful, the output of the three PNTD phases is a Social Territorial Agreement (STA).[49] The STA is a socially legitimized outcome of the dialogue and negotiation process that provides the foundation for future action and dialogue among the stakeholders. The STA does not necessarily determine specific natural resource use and management initiatives. More importantly the immediate objective of developing the STA is increasing social cohesion, strengthening the long-term bargaining power of marginalized actors, and clarifying the roles and responsibilities of local actors, organizations, and institutions. Furthermore the STA is used to determine the values, strategies and approaches for improving social, economic, and environmental sustainability of future work in the territory.

[49]FAO 2005. "An approach to rural development: Participatory and Negotiated Territorial Development."

4.2 Land Rights and Local Knowledge Systems in a Territorial Development Context

In understanding the territorial development approaches and strategies of agricultural communities, it is clear that the knowledge systems used for accessing and managing land and natural resources play a major role. Local knowledge systems in rural agricultural communities are intricately related to food security of the communities and the integrity of the local environment. Furthermore knowledge systems are key components of cultural identity, which must be respected in the territorial approach to development. These local knowledge systems are highly complex, adapting over generations to local conditions while providing significant contributions to broader public interests.[50] Increasingly FAO and the broader international community are recognizing the importance of these local knowledge systems for sustainable natural resource management in modern agricultural systems and incorporating them into food security and development efforts to address local and global challenges[51]:

> "Over the decades, FAO has included traditional and local knowledge and activities in policies, programmes and projects related to a wide range of issues, including farmers' rights, poverty alleviation, nutrition and health, and gender equity, among many others. More recently, it has used traditional knowledge to tackle the emerging problems of soaring food prices and climate change."[52]

Research and fieldwork indicate that local knowledge systems for agricultural production are highly dependent on farmers' rights, and in particular land rights, as local knowledge is used in, and adapted to, local environmental conditions such as climate, soil type and quality, and water availability. But local knowledge systems are also shaped by the tenure and management rules and tools that determine how and when farmers and communities use their local natural resources.[53] Thus in addition to environmental change,[54] changes to customary or formal land tenure as well as natural resource management and use arrangements resulting in displacement from land, limitations on traditional resource access, and modifications to property boundaries all have significant impacts on local knowledge and the communities who use and manage local resources. Therefore land rights play a fundamental role in either supporting or undermining local knowledge systems and the communities that depend on them.

This relationship between land rights and local knowledge systems was recognized by FAO and the other ICARRD conference delegates in 2006. In emphasizing secure land rights and participatory approaches to sustainable agrarian reform, the attendees agreed to support "local knowledge and experiences, assuring availability and effective access by traditional and family agriculture and other smallholder producers as well as women farmers, traditional rural communities and indigenous groups."[55] But despite the recognized importance and pledge of

[50] IAASTD 2009. "Agriculture at a Crossroads, Global Report."
[51] Ibid
[52] FAO 2009. "FAO and traditional knowledge: the linkages with sustainability, food security and climate change impacts."
[53] FAO 2000. "Gender, Biodiversity and Local Knowledge Systems to Strengthen Agricultural and Rural Development: The Tanzanian Context."; IAASTD 2009. "Agriculture at a Crossroads, Global Report."
[54] Such as climate change, resource degradation, pollution etc.
[55] ICARRD 2006 Final Declaration Principals.

support for local and traditional knowledge systems, numerous issues related to asymmetries of political power and economic exploitation present prominent barriers to equitably protecting and promoting local knowledge systems. Without analyzing all of the complex components of these issues (which have been researched extensively), it should be recognized that access to land, control of genetic resources, and cultural rights are a few significant factors.

Following ICARRD, in 2009 FAO and other United Nations agencies produced the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) report which provides an extensive analysis of agricultural knowledge systems, as well as a number of recommendations for supporting local knowledge systems that closely relate to FAO NRL's efforts to promote secure land rights through territorial development. For example, several sections of the IAASTD report highlight participatory approaches for recognizing and coordinating both scientific-orientated and local/traditional knowledge systems:

> There is also growing consensus among researchers concerned with sustainable agriculture that no single group of actors should appropriate the right to define what type of combination should exist between scientific and "local" forms of knowledge. As a consequence, participatory forms of co-production of knowledge, based on social learning among actors involved, have become a key feature of sustainable agriculture and resource management. This means that the role of science within a process of participatory knowledge production must be redefined. [56]
>
> The particularity of a transdisciplinary approach is that it implies examining "real-world problems" from a perspective that (1) goes beyond specific disciplines by combining natural, technical, economic and social sciences, and (2) is based on broad participation, characterized by systematic cooperation with those concerned.[57]

This statement advocating for a shift away from conventional top-down scientific approaches to knowledge systems is significant. In supporting participatory approaches to knowledge production the report takes an important step toward protecting local knowledge systems and promoting the potential broader benefits for sustainable agriculture development.

But despite the important points made by the IAASTD report on participation and multi-stakeholder approaches to knowledge systems, it must be recognized that issues of power asymmetries have to be addressed when engaging local knowledge issues related to land in order to avoid marginalization and exploitation of less powerful actors. Historically the rights and contributions of less powerful local stakeholders, such as individual farmers and agricultural communities, have not been respected in regard to local knowledge systems as "empirical research shows how economic drivers originating in larger systems of interest tend to undermine the autarchic gains made at local levels or to block further development and upscaling."[58]

[56] IAASTD 2009. "Agriculture at a Crossroads, Global Report."
[57] Ibid
[58] Ibid

This history of economic and political exploitation in many rural communities only compounds land-related injustices, such as the on-going global land grabbing trend, thus representing exploitation of both rural communities' intellectual and physical resources. As a result, this marginalization has left those stakeholders who traditionally have maintained local knowledge to be distrustful of mainstream organizations and institutions, which hinders efforts to engage these actors through traditional participatory mechanisms.[59] Given these challenges, the IAASTD report recommends that in order for local knowledge to be effectively protected and harnessed, it is of "paramount importance" that "issues of power and control" first be addressed, both in-terms of policy development and institutional infrastructure.[60] According to the report, in order for this to be accomplished development methodologies must ensure "that the diversity of actors, interests, complexity and dynamics of the processes involved (in agricultural knowledge systems) are given adequate consideration" for both development activities and policy creation.[61]


Photography Credit: ©FAO/Olivier Asselin

As mentioned above, local agricultural knowledge systems are intricately related to farmers' rights, and in particular land rights. For without security of access and use of land and natural resources, local communities and their knowledge systems are subject to increased risk of losing customary or formal tenure rights to lands upon-which local knowledge systems are based. The relation between land rights and agricultural knowledge systems are further recognized when examining the IAASTD recommendations for supporting local knowledge systems, several of-which relate to the PNTD approach to securing land rights. For example, principles of broad participation, multi-stakeholder platforms, multi-sectoral perspectives, and addressing power asymmetries are found in both the IAASTD report and in PNTD. The most significant variation between the two resources is that the PNTD approach goes beyond providing "adequate consideration" of stakeholder interests. By utilizing fair negotiation and direct empowerment of marginalized actors PNTD helps create a neutral forum in-which all stakeholders can advocate for their territorial and/or sustainable development interests and goals. This use of capacity-building and negotiation therefore aims to overcome the historical, and often institutionalized, power asymmetries recognized by the IAASTD report.

[59] Ibid
[60] Ibid
[61] Ibid

4.3 Recognizing and Respecting Local Knowledge, Traditional Values, and Cultural Diversity in a National Context

Farming production is always shaped by local conditions, whether this is to local climate, environmental conditions (plants, soil, water, etc.) or human values and needs. Industrial agriculture has sought to overcome local conditions by standardizing techniques and employing agro-chemicals and biotechnologies that correct for local differences, and machinery compensating for limiting labour capacities. In contrast, agro-ecology has emerged as a modern concept and approach to food production this is more adaptable to local conditions (which can be both limiting and beneficial), generally requires fewer natural resource inputs, and is more sustainable and resilient. This approach, to some extent, recognizes the benefit of including local farming knowledge as a resource to make the necessary adaptations, but is still based in science-based knowledge systems and generally does not embrace the full spectrum of traditional and/or indigenous knowledge. Some examples in-which agro-ecology and more traditional approaches to production (based on local knowledge) include some approaches and initiatives such Holistic Management Principles,[62] the Slow Food movement,[63] and of vedic agriculture in India. [64]

In considering how to strengthen local knowledge systems in agricultural production approaches such as agro-ecology it is important that the social values and interests, in addition to the physical natural resources be recognized and respected. Unfortunately the reverse approach is more common, i.e. selecting a convenient technology based on predominantly one criteria – monetary evaluation – and on the assumption that excess of money (profit) will resolve all needs. Thus a deeper impact analysis and diversification of objectives (multi-purpose farming) does not happen. If only limited selection/decision-making processes are used, participatory processes have not much of a role. But using participatory processes will most likely change the process and objectives and introduce diversity of objectives in order to serve the multiple needs to stakeholders. Approaches valuing personal or local priorities allow the integration of cultural values, i.e. the re-invigoration, reinforcement of local culture and knowledge systems. To succeed they will, of course, benefit from or need sufficient support in their social, economic and political environment.

A first analysis to reorient current objectives and actions could start with a look at: the values of local farming knowledge, of local agro-biodiversity, of crops and food to local community or knowledge groups and local adaptation of environmental services. A next step would be an analysis to see where these values are actually respected and protected in regulations, laws, special markets, awareness, and political agendas, especially when mineral rights, intellectual property rights and food production and trade are allowed to be operated in "open" markets, e.g. large market controlling seed and food enterprises, supermarkets and chain stores in any neighbourhood or communities.

A national or regional government can achieve this through regulations, laws, enforcement, special market opportunities, incentives, social safety nets, strategies, policies, education and

[62] Savory 1999. "Holistic Management – A New Framework for Decision Making."
[63] Slow Food, 2011. Indigenous Terra Madre : Slow Food, 2011. Indigenous Terra Madre: http://www.slowfood.com/international/food-for-thought/slow-themes/199769
[64] Deshpande, 2003. "Organic farming wrt Cosmic Energy."

research – all of which are its usual instruments. The critical factor is in how the content and processes within each of its activities are determined and how their interactive impacts are recognized, evaluated and managed. A minimum need for this is the recognition, incorporation and participation in each of these processes of all cultural groups, accommodating needs, rights, responsibilities and objectives/goals fairly and openly, and maintaining an overall balance between diversity and cohesion. Attempts at this approach through communication, understanding and equitable integration between different interests (private investors, civil society and government) have been initiated,[65] but are slow in non-conducive legal and economic environments.

4.4 Conserving and Linking Knowledge Systems through a Rights-based Approach to Territorial Development

The call to recognize and strengthen local knowledge systems has been made repeatedly by IAASTD[66], yet the general trend is toward less public funding for agricultural research in international research institutions like CGIAR, and lack of strong natural resource governance policies to support local knowledge continues. Despite the fact that participatory methodologies and the practice of participatory learning, research, and seed selection with small-scale farmers have long been successfully tested and applied (e.g. Farmers Field Schools (FFS), Participatory Plant Breeding (PPB)) in many countries and cultural settings, local knowledge is still not yet given sufficient recognition, respect and attention. And unfortunately this lack of effective action at the local to the international levels is increasingly allowing more powerful stakeholders and economic interests to encroach on or violate farmers and indigenous peoples' self-determination rights to their cultural choices and protection of their own food and crops.[67]

In considering how both local and science-based knowledge systems can be effectively linked through a rights-based approach to territorial development, it must be recognized that conserving and mainstreaming local knowledge in contexts of more science-orientated is a highly complex.

Local knowledge, like seeds, needs to be both conserved and integrated with other knowledge systems not only in databases and institutions, but also in-situ under dynamic interactive conditions. Knowledge is kept "alive" and relevant by the knowledge users, and vice versa the knowledge holders and their knowledge systems are kept alive by being able to produce food and engaging with the local and global environment. Thus conservation (i.e. local knowledge documentation, research etc.) of local knowledge systems through institutions plays a major role, but also must be supported through more dynamic and proactive engagement with knowledge stakeholders (i.e. through knowledge exchanges, participatory natural resource governance policy development etc.).

Two particularly important factors that should be considered when attempting to conserve and

[65] Hamilton, H. 2013. "Why Sustainable Food Needs Big Business and Why Business Can't Do It Alone"
[66] Ibid
[67] Trends in intellectual property rights regimes and seed saving and access offer a particularly relevant and important example.

link knowledge systems are gender roles and means of value exchange. Obviously the roles of different age and gender groups are significant in conserving and linking knowledge systems as these roles are often integral to the social fabric of local societies. Only a few of these roles are interchangeable. Substituting or filling such roles with different gender or age groups or even with paid labour has often even more dramatic consequences. Therefore functional changes, particularly if parallel to changes in perceived power or significance (value), often bring about far reaching social and knowledge impacts.

Similarly the means of value exchange (i.e. the kind of economy used at the local level) influence the type of prosperity, values and structure of a society, and its associated knowledge systems. Assigning economic values to agricultural knowledge, certain agricultural practices, or to environmental services almost inevitably leads to individualism and unequal power concentration because 1) this approach tries to bring everything down to a common denominator – monetary value – representing just one knowledge system or culture and thus losing or reducing the opportunity for diversity and participation of people motivated by other than only monetary gains, and 2) because it reduces the likeliness of giving due priorities to other values that simply cannot be expressed in monetary terms, like the right to a decent life, to happiness, to self-expression or the spiritual and cultural value of believes, landscapes, trees, animals, other humans, or culture and knowledge systems themselves, and 3) all externalities, whether they be immediate or future impacts, are difficult to account and compensate for and therefore the monetization of these processes is inherently inaccurate. Alternatively, many traditional and alternative currencies create social coherence and mutually supportive networks.[68] Thus even the choice of money used or promoted in a society influences that society's values and development, and therefore, is a potent determinant and result of local knowledge systems and sustainability of that society.[69]

Overcoming these challenges and accounting for such social, cultural, and environmental values mentioned above can only be done with awareness and through interactive processes. Here too, diversity and participation are key elements of sustainability, adaptability and flexibility.

Gender Differences in Knowledge of Traditional Rice Varieties in Mali

In Bafoulabé region in Mali, rice was traditionally considered a female crop. It was grown near rivers or where water stagnated during the rainy season. Women would take care of the field individually or in a group. Their knowledge of landraces was vast. They could identify 30 different varieties by growth cycle, plant growth habit, plant height, number of stems, grain yield, grain size, form, colour, preparation quality, utilization and taste of the end product. Men had very little knowledge of traditional rice varieties, but they had the main responsibility for three improved rice varieties introduced to the village.

In other locations, similar changes lead to seed losses, biodiversity loss, land degradation, and eventually also nutritional and economic poverty.

From: FAO Distance Learning Course: Gender Differences in Knowledge of Traditional Rice Varieties in Mali: http://www.fao.org/sd/erp/toolkit/Books/SARDLEARNING/CD-SL/m_3sl_ex_3_en.html

[68] Lietaer, 2001. The Future of Money
[69] Lietaer et al., 2012. "Money and Sustainability: The Missing Link. A Report to the Club of Rome."


Photography Credit: P.J. Mahler

Thus in considering how the benefits of local knowledge systems can be both conserved and made applicable on a broader scale, the IAASTD report and the PNTD approach offer a relevant approach. After emphasizing the importance of involving local knowledge stakeholders, the IAASTD report continues by clarifying the concept of "participation" by stating: "[w]hile the initial focus of combining knowledge was on increasing participation at local levels, today emphasis is shifting towards up-scaling participatory processes into the meso- and macro-levels of social organization resulting in multilevel and multi-stakeholder approaches."[70] This emphasis on taking the concept of participation beyond the simple process of consulting local knowledge users to actually mainstreaming this knowledge through multi-stakeholder approaches is critical. This kind of approach both relates to a rights-based approach to development and is in-line with several of the PNTD principles and offers a non-prescriptive and flexible approach to engaging local knowledge systems.

Using participatory processes that include agronomic adaptation, science-based innovation, valuing of personal or local priorities and knowledge, of the roles of different age and gender groups, and of cultural and economic values (i.e. the re-invigoration, reinforcement of local culture and knowledge systems) offers great potential and opportunity for conscious, gradual and flexible linking and merging of different knowledge systems. This interaction and adaptation among knowledge systems offers important opportunities for rights-based approaches to development to help support more dynamic, innovative, and sustainable agricultural systems. But for this to succeed local communities will need sufficient support in their social, economic and political environments.

[70]IAASTD 2009. "Agriculture at a Crossroads, Global Report."

The Next Level of Participation

Science-based knowledge systems' division of the environment into subsections like air, water, animals, plants, soil, forests, agro-ecosystems and landscapes makes understanding of certain observations of events and processes easier. However, to manage or co-manage these subsections' complex interactions, these different elements need to be respected, at least, if not understood, and higher communication skills need to be developed (like intuitive higher mental capacities) which allow a participatory approach of mutual feedback in which also those non-human partners of our environment have a meaningful role and voice. This means taking the already difficult human-based equitable participation to a yet higher level of participation.

Since we are still working on greater acceptance of the inter-human participation, it may seem pretentious to think of yet another level of participation. This is however not so farfetched, since a number of traditional cultures are still practicing this form of participation. It would be of benefit already to just recognize the importance of such capacities and action and increasingly incorporate it in different public institutions and governance mechanisms actions. For this to be possible, a wider understanding of our mental and spiritual capacities is needed. Isolated events and processes of this kind are already happening, but their isolation limits their potential impact and reinforcement through feedback.

With the help of those who still have both the understanding and capacities to communicate with the environment as a living system (like many indigenous peoples and other local knowledge holders) and with the help of open-minded leaders from the mixed and more science-based knowledge systems, it should be possible to mutually respect and support social and knowledge systems that are sustainable and dynamically nurturing nature's well-being. Such expanded, innovative levels of participation will create the greater synergies that are necessary to enable the deeper changes required for reaching our development goals.

From only the few preceding cases discussed in reference to their interconnectedness of knowledge, believes, behavior, values with social, economic and physical environment, it should be clear that to maintain certain values, knowledge and the whole knowledge system, a supportive environment is needed that allows and encourages the practice of all these elements, and to a certain degree protects the content, processes and structures (formal and informal institutions, new and old knowledge holders of local knowledge systems) against disproportionately stronger interests or influences. Particularly in a national context where there are several distinct knowledge systems and/or cultures – and the newer science-based knowledge systems and its resulting culture needs to be considered one such system – the maintenance (conservation) and interaction of these knowledge systems or cultures needs to be fair and well-informed. And similar to other systems (eco-, agro-eco-, economic or social systems) the whole chain needs to be maintained or else neither knowledge generation, nor its maintenance or dynamics will likely continue in a desired direction. Thus, awareness, support and protection are essential for maintaining knowledge, ecological and cultural diversity, as well as the protecting the rights of local communities.

5. Field Examples of Effective, Inclusive, and Participatory Territorial Development

Securing land rights through Participatory Land Delimitation in Angola

FAO intervention in Angola dates back to 1999 when at the request of the Government of Angola, the FAO Land Tenure Service began a series of activities in close collaboration with the National Directorate of Rural Organization of the Ministry of Agriculture. Through a number of field activities aimed at the recognition of the historic rights of the local communities and through meetings and debates, land tenure progressively became an issue in the national agenda. FAO's continued work has been articulated around three clusters: (i) to find measures to facilitate secure access to land; (ii) to regulate land issues (i.e. a legal framework, an information system on land and judiciary capacity building); and (iii) to develop complementary strategies for the use/management of natural resources.

Focusing on the access to land issue, FAO has piloted Participatory Land Delimitation activities in two provinces (Huíla and Bengo), and is now extending this work to other provinces. This process involves identifying local stakeholders and mapping community territorial lands and natural resources through participatory mechanisms. The result of these activities, carried out in collaboration with a number of NGOs, was that various communities were able to establish their territorial rights according to the context of mainly two laws: the Law of Territorial Planning and Urbanism (Lei de Ordenamento do Território e do Urbanismo Nº 3/04) and the Land Law (Lei de Terras Nº 9/04). The former in particular, fosters participation at all levels of the planning stages. It is within this framework that the FAO project team approached municipal authorities and proposed alternative ways to manage natural resources and recognize traditional community land rights with the consent and structured participation of local stakeholders around a table of dialogue and negotiation. It has thus been demonstrated that it is possible to work under the existing legal and institutional framework to promote secure access to land and recognition of territorial rights for local communities.

Given the existing complex situation, FAO has continued to focus its land tenure-related activities on a series of communities' land delimitation activities that are implemented in partnership with government institutions and NGOs. This set of activities also involves disseminating information and experiences from other countries on land tenure-related matters and in providing training in negotiated and participatory land delimitation methodology as well as in GIS mapping systems and other new technologies.

The reason for using the negotiated and participatory land delimitation methodology was based on the need to involve several social actors with multiple interests in order to achieve a lasting solution for such a complex situation.

Source:
FAO 2008. "Access to Legal Information and Institutions – Tales from Angola: San Land Rights in Huila Province."

A negotiated approach to dialogue and participatory forestry management in Ghana

In 2006 FAO was asked to act as an impartial mediator for a community conflict over user rights to forestry resources in the Kumasi region in Ghana. The dispute centered on multiple claims to resources, common property management, and broader struggles over political legitimacy that had been unresolved for over ten years. But when FAO got involved the conflict had quickly escalated toward violence.

In 1992 three communities in the Assin Tosa District agreed to work with the Forestry District Manager from the government's Forestry Commission on participatory community forest management. But not all families in the communities agreed to manage the common property forest more sustainably by ceasing to farm and clear the forest. Customary rules, family power asymmetries, and unclear national policies on forest and land rights further heightened the dispute. Serious conflict arose in 1996 when some families continued expanding their coco farms in the forest and hindered tree replanting efforts. In response, other community members supporting the forest management process destroyed the farming families' food crops on which they depended. The Forestry Commission was unable to resolve the dispute and armed conflict within the communities seemed likely. This is when FAO initiated a process of participatory negotiation through dialogue to deescalate the conflict, map the interests of the different actors, and facilitate a peaceful solution to the dispute. The result was an agreement reached by the community members that allowed the family to maintain their farm at a reduced size, halted further expansion of farming and deforestation, and brought broad legitimacy and support to the community's participatory forest management efforts.

Source:
Socio-Economic Development Program for the Transborder Onchocerciasis-Freed Zone of Ghana and Burkina Faso GCP/RAF/376/BEL

Community-based natural resource territorial development in Mozambique

Mozambique's 12 year civil war ended in 1992, and in 1994 FAO began supporting land rights security and participatory natural resource management strategies. Tchuma Tchato, covering roughly 200,000 ha in western Mozambique, was one of the first community-based natural resource management projects in the country after the war. Due to conflicts stemming from multiple community claims to natural resources, commercial pressures on land from private operators, and disputes with local government officials, the "intervention was required to promote collaborative management of resources, with stakeholders' benefits and obligations clearly defined." By supporting the Provincial Services of Forests and Wildlife of Tete Province, FAO was able to help identify and engage relevant stakeholders and facilitate a community-endorsed and community-based natural resource management strategy that involved participatory and gender-sensitive decision-making processes and tax revenue sharing. The program centred on community committees that allowed "horizontal dialogue between three interested parties: the private operator, the government and community members. These community-based organizations are growing into bodies that will guarantee an equitable and sustainable use of their natural resources." Government support and engagement in the project was also a critical factor and emphasizes the need for similar projects to be part of broader national level strategies for sustainable resource management.

Source:
Tchuma Tchato: an evolving experience of community-based natural resource management in Mozambique by Estevão Filimão, Estevão Filimão, Luís Namanha

Participatory plant breeding

In the first Participatory Plant Breeding (PPB) initiatives, more than 30 years ago, most collaboration among breeders, researchers and farmers on testing and producing new varieties of crops was driven by the needs of researchers rather than local farmers. Where (agro-)biodiversity conservation was a focus, local farmers participated in selection and in-situ conservation of valuable intra-specific variability, like in the Community Gene Bank Management Systems with in-situ Field Gene Banks in India (Swaminathan, 1999); however, these systems still did not recognize or emphasize the value of local knowledge systems in which the selection and production knowledge was embedded. But over the years, more participatory concepts evolved and some of the research-farming relations became real collaborative efforts between equal partners. With this trend came a growing recognition that farmers have both useful and deep understanding of their local conditions and of the multiple interactions between above- and below-ground fauna and flora. Some of this local knowledge has been documented under the umbrella of agro-biodiversity (FAO, 2005b), traditional food systems (Kuhnlein et al., 2009 & 2013), and Globally Important Agricultural Heritage Systems - GIAHS (FAO, 2012e). Also, Chinese PPB efforts demonstrated the value of local knowledge systems and the need for using it to conserve it (Li & Song, 2010).

Participatory Plant Breeding related to these initiatives has shown to increase agro-biodiversity in farmers' fields, improve access and distribution of seeds (Labrada et al., 2007, SEARICE 2008), reduce cost of seed multiplication and distribution, increase exchanges and markets for the locally best adapted and most desired seed varieties (including sometimes also externally selected seeds) and created new business opportunities. Furthermore, where PPB such as this has worked well, often in the context of Farmers Field Schools (Smolders and Caballeda, 2006), locally selected crops reach up the performance of commercial seeds, or better under certain climatic conditions, but without chemical inputs and needs for pesticides (Mexico and Cuba, Labrada et al., 2007). It is however of prime importance to include the real knowledge holders in all of those processes, as the impact on women and local knowledge has shown in all cases across the globe, where this aspect had been neglected.

Knowledge systems conservation, like in GIAHS, add the preservation and use of traditional knowledge to the ex- and in-situ conservation of traditional and local seeds, like in collective community seed banks (Bioversity, 2013; The Development Fund, 2011). Substantial costs can be reduced by facilitating community involvement and by facilitating technical and organizational support only to initiate, motivate and accompany the community or network processes.

Thus supporting locally-based knowledge through enabling facilitation and careful local adaptation, together with strategies and technologies from science-based knowledge systems, appears to be the most socially and economically effective way to rapidly build production levels (IAASTD, 2009), resilience to external changes, build local markets and seed and resource networks that can adapt to climate and other rapid changes, including emergencies, while maintaining sustainability, diversity, culture relevance and a locally acceptable level of well-being.

6. Conclusions

Increasing pressures on natural resources from a growing world population, globalization, climate change, and the evermore complex issues related to different systems/cultures interacting require that development and innovation be both respectful and collaborative with traditional cultures in order to prevent social conflict and environmental sustainability. Thus the issues of food security, land tenure, water, energy and other natural resource management, knowledge conservation and evolution, social justice, human well-being etc. all benefit from similar approaches as outlined in this text. If done comprehensively and holistically, a solution in one will strengthen solutions in other elements of the interconnected web of knowledge systems.

In traditional knowledge systems, the perception of land is based on interactive relationships between humans and other life rather than concepts of ownership, i.e. land as a commodity that is owned, used and traded. Consequently the different perceptions determine the way land is used. In the same traditional knowledge systems the "external" physical as well as non-physical environment, to which also land belongs, is most frequently perceived as an integral part of the human being and the human being as a part of it. To distinguish this integral concept of land from the commodity land, the term "territory" is used. In science-based knowledge systems, territories could be described as this biological, cultural and spiritual space and life in a certain geographic location/area.

In terms of science-based systems thinking, humans are inseparable parts of a larger environmental system. However traditional and local knowledge systems also include the social and cultural elements of territory and, if they are still aware of it, also the non-visible parts of nature in their larger and more inclusive vision of nature or the environment.

To work towards the goal of sustainability (social, economic, and environmental), integrative local knowledge systems are important factors to be considered and incorporated in any agricultural development effort. In particular this process must engage the diversity of stakeholders and their land rights and interests through a rights-based approach to determine how resources are managed and the knowledge systems that will be used. Territorial management is by its nature a multi-stakeholder participatory process in which non-human stakeholders can also be meaningful and respected participants.

Where natural resource governance mechanisms cause changes to local knowledge systems without the meaningful involvement of local stakeholders, cultural erosion and often a parallel loss of biodiversity is more likely to occur. To avoid these losses in all spheres of life, weaker and marginalized stakeholders and their knowledge systems need to be protected, strengthened and given due opportunity, information, and time to integrate into other knowledge systems. In terms of political rights this already takes place with special recognition and rights for some indigenous communities. Now it is time to extend this approach to the knowledge systems that sustain those communities. At the same time, it is of global interest to also integrate the traditional and many local knowledge systems into the currently dominating science-based knowledge systems so as to develop more sustainable, innovative, and effective agricultural practices. This integration is possible and is even necessary to achieve holistic sustainability. In working toward this goal, existing activities and experiences can be expanded by creating greater

awareness and capacities for these dynamic integration processes and creating more opportunities for their application at different scales, thus using hierarchical (top-down) structures in a beneficial way as well as existing horizontal local knowledge systems for the most basic horizontal bridging and foundation. As mentioned, these processes need to be protected, empowered and facilitated to varying degrees and be given time, space and openness/transparency to develop socially and biologically dynamic integration.

The understanding and joining of different knowledge systems reintroduces diversity, deeper analytical capacities and understanding and more flexible locally adapted solutions in all realms of life. The necessary processes of a fruitful or mutually beneficial integration needs to follow processes such as PNTD.

This fundamental democratic process is more deliberate than hierarchical decision maker processes since in many places equitable stakeholder participation has to be (re-)learned and accepted, and because the complexity and scale of decisions and their impacts are so much larger and faster in today's globalized context. Once re-established however, and appropriate structures and processes are in place, this participatory democratic process will deliver more sustainable and equitable agricultural and knowledge systems.

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