Sustaining Local Food Systems,
Agricultural Biodiversity and Livelihoods

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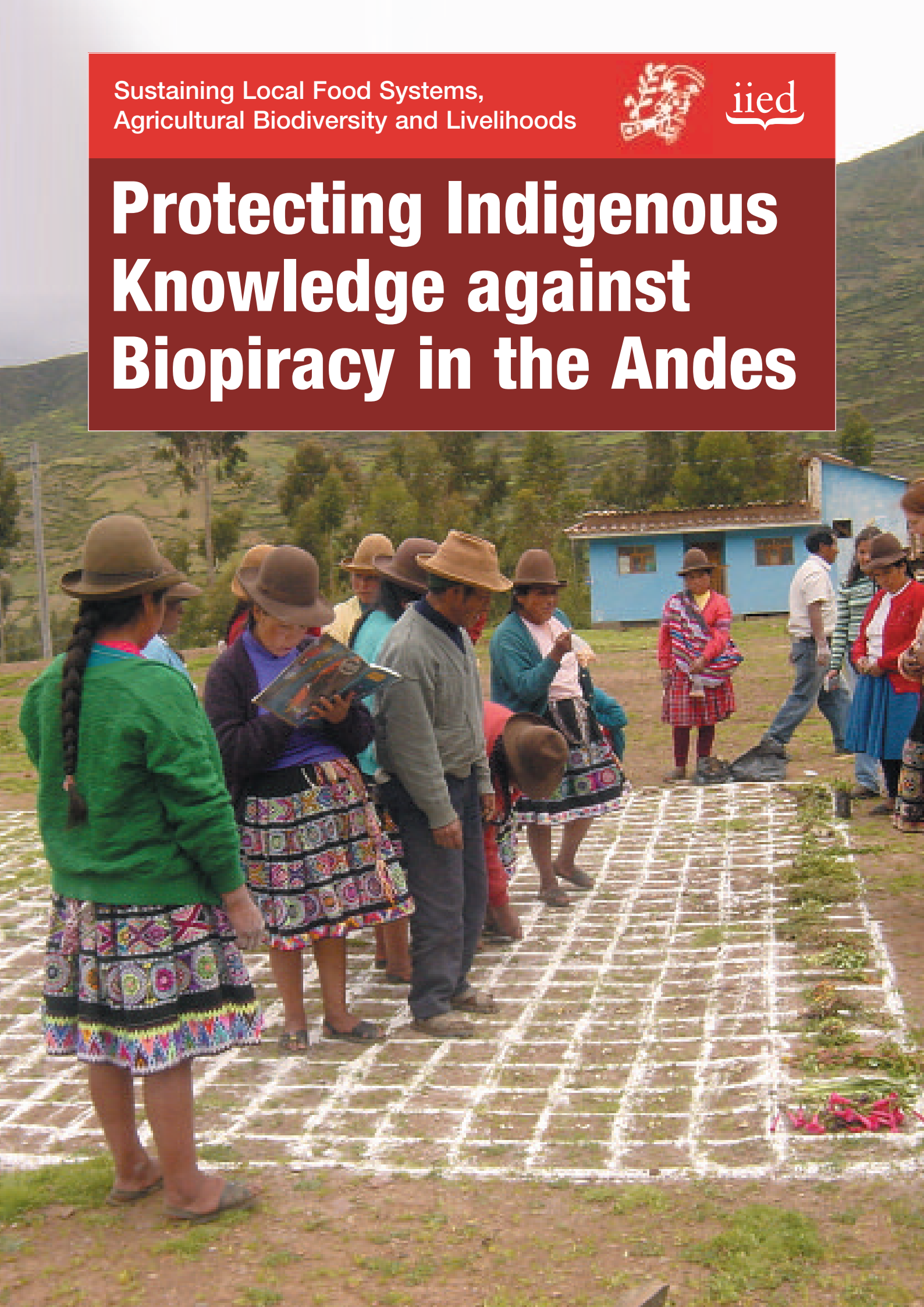
Protecting Indigenous Knowledge against Biopiracy in the Andes



Protecting Indigenous Knowledge against Biopiracy in the Andes

Biodiversity registers – a weapon against biopiracy

For centuries Andean communities have been pillaged for profit by outsiders, and despite recent progress in recognising the rights of indigenous people, these same communities are now dealing with a powerful new modern threat: biopiracy. Laws designed to protect the 'intellectual property rights' of inventors are being abused to deprive the rightful owners of generations of innovative plant breeding of the fruits of their labour.

Peru is one of the most biologically rich areas of the world. It is the region of origin of some 180 food crops, including Andean tubers like potato, *oca*, *olluco*, and *mashua*, as well as Andean grains and legumes like *quinoa*, *kañihua*, *kiwicha*, *tarwi*, and *pajuro*. While this richness is due in part to the country's geographic diversity and complexity, its cultural diversity has played an equally important role in preserving and developing plant diversity. For centuries, Andean civilizations and their descendants have been using and cultivating wild plants, selecting particular strains for desirable qualities and breeding them. New crosses enabled useful plants to be grown in a wider variety of Andean microclimates, making the communities' food supplies more secure and stable.

But today commercial interests, encouraged by governments and international organisations whose priorities are very different from those of indigenous peoples, are making the rules. They are doing precisely what their rhetoric about free and open trade condemns. Instead of counting on the market to buy the best product available, companies are securing their place in the market by using intellectual property rights to prevent others from competing fairly. Even where patent laws are designed to encourage innovation and development and prevent the patenting of life forms in their natural state, those with the money and the lawyers are able to stretch the limits of the law – and even break it. What they are banking on – usually successfully – is that the rightful owners of the germplasm will not have the money or the contacts to fight back.

Peru should be safe from biopiracy. It is a signatory to both the International Convention on Biological Diversity and Convention 169 of the International Labour Organization. Both

agreements should provide some protection for indigenous peoples, and some benefits from the commercial use of traditional knowledge. However, Peru has yet to implement effective, corresponding national legislation.

Specifically, steps need to be taken to implement Peru's Law 27811, the *Law for the Protection of the Collective Knowledge of Indigenous Peoples Related to Biological Diversity*, which has been in effect since September 10, 2002. Similarly, the government also needs to implement the Andean Communities' Decision 391 which establishes a *Common Access Regime to Genetic Resources* (October 21, 1993) that recognises the rights of indigenous peoples over knowledge, innovations, and practices; establishes prior informed consent requirements for indigenous communities; and guarantees monetary and non-monetary benefit sharing.

Unfortunately for indigenous peoples in the Andes – whose food security depends on the integrity of their traditional knowledge systems – national legislation to implement these international and regional commitments has been strongly undermined by the recent signing of the bilateral free trade agreement (FTA) between Peru and the United States. Despite Peru's seemingly unfaltering advocacy in multilateral fora for provisions such as prior informed consent, disclosure of origin, and equitable benefit sharing, the FTA fully contradicts such a stance by alleging that access to genetic resources or traditional knowledge can be adequately addressed through contracts.

This exclusion of any kind of provision to ensure that no patents are granted in the US without the authorisation of traditional knowledge holders (the result of strong lobbying in the US by the biotech and pharmaceutical industries) leaves the door wide open for a vigorous scaling-up of biopiracy in the Andes. It also signals the need for innovative approaches to protect local food systems and to restore local control and rights over traditional knowledge.

The IIED–ANDES Sustaining Local Food Systems, Agrobiodiversity, and Livelihoods Programme in Peru is chiefly concerned with intensifying sustainable agriculture; making local economies viable and equitable; sustainably managing natural resources; enabling local institutions; and creating a supportive policy environment for conservation and development initiatives. The abusive exercising of intellectual property rights by multinational companies to privatise indigenous-bred germplasm and associated ancestral knowledge jeopardises the achievement of all of these objectives and calls for a locally conceived and driven response that has repercussions on national and international fronts. The Indigenous Biocultural Heritage Registers are just such a response.

What is biopiracy?

Biopiracy is the illegal appropriation of life – micro-organisms, plants and animals (including humans) – and the traditional cultural knowledge associated with it. Biopiracy is illegal because, in violation of international conventions and (where these exist) corresponding domestic laws, it does not recognise, respect or adequately compensate the rightful owners of the life forms appropriated or the indigenous knowledge related to their propagation, use and commercial benefit.[1]

Box 1: What is a patent?

A patent for an invention is granted by government to the inventor, giving the inventor the right for a limited period to stop others from making, using or selling the invention without the permission of the inventor. When a patent is granted, the invention becomes the property of the inventor, which – like any other form of property or business asset – can be bought, sold, rented or hired.

To see the full description of what can and cannot be patented, go to www.patent.gov.uk/patent/whatis/definition.htm.

How does it happen?

An inventor, usually a company, claims their 'intellectual property rights' over a particular product, usually by taking out a patent that protects their product by allowing the inventor to prevent other people from making, using or selling the product without permission (see Box 1). The inventor applies for a patent from the governments of the territories over which he wants to assert his rights to prevent others from using his invention. Territories can be individual countries or regions such as the European Union, or the inventor can use the Patent Co-operation Treaty (PCT), administered by the World Intellectual Property Organization (WIPO), to apply for an international patent that will apply in as many countries as the inventor chooses. This is all perfectly legal. The problem arises when the product is based on plants whose unusual or unique properties are the result of years of breeding by farmers whose investment and work is unacknowledged and unrewarded – stolen, in effect. In these cases the patent holders have failed to both obtain the farmer's permission – or Prior Informed Consent (PIC) – and agree adequate compensation.

In some cases, the farmers have unwittingly helped outsiders to profit from their work. Areas like the Peruvian Andes are rich sources of biodiversity, but it is estimated that only one specimen in a collection of 10,000 random samples has an identifiable commercial use.[2] Consultation with indigenous peoples doubles this success rate. Searching biological resources

Box 2: CGIAR protection

The 15 international agricultural research centres that make up the CGIAR network encourage the development of agriculture that will benefit all humankind. They recognise that patents are often counterproductive to their aims, so all genetic material that is held in their collections is explicitly unpatentable. Anyone who wants access to any of their materials must sign a Material Transfer Agreement, which includes the following clauses:

'The material is held in trust under the terms of this agreement, and the recipient has no rights to obtain Intellectual Property Rights (IPRs) on the material or related information.'

'The recipient may utilise and conserve the material for research, breeding and training and may distribute it to other parties provided such other parties accept the terms and conditions of this agreement.'

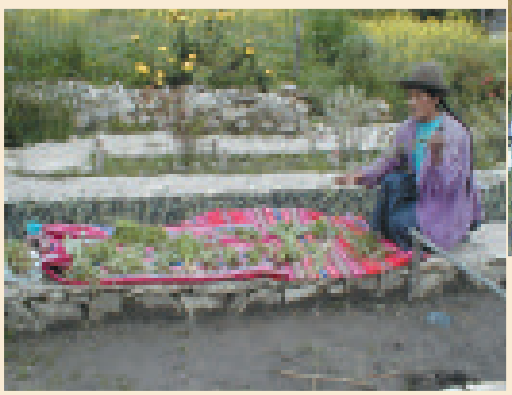
'The recipient, therefore, hereby agrees not to claim ownership over the material, nor to seek IPRs over that material, or its genetic parts or components, in the form received. The recipient also agrees not to seek IPRs over related information received.'

Nevertheless, as evidenced by the US patent granted to a laboratory cross of Andean nuña bean varieties – some of which belonged to the collection of accessions of CIAT, a Colombia-based CGIAR institute – companies that obtain genetic material outside of CGIAR genebanks are succeeding in patenting material that is supposedly 'in trust' for the benefit of all humanity.

Source: www.cgiar.org/pdf/mta2003_en.pdf

and their accompanying indigenous knowledge for commercial exploitation is known as *bioprospecting*. While not inherently harmful – for example, indigenous peoples have willingly contributed their knowledge of some medicinal plants that have led to commercial medicines – where there are inadequate safeguards, indigenous people have been exploited.

Increasingly corporations are bioprospecting in collaboration with intermediaries, such as universities, governments, and non-government organisations, which are able to contribute expert yet relatively low-cost field research and knowledge, and to gain access to biodiversity 'hot spots'. These intermediaries often receive project funding, scholarships, or technical hardware, while the corporations retain the vast share of the profits. Recently some environmental organisations, including Conservation International, have become involved in bioprospecting activities, lending a degree of 'credibility' to the ventures but also casting doubt upon the integrity of these organisations' commitment to social justice and environmental preservation.[3]



The biopirates' booty

Maca extract

A US company, Pureworld Botanicals, has succeeded in patenting the isolated composition and process used to produce an extract of maca, a very nutritious Andean root that has been used for centuries as a food supplement and to increase stamina and fertility. Pureworld markets its product as a 'natural Viagra'. 'Andean indigenous communities have been using maca for food and medicinal purposes since before the Conquest', explains Alejandro Argumedo of ANDES, the Quechua-Ayamara Association for Sustainable Livelihoods and IIED's project partners. 'Ironcially, we are now in danger of losing maca – not to extinction – but to predatory US patents.'

You can buy the real thing freshly prepared from stands in the streets in the Andes, where the roots are blended with water or fruit juice and then mixed with 'aguardiente', a type of alcohol. It is also available in a dried powder form. But should the patents ever have been granted? Is Pureworld's product really new and non-obvious? According to Professor Carlos Cuirós of the University of California, Davis, the process patented by Pureworld differs very little from the standard procedures that anyone would use to make an alcohol-based extract, and the end product is not very different to the traditional product. Pureworld remove the cellulose, but this is likely to make only an aesthetic difference.

Pureworld have at least two US patents on maca extract, and have patents pending in Australia, Europe, and at the World Intellectual Property Organization.

Nuña beans

All germplasm held in the collections of all the CGIAR institutes are held 'in trust', and cannot be patented (see Box 2). Despite this, however, US company Appropriate Engineering and Technology has been awarded a patent in the US and from WIPO for a cross of an Andean nuña bean which involves the use of nine accessions from the collection of CIAT, a Colombia-based CGIAR institute. All 33 Andean varieties that they cite in the patent have been bred and developed for centuries in Peru, Bolivia, Ecuador, and Colombia.

The nuña bean 'pops' when it is heated, much the same as popcorn, and the patent-holders want to sell it as a snackfood. Their development involved crossing many strains of nuña bean to produce a plant that can be grown in the US and has the right shape for industrial agriculture, that is it can be harvested mechanically. In addition to the injustice that the company is capitalising on hundreds of years of development courtesy of Andean farmers without asking, acknowledging or compensating them, the worry is that this patent will discourage or prevent others – perhaps even the Andean farmers who are the rightful owners of the knowledge – from developing potentially useful new beans.

Box 3. Can registers be standardised?

As awareness about the potential of registers to protect indigenous knowledge has grown, so have calls to develop an international standard for the data. Inevitably, suggestions for these standards are often based on the standards developed for IPR and patenting. These standards are rarely appropriate for traditional knowledge, however, and are not flexible enough to include the very things that make traditional knowledge unique – not only the social, economic, cultural and environmental dimensions, but also the spiritual dimensions.

To include all the dimensions of traditional knowledge any standardisation will have to involve a flexible framework that is adaptable and sensitive to local realities. There is also a danger that rushing to agree standards would pre-empt necessary debate on what form *sui generis* protection should take. It would be a mistake to agree any standards before there is an agreed international regime for *sui generis* protection of traditional knowledge.

Box 4. Why don't indigenous peoples use patents themselves?

The concept among Andean indigenous peoples of patenting their own knowledge, resources and products is virtually non-existent, and is unlikely to be successful for two main reasons: extremely high costs and, more significantly, cultural values.

Poor farmers cannot pay hundreds of thousands of dollars to win and defend patents as a means of protecting their knowledge and resources. Even if they did pursue intellectual property, businesses will still be encouraged to isolate, purify, or modify existing biological products and processes to win patents that are, at least in part, an appropriation and exploitation of someone else's innovation.

For indigenous peoples whose traditional values and lifestyle are rooted in communal living, shared resources, and the interdependence of all living things, patenting life is anathema to the very value system upon which their culture is based. Patents are a tool of western societies and reflect values of private ownership and the pursuit of wealth, which are not paramount in indigenous cultures. Contrary to what the World Intellectual Property Organization and others are promoting, patent regimes are incapable of recognising or rewarding the traditional knowledge and informal innovations of indigenous people.

Defending indigenous people's traditional knowledge

Given that the indigenous people with whom IIED and ANDES are working do not want and could not afford to apply for patents on a large scale, other ways to protect their traditional knowledge are being pursued. One response that is proving popular and effective in other cases, for example in India, is the compilation and registration of traditional knowledge in databases. Each of these databases has been adapted to local needs, knowledge, and laws. The aim of these exercises is to thwart the appropriation of traditional knowledge (TK) by making it public and accessible, which means that it becomes 'prior art', and unpatentable.

When a patent application is made, the 'inventor' must prove that their invention is new and innovative, not simply a discovery, not already publicly known, and not based on the uncompensated inventions of others. Creating databases of traditional knowledge and making them available to patent authorities will ensure that any false claims of novelty and inventiveness can more easily be quashed. This will help to prevent people from patenting knowledge that already belongs to indigenous people, but it is not without its risks.

Some people fear that such databases will simply provide increased access to traditional knowledge for the private sector, without actually establishing the rights of indigenous people to own their knowledge. For this reason such databases are considered a type of 'defensive protection', rather than the 'positive protection' that would be provided by legal recognition of the rights of indigenous people to own their traditional knowledge.

'Positive protection' can only happen when the legal rights of indigenous peoples to their traditional knowledge is recognised. There are two ways to assert these rights – through existing IPR regimes or *sui generis* regimes. There are two types of *sui generis* regimes, declaratory or constitutive.

Peru has a declaratory regime that recognises that rights over traditional knowledge derive from ancestral rights rather than any act of government, so that knowledge does not have to be in a declaratory register to qualify.

Panama, however, has a rights regime that goes further, granting exclusive property rights over traditional knowledge to indigenous people. There is a constitutive register, and registration of TK makes the public aware that indigenous people have rights over such knowledge.

The state acquires obligations once it accepts that traditional knowledge is cultural patrimony – and as such is inalienable and indefeasible, and should be protected from third parties wishing to expropriate or exploit it. Even greater progress would involve using customary law and practice as the basis for protecting TK, including defining the parameters of protection. The case for using customary law is even stronger where treaties or laws give indigenous peoples or local communities rights to full or partial self-governance and/or control access to and use of their resources and TK.

Local Registers in the Potato Park

Quechua subsistence farming communities in the provinces of Calca and Paucartambo, including the ANDES-supported communities in Pisaq, Lares, and Q'eros, are rich in biological and genetic resources and associated indigenous knowledge. To protect and promote this biocultural heritage, during the last four years the six communities of the Potato Park, an Indigenous Biocultural Heritage Area (IBCHA) in Pisaq, have been collecting, documenting, and administering these traditional resources using a model fashioned on the work of the Deccan Development Society (DDS) and a women's media collective – the Community Media Trust (CMT) – from Andhra Pradesh, India.

In 2002 a group of women from the CMT visited Cusco as part of the farmer's exchange segment of IIED's Sustaining Local Food Systems project. Their visit provided an unprecedented opportunity for the marginalised Andean communities of the Potato Park to learn how to register indigenous knowledge according the DDS's model – a Community Biodiversity Register (CBR). In Andhra Pradesh, the CMT collaborates with the DDS to encourage and register local democratic processes and the traditional knowledge of farmers and other users of plant and animal biodiversity. A crucial feature of their work is the design of a multimedia database that enables highly participative processes of both information gathering and recording. During their time in Cusco, women from the CMT shared their experience and know-how with the Potato Park communities who reciprocated with productive feedback based on their own experience.

The farmer's exchange led to the further refinement of the Community Biodiversity Register model for the benefit of both Quechua people in the Potato Park and women from the CMT. The Potato Park has since developed its own Indigenous Biocultural Heritage Register (IBCHR) that reflects the distinct Quechua identity of the Potato Park communities. This local register is based on the traditional Andean system of khipus, which were used in pre-Hispanic times to document a wide variety of biological, cultural, economic and demographic information. The Register plays a key role in contributing to meeting the Potato Park's management objectives as an IBCHA (see Box 5).

An Indigenous Biocultural Heritage Register can be defined as 'a database into which indigenous peoples put information regarding key components of their indigenous biocultural heritage (see Box 5) – particularly those resources threatened by biopiracy – in order to gain legal rights relating to that information'.

The Potato Park's Indigenous Biocultural

Box 5: The Potato Park as an Indigenous Biocultural Heritage Area (IBCHA)

The Potato Park focuses on protecting and preserving the critical role and interdependency of indigenous biocultural heritage (IBCH) for local rights, livelihoods, conservation and sustainable use of agrobiodiversity. IBCH refers to a wide range of traditional resources – both tangible and intangible – including land, biogenetic resources, traditional knowledge, customary law, spiritual values, and landscapes which are passed down from preceding generations and confer rights to current ones. The Park is located in an area known as a microcentre of origin and diversity of potatoes, one of the world's major food crops which has been protected for centuries by the deeply rooted local food systems of *Quechua* peoples. The Potato Park, as its name denotes, celebrates the tremendous diversity of native potato varieties and other native Andean crops characteristic of Andean food systems. The Potato Park is dedicated to safeguarding and enhancing these food systems and native agrobiodiveristy using the adaptive and holistic approach described by the IBCHA model. In the case of the Potato Park, the epistemological bridges prescribed by the IBCH approach link traditional and science-based understandings of the multiple functions of agricultural biodiversity – including the close interaction between wild and domestic plant and animal diversity – and how they sustain local livelihoods. The traditional knowledge, innovations, and practices of *Quechua* peoples are showcased in the Park for their essentially modern significance and utility including for the purposes of nutraceuticals, pharmaceuticals, biotechnologies, agroecotourism activities, and community-based conservation. In terms of the rights-based approach prescribed by the IBCH approach, the Potato Park is concerned with indigenous peoples' self determination and securing *Quechua* people's tenure and rights to agricultural biodiversity, local products, traditional knowledge, and related ecosystem good and services.

The IBCHA model describes a community-led and rights-based approach to conservation which ensures local livelihoods using the knowledge, traditions, and philosophies of indigenous peoples related to the holistic and adaptive management of their landscapes, ecosystems and biological and cultural assets. An IBCHA also incorporates the best of contemporary science and conservation models and rights-based governance approaches, including the IUCN's Category V Protected Areas and Community Conserved Areas (CCAs). As IBCHA, the Potato Park has been proposed as a *sui generis* system for the protection of traditional knowledge because it aims to protect TK systems within its cultural, temporal and spatial dimensions using a combination of positive and defensive protection tools.

Heritage Register has the following objectives:

- To promote respect for and the protection, preservation, wider application, and development of the diverse components of IBCH, especially the collective knowledge of *Quechua* peoples and associated native species threatened by biopiracy.
- To serve as a mechanism to claim the *Quechua* people's collective property rights to their knowledge and resources; and to identify collective rights holders.
- To promote the fair and equitable distribution of the benefits derived from the use of their collective knowledge and resources; and to identify who might be entitled to benefit sharing.
- To promote the use of IBCH for the benefit of indigenous peoples and mankind in general.
- To ensure that the use of their collective knowledge and resources takes place with the prior informed consent of indigenous peoples.
- To defend against biopiracy and the commodification of their collective knowledge and resources.
- To identify resources that can be used to create a local economy using IPR tools such as collective trademarks and denominations of origin.
- To promote respect for and the continued use of the *Quechua* language and customary law, as well as traditional systems of communication and information sharing.
- To enable the transmission of IBCH to future *Quechua* generations and authorised third parties.
- To serve specific, locally identified educational, social, cultural, spiritual and other purposes.

Key principles upheld by the Register include:

- Existing living organisms, including all plants and animals as well as their genes, are no one's invention and should never be patented and put under private control.
- Genetically modified organisms present a danger to the diverse components of IBCH, including traditional knowledge and biological diversity, and should be banned from further research, development, and commercialisation.
- Free sharing of biological resources, knowledge, and culture should be promoted in recognition of the inalienable rights of indigenous peoples.
- To uphold the Andean principle of duality, both scientific and traditional knowledge as well as positive and customary law should be employed in a complementary fashion to defend indigenous people's rights.

Modern technology enlisted in the service of tradition

The use of computer technology is arguably far removed from traditional indigenous practices of managing information. Nevertheless, in recent years indigenous communities around the world have come to appreciate the role that computers can play in documenting, sharing, and protecting their collective heritage and history.

While the presence of computers in indigenous communities may seem like a threat to tradition, if they are used in a way that is respectful of customary law and practices, then they may instead present an important opportunity for indigenous culture and values to adapt to and benefit from this technology. The Indigenous Biocultural Heritage Register in the Potato Park hopes to capitalise on this opportunity.

On the one hand, the register uses altogether modern tools for collecting, documenting, storing, and administering the contents of the register. These tools include:

- A personal computer
- Free/open source software
- Audiovisual equipment and records
- Geographic information systems (GIS) technology

On the other hand, the register is entirely based on traditional Andean science and technology, with customary laws regulating access and use both within communities and by external third parties. Ensuring that the register is compatible with the *Quechua* worldview is not only a means of promoting respect for and the continued use of indigenous knowledge, but is also essential for creating a system that is easily understood, appreciated, and used by community members in the Potato Park.

The following features of the register make it uniquely compatible with the *Quechua* worldview:

- Data for the register is first processed using a locally conceived tool (a simple matrix based on the abacus-like recording device used by the Incas called the *yapana*) which uses the same logic and design of the *khipu* (knot) system used by the Incas for recording information. The user interface when entering the data into the computer database reflects the local taxonomy for organising information in the Andes.
- The programme for entering data into the register is web-based free/open source software (FOSS) which is compatible with the *Quechua* customary practices of free and open sharing of knowledge.
- The FOSS programme is compatible with the binary code command sequences that give order to the *khipu* system and uphold the Andean principle of duality.
- The FOSS programme regulates access using Rights Expression Language (REL) that is sensitive to *Quechua* customary law.

The complementary use of both scientific and traditional knowledge and technologies is inspired by the Andean principle of duality, an important pillar of the *Quechua* worldview according to which objects, concepts and social structures naturally belong in pairs.

This same principle also prescribes the use of both positive law (IPR and Traditional Resource Rights) and customary law to reinforce local rights over IBCH and promote the local economy. Although IPR protection of traditional knowledge is largely considered an inappropriate mechanism to strengthen and empower indigenous peoples, certain IPR tools which respect the communally shared and owned nature of traditional knowledge and property may be used strategically to serve indigenous people's interests. The IPR tools employed to protect information within the Register include:

- Collective Trademark
- Denomination of Origin
- Copyrights
- Certificate of Origin

By and large, however, the purely economic nature of IPR protection, which implies the privatisation and commoditisation of traditional knowledge, does not mesh with indigenous people's own concepts of intellectual property and resource rights. Furthermore, the economic hardship faced by indigenous peoples and the unequal power relations between themselves and biopiracy-prone corporations would make it very difficult for communities to defend their IPR. Traditional Resource Rights (TRR) have been proposed as a means to provide adequate protection and compensation for the use of the traditional knowledge and resources of indigenous peoples. TRR, while including IPR

protection, also provide for a protection of traditional resources – both tangible and intangible – covered under a significant number of international agreements. The Traditional Resource Rights concept refers to a broad range of rights guaranteed by several binding and non-binding international agreements. Some of the TRR most relevant for the protection offered by the Register include:

- Human rights
- Rights to self-determination
- Collective rights
- Right to development
- Right to privacy
- Prior informed consent
- Environmental integrity
- Intellectual property rights
- Cultural property rights
- Recognition of customary law and practice

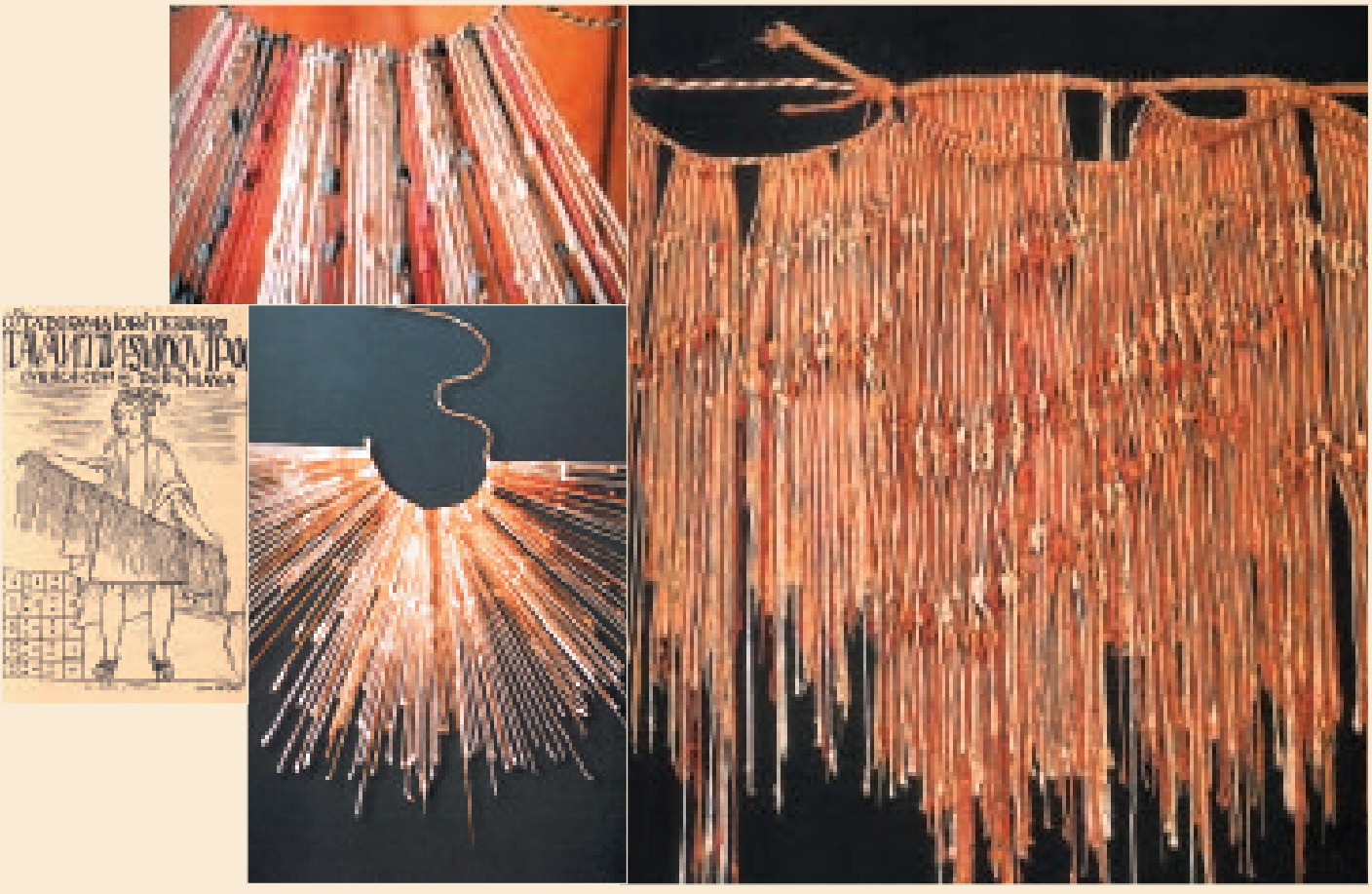
Finally, customary law in conjunction with Digital Rights Management is used to establish pre-defined policies for controlling access to digital data in the register (see the section on FOSS below).

Each of the register's features is discussed below, beginning with an overview of the *khipu* system which provides the logic and design for the documentation and registration of collective knowledge and uses a binary coding consistent with the computer technology used to store and administer this knowledge.

The *khipu* system

Believed to have been invented by Andean peoples sometime during what historians term the Middle Horizon period (600–1000 AD) and surviving even the Spanish Conquest, this complex and colourful device of knotted cords known as a *khipu* remains one of the most remarkable yet elusive communication systems that humanity has ever invented[4]. Remarkable because, according to one anthropologist, the *khipu*-making process had the capacity to encode 26 x 24 (for the 24 colours) = 1,536 distinct information units which might have corresponded to detailed information about goods and services, natural resources, taxes, statistics, demographics, laws, norms, ceremonies and rituals, and historic events. Elusive, because controversy persists surrounding just how detailed this information was, whether or not it verged on the conceptual clarity of written language, and the significance of properties such as colour, spin and knot direction, and decimal and non-decimal notation.

Khipus were created and managed by specialised Inca accountants, called *khipucamayocs*. They were spun and tied using cotton and wool, or sometimes both, and were different colours according to the four natural cottons produced by the Incas – white, light, medium brown, and green – and the diverse pigments of alpaca and llama wool. Dyes were also used to increase the range of colours. A *khipu* consisted of one long 'primary cord' to which a series of pendent cords were



attached. These pendent cords were encoded with information in the form of carefully placed knots as well as additional, knot-bearing, subsidiary pendent cords. Some *khipus* have up to 10 or 12 levels of subsidiary cords. Knots of different sizes and shapes were tied along the cords to register information in integer quantities as well in multiples of tens, hundreds, thousands, and tens of thousands. Believed by some anthropologists to be based on a combination of binary and decimal systems, *khipus* could record extensive information while avoiding a messy overcrowding of knots. The final product of the *khipucamoyocs* could be appreciated for its aesthetic qualities as much as for its practical use.

The Yapana Matrix

Although indigenous communities in the Andean highlands of Peru no longer use *khipus*, the same accounting logic that gave order to the *khipus* is very much alive in *Quechua* communities and manifests itself in other record-keeping devices. For example, anthropologist Enrique Mayer, during his field research in Tangor, described record-keeping using pebbles to establish who had contributed to community public service. Everyone who had served was counted by putting a pebble on a poncho placed on the floor by two commissioned record-keepers. According to Mayer, 'What I saw was social behaviour consistent with *quipu* record-keeping… The commissioned men were not only counting, they were memorising the names and the services rendered. Their memories constituted the record, and they remained available as expert witnesses in case of disagreement… Pebbles had replaced knots of the *quipu* strings'.[5]

Similarly, although *khipus* have disappeared from the Potato Park communities, the same rationale of organising information, of which *khipus* were ultimately only one manifestation, remain a fundamental part of a continuously evolving body of Andean knowledge alive in the Potato Park today. In order to advance their objective of registering indigenous knowledge, the Potato Park communities have developed a simple tool called the Yapana Matrix (as it is based on the Inca's abacus-like *yapana*), which is drawn or laid out on the floor using chalk or coloured strings. Although until now the matrix has been used primarily to document potato varieties, medicinal plants, and associated knowledge, the matrix could be used to document a range of other traditional resources including other ecosystem goods and services, cultural expressions, and customary law.

Much like the *khipu* system, the matrix consists of rows and columns that quantify information according to the decimal and binary systems. To quantify information about potatoes, medicinal plants, and associated knowledge, for example, the matrix uses seeds of various colours, shapes, and sizes, similar to the way knots vary in the *khipu* system. Additional cultural symbols and *Quechua* language are used in the matrix to indicate specific properties of the resource or knowledge, including spiritual significance and access privileges. Potatoes are classified according to medicinal, edible, ornamental, ceremonial and ritualistic uses. Medicinal plants are classified according to traditional categories, such as cold, warm, and hot, and uses related to plant and animal diseases.

Once the collective knowledge and resources have been categorised with the matrix, this information is transferred to the web-based register in the computer located in the Potato Park's interpretation centre. Data entry into the computer is made user-friendly for community

members by the user-interface, which reflects the local taxonomy of how information is organised in the Andes. This input is complemented by graphics, maps, photographs, relevant history and folklore, and video records prepared in *Quechua* by the Potato Park's video collective. Trained in the use of video equipment and camera techniques, the video collective documents the record-keeping process from start to finish, beginning with the exact place where the resource was collected (or with the person from whom the knowledge was retrieved) and ending with the categorisation of this information within the matrix and subsequent input into the register.

The FOSS for registration of biocultural heritage

In keeping with the Andean ethos of free and open sharing of information for the greater and widest possible good and rejecting the privatisation and commodification of knowledge, the Indigenous Biocultural Heritage Register of the Potato Park uses web-based free/open source software to administer data entry, access, and use. The nature of such software allows it to be adapted to the specific needs of *Quechua* knowledge protection and administration as well as to be shared freely – including through the internet – with other indigenous communities in and beyond the region.

Because the web server is administered from within the Potato Park, local communities retain full control of the software and can be sure that the information guarded by the register remains open and free according to customary practice.

Like standard computer software, the FOSS will use sequences (bytes) of eight adjacent binary digits (0 or 1) which are read as single units by the computer. These bytes may be strikingly compatible with the sequences encoded in *khipus*. According to a recent interpretation by anthropologist Gary Urton, who argues for *khipus* as an early form of writing, the sequences encoded in *khipus* are based on a binary code similar to the language of today's computers. Urton hypothesises that varying combinations of binary (either-or) options of material, colour, directions in which a cord is spun, and the size, shape, and placement of knots could represent values, objects, or events, much like graphic signs do in writing systems. Urton sees this binary system as a reflection of the underlying Andean principle of duality. While computers use eight-digit sequences of 1s and 0s, *khipus* appear to be coded in seven-bit sequences. Such an interpretation reveals that computers, by using sequences of binary digits as data units, are reconcilable on a fundamental level with the Andean worldview.

In addition to enabling the input and storage of collective knowledge and resources, the FOSS programme also has as one of its crucial functions the regulation of access to this information. In regulating access, the programme must negotiate a balance between the Register's objective of promoting the use of the stored information for the benefit of indigenous peoples and mankind in general, and its other objectives of respecting *Quechua* customary law, claiming collective property rights, and defending against biopiracy. The key

Five basic steps for registering resources

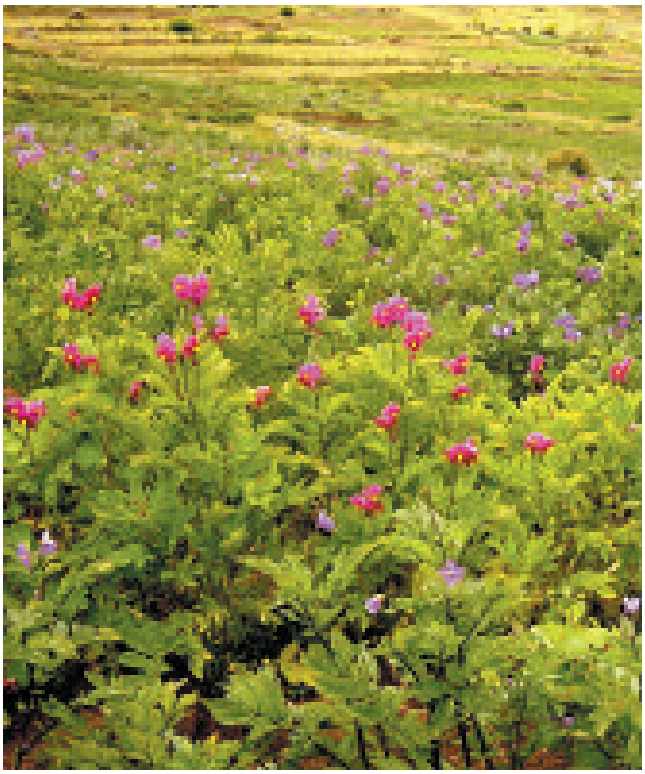
Step 1 The registration process begins with a biocultural mapping of the area to identify what resources are to be entered into the register.

Step 2 The resources identified by the mapping activity are then evaluated using the Yapana matrix tool. This evaluation establishes the specific uses of the resource (medicinal, food, and ceremonial) and also determines the level of necessary protection.

Step 3 Next the resource is documented using photographs, maps, drawings, and any relevant history or folklore.

Step 4 The next crucial step in the registration process is documentation through video of the uses and practices (know how) associated with the resource. A clip, recorded in *Quechua*, is created that demonstrates (a) the various uses of the resource, alone or in combination with other resources, (b) the know-how or innovative step of knowledge associated with this resource, and (c) the applications resulting from the use of this resource. The clip is usually one to two minutes in length.

Step 5 Finally, all the information accumulated in the above steps is entered into the computer database as a data file for the particular resource at hand.



to striking this balance lies in developing a programme that enables free and open access to the extent that *Quechua* customary laws are respected and upheld. Since the Register will be connected to the internet where web browsers operate on Markup Languages – mainly HTML and increasingly, in the future, XML – that provide instructions to computers on how to handle or display the contents of a file, these languages must be capable of describing the rights to the Register's digital resources in a manner consistent with *Quechua* customary law.

Moving Picture Experts Group (MPEG), an ISO/IEC working group, has already done significant work to establish standardised XML-based Rights Expression Languages (RELs) for the management and protection of intellectual property associated with multimedia content. However, these languages – mainly XrML and ODRL – have been designed and based on current copyright regimes which fail to adequately protect indigenous knowledge. Building on the work of the University of Queensland to harmonise RELs with requirements expressed by the Australian Aboriginal and Torres Strait Islander communities for the protection of their traditional knowledge, the Register in the Potato Park will use REL components that can express collective ownership, perpetuity of rights, the payment of royalties to traditional owners, and access privileges established by *Quechua* customary law.

Access privileges will be expressed using XML, XML Schema language, and XPath as extensions to existing RELs. These extensions can condition access to information in the Register according to a number of factors to which customary law applies. These include:

- the user's residency in a particular community or membership of a particular kinship group;
- the user's status within the community (president, *varayoc*, etc.);
- the user's gender;
- the user's customary role within the community or kinship group;
- the relationship of the user to people, traditional resources, or knowledge depicted in the information file;
- the death of people recorded in the information file; and
- the context in which the information will be used or reproduced.

While the above factors apply to users within *Quechua* communities, external third parties may also gain on-line access to information in the database according to a three-level (green, yellow, red) security system also based on REL extension languages. The security system administers all content of the Register according to the principle of copyleft, which

makes the content free and requires all modified and extended versions of the content to be free as well.

- Green level access means that information is accessible to any internet user that enters the Register's webpage. Prior Informed Consent (PIC) is implicit. Upon access, users agree to fully recognise the rights of *Quechua* peoples over their traditional knowledge and resources, including *sui generis* property rights afforded by Peru's declaratory regime. Users must also commit to the sharing of the benefits derived from the use of the information with indigenous peoples.
- Yellow level access means that information is not available to external third parties without the PIC of *Quechua* peoples. Only once PIC is granted can external third parties gain access to the specific information requested. Upon access, users agree to fully recognise the rights of *Quechua* peoples over their traditional knowledge and resources, including *sui generis* property rights afforded by Peru's declaratory regime. Users must also commit to the sharing of the benefits derived from the use of the information with indigenous peoples.
- Red level access means that information is entirely off limits to external third parties. This information is of a classified nature, accessible only to select individuals in *Quechua* communities. The REL extension language's sensitivity to customary law limits which users may access this level of information.

Sacred and secret nature knowledge is not stored in the register. Also, as long as a condition for recognising traditional knowledge as prior art is that it be placed in the public domain where indigenous peoples cannot claim rights over this knowledge, the Register in the Potato Park will not serve as a source of evidence of prior art. All levels of access assert *Quechua* people's legal rights over their traditional knowledge and resources in accordance with Peru's *sui generis* declaratory regime.

Lessons learned

The research partners have been working since 2000, reviewing existing biodiversity registers in India and in other countries and developing the Potato Park register with the community in Peru. During this time a number of important lessons have been learned that can be applied to all registers that seek to record the traditional knowledge of indigenous peoples in order to protect it.

Local systems for managing knowledge and innovations and for registering, storing and managing such information are the most appropriate tools to protect indigenous knowledge and associated genetic resources. The blending of traditional knowledge systems and technologies with modern ones enables culture and values to be nurtured for future generations, ensuring equity and *Quechua* dignity.

The main objective of the register should be to ensure the conservation, protection and promotion of indigenous peoples' knowledge systems for sustaining their livelihoods and traditional resource rights.

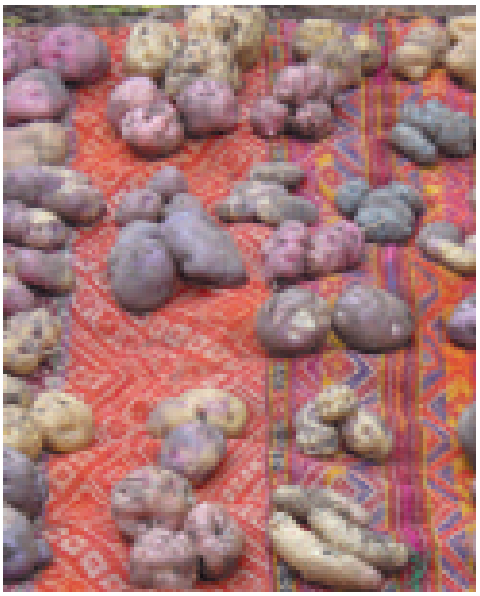
The local register should not be an intellectual property tool, but rather a tool to combat the system with the system's own tools. If local registers served as a source of evidence of prior art this would mean that poor farmers and indigenous peoples would be subsidising the IPR system (indigenous peoples would have to invest their spare resources to make registers for the use of patent lawyers working for corporate interests), strengthening a system that we know is corrupt and predatory of traditional knowledge systems. Playing such a role would mean that the local register would have to be managed by a national authority (and managed using the IPR system to allow patent officers to search for prior art), taking away the rights of local communities and indigenous peoples to use their own institutions and customary laws. Such a system would allow prior art to become a condition for recognising traditional knowledge systems. Accepting prior art would also mean that traditional knowledge systems' place is in the public domain, an IPR construct where indigenous peoples cannot claim rights over this knowledge.

The body of traditional knowledge in the public domain has been placed there mostly by the unethical knowledge-mining activities of anthropologists, priests, and other researchers who never recognised the rights of indigenous

Box 6. Repatriating the potato

As part of their efforts to re-establish their rights over the unique potato varieties that they have grown and bred for thousands of years, the Association of Communities of the Potato Park approached the International Potato Centre (CIP), which had held the rights over native varieties. The result was the signing of the landmark Agreement on the Repatriation, Restoration and Monitoring of Agro-biodiversity of Native Potatoes and Associated Community Knowledge Systems, signed between CIP and the Association of the Communities of the Potato Park represented by the Association for Nature and Sustainable Development (ANDES).

The signing of the agreement has so far led to the repatriation of more than 400 varieties of potatoes that had been held by CIP. These varieties have been distributed in the Potato Park and replanted in the area, where they are used for local food security, medicines and ceremonies. CIP agreed to pay for the cost of reintroduction as an acknowledgment of the benefits the organisation has derived from the indigenous knowledge of the region.



peoples. The public domain system does not recognise any of the core expressions of traditional knowledge systems (e.g. spiritual, collective nature).

In the past couple of years, traditional knowledge has been included in free trade agreement processes and specific provisions on traditional knowledge have been signed. In the process the US was defining their own legal systems of 'rights' to traditional knowledge – framing it as intellectual property – a commodity to be bought and sold under the conventional rules of exclusive private property. Linking the local registers to prior art/public domain would reinforce this process rather than protecting its integrity. By contrast, indigenous communities may respond to the failure of the state to protect their traditional knowledge by using tools, such as the local register in the Potato Park, based on traditions of collective use and ownership and guided by the Andean principles of reciprocity, equilibrium, and duality.

Linking the internet commons paradigm (e.g. copyleft) with customary laws in the development of multimedia database open source software to protect traditional knowledge may prove to be more effective than the public domain/prior art tools. Internet commons paradigm and customary laws used to build Rights Expression Languages (RELs) to manage and protect intellectual property associated with multimedia content would make the open source software a strong weapon against biopiracy and strengthen community rights, autonomy, and self determination.

The Biocultural local register contains comprehensive information on availability and knowledge of local varieties of native potatoes and medicinal plants, prepared at the community level with full participation of knowledge holders. It also organises and manages information on the potatoes repatriated from the International Potato Centre (CIP). This information will be maintained by a local committee which will provide access to this information under conditions established according to customary laws.

The Indigenous Biocultural Heritage Registers described here are part of a more comprehensive approach to the protection of Traditional Resource Rights in the Peruvian Andes (see the Peru country paper in this series). Indeed, the preservation of traditional knowledge is unlikely to be achieved by focusing only on the intellectual component of knowledge systems. Approaches for indigenous knowledge protection must be based on a good understanding of the distinct cultural, biological and ecological character of traditional knowledge systems. Moreover, just as intellectual property rights facilitate and encourage industrial innovation through market incentives, mechanisms to protect traditional knowledge should be designed to facilitate and encourage traditional innovations. This means respecting and strengthening the distinct holistic character and integrity of traditional knowledge systems, including the genetic and biological resources, landscapes, cultural values and customary laws which often form an integral part of such diverse systems.

Footnotes

1 'Bioprospecting/Biopiracy and Indigenous Peoples', ETC Group, November 30, 1994, www.etcgroup.org/article.asp?newsid=212

2 'The Value of Plants Used in Traditional Medicine for Drug Discovery', Daniel S. Fabricant and Norman R. Farnsworth, March 2001, http://ehp.niehs.nih.gov/members/2001/suppl-1/69-75fabricant/fabricant-full.html

3 'Conservation International: Privatizing nature, plundering biodiversity', Aziz Choudry, Grain, October 2003, www.grain.org/seedling/?id=272`

4 For more information about *khipu*, see http://khipukamayuq.fas.harvard.edu.

5 Enrique Mayer. *The Articulated Peasant*, Westview Press, Boulder, Colorado, 2002. p.128, 129

How – and under what conditions – can diverse, localised food systems be sustained in the twenty-first century? Who gains and who loses when local food systems are strengthened? These are some of the questions examined by the Sustaining Local Food Systems, Agricultural Biodiversity and Livelihoods project.

This project combines a political ecology perspective on food systems and livelihoods with action research grounded in local practice. As such it seeks to bridge the gap between the academic orientation of political ecology and the largely activist focus of food sovereignty, human rights and environmental justice movements.

The decentralised management of agricultural biodiversity by farmers and their communities is increasingly seen as a prerequisite for sustaining food systems, livelihoods and environments. Although the international community does emphasise the need to involve farming and local communities more centrally in the management of agricultural biodiversity, there are huge gaps in knowledge and institutional constraints that limit national capacities to scale up these approaches. In order to help fill these gaps, this research seeks to analyse how and under what conditions can decentralised governance, farmer participation and capacity building promote the adaptive management of agricultural biodiversity in the context of localised food systems and livelihoods.

The project is working with partners in four different countries, India, Iran, Indonesia and Peru. The research adopts an international, action-oriented, interdisciplinary and case study approach that builds on the expertise of local resource users and national and international partners. Throughout, the emphasis is on doing research with, for and by people – rather than on people – for learning and change.

PERU

The action research facilitated by ANDES (Quechua–Aymara Association for Sustainable Livelihoods) and IIED emphasises participatory and people-centred processes in sustaining local food systems, diverse ecologies, livelihoods and culture.

IRAN

Dialogues with partners identified in Iran have focused on a 'learning by doing' project aimed at reviving nomadic pastoralism and associated livelihoods and agricultural biodiversity. The Centre for Sustainable Development (CENESTA) is IIED's project partner in this endeavour.

INDONESIA

Working with a new foundation, FIELD – Farmers Initiatives in Ecological Literacy and Democracy – the project builds on the pioneering approach to farmer training, the Farmer Field School, and their work on community integrated pest management (CIPM), which depends heavily on both using functional biodiversity to control rice pests and co-ordinating action by farmers to sustain local livelihoods and change policies.

INDIA

Local control over biodiversity important for food and agriculture in the drylands of Andhra Pradesh is the focus in India. IIED's partner is the Deccan Development Society, and joint work between local farming communities and women's collectives (sanghams) has grown out of village-level dialogues where farmers identified priorities and opportunities for this participatory action research.

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