Rights to Plant Genetic Resources and Traditional Knowledge

Basic Issues and Perspectives

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4 Origin and Allocation of Traditional Knowledge and Landraces

Part 1: Origin and Allocation of Traditional Knowledge and Traditional PGRFA: Basic Questions

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4.1 Introduction

This chapter deals with the question of if and how it is possible to allocate local varieties of PGRFA and traditional knowledge to the communities and/or individuals that maintain and develop these types of informational values. Allocation would be the prerequisite to creating incentives for their maintenance and protection within the framework of trade, such as the sharing of benefits with the communities or the creation of *sui generis* rights.

The objectives would be to find ways to acknowledge and evaluate the creativity, skill and economic input vested by farmers, farming communities and people living in a traditional way, and to maintain and develop their knowledge about the natural resources that sustain their livelihoods.

These issues are to be discussed against the background of the goal of this study, which is to analyse possible (legal) instruments to foster the maintenance and sustainable use of biodiversity and TK in the context of international trade that would promote the goals of equity and fairness, and create the basis for autonomous decision-making and financial return.

Given the complexity of the problem (see Chapter 1), a mix of instruments will be needed, combining rights, instruments and institutions for their implementation. From the economic point of view, measures that increase the returns on sustainable use of biodiversity and maintenance of TK are of specific importance.

Economic theory holds that one goal incentives must fulfil is the closure of the profitability gap between the private and public sectors and/or the social values of biodiversity. To this end it is important that the financial returns accrue at the level where the good – in our case the informational value of PGRFA and TK – is created (see Chapter 1).

One legal option to secure financial compensation to the providers of the information, which is discussed in this context, is the allocation of private rights to PGRFA and/or associated TK (see Chapter 1 and WIPO/GRTKF/IC/3/8). This option is discussed in both this and the following chapter (Chapter 5).

At this point, the focus is on the

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conditions that must be met to allow the allocation of such rights to the resource-holders, i.e. to the 'local and indigenous communities embodying traditional lifestyles' (Article 8(j) CBD) and to the farmers and farming communities (Article 9 ITPGRFA).

The following elements are deemed essential to this end: it must be possible to localize the relevant information, i.e. to attribute it to a specific geographical region and/or social entity. To this end it must, first, be possible to define the information that is to be protected and to be able to distinguish it from other, possibly similar information; at the very least, the information must be identifiable. And secondly, it must be possible to identify the holder(s), owner(s) or author(s)[1] of the information (in the case of the farmer-breeders of the landrace) or, as mentioned, to specify a geographical place of origin. The key question in this context is, of course, how the 'legitimate' holder of the information can be determined, and this in turn leads, thirdly, to the necessity to determine the criteria for the allocation of the information to a specific social entity.

This will be analysed in the following discussion with respect to both PGRFA and associated TK.

4.2 Origin and Allocation of Traditional Knowledge

4.2.1 Introduction

As mentioned above, the allocation of traditional knowledge to its holders and stewards is the prerequisite for creating incentives for its maintenance, for its protection in the trade context, and as a basis for the fair and equitable compensation of its use. To this end it is necessary to define the knowledge to be protected, to identify the specific protective needs, and to specify whom – individual or community – is the holder of the knowledge.

In order to answer these questions, it is to be taken into account that TK has specific characteristics and protective needs in comparison with the information generated in the so-called formal creative and innovative processes. In creating a protective legal basis, these have to be taken into consideration, together with the goals of protection.

Definition and relevant characteristics

As mentioned in Chapter 1, at present no generally accepted, uniform definition of TK seems possible. The CBD gives some indications as to the TK falling under its regime. It speaks of 'knowledge, innovations and practices, relevant for the conservation and sustainable use of biological diversity' (Article 8(j)). This would mean for our context that: (i) only TK in connection with biological resources (i.e. in the CBD and IT context) is encompassed; and (ii) the protection would have to be limited to knowledge, innovations and practices which first originate in indigenous and local communities *embodying traditional lifestyles* and which are relevant for the *conservation and sustainable use of biological* diversity.

Three questions arise from this: Is this limitation to local communities living in 'traditional' ways practicable for the designation of owners of TK? What does 'traditional lifestyle' exactly mean? How could the delimitation be put into effect? The second question is closely linked to the first. It occurs in the context of the current debates on the protection of TK, which perceive the topic primarily in a 'North–South' dichotomy. The question would be whether the issue ought to be considered in a more generalized context and in a global perspective.

As to the characteristics, the following viewpoints may illustrate the difference between the 'traditional' and 'formal' approaches to science.

Augustine (1997), a Chief on the Mi'kmaq Grand Council, holding a Bachelor of Arts in anthropology and political science

[1] The 'author' here is understood in the non-technical sense of 'creator' in general, i.e. broader than in copyright.

from Canada, lives in 'both worlds' and has undertaken to analyse and to compare traditional aboriginal knowledge and occidental science.

He bases his analysis on the *Oxford English Dictionary*, which defines science as:

> 1) the state of fact of knowing, a theoretical perception of a truth; 2) knowledge acquired by study, mastery, trained skill; 3) a recognized department of learning ... ; and 4) in a more restricted sense, a branch of study ... (Augustine, 1997, p. 3).

He reckons that each of these definitions can to a greater or lesser extent be applied to indigenous science. He characterizes indigenous science as 'a disciplined approach to knowing and understanding the nature of reality, systems of relationships, and the energies and processes of the universe' (Augustine, 1997, p. 3).

He insists that TK also implies a specific process of learning: 'TK not only acquires knowledge from the distant past, but updates this knowledge according to its own methodologies' (Augustine, 1997, p. 8).

He sees the main difference to occidental science as the fact that '... TK can never be a branch or department of knowledge, but remains inseparable from the cohesive whole, from a way of being and of coming to learning' (Augustine, 1997, p. 3). He identifies as the main differences of the two systems/approaches: (i) the lack of a connection to Earth of the technological, industrial society (p. 6), which could tentatively be translated as a lack of knowledge of the limitation of resources and of a respectful approach to the environment; and (ii) the compartmentalization and fragmentation of the scientific approach in the occidental world, in comparison with the contextual analysis of the knowledge. 'Native traditions teach the whole of nature in a practical, functional macro approach to the environment' (Augustine, 1997, p. 6).

From a 'Western' point of view, van den Daele (2001) characterizes traditional knowledge (in a global sense) as 'embedded knowledge', that is, knowledge that, besides its value in information, also has social and cultural meaning, and as 'embodied knowledge', being knowledge that cannot be represented adequately in explicated rules or textbooks but is ingrained in people through socialization. Accordingly, he characterizes 'Western' scientific knowledge as disembedded and disembodied, as knowledge as 'information' which is global and impersonal, in contrast to knowledge as 'culture' which is local and personal.

Shortcomings of the formal IP system

These characteristics may explain some of the shortcomings of the formal system of intellectual property, which has been designed for the 'Western' type of science systems. It is submitted that for the creation of mechanisms to protect TK it is important to take these shortcomings into account. There is, first, the problem of the duration of the right. TK dates back for generations (or even time immemorial) and is handed down to future generations. Aboriginal people and communities therefore may want to protect their traditional knowledge for an unlimited time.[2] Formal IPR, in particular patents, protect only for a restricted period of time. Secondly, there might be a problem of control over the use made of the knowledge: communities want some control over the use of knowledge that originates from their culture. Formal IPR as a rule (except trade secrets) do not allow for such control, as there is an obligation to make the information available for the public, and as, in any case, the protected information falls back into the public domain after the expiry of the IPR. Thirdly, the scope of the formal IPR might be too narrow. Indigenous peoples want to protect their (entire) culture and not only one iso-

[2] See WBCSD (2003) Dialogue: Indigenous peoples' right of control over their knowledge should last as long as the community use of that knowledge is active and efforts are made to keep it confidential within the concerned group of holders of traditional knowledge.

lated manifestation.[3] Further, there is the problem of the enforcement of the rights. The enforcement of intellectual property rights is generally the responsibility of the rights holders. This requires knowledge of the IPR scene, finances, technical means, capacity and capability. Therefore aboriginal IP holders may be at a disadvantage when defending their IP rights if they do not have access to these resources (Indian and Northern Affairs Canada, 1999, p. 10).

4.2.2 Types of traditional knowledge

The above discussion indicates that different types of traditional knowledge exist. The following grouping is considered to be relevant as a basis for discussing legal solutions to the problem:

1. Traditional knowledge can be *associated* with a biological resource, which is the case for information on the effects of medicinal plants or on the specific qualities of a crop. However, it can also be *integrated* into a biological resource, as is the case of cultivated crop varieties and domesticated animals, which are the product of the skills of generations of farmers and breeders.
2. Traditional knowledge can be freely accessible within a community and be known by everybody, as is the case with folk remedies such as curcuma or neem. On the other hand, access and usage can be regulated and restricted within the community, such as plants used for ritual purposes in sacred ceremonies like *Ayahuasca/Yagé*.
3. Traditional knowledge can be allocated to a specific, clearly defined group within a community, such as to shamans or other healers acting as stewards of the knowledge; or to a community as a whole, as is the case with the *Hoodia* cactus that is used by the San people in southern Africa. Conversely, it can be integrated in the culture of a society in general.
4. Differences may also exist in the way that a community or a people deal with certain types of knowledge: it can wish to keep it secret within a community, or only transfer it as a gift, in that its spiritual character is opposed to marketability. Or it can wish to market the information, in which case insisting upon fairness in the transaction, including the sharing of the benefits.
5. Traditional knowledge can be documented in a written form, either by the holders of the traditional knowledge themselves, as is the case in some systems of traditional medicine such as Ayurveda and Siddha, or by others such as scientists or historians.

So a difference can be made in the degree of publicity and thus in the accessibility of the knowledge. There is knowledge that is strictly secret and not open to use by outsiders, even not by all members of the group. In turn there is knowledge that is generally known within a specific community: it might be openly accessible for all members of the community, or be protected by customary laws, or maintained and managed by specific stakeholders. And, finally, there is knowledge widely known within a society.

These examples illustrate that, in analogy with formal IPR, there may exist different protective needs, such as:

- Absolute protection and secrecy. This can, for instance, be the case for sacred knowledge.
- Autonomy to decide if and how the information is used, for instance, for medicinal knowledge belonging to a specific indigenous community or to several specific communities.
- Or the relatively free access to knowledge, but with compensation for the holders and/or sharing of benefits resulting from its use. This could be the case for knowledge that is generally known.

Therefore the option should be evaluated to create different categories of instruments, according to the protective needs.

[3] For a more detailed discussion see Chapter 6.

4.2.3 Degree of publicity: the 'public domain' discussion

In contrast to formal IPR, which prevent information becoming public domain knowledge, the goal of rights to TK might be to take TK out of the 'public domain' in the formal sense (WBCSD, 2003). This issue, as with formal IPR, involves different interests:

1. The interests of the holders of the information or, in the case of IPR, of the holders of the rights. In the IPR these interests are mainly defined as economic interests; in TK there might be wider and/or different interests involved, such as respect, autonomy and control. However, this is the interest in the private good character of the information.
2. The interest of the public in general to be able to make use of the information, e.g. to make use of a medicinal plant. This interest corresponds to the public good character of the information.
3. Finally, the interest of the public, which I would describe as a 'future interest', e.g. in maintaining creativity, or in maintaining traditional knowledge, as an important element for conservation and sustainable use of biogenetic resources in the future (which is the optional value, public good character).

It is submitted that in designing protective instruments for TK, a balance between these different interests must be found. In particular, the public and private interests should be carefully balanced. The private interest of holders of TK could be for example to keep the information secret and/or to respect taboos, or to maintain the autonomy to decide about (all) future uses. On the other hand, the private/public interest could consist of making use of TK as a starting point for further creative processes, or in the open exchange of crop varieties.

4.2.4 The question of ownership and origin

Origin

Origin can be defined from both geographical and social viewpoints.

The geographical definition of origin may be differentiated as follows. It might be possible to trace the knowledge to the specific area where it originated. An example could be the knowledge about kava, which originated in the Pacific Islands; St John's wort, which is a typical European TK; or Ayahuasca, which originated in the Amazon.

This geographical designation can vary in size from a village, where a healer has specific knowledge; to a region, where a specific community lives, or where specific knowledge is maintained, such as the knowledge about the *Hoodia* cactus in South Africa or the maintenance of potato varieties in the Peruvian Andes; to a country, such as neem and curcuma in India; or to parts of or an entire continent.

This leads to various types of ownership of the knowledge. TK can be owned by an individual holder, in his own right, as seems to be the case for African shamans (Nwokeabia, 2001). More frequently, however, TK is owned collectively and can be traced back to a specific community. In this case the prerequisites for protection can be further differentiated according to whether the community still exists; the knowledge is still in use in the community; or whether a time limit exists for knowledge that has only been in the open since a certain period.[4] One of the problems might be that several aboriginal groups claim ownership over the same or similar knowledge and may differ as to how this knowledge should be protected or shared. Further, knowledge that is so widely held may be considered public knowledge in a specific region. So the geographical, and possibly historical, origin might be a further connecting point, and the information might be allocated to a state.

[4] See, for instance, the Peruvian law on TK that clearly defines the public domain. If knowledge is in this public domain for no longer than 20 years, a part of the benefit resulting from its use has to be paid into the Fund for the Development of Indigenous Peoples (Article 13; see Chapter 2, this volume).

Registration schemes are proposed as an instrument to allocate TK for both privately owned and public TK (see second part of this chapter and Chapter 6).

4.2.5. Summary

The following questions are to be asked in relation to the creation of protective instruments:

First, which types of information should be protected, and what would be the objective of the protection? Would the goal be to grant autonomy to decide on the use made of the TK, or would it rather be to create a clear basis for its marketing? Secondly, which elements of ownership ought to be protected? Is it full ownership or a mere right to compensation for its use? And to what extent should be the scope of the protection in view of the subject matter, time frame and planned utilization? For instance, is the protection limited to industrial utilization?

What about an absolute right in the sense of duration and in the sense of vetoing its use at each stage of its development or analysis? Would this be compatible with a possible public interest in the broad commercialization of the knowledge, such as the development of new medicines?

These questions have to be answered in view of the goals of protection, such as the public interest in maintaining TK, and the private interests of owners of TK, such as respect for their 'taboos', autonomy to decide upon the use of their knowledge, and related economic interests; additionally, to make use of TK as a starting point for further creative processes.

It is submitted that different types of protective means might have to be created, which allow for a differentiated definition of 'public domain', and that regarding the protection of traditional knowledge, the public and private domain need to be carefully balanced.

4.3 The Concept of Origin of PGRFA

4.3.1 Background and terminology

As described above, the goal of legal instruments to protect the informational value contained in PGRFA would be the support and maintenance of *in situ* on-farm breeding. Accordingly, our focus will be the varieties of plant genetic resources as maintained and developed by local farmers or farming communities – the so-called landraces or farmers' varieties.

Within these traditional seed supply systems (which frequently are characterized as 'informal'[5]), different types can be distinguished (Correa, 2000, p. 13). First, the traditional system, based on the use and continuous improvement of farmers' varieties, characterized by farmers engaged in selecting and saving seeds, and bartering with neighbouring farmers or farmers in different villages. Secondly, a system in which some farmers specialize in the production of improved seeds for the local (regional) market[6] or even for the utilization in intensified farming systems.[7]

The two systems differ with regard to the characteristics relevant for the creation of *sui generis* rights. Whereas in the second case it is possible to clearly identify both breeders and bred varieties,[8] the crucial question is whether this is also possible in the first case.

Accordingly, the focus will be on the decentralized, traditional (informal) on-farm *in situ* breeding of farmers' varieties. The issue is whether in these systems it is possible to establish where a landrace comes from, and to establish this origin with enough precision that allows its allocation to a specific social entity.

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[5] Alternative terminology: decentralized seed supply systems or farmers' seed supply systems, in contrast to the industrialized, centralized production of seeds.

[6] Personal information: Sanjaya Gyawali, Li-Bird, Pokhara, Nepal.

[7] Personal information: Renato Salazar, PEDIGREA, Philippines. See also the initiative by SATIVA (http://www.sativa.org) in Switzerland.

[8] Or at least the variety for the time being, as it is bound to change over time (and space).

To this end, the term 'origin' has to be analysed more closely. On the one hand, the term 'origin of landraces' has to be examined. Is it to be understood in a geographical sense only, or does it contain elements of breeding in the technical sense too? And, if so, what would these elements be?

On the other hand, 'origin' is also a technical term, used in the CBD to define the ownership of the sovereign state over its biological resources. Therefore, the meaning of this terminology and its worth in the context of the allocation of landraces has to be explored.

To answer the first question, it is essential to clarify beforehand the notion of PGRFA and of farmers' varieties/landraces, to give some background information on their specific characteristics, and to describe the relevant characteristics of the *in situ* on-farm breeding of landraces.

Plant genetic resources for food and agriculture: landraces

The International Treaty on Plant Genetic Resources for Food and Agriculture defines PGRFA as 'any genetic material of plant origin of actual or potential value for food and agriculture'.[9] 'Genetic material' in turn is defined as 'any material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity'.

Landraces or farmers' varieties thus are a specific type of PGRFA. From the legal point of view, they can be negatively defined as varieties that cannot be protected by PBR[10] because they do not fulfil the prerequisites of uniformity, stability and distinctness. The question is whether a positive description or definition of farmers' varieties is possible.

The scientific literature offers a great variety of definitions of landraces, which, in addition, have changed over time (see in detail below. For instance, Jarvis and coworkers give a rather general definition. They characterize a landrace as a crop variety that is bred and cultivated by farmers and adapted to local environmental conditions (Jarvis *et al.*, 2000, p. 8). Harlan (1975) gives a more differentiated characterization of *populations* of landraces, implying their identifiability on a local level:

> Landrace populations are often highly variable in appearance, but they are each identifiable and usually have local names. A landrace has particular properties or characteristics ... Each has a reputation for adaptation to particular soil types ... They also may be classified according to expected usage ... All components of the population are adapted to local climatic conditions, cultural practices, and disease and pests. (cited in Jarvis *et al.*, 2000, p. 9)

Zeven (1998, p. 137), in turn, concludes that as landraces have a rather complex nature, it is not possible to give an all-embracing definition. He differentiates between autochthonous and allochthonous[11] landraces, and proposes to define an autochthonous landrace as a variety with a high capacity to tolerate biotic and abiotic stress, resulting in a high yield stability and an intermediate yield level under a low-input agricultural system (adapted from Mansholt, 1909).

In defining the difference between autochthonous and allochthonous varieties, Zeven introduces elements of time and variability. He defines an *allochthonous* landrace as an *autochthonous* landrace of a foreign region that has recently been introduced into the region

[9] This excludes the plant genetic resources which are of importance for their biochemical qualities in the context of, for example, pharmaceuticals and health care, or for their specific 'material' qualities (e.g. the non-wood forest products used for industrial, building and housing purposes) or 'industrial crops' (e.g. rubber, oil palm). They can be 'wild' or domesticated.

[10] As defined by the Convention of the International Union for the Protection of New Varieties of Plants (UPOV) (see Chapter 2, this volume).

[11] 'Autochthonous' means inhabiting a place or region from earliest known times; synonymously: aboriginal, derived from within a system, endemic, indigenous, native. Conversely, 'allochthonous' means originating from outside a system.

concerned.[12] After its introduction it may become contaminated with genotypes of the autochthonous landraces. Depending on the number of generations of aftergrowth and on the frequency of seed change, it may become an autochthonous landrace.

In sum, characteristics appearing in all definitions of landraces are their capacity to adapt to local environmental conditions and their high stress tolerance, and therefore yield stability. In the given situation of subsistence farming, these qualities appear as highly advantageous. The identifiability of varieties, in turn, is not as generally acknowledged.

In situ *on-farm conservation*[13]

Traditional farming systems, in maintaining and further developing farmers' varieties/landraces, essentially contribute to the diversity of agricultural biological resources. *In situ* on-farm conservation of agrobiodiversity thus is increasingly recognized as an important supplement to *ex situ* gene banks.

In situ conservation of PGRFA allows for the maintenance of mechanisms that are important for the further evolution of traditional PGRFA, such as the hybridization within and between populations of wild, weedy and cultivated plants, the competition among genotypes, the natural and conscious selection by farmers at the local level and the exchange of different genotypes among farmers and farms (Brush, 1994; see also Brush, 2000).

Farmers play an important role in this system, as the maintenance of agroecosystems, the further evolution of PGRFA, and human intervention are mutually interdependent. On the one hand, they contribute their breeding skills and their knowledge about farmers' breeding technologies. On the other hand they maintain the on-farm crop evolution system. This includes: (i) the maintenance and intergenerational tradition of the existing crop variety and relevant, additional information; (ii) the maintenance and intergenerational tradition of the innovatory breeding skills; and (iii) the maintenance of the ecosystem services provided by the non-industrial farming systems, allowing the intercropping between domesticated landraces and their wild and weedy relatives.

Zeven (1998, p. 136) underlines the influence of human selection on the development of landraces. The intensity of this on-farm selection process – between conscious or unconscious selection – varies. Unconscious selection is generated by the farmer in changing the growing conditions. Conscious selection is understood, for example, as choosing the best plant/seed for propagating or experimenting with new material or old material in new conditions.[14]

The question is what this means for the definition of origin and/or authorship of landraces and their allocation to specified social entities. Would it be possible and appropriate to honour the creative input into a specific landrace variety by defining criteria identifying its farmer-breeders? What would be these criteria? And would it be appropriate and possible to distinguish between the creators and origin, where 'creator' or 'breeder' indicates the result of

[12] A key issue in plant breeding is the open access to the resources and the exchange of crop varieties and related information at local, regional and international levels. At the local level, in traditional societies and in subsistence farming systems, sharing and exchange of varieties is traditional and of great importance for the evolution of local varieties, and to assure food security. This exchange takes place in a reciprocal relationship.

[13] For more details see Biber-Klemm (2002).

[14] In the legal context, the issue of conservation and maintenance of traditional PGRFA *in situ* on farm is discussed under the notion of Farmers' Rights. Farmers' Rights are the answer to the 'enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world' (Article 9.1 ITPGRFA; see Chapter 6).

conscious breeding, and 'origin' designates the localization of an 'autochthonous' landrace?[15] Or is the distinction between origin and creator simply one of degree rather than of principle?

From this it can be concluded that, as basic elements for the allocation of a landrace to a specific entity, the landrace must be distinguishable/identifiable and/or fulfil other criteria, such as the possibility of ascribing it to a specific social entity or geographical region, i.e. it must be possible to identify the social and/or geographical origin of the landrace.

The question is whether the notion of origin of plant genetic resources as used in the scientific debate on PGRFA and/or as integrated in the CBD is suitable to serve as a basis for creating rights to traditional PGRFA. This question will be treated in the next paragraph.

4.3.2 Origin

'Origin' of PGRFA seems to have different meanings in legal and scientific contexts.

The scientific understanding of origin

The notion of 'origin' of PGR in the scientific context is closely linked to the theory of N.I. Vavilov, postulating the existence of so-called 'centres of origin' of domesticated crops.

Vavilov found that there were certain areas in the world where crop plant diversity was extremely intense, i.e. regions containing a high level of diversity of a number of crops (see Fowler, 2000). The areas of greatest diversity were believed by him to represent the centres where the crops were originally domesticated (Hawkes, 1983, p. 52 ff.).

Besides these (primary) centres of diversity, so-called secondary centres of diversity are recognized for many crops. These are due to the movement and exchange of crops throughout history. The high degree of diversity in these secondary centres is due to a long history of cultivation of a crop, combined with environmental and social factors supporting diversification (Raymond and Fowler, 2001, p. 4).

However, the high degree of diversity in Vavilov's 'centres of origin' does not refer primarily to the diversity of individual crop varieties nor to distinctive properties, but rather to diversity in general. Vavilov's theory was that areas of high diversity correspond to the areas of origin, i.e. where the crops were originally domesticated. So, his notion of origin has nothing to do with the origin of individual varieties with distinctive properties (Fowler, 2000).

The distinction between primary and secondary areas of diversity deals with sequences in the development of agriculture. 'Vavilov, Zeven and de Wet and others, in their employment of the concept of "centres" were more interested in a crop's diversity or origins, which may not be quite the same as a species' (CGIAR, 2001, p. 1).

Thus, science looks not primarily at the diversity within a specific crop variety nor at its individual origin, but at the centres of crop diversity in general, being interested in where the greatest amount of diversity can be found. Integrated in this question is the enquiry after the process of domestication and diversification of a crop, a question that also eminently includes a historical element.

Yet, in our context it is important to be aware that 'diversity has no fixed address. New forms and combinations ... can arise wherever a crop is grown, regardless of where it was domesticated' (CGIAR, 2001, p. 2).

Country of origin according to the CBD

In the CBD, the notion of 'origin' is the connecting point for the identification of biological resources falling under the sovereignty of the state. Only genetic

[15] Zeven (1998) defines 'autochthonous' as a landrace grown for a long period in the farming system concerned. As the environment changes annually and as the landrace becomes 'contaminated' – purposely or not – with a few genotypes of other landraces or cultivars, it will continuously adapt itself.

resources of which the providing state is the 'country of origin' (or which have been acquired in accordance with the CBD) are covered by the access and benefit-sharing regulation of the CBD (Article 15.3).

The CBD defines the country of origin as the country that possesses the genetic resources in *in situ* conditions. *In situ* conditions for domesticated and cultivated species[16] are 'the surroundings where they have developed their distinctive properties' (Article 2.12).[17] In view of this definition, several details need to be considered.

First, the wording 'have developed' implies a time element. The question is whether this term points to the development of specific properties due to ecological factors only, or whether it also includes evolution furthered by indirect or direct human intervention. The CBD definition of 'domesticated or cultivated' species as 'species in which the evolutionary process has been influenced by humans to meet their needs' (Article 2.7) points to the latter interpretation. Secondly, the term 'distinctive properties of species' indicates a qualitative element. The primary question is, of course, what is meant by this criterion. This question is complicated by the fact that it is not clear on which taxonomic level the comparison has to take place. The CBD speaks of distinctive properties *of species*. Is this wording to be read as the difference *between* species,[18] or as the difference *within* species; that is, between varieties?[19]

As is apparent, this makes an enormous difference to the definition of 'origin'. If interpreted on the species level, the 'country of origin' would be where a specific crop species has been domesticated or basic traits have been developed in historical times. The interpretation of the level of variety, in turn, would allow a more current and narrow designation of origin.

Country of origin in the International Treaty on PGRFA

The International Treaty confirms the national sovereignty of states over their *own* PGRFA (Article 10), without defining criteria for ownership in detail.

The International Treaty speaks of 'centre of origin' and 'centre of crop diversity', referring to these notions in the context of farmers' rights (Article 9). According to its interpretation, 'centre of origin' means a 'geographical area, where a plant species, either domesticated or wild, first developed its distinctive properties'. 'Centre of crop diversity' refers to a geographic area too. It is defined as an area that contains a high level of genetic diversity in *in situ* conditions, i.e. in 'surroundings where they [crop species] have developed their distinctive properties' (see Article 2).

Thus, the International Treaty uses the same criteria (distinctive properties of species) as the CBD.

Discussion

The current discussions on the definition of origin in a legal context focus on the question with a view to the *state sovereignty* over domesticated genetic resources.[20] In this context the CBD speaks of distinctive properties of *species*. According to the wording of the Convention this can be read as differences *between species* (or possibly subspecies), but not a priori *within* species.

It is important to be aware that the questions asked by the CBD differ essentially from those asked by science. Science,

[16] Defined as 'species in which the evolutionary process has been influenced by humans to meet their needs' (Article 2 CBD).

[17] *In situ* conditions for wild species are defined as the ecosystem where they exist in natural surroundings, such as ecosystems and habitats (Glowka *et al.*, 1994, p. 22). Thus the definition differs for wild and for domesticated or cultivated species.

[18] Or possibly subspecies such as the potato *Solanum tuberosum*; but not, for instance, *S. andigenum* or *S. juzepczukii* (see Tapia and De la Torre, 1997, p. 12).

[19] Likewise Fowler (2000).

[20] Compare, for example, Fowler (2000) and Hardon *et al.* (1994).

in inquiring into 'origin', asks for the (historical) centres of crop diversity, being interested in where the *greatest amount of diversity* can be found. The legal interest, in turn, is to establish *ownership*. Science asks where a crop species has been domesticated, and enquires after the (historical) *process* of domestication and diversification: the CBD asks for the *place* specific properties of species have been developed.

Accordingly, in scientific and legal literature the line of argument in the interpretation of the notion of origin varies. Difficulties arise through the CBD's link between 'origin' and '*in situ* conditions'.

Glowka *et al.* (1994), in an early interpretation of the CBD, seem to understand the CBD definition as referring to varieties, in particular landraces. For the interpretation of '*in situ* conditions' they refer to the known formula of 'surroundings where they have developed their distinctive characteristics', which – in connection with *in situ* conservation – they interpret as 'those areas where humans have created agricultural systems in which they have, in turn, developed identifiable plant varieties (known as landraces) ... This is independent of the (geographical) relation to the wild populations from which they originated' (p. 22).

In contrast, in the scientific literature treating origin in connection with the CBD's assertion of state sovereignty over genetic resources, origin seems in most cases to be interpreted in an historical (Vavilovian) sense.[21] Fowler (2000) argues at the historical and species level and concludes that the definition of origin is technically and financially not feasible. He maintains that the CBD definition is to be understood in an historical sense, as most crops and certainly most of their properties originated long ago (p. 4, although in his examples he mixes species and varieties).[22] He argues,

> many properties come in infinite gradations. Many ... will have been developed over time, and over a wide expanse of territory, encompassing more than one country. Some properties might have multiple origins both in time and place ... Proving the historical origin – pinpointing both the time and place of each – is well beyond the grasp of today's science or science budgets (Fowler, 2000, p. 5).

In contrast, Hardon *et al.* (1994, p. 12), differentiate between 'origin' (apparently understood in an historical sense) and the current geographical distribution in referring to 'landrace groups which can be distinguished within geographical regions on the basis of a complex of name, morphology or usage'. They conclude that it might be theoretically possible to trace the origin of samples to their original site or origin of the population/landrace. However, it requires the actual sample to be a true representation of its *original source*. The problem of tracing origin becomes even more intractable if the combinations of genes and genotypes in a sample has been altered by selection and recombination and/or regeneration (Hardon *et al.*, 1994, p. 15).

In the literature (for instance, Hardon *et al.*, 1994; Girsberger, 1999; Fowler, 2000) the viewpoint prevails that the origin (in the CBD sense) of domesticated crops or, more precisely, crop species, cannot be clearly defined given: (i) the evolution of the distinctive properties since time immemorial; (ii) the breeding history of the crops, involving an uncountable number of parental lines; and (iii) the culture/custom

[21] This might stem from the fact that the 'origin' discussion was, or is, inspired by the discussion on the creation of a multilateral system of access and benefit-sharing in the IU revision process, the lines of arguments being built up to prove that the clear definition of origin is not practical or feasible and therefore other solutions must be found. This line of argument has to be seen given the background of the strong rejection of models of ownership and property, from the apprehension that such models could prevent the free flow of germplasm that is vital for the maintenance and evolution of crops.

[22] 'Vavilov's theory focused on *crops* and on *regions;* the CBD's on *properties* and countries, a definition requiring a considerably higher level of precision. Nevertheless both depend on a detailed knowledge of history that, for the most part, must reach back beyond the founding of the nation state itself' (Fowler, 2000, p. 4).

of open exchange of crops and their (intercontinental) flow (see Brush in Girsberger, 1999, p. 60).

These findings and conclusions as to the CBD definition of 'origin of domesticated *species*' somehow contrast with the results of ethnobotanical research, which – at least at the level of crop *varieties* – describe distinctive local breeds.[23]

Thus, in the following discussion it is proposed to examine whether the reference to this historical understanding of 'origin' is compelling and useful in our context. It is suggested to investigate whether the question of origin could be considered on two different levels: (i) the level of differences *between species, and subspecies*, which are relevant to establishing origin in view of state sovereignty; and (ii) the differences *within* species, between varieties, which could be relevant to establishing origin on a lower geographical level.[24]

Conclusions

The key question as to the definition of origin is how the notion of 'distinctive properties' of species and/or of varieties is to be understood.

As a working hypothesis it is put forward that, for the sake of the allocation of the genetic information as contained in landraces, the legal (CBD) definition of origin is not differentiated enough. As it is positioned on the species level (apparently on the basis of the more historical scientific understanding of the term), further interpretative steps are necessary.

Thus, in the context of the question of the allocation of landraces to specific social or geographical entities, the necessity of a *functional* interpretation of the term 'origin' is proposed, answering to the specific characteristics of landraces.

From this, the following questions arise. First, can specific characteristics be established that allow the distinction of different varieties of landraces; and secondly, do these characteristics allow the allocation of a variety to a geographical entity on a relatively low level (such as community or farming family)?[25]

4.3.3 A functional interpretation of origin

In general

The goal of the CBD's definition of 'country of origin' is to allocate genetic resources to the state. The notion of 'country of origin' is the connecting point for the establishment of the ownership of the state over its genetic resources. So, the definition refers to the level of the nation states in defining the origin of the genetic information.

However, as elaborated above, for the creation of effective incentives for the conservation of traditional PGRFA, the allocation to a lower level, in a geographic or socio-political sense, would be preferable.

The question is – what would be the relevant criteria? Could the CBD criteria for the definition of 'origin' be adapted for this purpose? As mentioned above, the CBD definition of origin of domesticated species encompasses several elements: geographical (being the surroundings); biological (distinctness); social (influence of the evolutionary process by human needs); and temporal (that it has developed).

Among these criteria, distinctness seems

[23] See, e.g. Schneider, 1995; Asfaw, 1999; Gonzales, 1999; Pionetti and Suresh, 2002.

[24] This question is to be answered first from a botanical/taxonomic point of view. Does the allocation of species/subspecies to a 'regional/national' (i.e. higher), and of varieties to a 'subnational' (i.e. lower), geographical level make sense from the botanical/taxonomic point of view? Or are domesticated plants always species (as, for instance, the potato *Solanum tuberosum*; but consider *S. andigenum* and *S. juzepczukii* (see Tapia and De la Torre, 1997, p. 12).

[25] This question has to be distinguished from the protective criteria, which must be defined according to the goals the protection is intended to fulfil. From this incentive point of view, in the case of PGRFA, the maintenance of the crop diversity and its evolutional potential (genetic diversity and adaptability to exogenous factors, in contrast to the UPOV criteria of uniformity and stability), as well as the conscious innovative breeding, are all relevant (see Zeven, 1998).

to be a basic element for the identification of a variety. The central point is that a variety must be distinct enough to be able to identify it in comparison with other varieties. If not, the problems of multiple protection of one variety, and an infinite duration of rights over a variety, would arise (IPGRI, 1999).

Further elements could be found in the characteristics of a landrace. Among the elements to describe landraces discussed by Zeven (1998, pp. 35–36),[26] the criteria of the breeding history, in particular in connection with human selection, and the element of the common appearance (integrity, combined with diversity), seem, in analogy with the above-mentioned CBD criteria, to be promising for the identification of specific landraces.

The question is whether one or a combination of these criteria could provide connecting points for the definition of the origin of a landrace.[27]

The criterion of distinctness

Zeven (1998), citing Kiessling (1912), states that a landrace is a mixture of phenotypes, but that (the majority of) these phenotypes have a common appearance, which makes them at least somewhat different from another landrace of the same crop.

Thus, one element in identifying a landrace could be its appearance, as even if the landrace is genetically diverse, the genetic diversity may not hold for all (expressed) characters.

Distinctness, besides stability and uniformity, is one of the criteria for the allocation of Plant Breeders' Rights. It is true that – as a rule – landraces cannot be protected by PBR, because by definition they do not correspond to the criteria of stability and uniformity. On the contrary, the opposite qualities of genetic diversity within a specific landrace and its resulting capability of adapting to exogenous (detrimental) factors are specific characteristics that, according to scientific literature, should be encouraged.

However, keeping in mind these specific qualities, the question might be asked whether the criterion of *distinctness*, as elaborated in the application of the UPOV regulations, might be helpful for the identification of landraces and possibly adopted to this end.

THE UPOV CRITERION OF DISTINCTNESS

UPOV defines 'variety' as a plant grouping within a single botanical taxon of the lowest known rank.[28] Such a variety is distinct if it is clearly distinguishable from any other variety whose existence is commonly known at the time of the filing of the application (see UPOV, 1991, Article 1(vi)). The question is how the criterion of 'clear distinguishability' is implemented in practice.

TESTING DISTINCTNESS

UPOV has created guidelines for testing distinctness, homogeneity and stability of new varieties of plants.[29]

According to the Revised General Introduction to the Guidelines, the characteristics used for the identification of crop varieties must be capable of precise recog-

[26] Breeding history, diversity/integrity, adaptation, yield stability/lower yield, resistance/tolerance and human selection.

[27] These criteria need not correspond to the requirements that a *sui generis* right would have to comply with. These would have to be defined taking account of the activities to be supported, taking care to avoid any detrimental effects.

[28] This means distinct types at the lowest level taking account of the botanical nomenclature such as species or a subspecies: UPOV (International Convention for the Protection of New Varieties of Plants) as revised (1991) Article 1.vi.

[29] This consists of a general introduction and guidelines for individual crop species: UPOV Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants. TG/1/2, 1979–11–14. UPOV Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability: Potato *Solanum tuberosum* L.. TG/23/5, 1986–11 21. A list of test Guidelines can be found at http://www.upov.org/eng/publctns/pdf/testguid.pdf

nition and description. The varieties with which a tested variety has to be compared are those whose existence is a matter of common knowledge. The first basis of comparison is normally those varieties that are considered to be similar to the tested variety (Revised Introduction s.19).

Testing is then done according to qualitative and quantitative criteria. A *qualitative*[30] difference exists when 'the respective characteristics show expressions which fall into two different so-called "states of expression"', that is, different characteristics as described in the species guidelines. For potato leaves this would, for example, be the size (very small to very large), the width (narrow to broad), the waviness of margin (low to high), and the depth of veins (shallow to deep). *Quantitative* characteristics are those that are measurable on a one-dimensional scale and show continuous variation from one extreme to the other.

It seems that the tests are conducted on the basis of testing the expressions of genetic variety, i.e. on the basis of morphological and physiological[31] criteria only, not (yet?) taking account of recent techniques to enable the characterization of the *genetic material*, such as, for example, DNA sequencing (for details see Hardon *et al.*, 1994, pp. 9–11).

With a view to the identification of landraces, Hardon *et al.* (1994, p. 7) maintain that the recognition of the contribution of farmers in maintaining and enhancing genetic diversity requires reliable and objective *genetic* definition of the identity of landraces (and populations of wild species). However, taking account of the UPOV testing procedures, the question is whether, if not based on UPOV, another system for identifying landraces based rather on *morphological* and *physiological* analyses might be developed.

To this end, it must be possible to distinguish landraces of the same variety from other, similar varieties. This leads to the questions of first, to what extent a variety has to be distinct; secondly, to which characteristics this criterion ought to apply; and thirdly, how the 'state of the art', that is, the stock of landraces the examined variety would have to be compared with, is to be defined.

ADDITIONAL INDICATIONS FOR DISTINCTNESS OF LANDRACES

Additional indications for distinctness of a landrace could be: (i) its use being current in a specific, clearly demarcated geographical area to which, in turn, a specific social community can be ascribed; and (ii) its specific name (if more than one landrace of the same species is grown in the same region). The name might indicate specific distinctive characteristics (e.g. colour, region of provenance, size of plant or grains) (Zeven, 1998, p. 135).

The problem here is that (morphologically or genetically?) identical varieties can have different names in different regions and that due to the custom of open exchange, the allocation to a specific region could be difficult (although findings in the IPGRI paper in part 2 of this chapter suggest this is not the case).

The criteria of uniformity and identifiability

The criterion of uniformity is closely linked to the criterion of distinctness. It serves, first, to define clearly the subject matter to be protected. It means that the characteristics that are required to define distinctness must (in principle) be uniform for the variety: uniformity is used to distinguish between varieties.

The criterion of uniformity required by the UPOV plant variety protection regime is presently controversial. The concern is that this criterion reinforces trends towards

[30] Qualitative characteristics should be those that show discrete discontinuous states with no arbitrary limit on the number of states (Revised General Introduction, pp. 10–11).

[31] Plant anatomy, or 'morphology', refers to the description of the structure and parts of a plant. The 'phenotype' is the 'outward physical manifestation' of the organism, anything that is part of the observable structure, function or behaviour of a living organism (in contrast with the genotype, which is the internally coded, inheritable information).

genetic uniformity and thus has a negative effect on agrobiodiversity.

Therefore it is proposed to replace 'uniformity' with 'identifiability', the latter term leaving more flexibility to include landraces and thus to encourage heterogeneity (IPGRI, 1999, p. 15).

The element of time

As mentioned above, the breeding history can be another element for defining the functional origin of a landrace. It can be imagined that a specific variety has a long history in a specific region, or even that it traditionally belongs to a specific farming family. Accordingly, it is submitted that the breeding history, the creative input by farmers into a specified landrace (in analogy with the input of the formal breeder), and the social aspect inherent in the *in situ* breeding process, could be taken account of by a time criterion.

The problem is, however, to establish the relevant time period and to create supporting evidence.

4.3.4 Conclusions

The question at the outset was whether it is possible to establish a specific type of 'farmer-breeders' or, more appropriately, a functional definition of origin of landraces. This, in turn, leads to the question as to what would be the criteria for defining such a functional notion of origin.

Identified as possible criteria were distinctness and/or identifiability (by morphological criteria, possibly supported by the name and/or a delimited geographical origin); time as an indicator for the breeding history; and the social element.[32]

Accordingly, the question arises as to whether it would be possible to establish these facts in the field, and whether this kind of information has already been, or could be, stored in registration schemes containing the passport data of collected landrace-accessions. In the following part of this chapter, the authors conduct such a test of the data included in the CGIAR System-wide Information Network for Genetic Resources (SINGER), not with the intention of actually facilitating IPR claims, but just to test one of the biggest PGR databases in the world. If this is not the case, the subsequent question is whether it would be possible to create corresponding documentation schemes in the future.

4.3.5 Questions for further research

Given the above, several questions may be deduced for further research regarding the feasibility of allocating traditional PGRFA (and traditional knowledge) by registration systems. The basis would be to evaluate the described options by analysing an existing registration system. The basic question is: which of the above-described criteria (being time frame/breeding history; distinctness/identifiability) ought to be considered as a connecting point and could be made operational for the allocation of landraces?

This leads to the more scientific, technical and practical questions, such as:

- To what degree are landraces distinct between communities or regional entities? Is it possible, and frequently occurring, that specific villages, farming families or regions have specific (distinguishable) landraces with specific characteristics?
- Is it possible, theoretically and practically, to determine the number of years a specific landrace has been managed by a specific social unit? (5 years, 10 years, 20 years?) How long would this period have to be in order to allow for a legitimate allocation?
- And would it be possible in practice to allocate on the basis of these data specific landraces to specific (legally rele-

[32] Other characteristics such as adaptation, yield stability/lower yield, resistance/tolerance are criteria for distinguishing landraces from formally bred varieties. They are the elements that ought to be considered in establishing protective criteria.

vant) entities such as communities or families?

In evaluating the SINGER database, the question is whether in its present set-up it can be used as an instrument of allocation to specific communities on the basis of the *passport data* of the accessions stored in the system. Do the passport data for the accessions contain the relevant categories? Would an allocation be possible on the basis of the *existing entries*; or, if not, would it be possible and practicable to create additional passport data to this end?