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Biodiversity and the Patent System: An Introduction to Research Methods

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Introduction:[1]

The 1990s witnessed the expansion of patent protection to biological and genetic material on the international level under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

For advocates of patent protection in relation to biological and genetic material this process of expansion is vital to enable companies and other organisations to secure capital, protect their investments in R&D from competitors, and to secure a return on these investments. On a wider level it has been argued that the internationalisation of patent protection has an important role to play in the world trade system through the promotion of increased Foreign Direct Investment (FDI), technology transfer and enhanced trade in goods and services.[2]

However, the rapid extension of patent protection to biological and genetic material also raises substantive questions surrounding the human rights, ethical, social, scientific, economic, environmental and legal implications of intellectual property protection in the realm of biological diversity. These questions range across the spectrum of biological diversity from microorganisms, to plants, animals, humans and the biological and genetic make-up of life on this planet.

On the international level the intensity of debates about intellectual property protection in the realm of biological diversity is exemplified in the concept of "biopiracy". The concept of biopiracy emerged during the mid-1990s to describe the processes through which individuals and institutions from developed countries were collecting potentially valuable knowledge and resources in the South that were then enclosed through intellectual property at the expense of the rights of indigenous peoples, local communities, farmers and developing countries.[3] The problem of biopiracy is now a major focus of international attention under the Convention on Biological Diversity, within the World Intellectual Property Organisation and the TRIPS Council under the World Trade Organisation.

However, the promotion of strong forms of intellectual property protection in relation to biological and genetic material is also increasingly seen as problematical in developed countries. These concerns range from the ethics of patenting DNA and stem cells, to the impacts of patent activity upon the openness of scientific research, competition policy in the realm of industry, and the implications of the internationalisation of patent protection for international development.

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2 World Bank (2001) *Global Economic Prospects and the Developing Countries 2002*. Washington: The International Bank for Reconstruction and Development/The World Bank.

3 RAFI (1994) 'Bioprospecting/Biopiracy and Indigenous Peoples', *Communiqué*, November 30, 1994. Rural Advancement Foundation International. RAFI is now the ETC Group. For more recent information on biopiracy see the ETC Group website <http://www.etcgroup.org> and the work of GRAIN <http://www.grain.org/front/>.

In particular, within countries such as the United States there is growing concern that the integrity of the patent system has been undermined to such an extent that it is now an impediment to science and innovation.[4] On this basis a number of proposals for reform are emerging. These include open review of patent applications and the development of new "open" or "commons" models adapted to the changing nature of science and innovation in the 21st Century.[5] Above all, there is a growing recognition that in the realm of biodiversity and what has been called the emerging "bioeconomy" on the cellular and genetic level one size will not fit all.[6]

A central problem within these debates is that intellectual property is by its very nature difficult to see. As a result existing approaches by pioneering NGOs and researchers have focused on individual case studies as a means to highlight the nature of the problems and concerns generated by intellectual property. However, as the OECD has recently argued, in an era of the globalisation of intellectual property there is a need for a "clearer view" in relation to patent activity.[7]

This paper is concerned with contributing to the development of a clearer view of patent activity in relation to biological diversity and traditional knowledge. The paper focuses on the need for evidence based approaches to the analysis and assessment of patent activity and addresses three main questions:

1. What is actually happening in relation to the patenting of biological and genetic material and traditional knowledge?
2. Who is doing what, where, and how?
3. How are we to assess the implications of these activities for science, society and policy?

The paper focuses on addressing the methodological challenges involved in trying to answer these questions and provides an introduction to research methods to address these questions. The paper does not assume any prior knowledge of the patent system. Researchers are strongly encouraged to use, refine and improve on the methods presented in this paper and to share their findings with the wider community.

The paper is divided into four sections. Section I provides a basic introduction to the international patent system. Section II provides a series of research tools for carrying out patent research in relation to biological diversity and traditional knowledge. Section III introduces the international patent portfolio approach to patent research using a working example. Section IV provides a series of quantitative and qualitative assessment criteria that researchers may find useful in seeking to examine patent activity in relation to a particular species, genus or sector of patent activity involving biodiversity and traditional knowledge.

The paper makes four recommendations in relation to the evidence based assessment of the relationship between biodiversity, traditional knowledge and the patent system.

1. The formation of open-ended interdisciplinary research groups to conduct and coordinate evidence based analysis;
2. The refinement and improvement of research methods for biodiversity, traditional knowledge and the patent system;
3. The development of indicators on the national, regional and international level to inform science, society and policy;
4. The development of alternative models to promote science and innovation directed towards agreed goals.

Section I

The International Patent System

What is a patent?

A patent is a legal certificate that awards a temporary legal monopoly over a claimed invention for a period that is generally twenty years.[8] Patents are awarded in accordance with three criteria, they must be:

a) new (or novel);

b) involve an inventive step (be non-obvious), and;

c) be capable of industrial application (be useful or of utility).

A patent awards an exclusive temporary protection to its holder including the right to exclude others from "making, using, offering for sale, or selling" or "importing" the pro-

4 Merrill, S, and Levin, R and Myers, M (eds.) (2004) *A Patent System for the 21st Century*. Committee on Intellectual Property Rights in the Knowledge-Based Economy, Board on Science, Technology and Economic Policy and Global Affairs Division. National Research Council of the National Academies. Washington: National Academies Press. Location: <http://www.nap.edu/html/patentsystem/0309089107.pdf>.

5 Dennis, C (2004) 'Biologists launch 'open-source movement», *Nature* 431, 494, (2004). SciDev.Net access: <http://www.scidev.net/dossiersindex.cfm?fuseaction=dossierReadItem&type= 1&itemid=1636&language=1&dossier=8>. See also, the Peer to Peer Patent Project <http://dotank.nyls.edu/communitypatent/> and the Science Commons <http://www.sciencecommons.org>.

6 OECD (2005) Proposal for a major Project on the Bioeconomy in 2030: A Policy Agenda. Organisation for Economic Co-operation and Development. Location: <http://www.insme.org/documenti/THE BIOECONOMY IN 2030_project.pdf>.

7 OECD (2004) *Patents and Innovation: Trends and Policy Challenges.* Paris: Organisation for Economic Co-operation and Development. Location: <http://www.oecd.org/dataoecd/48/12/24508541.pdf>.

8 WIPO 'Inventions (patents)'. Location: <http://www.wipo.int/about-ip/en/patents.html>.

tected invention into a jurisdiction where the patent protection is in force, or to charge others for any uses or purposes involving the protected invention within such jurisdictions (i.e. through licensing).[9]

The availability of patent protection as a strong form of legally enforceable monopoly has historically been justified in terms of the provision of incentives for innovation on the grounds that in the absence of incentives innovators will either cease to invent, or that they will choose to keep their inventions secret. The patent system seeks to simultaneously promote innovation through the provision of an incentive (an exclusive period of monopoly) and to promote the wider use and availability of inventions by requiring that patent applicants disclose their invention within applications. This is frequently presented in terms of a "bargain" between society and inventors in which society agrees to accept the burden of a limited period of monopoly in return for useful inventions becoming widely available to the public once the period of protection ends.

The 1990s witnessed the extension of this reasoning to biological and genetic material on the international level under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) that emerged from the Uruguay Round of the GATT trade negotiations.[10] The following provisions of the TRIPS agreement are directly relevant to understanding this process of expansion in relation to biodiversity and the patent system:

> **Article 27:** Patentable Subject Matter
>
> 1. Subject to the provisions of paragraphs 2 and 3, patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. Subject to paragraph 4 of Article 65, paragraph 8 of Article 70 and paragraph 3 of this Article, patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.
>
> 2. Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.
>
> 3. Members *may also exclude* from patentability:
>
> (a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals;
>
> (b) plants and animals other than *micro-organisms*, and essentially biological processes for the production of plants or animals *other than non-biological and microbiological processes*. However, Members *shall* provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement. (emphasis added)

The provisions of the TRIPS agreement have been a major focus of scholarly and policy attention.[11] TRIPS introduces an international requirement for member states of the World Trade Organisation (WTO) to extend patent protection to biological and genetic material with very limited exceptions. Thus, Article 27.3 (b) establishes that limited exceptions are available for patentability in relation to plants and animals, but that protection must be made available for microorganisms, non-biological and microbiological processes. Furthermore, member states shall also provide patent protection or *sui generis* (specially generated/of its own kind) protection for plant varieties (or both).[12] The provisions of the TRIPS agreement have been accompanied by stronger provisions for intellectual property protection in relation to biological and genetic material within regional and bi-lateral trade agreements.[13]

This paper is not concerned with a detailed assessment of the TRIPS agreement or proposals for reform, but instead asks the basic questions: a) what is actually happening in relation to patent activity for biological and genetic material in a post-TRIPS world, and; b) how do we find out? In order to answer these questions we need to begin by gaining a basic understanding of the scale of the global patent system.

9 United States Patent and Trademark Office 'General Information Concerning Patents' online brochure. Citation at 'What is a patent?'. Location: <http://www.uspto.gov/web/offices/pac/doc/general/>. See also Article 28 of the TRIPS agreement.

10 For further information and the text of the agreement see the TRIPS Gateway. Location: <http://www.wto.org/english/tratop_e/trips_e/trips_e.htm>.

11 For a detailed introduction to debates on the TRIPS agreement see, UNCTAD-ICTSD (2005) *Resource Book on TRIPS and Development.* Cambridge: Cambridge University Press. Available in electronic form at: <http://www.iprsonline.org/unctadictsd/ResourceBookIndex.htm>.

12 Dutfield, G (2000) *Intellectual Property Rights, Trade and Biodiversity*. London: Earthscan.

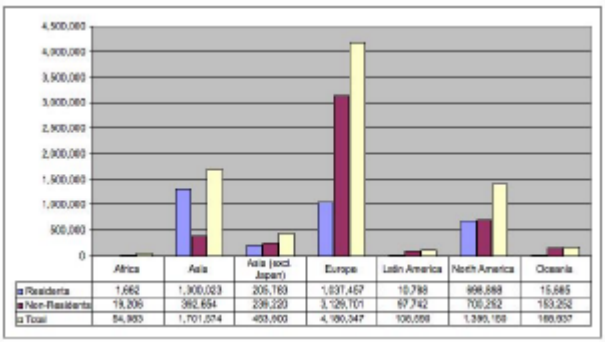
13 GRAIN (2004) 'Bilateral and regional agreements imposing TRIPS-plus standards for IPRs on life in developing countries'. GRAIN, February 2004. <http://www.grain.org/rights_files/trips-plus-table-en.pdf>. See also, Correa, C (2004) *Bilateral Investment Agreements: Agents of new global standards for protection of intellectual property rights?* An independent study for GRAIN, August 2004. Location: <http://www.grain.org/briefings/?id=186>.

Understanding the Scale of the Patent System:

According to statistics from the World Intellectual Property Organisation (WIPO) between 1990 and 2000 an estimated 7.6 million patents were granted worldwide across all areas of invention.[14] In 2001 an estimated 812,667 patents were granted worldwide rising to a reported 954, 469 in 2002.[15]

The scale of the patent system as it emerged during the 1990s can be appreciated from the figures for patent grants across 114 countries provided in Figure 1 based on WIPO statistics for 1990-2000 broken down by United Nations geographical "macro regions" for the purpose of illustration.[16]

Figure 1: Patent Grants by Geographical Macro-Region 1990-2000



In considering Figure 1 it should be noted that the data refers to reports from countries within each "macro region" on patents granted in accordance with whether the awards were made to residents or non-residents.[17] It should also be noted that because we are dealing with large "macro regions" the data for non-residents will include awards to applicants within the region (i.e. Europe as a macro region).

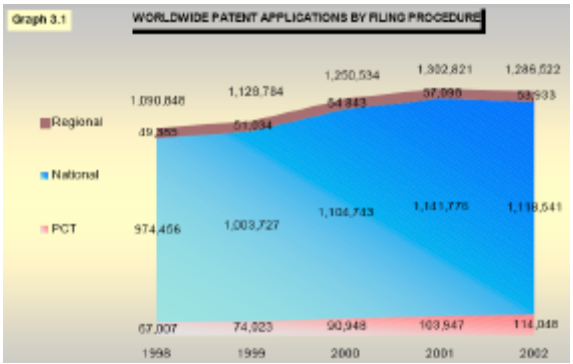
However, Figure 1 clearly demonstrates that the 1990s witnessed the emergence of major demand for patent protection. Figure 1 also provides an initial indication of variations in demand across the major world regions and the importance of grants to non-residents. In seeking to understand these developments we need a basic understanding of the role of patent instruments.

The Role of Patent Instruments:

In order to make it easier and less costly to secure patent protection, applicants are increasingly provided with a range of routes through which to file their applications. These routes are: a) national; b) regional, and; c) international.

In the case of the national route, the majority of patent applications are submitted through the national patent office in the country of origin. This can be illustrated for patent applications worldwide in the period between 1998 and 2002 as established by the Trilateral Offices (the European Patent Office, the Japan Patent Office and the United States Patent and Trademark Office) and set out in Figure 2.

Figure 2: Trends in worldwide patent applications by filing procedure[18]



Source: Reproduced from the Trilateral Statistical Report 2003: 20

Here we can clearly see that the majority of patent applications in 2002 (an estimated 1,118,541 applications) were filed on the national level. In contrast a total of 53,933 applications were filed under regional instruments and 114,048 were filed under the Patent Cooperation Treaty (PCT).

14 WIPO Patent Statistics 1990-2000. Location: <http://www.wipo.int/ipstats/en/statistics/patents/index.html>.

15 WIPO Patent Statistics 2001 and 2002. Location: <http://www.wipo.int/ipstats/en/statistics/patents/index.html>.

16 United Nations Statistics Division, Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings. Location: <http://unstats.un.org/unsd/methods/m49/m49regin.htm>.

17 In some cases, notably Africa, full information was not provided on awards by resident/non-resident status. For this reason the data for residents/non-residents does not correspond with the total reported for patent grants.

18 EPO, JPO, USPTO (2003) *Trilateral Statistical Report 2003.* Location: <http://www.trilateral.net/tsr/>.

However, these raw figures disguise the importance of regional and international patent instruments. Under the terms of regional patent instruments and the Patent Cooperation Treaty (PCT) applicants based in one country are able to submit a single application as a basis for potential protection in one or more of the member states that are part of the regional/international agreements.[19] These instruments, the administering authority for the instruments, and numbers of Contracting States are provided in Table One.

Table One: Regional and International Instruments

Instrument	Administering Authority	Contracting States
European Patent Convention 1973, last amended 1998	European Patent Organisation (EPO)[20]	30 Contracting States 5 Extension States
Bangui Agreement 1977	Organisation Africaine de la Propriété Intellectuelle (OAPI)[21]	16
Lusaka Agreement 1976, amended 1985	African Regional Intellectual Property Organisation (ARIPO)	16
Eurasian Patent Convention 1994	Eurasian Patent Organisation (EAPO)[22]	10
Gulf Cooperation Council (GCC)[23]	Patent Office of the Cooperation Council for the Arab States of the Gulf (GCCPO)	6
Patent Cooperation Treaty (PCT) 1970, amended 2001	Organisation (WIPO) World Intellectual Property	128
Paris Convention, 1884, last amended 1979	World Intellectual Property Organization (WIPO)	169

The effect of the growing number of regional patent instruments and the Patent Cooperation Treaty (PCT) is to introduce a series of *multiplier effects* into the international patent system. This can be briefly illustrated for the most important of these instruments, the Patent Cooperation Treaty (hereafter, the PCT).

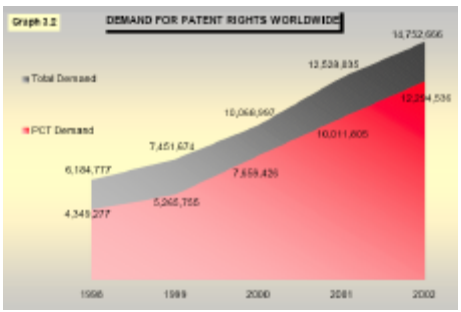
Under the terms of the PCT a patent applicant is able to submit a single patent application for protection which names ("designates") other Contracting States. As of the 1st of January 2004, all PCT applications automatically designate the 128 member states. The effect of the PCT is that in theory the 114,048 PCT applications filed in 2002 could result in applications for patent protection in upto 128 Contracting States.[24]

In practice, a single application under the PCT rarely, if ever, results in applications in all Contracting States. However, the multiplier effects of the PCT upon international demand for patent protection is brought into greater focus by data on trends provided by the Trilateral Offices in Figure 3.

Figure 3 suggests that the impact of the PCT upon cumulative demand for patent protection world-wide is dramatic. According to these figures in 1998 worldwide demand for patent protection consisted of 6,184,777 applications rising to 14,752,666 by 2002. In 1998 the figures suggest that applications under the PCT accounted for 70.3% of demand with over 4 million applications rising to 83.3% or over 12 million of 14.7 million applications by 2002.

In reality this tells us more about the *potential* impacts of the PCT upon international demand than what is actually going on. The reason for this is that calculating the impact of the Patent Cooperation Treaty applications upon global demand for patent protection is fraught with difficulty. Thus, in developing statistics on the PCT the World Intellectual Property Organisation (WIPO) originally counted the countries named ("designated") in PCT documents as if they were actual applications. In contrast the Trilateral Offices use a simple ratio to estimate PCT demand based on the average number of named countries.[26] However, this remains an estimate.

Figure 3: The Patent Cooperation Treaty and Demand for Patent Protection[25]



Source: Reproduced from the Trilateral Statistical Report 2003: 21.

19 For an introduction to the Patent Cooperation Treaty see, location: <http://www.wipo.int/pct/en/treaty/about.htm>.

20 Source European Patent Office 'Toolbox for Applicants'. Location: <http://www.european-patent-office.org/_new_tb_applic/index.en.php>.

21 Organisation Africaine de la Propriété Intellectuelle (OAPI). Location: <http://www.oapi.wipo.net/index.html>.

22 Eurasian Patent Organisation. Location: <http://www.eapo.org/eng/information/about.html>.

23 Patent Office of the Cooperation Council for the Arab States of the Gulf. Location: <http://www.gulf-patent-office.org.sa/>.

24 Contracting Parties as of the 1st of August 2005. Source: WIPO, location: <http://www.wipo.int/pct/en/texts/pdf/pct_paris_wto.pdf>.

25 EPO, JPO, USPTO (2003) *Trilateral Statistical Report 2003.* Location: <http://www.trilateral.net/tsr/>.

26 EPO, JPO, USPTO (2003) *Trilateral Statistical Report 2003.* Location: <http://www.trilateral.net/tsr/>.

In reality, as the OECD has argued, designations can best be described as a potential *option* to pursue protection in multiple countries.[27] The practical consequence of this is that while the PCT is the main driver of demand for patent protection on the international level, the impact of the PCT on global demand is exaggerated by the manner in which the statistics are calculated.

As the OECD has recently established in the case of European Patent Office, the inclusion of PCT data results in a 23.7% over-estimate of demand for patent protection.[28] This figure may be considerably higher in developing countries where over 90% of *apparent* patent demand may be through the PCT route.[29] These problems expose the general lack of attention that was paid to methodological development and evidence based analysis at the time of decisions to internationalise the patent system.[30]

Nevertheless, international demand for patent protection has undoubtedly expanded dramatically. For the present purposes the data on global patent trends helps to bring into focus the scale of the international patent system and the challenges confronting researchers seeking to focus on patent activity in relation to biodiversity and traditional knowledge. The key question arising from the scale of the international patent system for researchers is how can biodiversity and traditional knowledge be isolated within the patent system? In order to answer this question a basic understanding of the classification of patent documents is required.

The International Patent Classification (IPC):

One option in conducting research on patent activity in relation to biodiversity is to simply insert the name of a species, genus or common names into a patent database and read the results. We will use this approach below and it works well where there are small numbers of results. However, in some cases the number of results may be overwhelming (i.e. rice) and/or the majority may be irrelevant to the analysis of patent activity that makes claims over biodiversity and traditional knowledge.

In order to organise and manage patent documents patent offices have developed classification systems that operate on the national, regional and international level. These classification systems commonly consist either of numerical classifiers (i.e. the United States Classification or USC) or of combinations of letters and numbers (i.e. the European Classification or ECLA). The primary purpose of patent classification systems is to allow patent examiners to easily retrieve patent documents for the purpose of assessing patent based prior art when reviewing new patent applications.

For the purposes of international research on biodiversity the most important patent classification system is the International Patent Classification (IPC). The IPC was established under the 1971 *Strasbourg Agreement Concerning the International Patent Classification* to facilitate the identification of prior art.[31] The IPC is in use by patent offices worldwide and the latest version of the IPC (IPC8) includes approximately 20,000 classification codes on the "core" level and an additional 50,000 codes on the "advanced" level.[32]

The IPC structures the classification of patent documents into eight sections according to the area of technology. These are:

Section A: Human Necessities
Section B: Performing Operations; Transporting
Section C: Chemistry; Metallurgy
Section D: Textiles, Paper
Section E: Fixed Constructions
Section F: Mechanical Engineering; Lighting; Heating; Weapons; Blasting
Section G: Physics
Section E: Electricity

The International Patent Classification is of central importance for the analysis of patent activity in relation to biodiversity because it allows researchers to narrow the field of enquiry. Thus, the vast majority of biodiversity and traditional knowledge falls within two areas of the patent system: Section A for Human Necessities and Section C for Chemistry. Additional, albeit more limited, references are located in other Sections (Section B – transporting in relation to bionanotechnology, Section G – Physics in relation to genomics and proteomics and Section E – Electricity for bioinformatics etc.).

The IPC is hierarchical in nature and each section is subdivided into a series of more detailed classifiers at the level of classes, sub-classes, groups and sub-groups. The hierarchical nature of the IPC can be briefly illustrated in Table Two.

27 Dernis, H and Guellec, D and Pottelsberghe, B (2001) *Using Patent Counts for Cross-Country Comparisons of Technology Outputs.* Economic Analysis and Statistics Division of the OECD Directorate for Science, Technology and Industry, and Free University of Brussels. Location: <http://www.oecd.org/dataoecd/26/11/21682515.pdf>.

28 Khan, M and Dernis, H (2005) Impact of Patent Cooperation Treaty Data on EPO Patent Statistics and Improving the Timeliness of EPO Indicators. STS Working Paper 2005/2. Organisation for Economic Cooperation and Development. Location: <http://www.oecd.org/LongAbstract/0,2546,en_2649_33703_34407831_119684_1_1_1,00.html>.

29 Oldham, P 'Global Patent Trends'. Working Paper.

30 For a background history to this process see Drahos, P with Braithwaite, J (2002) *Information Feudalism: Who Owns the Knowledge Economy?* London: Earthscan.

31 *Strasbourg Agreement Concerning the International Patent Classification*. Location: <http://www.wipo.int/treaties/en/classification/strasbourg/>.

32 For further information including the IPC searchable interface and guide see the IPC website. Location: <http://www.wipo.int/classifications/ipc/en/>.

Table Two: Hierarchical Structure of the IPC

Section	C - Chemistry; Metallurgy
Sub-Section	Chemistry
Class	C12 - Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering
Sub-Class	C12N - Microorganisms or Enzymes; Compositions thereof
Group	i.e. C12N15 - Mutation or genetic engineering; DNA or RNA concerning genetic engineering, vectors.
Sub-Group	C12N15/82 …for plant cells

The practical significance of the hierarchical structure of the IPC is that it can be used to locate patent documents that make reference to biodiversity and examine trends in specific sectors of activity related to biodiversity. Table Three sets out the basic IPC classifiers that are related to biodiversity and traditional knowledge based on a detailed review of the IPC.

Table Three: Basic IPC Classifiers for Biodiversity

IPC Classifiers	Summary
	Basic Classifiers (Class Level)
	Section A: Human Necessities
A01	Agriculture; Forestry; Animal Husbandry; Hunting; Trapping; Fishing
A23	Food or Foodstuffs; their Treatment
A61	Medical or Veterinary Science; Hygiene
	Section B: Transporting
B82	Nanotechnology
	Section C: Chemistry
C07	Organic Chemistry
C08	Organic Macromolecular Compounds
C11	Animal or vegetable oils, fats, fatty substances or waxes; fatty acids
C12	Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering
C40	Combinatorial Technology
	Section G: Physics
G01	Measuring; Testing
G06	Computing

Knowledge of the basic structure of the IPC is particularly powerful in refining searches for biodiversity and traditional knowledge using patent databases. Thus, the basic classification codes provided above can be combined with searches for species, genera, families or the components of organisms using simple formulas within patent databases. The main advantage of this approach is that it reduces the number of irrelevant results when conducting patent research and facilitates the analysis of sectors of activity. For example, a general formula to capture biodiversity and traditional knowledge using the basic classifiers in Table Three is as follows:

(species or genera or family or common name or components) and (A01 or A23 or A61 or B82 or C07 or C08 or C11 or C12 or C40 or G01 or G06)

Table Four provides the results of a search of patent documents for the United States (applications and grants), the European Patent Convention (applications and grants), the Patent Cooperation Treaty (applications) Japan (applications), Germany (applications), the United Kingdom (applications) and France (applications) using the Micropatent whole text "Aureka Gold" database service. The table compares the results of simple searches for a range of biodiversity related terms compared with the results of searches using the search formula provided above.

Table Four: Formula Data capture for selected test examples[33]

Search Terms	Total 1991-2005	Formula Capture (%)	Total Claims (only) 1991-2005	Formula Capture (%)
Oryza	8,380	98.91	359	98.91
Oryza or rice	97,938	77.08	9,705	82.98
Azardichta or Azardichtin or neem	916	92.79	283	92.57
Banisteriopsis or caapi or harmaline or harmine or tetrahydroharmine	160	89.37	28	57.14
Lepidium or p-methoxybenzyl isothiocyanate	2,372	99.57	46	97.82
Alkaloid	8,387	95.95	1,353	97.04
DNA or deoxyribonucleic acid	295,469	96.35	82,069	98.27
RNA or ribonucleic acid	191,698	97.64	34,245	97.93
Polypeptide	163,842	98.36	65,595	98.87
Enzyme	341,679	95.85	57,599	95.52
microorganism or bacteria or microbe or microbial	309,079	84.05	44,478	87.09
Genome	127,401	98.87	15,236	99.44
Proteome	3,612	95.18	179	96.08
stem cell or meristem or	36,856	98.96	5,458	99.08
pluripotent or totipotent	(31,997)*	(98.98)*	(5,177)*	(99.09)*
mitochondria or mitochondrion	20,123	98.09	778	98.32

*Results excluding meristems for plants

33 Searches were conducted on the 30th and 31st of December 2005 and repeated on the 6th of January 2006 using the Micropatent "Aureka Gold" whole text patent analysis software.

Table Four clearly reveals that the vast majority of references to the selected biodiversity terms fall within the eleven areas of the patent classification identified in Table Three. The key point surrounding the use of patent classifiers is that we now have a much clearer idea of where the majority of biodiversity and related traditional knowledge is located in the patent system.

However, it is also important to recognise that patent activity relating to biodiversity and/or traditional knowledge can be divided into a number of sectors. Patent activity in one sector (i.e. agriculture) may possess very different characteristics and implications when compared with patent activity in another sector (i.e. ethnobotanical or traditional medicines). These sectors will also involve different actors. Knowledge of the IPC provides a powerful tool for confining research to these specific sectors of activity (i.e. cosmetics or genomics) in order to examine the actors involved and the implications of patent activity for science, society and policy (see below).

Section II

Research Tools:

So far we have seen that researchers seeking to examine patent activity in relation to biodiversity and traditional knowledge are immediately confronted by the problem of the scale of the international patent system. We have also seen that a basic knowledge of the International Patent Classification can assist researchers in targeting their research to those areas of the patent system involving actual claims over biodiversity and traditional knowledge. We now turn to key research tools that can be used for patent research in relation to biodiversity and traditional knowledge.

The general objective of patent research for biodiversity is to capture, to the extent possible, the complete universe of patent activity relating to a particular species, genus, family or the components of organisms and related traditional knowledge. The results, or representative samples of the results, can then be compiled to create an international patent portfolio (IPP) for further analysis. To do this researchers will need to use a range of research tools. This section focuses on the use of the following tools:

1. Patent Databases
2. Keyword Search Strategies
3. Searches by sector of patent activity

We will use these tools to develop an international patent portfolio for the species, genus, family or components of organisms in a method involving six simple steps:

1. Compiling patent publication numbers from a national patent database;
2. Compiling patent publication numbers from the United States patent database;
3. Searching the esp@cenet worldwide database and compiling the results;
4. Collecting additional information on the patents;
5. Identifying any additional documentation for the patents;
6. Compiling the information to create an international patent portfolio.

1. Patent Databases

Patent databases are the primary tools for patent research in relation to the assessment of patent activity on the national, regional and international level and the statistical analysis of patent trends. The importance of patent databases is likely to accelerate as patent offices increasingly switch to the electronic filing of patent applications.

In broad terms, patent databases are divided between freely available databases and commercial databases. Commercial databases such as the Word Patent Index or Micropatent offer significant advantages in terms of coverage and analytical tools compared with free databases. It is therefore strongly recommended that institutions and organisations with financial resources should acquire commercial services. However, the cost of commercial services may be beyond the resources of many researchers and organisations. [34] This discussion therefore focuses on the use of free research tools. Much can be achieved through the use of these tools.

In considering the use of databases it is important to recognise the strengths and weaknesses of particular database systems. In some cases, such as the European Patent Office esp@cenet database, searches for species, genera, common names or components are limited to searches of the title or abstract of patent documents. This means that searches will only capture references to the search terms where the terms are included in the title or abstract of the documents. In contrast, searches of whole text databases are not limited in this way but may cover a lower number of countries or limit searches in various other ways (i.e. the databases of the United States Patent and Trademark Office).

These constraints can at least partly be overcome through the use of a combination of freely available tools. Key freely available resources include:

1. National patent office databases (i.e. United States Patent and Trademark Office); [35]

34 Databases such as the Thomson Corporation "Delphion" service can be used to access the World Patent Index (WPI). However, the minimum cost for access at the time of writing was US$95 per month and additional pay per view charges or US$253 per month for higher level access plus additional pay per view charges (at US$4 per search). For further information see the Thomson Delphion website. Location: <http://www.delphion.com>.

35 United States Patent and Trademark Office Databases. Location: <http://www.uspto.gov/patft/index.html>.

2. Regional databases (i.e. LATIPAT for Latin America);[36]
3. International patent databases (i.e. the European Patent Office esp@cenet "worldwide" database);[37]
4. Specialist databases in the life sciences (i.e. the BIOS "Patent Lens" of life science patents).[38]

The approach set out in this paper employs free search tools and requires researchers to familiarise themselves with:

1. their national patent database (where available);
2. the database of the United States Patent and Trademark Office (USPTO), and;
3. the European Patent Office (EPO) esp@cenet database.

National Patent Databases:

In the context of international debates surrounding "biopiracy" much attention has focused on the patenting of resources and knowledge originating in the South by organisations and entities based in the North. However, a "South" vs. "North" perspective fails to capture the reality that most patent applications worldwide are filed directly with national patent offices. While national patent filings are dominated by developed countries, national level patent activity in developing countries may hold substantive implications for indigenous peoples, local communities and other members of society. Here it may be noted that a number of developing countries, such as China and India, are becoming increasingly active in patenting on the national and international level. A non-discriminatory approach to the analysis of patent activity will therefore provide a clearer view of actual activity than a "South" vs. "North" perspective. Analysis of patent activity in relation to particular species, genera or the components of organisms should therefore begin on the national level.

National level patent databases can be located through services such as ipmenu.com, the British Library or WIPO.[39] Individual national databases will vary both in terms of the quantity of information that is publicly available and the capacity to conduct searches.

The United States Patent and Trademark Office (USPTO) databases:

The United States is a major world market and as a consequence patent applicants frequently seek protection in the United States irrespective of their country of origin. According to the USPTO an estimated 48-49% of patent grants in the United States are awarded to non-residents.[40] This provides an important opportunity to identify patent activity in relation to biodiversity and traditional knowledge outside national jurisdictions and a platform for further research on international patent activity.

The USPTO database is a whole text database including US patent grants, patent applications and plant patents. The database also provides options for the use of IPC formulas to refine searches.

The USPTO database provides four search options:

a) Simple search of *patents granted* between 1976 and the present;
b) Advanced search of *patents granted* between 1976 and the present using Boolean search terms;
c) Simple search of *published applications* from the 15th of March 2001 to the present;
d) Advanced search of *published applications* between the 15th of March 2001 and the present using Boolean search terms.

In practice, patent researchers should search both patents granted and published applications in developing an international patent portfolio (see below). Additional functionality in searching the USPTO database is provided by free services such as freepatentsonline.com or BIOS Patent Lens.

The European Patent Office esp@cenet "worldwide" database:

The European Patent Office hosts the esp@cenet database. esp@cenet is the largest freely accessible patent database in the world and brings together patent information from over 70 national patent offices, four regional patent organisations and the World Intellectual Property Organisation (WIPO) for the Patent Cooperation Treaty. esp@cenet contained an estimated 59 million patent related publications in September 2005.[41]

36 European Patent Office esp@cenet LATIPAT database. Location: <http://lp.espacenet.com/>. See also the LATIPAT interface hosted by the Spanish Patent and Trademark Office (OEPM). Location: <http://www.oepm.es/bases-documentales/latipat_sp?ACTION=RETOUR>.

37 European Patent Offices esp@cenet worldwide database. Location: <http://ep.espacenet.com/>.

38 CAMBIA "BIOS Patent Lens". Location: <http://www.cambia.org/daisy/bios/50>.

39 For patent resources by country at IPMenu.com see, location: <http://www.ipmenu.com/country.htm>. For patent resources at the British Library see location: <http://www.bl.uk/collections/patents/keylinks.html>. For patent resources from WIPO see, location: <http://www.wipo.int/directory/en/urls.jsp>.

40 In 2002 and 2003 the percentage of grants to foreign applicants was 48% rising to 49% in 2005. Source: Trilateral Statistical Report 2003 at page 18 and Trilateral Statistical Report 2004 at page 18. Location: <http://www.trilateral.net/tsr/>.

41 European Patent Office esp@cenet . Location: <http://ep.espacenet.com/ep/en/helpV3/espacenet.html>.

esp@cenet is a vital tool for patent research in relation to biodiversity and traditional knowledge. However, search options in the worldwide database are presently limited to the titles and abstracts of patent publications in English. This situation is likely to change in the next few years as demand for full text searching grows from users.

esp@cenet offers a "basic" and an "advanced" search option. esp@cenet also presents a choice of databases to search:

a) Worldwide (all jurisdictions)
b) EPO – European Patent Office (only)
c) WIPO – World International Patent Organisation (Patent Cooperation Treaty only)

Separate access is also provided to the regional esp@cenet LATIPAT database with over 230,000 entries in Spanish and Portuguese from 19 Ibero-American countries.[42] Free access can also be gained to individual European national databases hosted through esp@cenet.[43]

For the purpose of assessing patent activity for biodiversity the "worldwide" option is generally to be preferred. For more refined research, i.e. the European Patent Office, the Patent Cooperation Treaty (PCT) or Latin America, the searches can be confined to the respective individual databases.

It is also important to recognise that esp@cenet only contains patent publications that have been submitted by the participating national and international patent offices. In using esp@cenet it is therefore important to note that the national patent office (i.e. the country of origin) may possess more complete records than esp@cenet. Details of data coverage for participating patent offices should be consulted in employing esp@cenet for patent research.[44] This is also true for research using regional databases such as LATIPAT which contains content in Spanish and Portuguese that is distinct to that within the main worldwide database.[45]

However, while it is important to recognise the limitations of esp@cenet it is also important to recognise its very considerable strengths as the main freely accessible worldwide patent database. At the time of writing users are increasingly demanding the creation of a full text version of the database and the expansion of the free "Open Patent Service" facility.[46] Third parties are also seeking to provide additional functionality in searching esp@cenet through the provision of a range of software tools. [47]

Other Database Services:

Other important database services include the following:

a) BIOS Patent Lens:

The BIOS Patent Lens is a free whole text patent database that now includes over 2 million life science patents. This initiative forms part of the work of the non-profit Centre for the Application of Molecular Biology to International Agriculture (CAMBIA) in Australia directed towards the promotion of open source biology and biotechnology. The patent database presently covers PCT, European Patent Convention (grants), United States Patents (applications and grants) and Australian patents (grants).

b) Derwent Delphion and the World Patent Index:

The Derwent Delphion service is a commercial service with limited free access options. Patent searching options include the major jurisdictions. Delphion also provides pay per view access to the World Patent Index which is owned by its parent company the Thomson Corporation. The World Patent Index includes enhanced coverage of international patent publications. Titles and abstracts are also re-written to provide more detail. The World Patent Index is used by the major patent offices for this reason. However, statistical analysis tools are limited. The World Patent Index can be accessed through a variety of Thomson Corporation information portals notably: Dialog, Questel.Obit, STN and Westlaw.

c) Micropatent

Micropatent offers a range of commercial database services including the Micropatent Index and the Aureka patent analysis software.[48] This includes powerful analytical tools and is recommended for those with sufficient resources. Data coverage for Aureka is presently limited to the United States, the European Patent Convention, Japan,

42 LATIPAT is available through two routes. The esp@cenet version of LATIPAT in Spanish and Portuguese can be accessed at Location: <http://lp.espacenet.com>. The version hosted by the Spanish Patent and Trademarks Office can be accessed via <http://www.oepm.es/internet/bases_datos/inven.htm>.

43 National esp@cenet interfaces in relevant languages are available through, location: <http://www.espacenet.com/access/index.en.htm>.

44 For esp@cenet worldwide database coverage see, location: <http://ep.espacenet.com/espacenet/ep/EN/helpV3/detailedcoverage.html>.

45 For LATIPAT data coverage see, location: <http://lp.espacenet.com/search97cgi/s97_cgi.exe?Action=FormGen&Template=lp/ES/info.hts&INFO=locpat>.

46 The European Patent Office "Open Patent Service" provides free access to a limited amount of esp@cenet information using XML codes. For technical information see, location: <http://ops.espacenet.com/>.

47 The use of patent search software can greatly increase the speed of searching. However, problems have been reported with software retrieval "robots" severely affecting the performance of database such as esp@cenet. The use of software that does not comply with the database rules may lead to blocked access. Their use should be approached with a degree of caution unless compliance is assured.

48 For further information see, location: <http://www.micropatent.com/>.

Germany, France, Great Britain and the Patent Cooperation Treaty. Access is provided on the basis of yearly contracts. Micropatent is also part of the Thomson Corporation.

2. Keyword Search Strategies:

The most commonly used method for assessing patent activity in relation to a particular species or genus is through the use of keywords (i.e. for a specific species or its components).

Two issues are involved in keyword based search strategies:

a) The key terms to be used;

b) The type and limitations of the database that is to be searched.

In approaching research on the presence of biodiversity within the patent system a key challenge is the identification of the relevant variety, species, genus, family and components of organisms. These materials can be compiled from a variety of sources, notably botanical literature, herbaria and museums, private databases and online databases. A non-exhaustive list of useful resources is provided in Annex 1.

In considering the wide range of resources available on plants, animals and other organisms from many parts of the world researchers will need to think carefully about the species, genera, family or component they wish to target. In preparing lists of keywords for use in patent research the following information is desirable:

a) Variety, species, genus and family names;

b) Common names (including variant spellings);

c) Names of indigenous peoples or local communities known to use the species, including commonly used names, auto-denominations and variant spellings;

d) Known chemical compounds isolated from the species or genus of interest;

e) DNA/amino acid sequences for detailed research on the genetic level.[49]

In preparing to use key word search strategies for the assessment of patent activity for biodiversity and traditional knowledge it is important to recognise two constraints.

First, on the international level there are presently no clear and consistent rules surrounding the disclosure of the species or genus name, associated common names, the country of origin or source (i.e. a public collection) of the material, and the names of indigenous peoples and local communities within patent applications. Second, patent claims may be made at the level of a genus (i.e. Lepidium), the family level (i.e. Brassicaceae), or at the genetic level, rather than at the level of individual species or varieties. In the case of chemical compounds isolated from a species or genus the origins of the compounds with biodiversity can be very difficult to detect.

This introduces a need to use a combination of species names and common names in patent searches to enhance data capture but also raises questions surrounding the extent to which searches will capture all relevant patents. A considerable amount can be achieved using key terms. However, data capture will not be ensured in the absence of additional requirements for patent applicants to provide specific information.

A second issue concerns the nature of patent databases. In the case of the USPTO it is possible to search the whole text of patents. In contrast, in the case of the European Patent Office esp@cenet worldwide database only the title or abstract of publications in English may be searched. The significance of the limitations of databases such as esp@cenet compared with whole text databases can be revealed by examining the raw results of a search of the USPTO for patents involving or related to: *Banisteriopsis caapi* (for Ayahuasca from Amazonia) and *Lepidium meyenii* (Maca from the Peruvian Andes) and; rice (genus Orzya for wild rice relatives and *Oryza sativa* for domesticated rice) as set out in Table Five.

Table Five: USPTO Search Results for Patents Granted by Document Section

Patent Application Form by Section	Banisteriopsis caapi, caapi, ayahuasca, harmaline, harmine, tetrahydro-harmine.	*Lepidium meyenii* or p-methoxybenzyl isothiocyanate	Oryzaor Oryza sativa or rice
All Sections	80	10	47,988
Title	2	3	485
Abstract	2	3	1,305
Specification (Description)	60	10	33,230
Literature citations	25	3	2,708
Claims	9	1	3,781

As Table Five makes clear, the majority of references to the genus, species and components of organisms are located in the specification (description) section of USPTO patents with only limited references in the title and abstract. As this suggests, the key constraint in the use of terms to search the titles and abstracts of patent publications in esp@cenet is that it will not capture the full spectrum of patent publications including the particular genus, species or components of an organism or references to the

49 Searching for DNA and protein sequences is not covered further in this introduction. For information on sequence searching see, Yoo, H *et al.* (2005) 'Intellectual property management of biosequence information from a patent searching perspective.' *World Patent Information* 27 (2005) 203-211.

knowledge, innovations and practices of indigenous peoples and local communities.

In the case of patent publications in Spanish and Portuguese the LATIPAT database provides search facilities for patents in these languages. Furthermore, patent filings under the European Patent Convention are formally made available in English (as an official language) and Patent Cooperation Treaty (WO) publications will frequently be available in English. Nevertheless, language represents a significant limitation in international research relating to biopiracy and tracking the presence of biodiversity within the patent system.

Using Search Formulas:

In approaching patent research for biodiversity the simplest form of search will consist of a single species name i.e. *Lepidium meyenii* or Maca from Peru.[50] One option for researchers is to simply print out the results for an individual variety, species or genus or components of interest. However, a variety or species may possess one or more common names (i.e. Maca, Peruvian ginseng, maka, mace, Maca-Maca, maino, ayak chichira, ayuk willku, pepperweed) that may be used by patent applicants.[51] Furthermore, this becomes more complex when chemical compounds or the genetic components of organisms are involved. Conducting individual searches for each of these terms will produce many duplicate results and is time consuming. These difficulties can partly be addressed through the use of simple search formulas in conjunction with patent databases.

a) Simple Search Formulas:

Searches of patent databases can be automated in a variety of ways using simple "Boolean" formulas consisting of terms, known as operators, such as AND, OR and NOT.[52] These terms can be used to combine searches of multiple key words or confine searches to areas of the patent system that are known to be relevant to biodiversity and traditional knowledge. Examples of such formula include the following:

("Banisteriopsis" OR "caapi" OR "ayahuasca")

This search will focus on patents which contain these terms anywhere within patent publications within a database. The formula has the effect of searching for documents containing the genus Banisteriopsis, followed by the term caapi and finally ayahuasca and then compiling the results. When compared with using individual search terms i.e. Banisteriopsis, one by one this has the advantage of compiling all the results in one search. This saves time by reducing the number of results that are repeated.

In the case of USPTO patent grants this formula produces 3 results. Where the chemical constituents of a plant or other organism of interest are known, this can be extended to include known compounds:

("Banisteriopsis" OR "caapi" OR "ayahuasca" OR "harmaline" or "harmine" or "tetrahydroharmine")

In the case of the USPTO this produces 82 results. The results pages can then be printed and individual patents checked for relevance as a basis for constructing a portfolio of results and further analysis.

b) Multi-Species Searches:

Using a similar approach searches can be constructed for multiple species, genera or families of interest as follows:

("Abrus precatorius" OR "Achyrocline satureoides" OR "Adiantum capillus-veneris" OR "Ageratum conyzoides" OR "Alchornia castaneifolia" OR "Anacardium occidentale" OR "Andira inermis" OR "Aniba canelilla" OR "Aniba rosaeodora")

This search produces 160 raw results when used with the USPTO patent grants database and can provide a basis for further research relating to patent activity in relation to the chemical constituents of these plants. Many databases will place limits on the number of characters that can be included in a search. Thus, it will not generally be possible to construct multi-species searches for tens or hundreds of species or genera using free tools. Furthermore, the results of such searches may be overwhelming and unmanageable.

c) Country of Origin/ Indigenous Peoples:

These searches can also be targeted to patents which make reference to particular countries or indigenous peoples through the use of the term AND.

("Brazil") AND ("Abrus precatorius" OR "Achyrocline satureoides" OR "Adiantum capillus-veneris" OR "Ageratum conyzoides" OR "Alchornia castaneifolia" OR "Anacardium occidentale" OR "Andira inermis" OR "Aniba canelilla" OR "Aniba rosaeodora")

This formula functions in two ways. First, the database searches for the term Brazil in patent documents. There are a total of 2,377 patents in the USPTO patent grants database that contain the term Brazil. Second, the database then searches within those patent documents for documents containing one or more of the species names

50 This section builds on the work of a working group established by the National Institute for the Defense of Competition and Protection of Intellectual Property in Peru to investigate patent activity for *Lepidium meyenii* or maca. The report of the working group is provided in *Patents Referring to Lepidium Meyenii (Maca); Responses of Peru*. Document submitted by the Delegation of Peru. Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore, Fifth Session, July 7- 15, 2003. Document WIPO/GRTKF/IC/5/13. Location: <http://www.wipo.int/documents/en/meetings/2003/igc/pdf/grtkf_ic_5_13.pdf>.

51 Source of common terms, Raintree Health. Location: <http://www.rain-tree.com/Maca.htm>.

52 In some cases, such as the USPTO database, the term AND-NOT is used in preference to NOT.

within those documents. This reduces the total to 13 raw results and saves considerable time.

However, there are significant limitations to this approach. Thus a search for Peru and *Lepidium meyenii* reveals 2 patent grants. In contrast, a search for *Lepidium meyenii* reveals 6 patent grants while a wider search for the genus Lepidium reveals 841 results. This reveals that while country of origin searches can contribute to the identification of patents arising from collection in specific countries, or sourced from such countries, in practice the inclusion of country of origin (or indigenous peoples) is presently at the discretion of applicants. The main utility of the above formula is in providing initial leads for further research. A more accurate picture will only emerge through the use of the names of species or genera that are known to have their origins in a particular country or region.

d) Using Patent Classifiers:

One of the major problems in conducting patent research for biodiversity is reducing the number of irrelevant results. Thus, for example, the search term "maca" captures patents in the realm of chemistry and physics that do not refer to an Andean plant and other irrelevant results i.e. "macaroni". Furthermore, the aim of patent research in relation to biodiversity is assumed to be to capture patent activity that makes claims in relation to organisms or their components and the uses of those components. In cases such as rice (*Oryza sativa*) this presents the problem that tens of thousands of patent publications make reference to the search term but may not actually involve claims to rice or its components. Thus, patent search results for rice will include machinery for processing or transporting rice, kitchen equipment and the surname "Rice". In short, there may be many thousands of irrelevant results.

In order to address this problem, IPC classifiers can be used to confine the searches to areas of the patent system known to involve claims over biodiversity and the components of organisms. As we have seen above, the generic IPC formula below reveals that in general biodiversity related patent activity falls into eleven areas of the international patent system.

> (species or genera or family or common name or components) and (A01 or A23 or A61 or B82 or C07 or C08 or C11 or C12 or C40 or G01 or G06)

This formula is constructed on the class level and is designed to capture the vast majority of patent activity that involves claims to biological diversity, the components of organisms and traditional knowledge.

However, the class level is quite general and in practice the majority of biodiversity falls into quite specific areas of the patent system on the sub-class level. This knowledge can therefore be used to target searches to these specific areas.

In the case of the USPTO databases searches are confined to the sub-class level (the level immediately below the general formula provided above) and require the introduction of specific characters (i.e. additional zeros in IPC classifiers or truncation marks such as $) in order to function. In some cases, such as the USPTO, the total number of characters that can be used within formulas are also limited. For example, the USPTO limits the number of characters to 256 following conversion ("parsing") by the database.[53]

The formula used below has been constructed for use with the USPTO patent grants database and pushes the database to its limits. The use of shorter formulas to target sectors of activity is discussed in detail below.

The formula is intended to limit searches to the main areas relating to biodiversity while reducing the numbers of false results. For this reason, areas of the patent system i.e. baking, or resins and paints have been excluded for the moment. Relevant classifiers in the area of physics are also excluded for the moment on the basis that their inclusion tends to introduce many false results for common names. These exclusions will be addressed below and further guidance on the use of formulas to search specific sectors is also provided below.

IPC formula combinations can be used in a variety of ways: a) for species, lists of genera, common names or components of organisms; b) for the names of countries of origin or indigenous peoples; c) for regions. The following formula can be used with the USPTO patent grants database.

> ("Lepidium meyenii" or "maca") and icl/(A01H$ or A01N$ or A23L$ or A61K$ or B82B$ or C07C$ or C07D$ or C07H$ or C07K$ or C08H$ or C08L$ or C11B$ or C11C$ or C11D$ or C12N$ or C12P$ or C12Q$ or C12R$ or C40B$)

In the case of these search terms the formula produces a total of 29 raw results for patent grants. The search can also be refined to limit the results to specific dates as follows.

> ("Lepidium meyenii" or "maca") and icl/(A01H$ or A01N$ or A23L$ or A61K$ or B82B$ or C07C$ or C07D$ or C07H$ or C07K$ or C08H$ or C08L$ or C11B$ or C11C$ or C11D$ or C12N$ or C12P$ or C12Q$ or C12R$ or C40B$) and isd/(01/1/1990->12/31/2005)

This produces 27 raw results for patent grants between the specified dates. In contrast a search for the simple term "maca" without the formula produces 163 results. The effect of the formula is to remove areas of the patent system (notably physics) where maca is also a commonly used term but does not refer to an Andean plant. Once again the raw results will need to checked to exclude irrelevant results.

In the case of countries of origin the same formula search using the term Brazil revealed 1,166 raw results across USPTO patents granted and 1,392 in the case of Mexico

53 See USPTO Notices, location: <http://www.uspto.gov/patft/help/notices.htm>.

as a basis for further research. A regional level search for the term Amazon produces 94 raw results and 78 raw results for Andes or Andean between the specified dates.

As this suggests, IPC classifiers perform the useful service of targeting searches to areas of the patent system that are known to involve claims over biodiversity, the components of organisms and/or traditional knowledge.

In particular, it is important to emphasise that patent documents are commonly awarded more than one classifier. This trend will increase under the new IPC8 which is promoting the increasing use of classifiers to fully describe the contents of patent documents.[54] In seeking to capture the universe of patent activity the use of multiple classifiers has the advantage of cutting down repeated results and removing potentially large numbers of irrelevant results. However, this does not exclude the need to carefully check through the results to remove irrelevant results. Furthermore, as noted above, we need a method to ensure that we have captured areas of the patent system that may be relevant but are not included in the formula.

e) Enhancing Data Capture:

The simplest way to check that we have captured the patent universe and areas of activity that may be relevant for biodiversity (i.e. other areas of foodstuffs – A23, or C09 for dyes, paints, polishes, resins or G for physics) is to simply reverse the formula and check the results. To do this we will use the term ANDNOT i.e.

> ("maca") ANDNOT icl/(A01H$ or A01N$ or A23L$ or A61K$ or B82B$ or C07C$ or C07D$ or C07H$ or C07K$ or C08H$ or C08L$ or C11B$ or C11C$ or C11D$ or C12N$ or C12P$ or C12Q$ or C12R$ or C40B$) and isd/(01/1/1990->12/31/2005)

The effect of this formula is to search for the selected biodiversity terms in all areas of the patent system outside the classifiers in the formula.

In the case of the common name maca, this produces 113 results for patent grants of which none refer to the Andean crop maca. An alternative example using the components of *Banisteriopsis* within USPTO patent grants produces a total of 54 raw results. However, when the ANDNOT formula below is used an additional 15 raw results emerge including relevant results relating to the use of derivatives of harmine and harmaline in imaging systems in the area of physics (G03G).

> ("Banisteriopsis" or "caapi" or "harmine" or "harmaline" or "tetrahydroharmine") ANDNOT icl/(A01H$ or A01N$ or A23L$ or A61K$ or B82B$ or C07C$ or C07D$ or C07H$ or C07K$ or C08H$ or C08L$ or C11B$ or C11C$ or C11D$ or C12N$ or C12P$ or C12Q$ or C12R$ or C40B$) and isd/(01/1/1990->12/31/2005)

As this suggests, while the use of search formulas may at first sight appear intimidating a combination of care in the construction of formulas and cross-checking can considerably reduce the workload involved in conducting patent research for biodiversity.

One important limitation of free databases is that it will often only be possible to use short formula (i.e. for USPTO patent applications). However, the scale of patent activity in relation to biodiversity is such that it will often be desirable to confine searches to specific sectors of patent activity.

3. Searching by Sector of Patent Activity

It is important to recognise that a particular species, members of a particular genus or the components of organisms may be used in a variety of ways across a range of different economic sectors. These sectors may involve different actors, serve different markets, use distinct technologies and involve claims over biological diversity at very different levels. Furthermore, the implications of patent claims may be very different between different sectors of activity.

For example, patents relating to the use of crude extract from plants or other organisms may have implications for species classified as endangered or protected under CITES.[55] Alternatively patents over extracts or chemical components from a plant that is regarded as sacred may raise substantive issues for the indigenous peoples and/or the country concerned. However, the patenting of a whole genome (i.e. *Methanococcus jannaschii* from the deep sea bed) or elements of a genome such as rice (*Oryza sativa*) will have different implications to that of an endangered species, a plant extract or chemical compound.[56]

Using the IPC codes provided in the formulas above, we can begin to engage in a more detailed exploration of the international patent system by sector of activity in an organised way. The details of the classifiers used in the formulas above are provided in Table Six. Additional classifiers for potential areas of interest for sectoral analysis are also included and marked (*).

54 For discussion of the reform of the IPC and its implications for searching see the esp@cenet website. For detailed discussion see, Wongel, H (2005) 'The reform of the IPC - consequences for the users', *World Patent Information* 27 (2005) 227-231.

55 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Location: <http://www.cites.org/>.

56 On whole genome patenting see, O'Malley, M and Bostanci, A and Calvert, J 'Whole Genome Patenting', *Nat. Rev. Genet.* doi:10.1038/nrg1613, 10 May 2005. For rice see, Oldham, P (2004) 'Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology,' *Global Status and Trends in Intellectual Property Claims.* No. 1. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>.

Table Six: Main Classifiers for Biodiversity (*Class* and Sub-Class Level)

	Classifiers (Sub-Class Level)
Section A	**Human Necessities**
A01	*Agriculture*
A01H	New plants or processes for obtaining them
A01N	Preservation of Bodies of Animals or Plants or Parts thereof; biocides
A23	*Food or Foodstuffs*
A23L	Foods, Foodstuffs, or Non-Alcoholic Beverages
A61	*Medical or Veterinary Science; Hygiene*
A61K	Preparations for Medical, Dental or Toilet Purposes
Section B	**Transportation**
B82	*Nanotechnology*
B82B	Nanostructures, Manufacture or treatment thereof
Section C	**Chemistry; Metallurgy**
C07	*Organic Chemistry*
C07C	Acyclic or Carbocyclic compounds
C07D	Heterocyclic compounds
C07H	Sugars; derivatives thereof; nucleosides, nucleotides; nucleic acids
C07K	Peptides
C08	*Organic macromolecular compounds*
C08H	Derivatives of natural macromolecular compounds
C08L	Compositions of macromolecular compounds
C09*	Dyes (C09B); Paints (C09D); Natural Resins (C09F); Polishes (C09G); Adhesives (C09J); Other Applications (C09K)
C11	*Animal or vegetable oils, fats, fatty substances or waxes*
C11B	Producing, refining preserving fats, fatty substances, waxes
C11C	Fatty acids from fats, oils, waxes
C11D	Detergent compositions
C12	*Biochemistry, Beer, Spirits, Wine, Vinegar, Microbiology, Enzymology, etc.*
C12N	Microorganisms or Enzymes; Compositions thereof…; Mutation or genetic engineering…
C12P	Fermentation or Enzyme using processes to synthesise chemical compounds
C12Q	Measuring or testing processes involving enzymes or microorganisms
C12R	Indexing classifier for microorganisms & biochemistry.
C12S*	Processes using enzymes or microorganisms to liberate, separate or purify a compound, to treat textiles or clean solid surfaces
C40	*Combinatorial Technology*
C40B	Combinatorial Chemistry; Libraries
*G01**	*Measuring; Testing*
G01N	Investigating or analysing materials by determining their chemical or physical properties i.e. for biochemical electrodes
*G06**	*Computing*
G06F	Electrical Digital Processing

We have seen earlier that the vast majority of references to biodiversity and the components of organisms fall into 11 main areas (classes) of the patent system (in italics). We have also seen that the use of sub-classes allows researchers to limit the results when seeking to capture the universe of patent activity in relation to a species, genus or components of interest. Combinations of these IPC sub-classes permit the analysis of activity by sector (i.e. agriculture) and the type of technology involved (i.e. recombinant genetic engineering).

To do this, we will begin by identifying one or more main indicators for a particular sector (i.e. agriculture). We will also use a series of classifiers for particular areas of science and technology within that sector (i.e. organic chemistry or biotechnology). These classifiers can then be combined when conducting searches. As an aid to researchers a matrix of the main sector and technology indicators is provided in Annex 2. We now turn to a brief discussion of each sector.

1. Agriculture: (main indicator A01H)

In the case of agriculture the logical starting point for research is to combine a search for a species or genus with the main IPC classifier for agriculture (A01H). As of mid-2005 there were approximately 50,005 patent publications worldwide under this indicator.[57]

This can then be extended to examine patent activity in relation to plant phenotypes (A01H3), genotypes (A01H1) and tissue culture techniques (A01H4). For flowering plants the main indicator is A01H5. As of mid-2005 approximately 37,553 of the 50,005 patent publications worldwide under A01H were located in A01H5.

This research can then be extended to focus on the area of technology. For example the main indicator for DNA is classifier C07H. DNA related patents are also commonly found under C12N. Within C12N there is a specific classifier for recombinant genetic engineering for plants (C12N15/82). There were approximately 19,514 patent publications for plants under this specific indicator as of mid-2005. Additional activity is also observable in relation to undifferentiated plant cells and tissues (i.e. plant meristems) under indicator C12N5/04 with 6,088 publications worldwide.

If we wished to capture patent activity in relation to the general area of agriculture and biotechnology in relation to a particular variety, species or genus a basic formula for the sub-sector would appear as follows.

(variety or species or genus) and (A01H or C07H or C12N15 or C12N5)

If we then wished to narrow the search to focus only on genetic modification in the realm of agriculture we might focus on just two indicators – A01H1 for modification of genotypes and C12N15/82 for recombinant genetic engineering for plants as follows:

57 All data for worldwide trends refers to patent publications and is based on a detailed review of esp@cenet for each indicator. All numbers are approximate.

(variety or species or genus) and (A01H1 or C12N15/82)

The first of the formulas for agriculture casts the net widely in relation to indicators for biotechnology. The second formula narrows the focus to only those areas of the patent system relating to the modification of the genotypes of plants (plant genetics) and recombinant genetic engineering for plants.

The reason that the term "or" is used in these formulas is that patent classifiers are awarded by patent examiners in patent offices around the world. In some cases, patent examiners may award one classifier (i.e. A01H1) in other cases they may award another classifier (C12N15/82) while in other cases they will use both. The use of the term "or" captures all of these possibilities.[58]

However, the term AND (i.e. A01H1 and C12N15/82) can also be used to explore only those patent documents that are linked together. This is particularly important where there are large numbers of results or when dealing with emerging areas of technology (i.e. nanotechnology). The matrix in Annex 2 provides a guide to constructing these formulas by sector and area of technology. Creative experimentation in constructing formulas is strongly encouraged.

2. Biocides: (main indicator A01N)

For plants or other organisms with biocidal properties the logical starting point for patent research is indicator A01N (153,118 publications world-wide by mid-2005). In the case of neem ("Azadirachta indica" or "azadirachtin" or "neem") a total of 655 patent grants are recorded within the USPTO patent grant database containing one or more of these terms. Of these patents a total of 377 (57.5%) are classified under A01N for biocides. Where dealing with large numbers of results this therefore provides a logical starting point for analysis. The outstanding results can then be reviewed as analysis proceeds. For example, the remaining results in relation to neem are predominantly located under heterocyclic compounds within organic chemistry (C07D) and refer to the use of derivatives from neem as pesticides.

A formula that would capture the majority of activity for a biocide such as neem is:

(genus or species or component) and (A01N or C07D)

The search can then, as needed, be extended to other areas, i.e. DNA under C07H and biotechnology i.e. C12N to C12S (see below) to build up a fuller picture of patent activity relating to biocides across a range of areas of technology related to biodiversity.

58 IPC8 advocates the use of increasing numbers of classifiers. The problem of individual classifiers awarded in different areas of the patent system that relate to the same type of material or technology should therefore diminish over time.

3. Foodstuffs: (main indicator A23L)

The main classes for foodstuffs stretch from class A21 for Baking and Baking Equipment, to class A22 for Butchering, and Meat Treatment and processing of Poultry and Fish to A23 Food or Foodstuffs or their treatment not covered elsewhere. As this suggests foodstuffs are a large area of the patent system.

However, many of these indicators appear not to involve direct claims to biodiversity or will be covered by other classifiers in the formula. For example, the use of micro-organisms or enzymes in baking will already be captured by C12S in the formula.

Within this area of the patent system the main indicator for patent claims over biological diversity appears to be located in sub-class A23L (over 100,000 publications worldwide). A search for the use of a particular plant or organism in nutritional supplements or foodstuffs would logically begin here. This search might then be extended to animal fodder (i.e. A23K) and to the main indicators for ethnobotanical/traditional/herbal medicines (A61K35 and A61K36 see below). The basic formula for such a search is:

(genus or species or component) and (A23K or A23L or A61K35 or A61K36)

Once again, this is a logical starting point for research on the use of a particular species or genera or components within the foodstuffs sector, including nutraceuticals. The matrix provides further guidance on searching this sector in relation to specific areas of technology.

4. Cosmetics and Dental Preparations: (main indicators: cosmetics - A61K7, A61K8; dental - A61K6)

The main indicator for dental preparations (i.e. toothpastes) within the patent system is sub-class A61K6. The main indicators for cosmetic preparations are A61K7 (historic) and A61K8 (new). To limit the search only to dental preparations use A61K6 and for cosmetics use both A61K7 and A61K8 i.e.

(genus or species or component) and (A61K7 or A61K8)

In common with the other classifiers, these indicators can also be used to extend the search by technology sector i.e. C07H for DNA, C12N to C12S for biotechnology or B82B and A61K9/51 for nanotechnology (see below).

5. Ethnobotanical Medicines: (main indicators A61K35 and A61K36)

The main indicators within the patent system for ethnobotanical medicines (traditional or herbal medicines) are A61K35 and A61K36. Patent activity in this area is dominated by material from plants (i.e. 59,721 publications). Until January the 1st 2006 medicinal plant material was classified under A61K35/78.

However, in view of accelerating demand in this area a new classifier A61K36 has been introduced in IPC8. This

classifier refers to "Medicinal preparations of undetermined constitution containing material from algae, lichens, fungi or plants, or derivatives thereof, e.g. traditional herbal medicines" and is accompanied by a series of detailed classifiers for species and genera.

A basic search for activity within this sector would appear as follows:

(genus or species or component) and (A61K35 or A61K36)

This type of search can as necessary be targeted towards plant material (i.e. A61K35/78 or A61K36) or extended to incorporate areas of technology within the patent system.

6. Medicinal/Pharmaceutical Compounds: (main indicators A61K35 and A61K31)

The main indicators for Medicinal/Pharmaceutical compounds are A61K35 for compounds with undetermined constitution and A61K31 for compounds that are wholly or partially described. Classifier A61K35 primarily refers to ethnobotanical medicines and crude extracts and has been addressed above. In contrast A61K31 is the main indicator for pharmaceutical compounds.

Classifier A61K31 encompasses a variety of types of chemical compounds arising from biodiversity. These range from partially described organic compounds from plants and other organisms using biological trivial names, to semi-systematic names for natural compounds, fully described or "characterised" compounds and their derivatives, and synthetic compounds and their derivatives. This area of the patent system is a major area of international demand i.e. in relation to pharmaceutical companies.

Where the chemical components of a particular species or genus of interest are wholly or partially described they will be classified under A61K31. This classifier thus represents the logical follow on for any research relating to ethnobotanical medicines (i.e. from plants under A61K35/78 and A61K36). A researcher seeking to understand patent activity in relation to a specific plant or organism in the area of medicines can simply construct the following formula:

(genus or species or component) and (A61K35/78 or A61K36 or A61K31)[59]

At a more detailed level the International Union of Pure and Applied Chemistry has developed a classification (nomenclature) for chemical compounds.[60] This includes Section F on Natural Products containing 148 fundamental parent structures i.e. alkaloids, terpenoids. These parent structures are generally heterocyclic (see A61K31/33) but also appear in carbocyclic form (C07C).[61]

The increasing use of combinatorial technology (libraries of compounds or genetic material) in the pharmaceutical and biotechnology sectors is reflected in the recent addition of sub-class C40B within the International Patent Classification (IPC8) that entered into force in January 2006. This indicator will become increasingly available for research within the major jurisdictions as patent offices reclassify patent documents to reflect the changes in IPC8.

It is strongly recommended that researchers seeking to conduct patent research in relation to natural product compounds should study the patent classification in further detail, possess a good knowledge of organic chemistry, or seek advice from qualified chemists.

7. Organic Chemistry: (C07 and C08)

In the context of debates surrounding biopiracy much attention has focused on the pharmaceutical and agricultural sectors. However, the wider sector of industrial chemistry and its related sub-sectors merits greater attention.

Organic Chemistry encompasses a wide range of activities and sub-sectors. There are a number of main indicators for industrial organic chemistry. Thus the general indicators for organic chemistry are C07 (Organic Chemistry) and C08 (Organic macromolecular compounds). In the case of biodiversity initial attention might usefully focus on Heterocyclic compounds (C07D), Carbocyclic Compounds (C07C) and 'Derivatives of natural macromolecular compounds' (C08H) or 'Compositions of Macromolecular compounds' (C08L).

DNA (C07H):

DNA related patent activity is located in two main areas of the patent system. First, under CO7H for "Sugars, Derivatives thereof, Nucleosides, Nucleotides and Nucleic Acids". Second, under biochemistry within class C12.

59 Note that the USPTO database requires the insertion of a zero after the sub-class letter in order to identify groups and subgroups. Thus A61K35/78 becomes A61K035/78. For searches on the sub-class level to capture relevant groups and sub-group the following constructions should be used i.e. A61K036$. For example: («lepidium») and icl/(A61K035$ or A61K036$ or A61K031$). Where sub-groups are included within formulas i.e. A61K35/78 the "/"should be removed to form the following formula («lepidium») and icl/(A61K03578$ or A61K036$ or A61K031$). For details of characters for use in the construction of formulas see the USPTO help pages, location: <http://www.uspto.gov/patft/help/helpflds.htm#International_Class>.

60 International Union of Pure and Applied Chemistry, Commission on Nomenclature of Organic Chemistry. 'Revised Section F: Natural Products and Related Compounds (IUPAC Recommendations 1999). Giles, P *Pure Appl. Chem.*, Vol 71, No. 4. pp.587-643 1999. See location: <http://www.chem.qmul.ac.uk/iupac/sectionF/app.html>. The online version of the Nomenclature for Natural products includes a small number of additions to the list as set out in 'Errata Revised Section F: Natural products and related compound (IUPAC Recommendations 1999). Corrections and Modifications (2004). Favre, H (et al) *Pure Appl. Chem.*, Vol. 76, No. 6, pp. 1283-1292, 2004.

61 For an accessible introduction see the Wikipedia entry, location: <http://en.wikipedia.org/wiki/Heterocyclic_compound>.

Research relating to DNA is best conducted using C07H and C12 (see below). The reason for this is that some patent offices may generally classify DNA under C07H while others will only classify DNA under the main indicators for biotechnology in C12 (i.e. C12N to S). Combining the classifiers in a search formula is more likely to enhance data capture (see below).

Peptides (C07K):

Peptides are short strings of amino acids that form part of a protein. The main indicator for peptides is CO7K and this is a very significant area of demand for patent protection. Peptides may be used in a variety of sectors of activity and classifiers can as necessary be combined to target associations (i.e. A61K31 and C07K). Links between peptides under C07K within Organic Chemistry and the main classifiers for biotechnology (C12N to S) are extremely strong.

Dyes, Paints, Resins, Adhesives (C09):

Specific areas of interest in industrial chemistry include C09 which encompasses Dyes, Paints, Polishes, Natural Resins, Adhesives and other applications of materials not addressed elsewhere. See in particular: C09B for Organic Dyes; C09D for Coatings, paints and varnishes; C09F for natural resins; C09H for glues, C09J for adhesives, and; C09K for other materials and applications. This area of the patent system is not presently included in the general formula but should be borne in mind in conducting searches and as a focus for sector analysis.

Oils, Fats, Waxes and Perfumes (C11):

In connection with animal or vegetable oils, fats and waxes the main indicator is class C11. This classifier includes: Producing or refining fats, oils and waxes (C11B), Fatty acids (C11C); Detergents (C11D). Research in relation to biodiversity and the perfumes sector will logically target classifier C11B9 (Essential oils; perfumes). This is an emerging area of demand for patent protection with 15,155 publications worldwide by early 2006.[62] A significant association exists between patent activity for foodstuffs under A23L and C11B9 for perfumes (3,143 publications worldwide) and C11B9 for perfumes and C07D for heterocyclic compounds (2,907 publications worldwide). These areas of the patent system are included in the search formula provided above for general searching.

Further research is recommended on other areas of industrial chemistry that may involve biological diversity notably in the area of Physics (Section G) and the use of compounds originating with biological diversity and trends in biotechnology (below).

8. Biochemistry and Biotechnology (C12N to C12S):

An underlying review of global patent activity using an OECD working definition of biotechnology revealed that the main indicator for Biochemistry and Biotechnology is class C12.[63] Within this class the most important indicators in relation to biotechnology are sub-classes C12N, C12P, C12Q and to a lesser extent C12S. Researchers interested in the analysis of the role of biodiversity (including humans and animals) in biotechnology should focus their research on these main classifiers.

Microorganisms (C12R):

Researchers interested in microorganisms should also note the use of the indexing classifier C12R for described microorganisms (a category including cell lines).[64] This is incorporated in the formula for general searches for this reason. However, the classification of microorganisms is based on an old version of *Bergey's Manual of Determinative Bacteriology*.[65] While representing a useful starting point, researchers focusing on microorganisms may also wish to consider rapidly expanding searchers to classifiers C12N, C12P, C12Q and C12S. Additionally, classifiers for Peptides (C07K) in chemistry are likely to enhance the search results.

Human and Animal biological and genetic material (C12 and C07H):

As a general observation, the vast majority of human and animal genetic material within the patent system will be located within classifiers under C12 provided above and search formulas relating to DNA should include C07H to enhance data capture.

Stem Cells (C12N5):

In the case of research relating to undifferentiated human, animal, and plant tissues or stem cells and plant meristems the classifier C12N5 is the logical starting point for research. Targeted research can be conducted for: human material under C12N5/08; animal material under C12N5/06, and; C12N5/04 for plant material.[66] It should be noted that the search should then be expanded to include the wider classifier C12N5 in order to enhance data capture.

Genomics:

Researchers focusing on issues such as genomics (the genetic complement of a cell or organism) may wish to

62 Search of esp@cenet worldwide conducted on the 21st of February 2006.

63 Oldham, P (2004) Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology. *Global Status and Trends in Intellectual Property Claims*, Issue No. 1. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>

64 Oldham, P (2004a) Global Status and Trends in Intellectual Property Claims: Microorganisms. *Global Status and Trends in Intellectual Property Claims*, Issue No. 2. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>

65 See the *Bergey's Manual Trust* website. Location: <http://www.bergeys.org/publications.html>.

66 For discussion see Oldham, P (2004a) Global Status and Trends in Intellectual Property Claims: Microorganisms. *Global Status and Trends in Intellectual Property Claims*, Issue No. 2. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>.

note that references to the term genome in the main patent jurisdictions worldwide are predominately located in sub-classes C12N, C12P, and C12Q. In the main jurisdictions between 2001-2003 these indicators collectively accounted for 37,833 (or 74.5%) of 50,721 patent documents containing the term genome.[67] These three classifiers therefore represent a logical starting point for research on patent activity for genomics and are strongly linked with indicators under Physics (G).

Proteomics:

In the case of the emerging area of proteomics (the protein complement of a cell or organism) a total of 3,690 patent documents were recorded in the main jurisdictions between 1991 and the end of 2005. Of these 3,018 are collectively located in classifiers C07H, C12N, C12Q, G01N or G06F representing 81.78% of patent documents containing the term proteome.

Nanotechnology:

Patent activity in relation to nanotechnology has become an increasing focus of international demand and public and policy attention. In response to this IPC indicators have been introduced for nanotechnology. The key indicators in this area within the IPC are B82B (parent B82) and A61K9/51 for nanocapsules for medicinal preparations. In addition the USPTO has introduced classifier 977 and the European Patent Office has now incorporated a "tag" Y01N within the European Classification to facilitate the identification of nanotechnology patents in esp@cenet. In order to explore bionanotechnology the main biodiversity classifiers should be combined with nanotechnology classifiers. For example, patents relating to ethnobotanical medicines (A61K35/78 or A61K36) can be identified by adding either B82B or A61K9/51 to the search using the IPC (i.e. A61K35/78 or A61K36 and B82B or A61K9/51).[68]

Bioinformatics:

Finally, the convergence of disciplines and technologies surrounding biodiversity on the cellular and the genetic level has largely been made possible by the application of information technology in the area of "bioinformatics". Initial research suggests that classifier C12Q1/68 (Measuring or testing processes involving nucleic acids) combined with the classifiers in Physics (G01N and G06F) represent important starting points for further research in relation to patent activity for bioinformatics.

67 Search conducted using Micropatent Aureka Gold for US (applications and grants), EP (applications and grants), PCT (applications), Japan (applications), Germany (applications), France (applications) and UK (applications).

68 In the case of esp@cenet this functions by searching using the ECLA search category combined with biodiversity indi cators. Note that in some cases it may be necessary to consult the ECLA via esp@cenet to identify relevant classifiers in ECLA format.

The Domains of Life:

In an ideal world research on biological diversity and the patent system would perhaps proceed in accordance with the main domains of life as they are understood by biologists (Eukarya, Bacteria and Archaea).[69] This is particularly significant in a context in which the TRIPS agreement requires patent protection for microorganisms. At present, the patent system classifies material from Eukarya (i.e. humans, animals and plants) as microorganisms whereas this classification is more appropriately applied to Bacteria and Archaea.[70]

On a more general level, the International Patent Classification system does not seek to answer the questions that researchers may be asking about biodiversity. The recent adoption of IPC8 and the introduction of indicators for ethnobotanical medicines raises the prospect that clearer indicators may be introduced to facilitate analysis of patent activity for the major domains of life.

Conclusion:

In this section we have moved from conducting simple searches for biodiversity using basic formulas to more advanced searches using IPC classifiers to target sectors of activity and areas of technology. The use of IPC classifiers may at first sight appear intimidating and the demands of different databases (i.e. the addition of zeros) can be frustrating. For many researchers the simple searches provided above may be sufficient.

However, the International Patent Classification system exists to facilitate patent research. An initial combination of time, patience and a willingness to experiment with formulas will ultimately save time in conducting detailed and accurate patent research at a later stage. The use of IPC codes will also be central to the wider task of developing indicators for patent activity relating to biodiversity and traditional knowledge on the national, regional and international level. These issues are addressed in the companion paper *Biodiversity and the International Patent Classification: Towards International Indicators*. We now turn to the use of the methods outlined in this section to construct an international patent portfolio.

69 For an accessible introduction to the domains of life see the Wikipedia entry, location: <http://en.wikipedia.org/wiki/Three-domain_system>.

70 The UK Commission on Intellectual Property Rights concluded that developing countries should adopt a restrictive definition of microorganisms in approaching international obligations under TRIPS. See CIPR *Integrating Intellectual Property Rights and Development Policy*. Report of the UK Commission on Intellectual Property Rights. London, (2002). Location:<http://www.iprcommission.org/graphic/documents/final_report.htm>. For further discussion and analysis see Oldham, P (2004a) Global Status and Trends in Intellectual Property Claims: Microorganisms. *Global Status and Trends in Intellectual Property Claims*, Issue No. 2. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>.

Section III

Constructing an International Patent Portfolio

We have seen above that searches for biodiversity related patent activity can be constructed in a variety of ways, ranging from very simple searches, to searches combined with classification codes between specific dates and searches by sector of activity.

The development of an international patent portfolio for a species, genus, family, the components of an organism or a specific sector consists of a series of simple steps.

1. Compiling patent publication numbers from a national patent database;
2. Compiling patent publication numbers from the United States patent database;
3. Searching the esp@cenet worldwide database and compiling the results;
4. Collecting additional information on the patents;
5. Identifying any additional documentation for the patents;
6. Compiling the information to create an international patent portfolio.

For the purpose of illustration we will employ *Lepidium meyenii* from Peru as a working example.[71] The steps involved in this process can be compressed where using commercial databases covering the main patent jurisdictions.

Step 1: national level

The results of searches of the national level database (where available) should be checked to remove irrelevant results. The patent publication numbers should be compiled in a list. The relevant documents should also be printed and stored for further research (where the results are manageable).

Step 2: United States Patent and Trademark Office

Enter a simple formula i.e. ("Lepidium meyenii" or "maca") into the USPTO Patent Grants Advanced search facility. Print the results and remove false returns. The patent numbers should then be written down or copied into a table.

Where there are large numbers of results use an IPC formula to target areas of the patent system relating to biodiversity (below). Cross check for missing results by reversing the formula using ANDNOT.

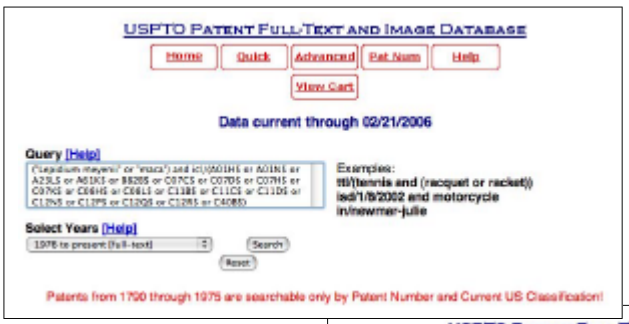


Figure 4: Entering A Search Formula into USPTO Patent Grants (1976-present)

Figure 5: Formula Search Results for USPTO Patent Grants (1976-present)

71 As noted above this section builds on the work of the INDECOPI working group in Peru as set out in Document WIPO/GRTKF/IC/5/13. Location: <http://www.wipo.int/documents/en/meetings/2003/igc/pdf/grtkf_ic_5_13.pdf>.

The results pages for this search should then be printed off and checked by hand and the patent numbers compiled. The procedure should then be repeated using the USPTO Patent Publications Database. Note that the use of IPC search formulas is more limited in the case of the Publications Database.

The results of the searches on the national level and at the USPTO should then be compiled into one table of publication numbers. At this stage commas should be removed and the country code i.e. US for the United States or MX for Mexico should be inserted before the number.[72] The combined results of this exercise for Lepidium meyenii/ maca are provided in Table Seven. In total the results of this search revealed 9 patent grants and 26 published patent applications.

Before entering into the next step in the procedure using esp@cenet it is important to note that patent publication numbers may be used in different ways in different databases. Thus, the USPTO records patent publication numbers in the following format i.e. 20060034897. However, in esp@cenet the first zero following the year may not be recorded and may give the impression that the document is not present. In practice it can often be located by *removing* the first zero after the year i.e. US20060034897. This appears to reflect difficulties in pursuing and implementing harmonized data formats.

Table Seven: Patent Grants and Patent Applications at the USPTO –(*Lepidium meyenii* or maca)

Note: to locate published applications at USPTO remove the country code. To locate applications in esp@cenet keep the country code and remove the first zero after the year.

Patent Grants	Title	Pub No.	Title
1. US6878731	Imidazole alkaloids from Lepidium meyenii and methods of usage	6. US6093421	Maca and antler for augmenting testosterone levels
2. US6552206	Compositions and methods for their preparation from lepidium	7. US6444237	Herbal composition for enhancing sexual response
3. US6428824	Compositions and methods for their preparation from lepidium	8. US6803060	Composition to boost libido
4. US6267995	Extract of Lepidium meyenii roots for pharmaceutical applications	9. US6737085	Apocynum venetum extract for use as antidepressant
5. US6368617	Dietary supplement		
Applications			
1.US20060034897	Delivery system for two or more active components as part of an edible composition	14. US20040034079	Imidazole alkaloids from lepidium meyenii and methods of usage
2. US20060018867	Cosmetic composition and production thereof	15. US20030180414	Method of controlling release of bitterness inhibitors in chewing gum and gum produced thereby
3. US20060004026	Compositions for ameliorating attention-deficient/ hyperactivity disorder	16. US20030104076	Process for preparing dry extracts
4. US20050181083	Diet food product	17. US20030099689	Dietary formulations including peptides
5. US20050089584	Methods and compositions for oral delivery of Areca and mate' or theobromine	18. US20030077296	Sense Enhancing Topical Gel
6. US20050089499	Active substances for use in cosmetic and/or pharmaceutical products, obtainable from the fermentation of plant components and/or plant extracts	19. US20030068388	Compositions and methods for their preparation from lepidium
7. US20050053678	Methods and compositions for betel nut chewing gum	20. US20030018009	Adenosyl-cobalamin fortified compositions
8. US20050036954	Combination of toothpaste, a chemical agent and natural herbs for improving sexual performance	21. US20020192316	Novel chocolate composition as delivery system for nutrients and medications
9. US20050008690	Multi-phase, multi-compartment capsular delivery apparatus and methods for using same	22. US20020127285	Rhodiola and uses thereof
10. US20040265400	Compositions for enhancing sexual responsiveness	23. US20020090403	Antidepressant
11. US20040202738	Methods and compositions of areca catechu	24. US20020068728	Composition to boost libido
12. US20040137131	Maca products and their uses	25. US20020061341	Compositions and methods for their preparation from lepidium
13. US20040071825	Agglomerated granular protein-rich nutritional supplement	26. US20020042530	Compositions and methods for their preparation from lepidium

72 Country codes are two letter codes that are used for country or patent instrument descriptions (i.e. WO for Patent Cooperation Treaty publications). The country codes are provided as part of the PCT Applicants Guide and can be downloaded. Location: <http://www.wipo.int/pct/guide/en/gdvol1/annexes/annexk/ax_k.pdf>.

Step 3: esp@cenet

The next step in the process involves conducting an additional search for patents within esp@cenet using the search terms. This will assist with picking up additional patents that make reference to the search terms in the title or abstract of publications in English.

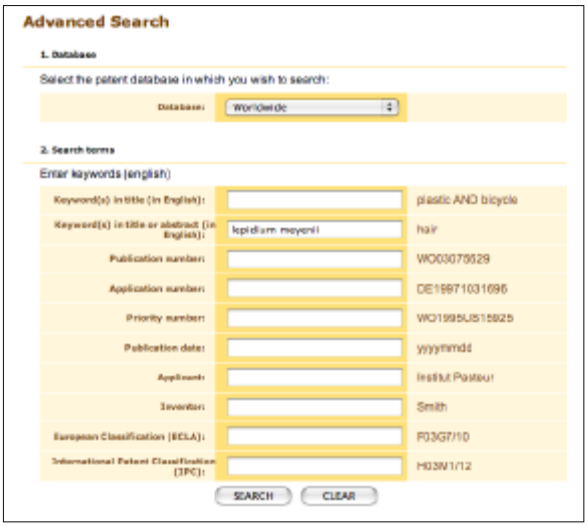


Figure 6: Entering Search Terms into esp@cenet

Short formula can also be entered into the title or abstract search box (upto four terms) i.e. “Lepidium meyenii” or “maca”.

If many irrelevant results are encountered it is often possible to reduce false returns by entering A or C into the International Patent Classification search box and to cross check for any missed results using sections of the IPC (i.e. B for transporting, G for Physics etc).

At this stage the research will begin to pick up patent documents containing the search terms in the title or abstract from other countries as can be seen in Figure 7 for Japan (JP).

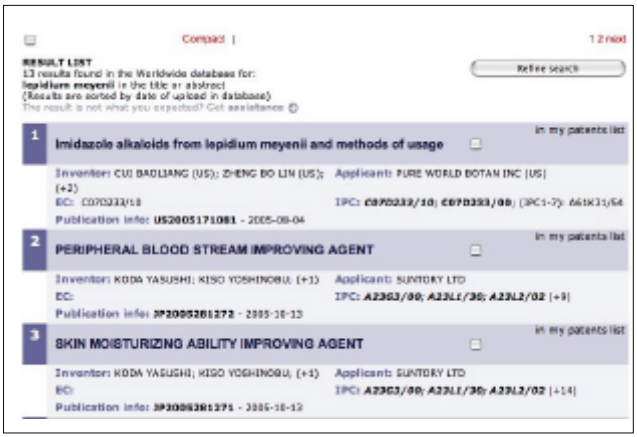


Figure 7: Raw Search Results from esp@cenet

The results of the searches should then be printed off, checked for relevance, and the patent publication numbers should be compiled in a table. It is also possible to temporarily save upto thirty results from different searches within esp@cenet by selecting results for storage in “my patents” or to retrieve the data from freepatentsonline.com or the BIOS “Patent Lens”.

The additional list of patent documents that have been compiled through this combination of methods is presented in Table Eight.

The important point here is that we are beginning to capture patent applications under the Patent Cooperation Treaty and individual patent applications in countries such as Japan and China.

The next sub-step in the procedure is to compile a complete list of patent publication numbers from the national, USPTO and esp@cenet searches. In the case of USPTO patent publication numbers it may be necessary to remove the first zero following the year of publication so that US20060034897 becomes US2006034897. In Step 4 we will enter each of these patent publication numbers into the esp@cenet database with the aim of capturing additional information. Specifically, we will focus on capturing additional information on “patent families”.

Table Eight: Patent Search of Titles and Abstracts (esp@cenet)

Publication Number	Title	Country of Filing (priority)
1. WO03053146	Composition and Method for improving sexual desire and overall sexual activity	United States
2. WO03047610	Composition and method to increase female sexual desire and sexual satisfaction	United States
3. JP2005143397	Method for producing root vegetable tablet, and the resultant root vegetable tablet	Japan
4. JP2005000033	Food	Japan
5. JP2004224784	Esthetic clinic for infertility using Lepidium Meyenii WALP	Japan
6. JP2004000171	Functional food containing Maca	Japan
7. JP2000319120	Cosmetic composition including vegetable extract having moisture retaining property	Japan
8. JP2002161043	Skin Care Preparation	Japan
9. JP2002034507	Health Assisting Food	Japan
10. JP2001354526	Hair restoration or hair tonic	Japan
11. JP2001348334	Nutrition Supplement	Japan
12. JP2001136920	Vitality Promotion food and method of producing the same	Japan
13. JP2001039854	Skin preparation for external use	Japan
14. JP8012565	Skin external preparation	Japan
15. WO2005094860	Agent Improving Peripheral Blood Flow	Japan
16. WO2005094859	Agent improving moisture retention function of skin	Japan
17. WO2005095573	Alcoholic Dring [Drink] Containing Maca Extract	Japan
18. WO2005072684	Process for Producing Maca Extract	Japan
19. WO2004052123	Zinc-Rich Foods having effect of preventing diabetes	Japan
20. CN1615965	Maka nano liposome and its preparing method	China
21. CN1416734	Anti-fatigue health food	China
22. WO2004112742	Maca extract and cosmetic composition containing such an extract	France
23.WO03059368	Active substances for use in cosmetic and/or pharmaceutical products, obtainable from the fermentation of plant components and/or plant extracts	France

Step 4: Collecting Additional Information on the Patents:

Patent Families:

A patent family as defined by the International Patent Documentation Centre (INPADOC) is a set of patents that all link to a single patent document by the priority number.[73] This number is awarded when a patent is filed anywhere in the world for the first time. Any subsequent patent publications or applications, i.e. under a regional instrument or the Patent Cooperation Treaty, that links to this priority number form part of the patent family.

We can compile information on the patent family to place in the international patent portfolio using the list of patent publication numbers previously collected. The steps involved in compiling additional information can be illustrated for patent publication number JP2005281272 as follows.

Figure 8: Collecting Patent Family Data

73 For further information see EPIDOS News. Location: <http://www.european-patent-office.org/news/epidos-news/source/epd_3_01/3_3_01_e.htm>. It should be noted that a variety of definitions exist for patent families. In particular families of IPC indicators can be used to define particular areas of technology as a "family" of related patents.

esp@cenet compiles patent family members and links them to each patent within an "INPADOC Patent Family". In this case, selecting "View INPADOC Patent Family" produces the following results.

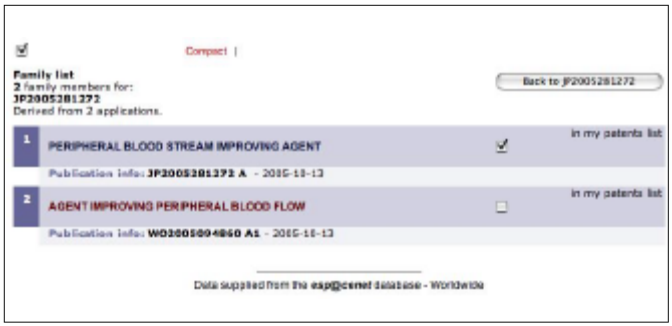


Figure 9: Patent Family for JP2005281272

Patent families include patent publications by the same applicant, patent publications under regional and international instruments and patent publications in other jurisdictions. The type of patent publication (i.e. an application, a re-publication with a search report on the prior art, or a patent grant) can be understood through the analysis of "kind codes" that feature after the publication number.[74] These codes will provide information on the stage that an application has reached within the patent procedure in the relevant jurisdictions.

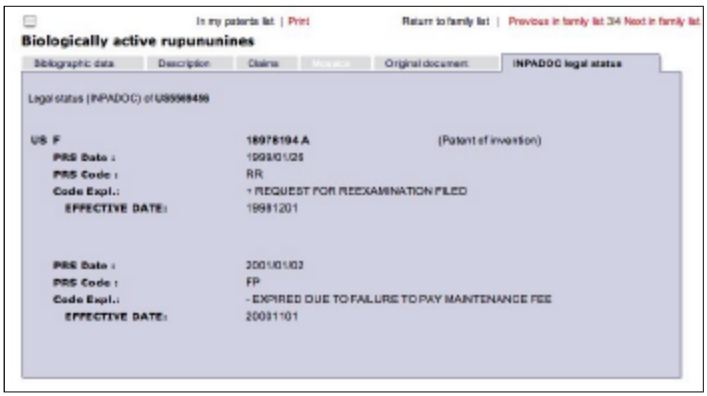
For the purposes of the compilation of an international patent portfolio the patent publication numbers should be copied into a table. The international patent portfolio for Lepidium meyenii and maca is provided in Annex 3 for the purpose of illustration.

This procedure reveals a series of additional applications and patent grants within patent families linked to our sample including: Australia, Brazil; Canada; China; the European Patent Convention; France; Japan; Mexico; the Patent Cooperation Treaty; Poland; the Russian Federation, and; the United States.

Legal Status Information:

Using esp@cenet it is also possible to obtain information on the legal status of patent documents in the patent procedure by selecting "INPADOC Legal Status". In some cases (i.e. JP2005281272) no information is available. In other cases the Legal Status information can prove to be revealing. The following example is taken from a historic case of biopiracy relating to the violation of the rights of the Wapishana of Guayana and Brazil arising from patenting elements of the Greenheart tree (*Ocotea rodiaei*).

Figure 10: Legal Status Information for US5694560



The use of legal status information can therefore provide useful information on whether a patent application is being pursued, the status of an application in the patent procedure within particular jurisdictions and whether the patent is in force. Legal status information will also include information on whether patent ownership has been transferred ("assigned") i.e. between companies or individuals.

Step 5: Compiling Additional Documentation:

In the case of patent documents that are examined by the European Patent Office (i.e. European Patent Convention and PCT or WO applications) additional documentation is frequently available through the separate Online Public File Inspection. This is a very important service through which communications between the patent office and applicants are ultimately made available for public inspection.[75] This information is only available for patent documents processed by the European Patent Office.

74 For details of patent kind codes see, location: <http://www.delphion.com/help/kindcodes>. See also, location: <http://www.european-patent-office.org/inpadoc/faq/kindcode.pdf>.

For example, patent application WO0051548 concerning "Compositions and Methods for their Preparations from Lepidium" provides extensive information, including 261 pages of prior art provided by the Institute for the Defense of Competition and Intellectual Property (INDECOPI) in Peru objecting to the patent application. Further information on the status of a patent may be available by selecting the European Patent Register.

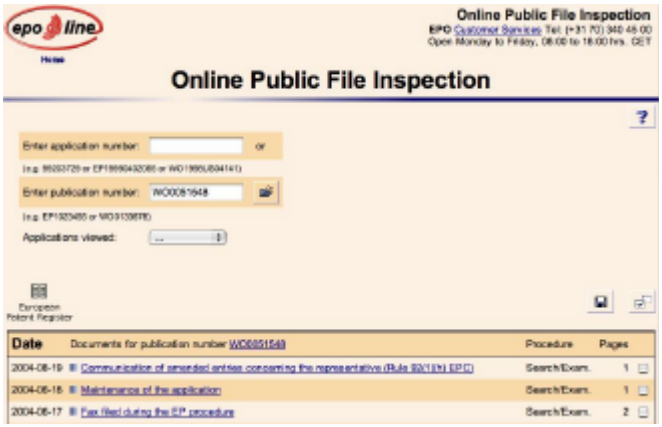


Figure 11: European Patent Office Online Public File Inspection[76]

Step 6: Compiling the International Patent Portfolio

The final step in the procedure is to compile and order the information in an international patent portfolio. This can be done in a variety of ways, i.e. in a word document, an Excel spreadsheet or database formats as a basis for further research or monitoring activity. The full patent portfolio arising from this procedure for the search terms *Lepidium meyenii* or maca is provided in Annex 3.

In developing an international patent portfolio it is important to recall that the contents of the portfolio are restricted to the search terms used. Thus, this example has limited the searches to *Lepidium meyenii* and maca. Wider research on the genus or in relation to the components of organisms may yield further relevant results. For the purpose of illustration interesting results for Lepidium and the "p-methoxybenzyl isothiocyanate" are included in the portfolio provided in Annex 3.

Section IV: Assessment Criteria

> "Considering the exclusive right to invention as given not of natural right, but for the benefit of society, I know well the difficulty of drawing the line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not." Thomas Jefferson 1813.[77]

In approaching the assessment of patent activity revealed within an international patent portfolio we will focus on the human rights, ethical, social, scientific, economic, environmental and legal dimensions of patent activity. This involves the development of a series of questions that can be applied to portfolios for individual species, a genus, the components of organisms or to sectors of activity and the technologies employed within those sectors.

In approaching the analytical assessment of patent activity a systematic approach is desirable. This approach will ideally combine quantitative assessment criteria (i.e. who is doing what, where and how?) with qualitative assessment criteria (i.e. what are the implications of activity?). On a wider level this can be linked to the development of statistical indicators and statistical analysis to inform decision-making.[78] The following lists of questions are intended to provide a basic guide to assessment criteria.

1. Quantitative Assessment Criteria:

1. Who is engaged in patent activity in relation to biodiversity and traditional knowledge (i.e. individuals, companies, public research organisations such as universities) and from which countries?

75 The Online Public File Inspection is available through <http://ofi.epoline.org/view/GetDossier>.

76 The Online Public File Inspection is available through <http://ofi.epoline.org/view/GetDossier>.

77 Thomas Jefferson (1813) 'To Isaac McPherson, August 13, 1813', in Appleby, J and Ball, T (1999) *Jefferson: Political Writings*. Cambridge: Cambridge University Press. Citation at 581. Also available via the University of Virginia *Thomas Jefferson Digital Archive*. Location: <http://etext.lib.virginia.edu/jefferson/>.

78 The development of statistical indicators is addressed in the companion paper *Biodiversity and the International Patent Classification: Towards International Indicators*. Copies of the paper are available upon request.

2. Where are applicants seeking to secure patent protection and through what routes (i.e. national, regional, international)?
3. What is the legal status of the grants or applications (i.e. are they in force)?
4. In what sectors of activity does patent activity fall (i.e. agriculture, biocides, foods, cosmetics, ethnobotanicals, pharmaceuticals, biotechnology, industrial chemistry etc.)?
5. At what level are claims to biodiversity and traditional knowledge being made (i.e. extracts, compounds, genetics, varieties, species, genera, families or classes of organism)?
6. Do patent applications involve more than one type of species or organism or their components?
7. Do patent applicants disclose the origin(s) or source(s) of the biodiversity and/or traditional knowledge involved in the patent application (i.e. country or region, or indigenous peoples)?

Quantitative assessment criteria are intended to assist with developing a fuller picture of the nature of patent activity as a basis for the analysis of the implications of this activity. To make this easier a draft coding matrix is provided in Annex 4 for use when reviewing patent portfolios.

2. Qualitative Assessment Criteria:

Qualitative assessment refers to the analysis and assessment of the implications of patent activity revealed in a portfolio. It is at this stage that we can begin to ask questions surrounding the concept and nature of biopiracy. Specifically, we can begin to interrogate the meaning of biopiracy and to set this within the context of the wider assessment of the human rights, ethical, social, scientific, economic, environmental and legal implications of patent activity in relation to biodiversity and traditional knowledge.

Qualitative assessment should be *evidence based* but will also require subjective judgement. The important point here is that such judgements should be reasoned. At this stage we can begin to ask the following basic questions in relation to patent activity revealed in the portfolio.

a) Human Rights and Ethics:

1. Do patents within the portfolio involve substantive human rights issues?
2. Do patents within the portfolio raise substantive ethical issues?

Examples of issues to be considered here include whether patent activity raises substantive human rights issues under international, regional or national laws relating to the rights of indigenous peoples or the rights of individuals (i.e. in relation to traditional knowledge or human genetic material).

In a broader sense the analysis of a patent portfolio involves moral or ethical judgements surrounding the contents of patent applicants and grants. These judgments will vary according to the moral and ethical value systems within particular countries and societies, the procedures and methods through which material disclosed was obtained and manipulated, and the type of organism or material involved.

Two basic approaches to ethical analysis of patent activity can be said to predominate. The first is represented by a principalist approach i.e. as a matter of moral or religious principle should biological diversity be the subject matter of intellectual property rights? Answers to this question are likely to vary. However, the important point is to bring the moral valuations that provide the basis for such answers into focus.

The second approach is consequentialist. That is, what are the likely consequences of permitting patent protection for society, sectors of society, and individuals? That is what 'goods' will be served if patent protection is permitted relative to the likely 'bads' that may result? On the basis of these judgements it is then possible to determine whether patent protection should be permitted and to establish norms in the form of rules to implement decisions based on those judgements. This is likely to take the form of prohibiting patentability, permitting patentability, or restricting patentability in a variety of ways. This may also take the form of developing alternative incentive measures and governance models.[79]

As this suggests questions surrounding the assessment of the ethical dimensions of patent protection require a series of balanced judgements. The nature of the ethical questions and judgements required may vary according to the context and subject matter. For example, patent activity relating to the collection of material and knowledge among indigenous peoples raises issues that are somewhat different to, but may overlap with, the ethical issues surrounding the patenting of human embryonic stem cells in relation to the rights of women, gender and valuations surrounding the status of embryos.

Issues surrounding the ethics of permitting patentability are explicitly recognised within the patent system in the form of "*ordre public* or morality" clauses. However, this is an area in which patent examiners and patent professionals lack both training and authority to make decisions. In response to this problem European countries are increasingly turning to specialists to advise on the ethical implications of permitting patentability in particular areas (i.e. stem cells) on the national, regional and international levels. This is also reflected in the adoption of an increasing number of codes and guidelines that address ethical issues surrounding patentability (i.e. the work of the Ethics Committee of the Human Genome Organisation,[80] the UNESCO 'Universal Declaration on Bioethics and

79 See for example the work of the EC funded research project on Property Regulation in European Science, Ethics and Law (PropEur). Location: <http://www.propeur.bham.ac.uk/>.

80 HUGO Ethics Committee. Location: <http://www.hugo-international.org/committee_ethics.htm>.

Human Rights,[81] and the work of the Commission on Human Rights and related bodies).[82]

While these developments are to be welcomed, judgements surrounding the ethics of patentability should appropriately be made as part of a wider public debate that simultaneously recognises that common moral values may exist and the reality that in a world characterised by multiculturalism and multiple value systems there will be a variety of overlapping and competing perspectives. The analysis of patent portfolios will not in itself resolve these issues. This approach will however contribute to promoting public debate and decision-making that is informed by evidence based analysis.

These types of questions ultimately link to wider questions surrounding the implications of patent activity for society.

b) Social Issues:

3. Do patents within the portfolio raise substantive social issues?

Examples of issues to be considered here are whether the patent is likely to positively contribute to society by making new knowledge and innovations available within that society? The assessment of this question will need to be balanced against assessment of whether the patent may generate negative impacts such as restricting access to medicines, agricultural resources, scientific knowledge or technological innovations.[83]

For example, the patenting of traditional medicines within developing countries may raise substantive social issues surrounding whether such behaviour is appropriate in relation to the rights of indigenous peoples or knowledge and material regarded as forming part of the 'collective' national heritage. Substantive questions may also be raised surrounding gender and the status of women i.e. in relation to traditional knowledge or the implications of the collection of unfertilised eggs during IVF treatment that may subsequently form the foundation for patent applications.

c) Science:

4. Do patents within the portfolio raise issues for science and the openness of science (positive or negative)?

Examples of issues to be considered in the assessment of the implications for science include evaluation of the quality of the scientific contribution set out within the application or grant. At this point assessment of whether the knowledge, methods and material set out within the application is new, involves an inventive step (is non-obvious), and is capable of industrial application is appropriate. Furthermore, is the information provided within the patent sufficiently clear that someone "skilled in the art" could reproduce the claimed invention based on the information provided?

This in turn is linked to the question of the nature of the claims set out in the application. Thus, does the patent clearly disclose a definable product? Alternatively, are the claims within the patent constructed in such a way as to encompass all potential conceivable uses, or multiple uses, of the biological and genetic material? Particular attention should be paid here to patents that make reference to the components of organisms on the species, genus, family and class level and to the use of terms such as "comprising" and "homology" or "homologous" or similar terms intended to maximise the scope of protection. These patents commonly fall into the category of "research tools" style patents intended to make claims over the basic components of organisms and basic scientific knowledge (i.e. raw extracts, compounds, DNA and proteins such as enzymes) rather than a specific product. [84]

The assessment of the scientific content and quality of patents within a portfolio or multiple portfolios can contribute to the assessment of the wider implications of patent activity for the science community (broadly conceived) on the national level. In particular, this assessment can contribute to developing analysis of the potential or actual positive impacts of patent protection upon science and innovation and the potential or actual negative impacts of permitting patent protection. Here it may be noted that these questions are increasingly at the heart of intensifying debates surrounding science and the patent system in developed countries.[85]

81 UNESCO Bioethics site. Location: <http://portal.unesco.org/shs/en/ev.php-URL_ID=1372&URL_ DO=DO_TOPIC&URL_SECTION=201.html>.

82 The SciDev.net web portal provides a useful series of resources in relation to ethics. Location: <http://www.scidev.net/dossiers/index.cfm?fuseaction=dossierItem&Dossier=5>.

83 For debates in relation to intellectual property and access to medicines see the recent work of the World Health Organisation Commission on Intellectual Property Rights, Innovation and Public Health. Location: <http://www.who.int/intellectualproperty/en/>. For recent debates in relation to Agriculture see the work of GRAIN <http://www.grain.org/front/> and the ETC Group <http://www.etcgroup.org/>.

84 National Research Council (1996) *Intellectual Property Rights and Research Tools in Molecular Biology*. Summary of a Workshop Held at the National Academy of Sciences, February 15-16, 1996. Location: <http://books.nap.edu/html/property/>.

85 Royal Society *Keeping Science Open: The Effects of Intellectual Property Policy on the Conduct of Science*. London: Royal Society. (2003) Location:<http://www.royalsoc.ac.uk/files/statfiles/document-221.pdf>. See also, Merrill, S, and Levin, R and Myers, M (eds.) (2004) *A Patent System for the 21st Century*. Committee on Intellectual Property Rights in the Knowledge-Based Economy, Board on Science, Technology and Economic Policy and Global Affairs Division. National Research Council of the National Academies. Washington: National Academies Press. Location: <http://www.nap.edu/html/patentsystem/0309089107.pdf>. See also proposals relating to open patent reviews, Location: <http://dotank.nyls.edu/communitypatent/>, and the "science commons", location: <http://sciencecommons.org/>.

d) Economic:

5. Do patents within the patent portfolio raise substantive economic questions?

The rationale for permitting patent protection in relation to biological and genetic material and traditional knowledge is ultimately an economic one. The key argument here is that in the absence of incentives to invest in innovation this will not take place. When viewed internationally, a central argument behind the internationalisation of patent protection is that in the absence of the security provided by patent protection, companies and other economic actors will not possess security that their inventions will not be cheaply reproduced by potential competitors. This lack of security represents a disincentive to invest in research and development in the country concerned or to make the product available in the country concerned. This is particularly true, it is argued, in the case of "knowledge" goods that are easily reproduced once the knowledge and techniques involved are known.

In approaching the economic implications of patents within a portfolio a two stage approach is likely to be the most practical. The first of these relates to patents that may be held over biological and genetic material within a specific country (i.e. a country of origin). The second stage involves considering the economic implications of patent activity in other countries.

On the national level the central questions are:

1. Does the applicant make a substantive contribution to new knowledge directed towards contributing to the economy by making a new and useful product available within the country?
2. Is the application or grant essentially speculative in character and directed towards securing rents through licensing?
3. Will the award of a patent within the country of origin impact upon economic activity relating to that material or knowledge within the country of origin (i.e. positively or negatively)?
4. Is any evidence provided of benefit-sharing, or intentions to engage in benefit-sharing, with indigenous peoples, farmers or local communities providing knowledge or material disclosed in the patent application?
5. What will be the implications of the patents for the realisation of the Millennium Development Goals and related development commitments.

In relation to patent activity outside the country of origin the following questions arise:

1. Will patent grants in relation to the claimed material impact upon the capacity of the country of origin to export the material, either in raw or modified product form, into jurisdictions where patent protection is in force?
2. Is any evidence provided or otherwise available for benefit-sharing agreements or arrangements to share benefits with communities and countries of origin?
3. Is there any evidence (i.e. financial filings with state authorities) that the individual, company or organisations holding a patent has secured revenue based on the patent?
4. If so, what form has this revenue taken (i.e. sale of a material product on the market, or income in the form of rents derived from licensing or combinations of the two)?
5. Is the patent likely to make a substantive contribution to new knowledge directed towards contributing to the economy of the country where the patent is in force, or being sought, or is it essentially speculative in character?

These questions are located in the wider context of debates surrounding the positive and negative impacts of patent activity upon Foreign Direct Investment (FDI), enhanced trade in goods and services, and technology transfer in relation to patent activity.[86] To date, the evidence for such positive effects has been both limited and mixed in the case of developing countries.[87] However, limited attention has so far been paid to economic analysis of the relationship between biotechnology and patent protection in developing countries. Furthermore, the relationship between the patent system and competition policy in the biotechnology sector is an increasing focus of attention on the national and international level.[88]

The analysis of patent portfolios is likely to make a constructive contribution to evidence based approaches to the actual economic effects of patent protection in relation to biodiversity and traditional knowledge in an era of globalisation. This analysis is presently severely lacking and is linked to the need to develop indicators of national, regional and international activity to inform analysis and decision-making for patent activity in relation to biological diversity and traditional knowledge.[89]

86 World Bank (2001) *Global Economic Prospects and the Developing Countries 2002*. Washington: The International Bank for Reconstruction and Development/The World Bank.

87 Fink, C and Maskus, K (eds.) (2005) *Intellectual Property and Development: lessons from recent economic research.* Oxford: Oxford University Press and the International Bank for Reconstruction and Development/ The World Bank. Location: <http://www.worldbank.org/research/IntellProp_temp.pdf>.

88 OECD (2005) *Intellectual property and competition policy in the biotechnology industry*. OECD Policy Brief, June 2005. Paris: Organisation for Economic Co-operation and Development. Location: <http://www.oecd.org/dataoecd/36/4/35040373.pdf>. See also, FTC 2003 *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*. A Report by the Federal Trade Commission, October 2003. Location: <http://www.ftc.gov/os/2003/10/innovationrpt.pdf>.

89 OECD (2005) *A Framework for Biotechnology Statistics*. Paris: Organisation for Economic Co-operation and Development. Location: <http://www.oecd.org/dataoecd/5/48/34935605.pdf>. For wider discussion see Maskus, K and Reichman, J (eds.) (2005) *International Public Goods and Transfer of Technology Under a Globalized Intellectual Pro*

e) Environmental:

6. Are there any substantive environmental issues associated with the patent portfolio?

The association between patent activity and environmental issues relating to the conservation and sustainable use of biological diversity may be indirect.[90] That is impacts upon the conservation status of a particular species, or the impacts of a particular technology such as "Terminator" or Genetic Use Restriction Technologies (GURTS), featuring in a patent portfolio may occur independently of the existence of patents.

However, patent activity contained within an international patent portfolio can serve to highlight emerging trends and provide a basis for analysis of the implications of new technologies in accordance with the precautionary principle.[91] The following basic questions arise in relation to the environmental implications of patent activity for biodiversity.

1. Do patents in the portfolio involve species that are listed under CITES, the IUCN "Red List" or otherwise classified as endangered or protected?[92]
2. Do patents within the portfolio involve the use of raw extracts of species or non-synthetic compounds collected *in situ* from species listed under CITES, the IUCN "Red List" or otherwise classified as endangered or protected?
3. Do the technologies disclosed in the patent portfolio raise substantive environmental issues regarding actual or potential impacts upon the conservation and sustainable use of biological diversity when viewed from the perspective of the precautionary principle?[93]
4. Will technologies disclosed in the patent portfolio impact upon the conservation and sustainable use of agricultural biodiversity and the ability of farmers to freely conserve, exchange, use and sell seed (i.e. under Annex 1 of the ITPGRFA)?[94]
5. Will patent activity impact upon protected areas and the inhabitants of protected areas (i.e. positively or negatively)?[95]

f) Legal dimensions:

7. Do patents within the international patent portfolio raise substantive legal issues?

Legal issues arising within an international patent portfolio relating to biological diversity will be observable on a variety of different levels and encompass a range of areas of law including the customary laws of indigenous peoples. In the first instance analysis of the legal implications of a patent portfolio should proceed with analysis of compliance with national legislation relating to access to genetic resources (where such legislation exists) and other relevant areas of law i.e. the customary laws of relevant indigenous peoples. The analysis should then proceed to regional and international level agreements, treaties and Conventions. In considering international level agreements attention is drawn to the need for assessment of the relationship between the provisions of the Convention on Biological Diversity and the TRIPS agreement as a key point of contention in international debates.

Conclusions and Recommendations:

The methods set out in this paper provide a practical guide to conducting research on patent activity for biological diversity and traditional knowledge within the international patent system. While the problem of biopiracy has become a major focus of attention within developing countries, this paper has revealed that the problem must be seen in the wider context of concern surrounding the implications of patent protection in both developing and developed countries.

As the OECD has remarked, one central problem with the internationalisation of the patent system over the course

perty Regime. Cambridge: Cambridge University Press. See also, Scotchmer, S (2004) *Innovation and Incentives*. Cambridge, Mass: MIT Press.

90 Dutfield, G (2000) *Intellectual Property Rights, Trade and Biodiversity*. London: Earthscan.

91 The precautionary principle as set out in the 1992 *United Nations Declaration on Environment and Development* states that: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".

92 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Location: <http://www.cites.org/>. IUCN Red List. Location: <http://www.iucn.org/themes/ssc/redlists/rlindex.htm>. For issues raised in Antarctica see Lohan, D. and Johnston, S. (2003) *The International Regime for Bioprospecting: Existing Policies and Emerging Issues for Antarctica*. UNI/IAS Report. UNU-IAS Institute of Advanced Studies. Tokyo: United Nations University. In relation to marine resources on the deep sea bed see, Arico, S. and Salpin, C (2005) *Bioprospecting of Genetic Resources in the Deep Seabed: Scientific, Legal and Policy Aspects*, UNU-IAS Institute of Advanced Studies. Tokyo: United Nations University.

93 For example Genetic Use Restriction Technologies (GURTS). For information under the Convention on Biological Diversity see, location: <http://www.biodiv.org/programmes/areas/agro/gurts.asp>. For information on NGO views see ETC Group <http://www.etcgroup.org/> and Ban Terminator <http://www.banterminator.org/>

94 International Treaty on Plant Genetic Resources for Food and Agriculture. Location: <http://www.fao.org/AG/cgrfa/itpgr.htm>.

95 Johnston, S and Lohan, D (2003) Biodiversity and access and benefit-sharing policies for protected areas. UNU-IAS Institute of Advanced Studies. Tokyo: United Nations University. See also, Oldham, P (2004a) Global Status and Trends in Intellectual Property Claims: Microorganisms. *Global Status and Trends in Intellectual Property Claims*, Issue No. 2. Location: <http://cesagen.lancs.ac.uk/resources/papers.htm>.

of the last 20 years is that this process of expansion was not based on 'hard economic evidence or analysis'.[96] Limited attention was also initially paid to the evidence based analysis of the human rights, ethical, social, scientific, economic, environmental and legal implications of this process. Where such analysis has been conducted it has generally been limited to consideration of specific issues (i.e. patentability for DNA, the ethics of stem cell patents). The relative paucity of attention to the economic justification for the extension of patent protection into the realm of biological diversity and the wider implications of intellectual property appears to owe more to the influence of pressure groups and rent-seeking behaviour than attention to evidence.[97]

This paper has argued that the assessment of patent activity in relation to biodiversity and traditional knowledge requires an integrated evidence based approach that combines quantitative and qualitative analysis. Taking into account the scale of patent activity in relation to biodiversity this can best be achieved through the promotion of increased research collaborations between individuals and organisations directed towards, but not limited to, the main questions provided in this paper. These collaborations will ideally contribute to a wider open review or audit of the patent system and the purposes it is intended to serve in the 21st Century.

The pursuit of evidence based assessment of patent activity for biodiversity and traditional knowledge is occurring at a time of rapid transformations in scientific understandings of biological diversity on the genetic and the cellular level. As we have seen in this paper this is reflected in the wide range of techniques and technologies that are being applied to biological diversity within the patent system. The transformations described in this paper are being heralded by some as the emergence of a "knowledge based bioeconomy" that promises the arrival of technologies and products that are "clean, clever and competitive".[98] Intellectual property protection is seen as central to this process.

However, the application of a single model of intellectual property protection to diverse areas of science and technology is increasingly being questioned by civil society organisations, the scientific community and industry. At a time of dramatic transformations in science and technology we need to take a step back and allow ourselves to ask bold questions. What do we want the world to look like and what purposes should the emerging bioeconomy serve? What is the appropriate role of the patent system in pursuing those purposes and what adjustments are necessary? On a wider level what alternative models might be developed to promote science and innovation directed towards those purposes that recognise the human rights, ethical, social, economic, environmental and legal contexts in which particular models are located?

In seeking to address these questions this paper provides four practical recommendations:

1. The formation of open-ended interdisciplinary research groups to conduct and coordinate evidence based analysis;[99]
2. The refinement and improvement of research methods for biodiversity, traditional knowledge and the patent system;
3. The development of indicators on the national, regional and international level to inform science, society and policy;
4. The development of alternative models to promote science and innovation directed towards agreed goals.

96 OECD (2004) *Patents and Innovation: Trends and Policy Challenges.* Paris: Organisation for Economic Co-operation and Development. Location: <http://www.oecd.org/dataoecd/48/12/24508541.pdf>.

97 Ibid. OECD (2004). For information on rent-seeking see: a) Tullock, G (1993) *Rent Seeking.* The Shaftesbury Papers, 2. Aldershot: Edward Elgar Publishing Ltd, and; b) Krueger, A (1974) 'The Political Economy of the Rent-Seeking Society', *American Economic Review*, vol. LXIV, 291-303.

98 OECD (2005) Proposal for a major Project on the Bioeconomy in 2030: A Policy Agenda. Organisation for Economic Co-operation and Development. Location: <http://www.insme.org/documenti/THE BIOECONOMY IN 2030_project.pdf>. See also the website of the European Commission, location <http://europa.eu.int/comm/research/conferences/2005/kbb/links_en.html> and EuropaBio <http://www.bio-economy.net/>. See also UNCTAD (2001) The New Bioeconomy: Industrial and Environmental Biotechnology in Developing Countries. Ad Hoc Expert Group Meeting, Palais de Nations, Geneva 15-16 November 2001. Location: <http://r0.unctad.org/trade_env/test1/publications/newbioeconomy.pdf>

99 The work of INDECOPI in Peru in establishing a working group to review maca related patents provides a useful example of the formation of such groups on the national level.

Annex 1: General Resources for Patent Research on Biological Diversity and Traditional Knowledge[100]

Global Biodiversity Information Facility (GBIF)	<http://www.gbif.net/portal/index.jsp>	Free
TROPICOS	<http://mobot.mobot.org/W3T/Search/vast.html>	Free
Royal Botanic Gardens, Kew	<http://www.rbgkew.org.uk/data/categories.html>	Free
Plants Database	<http://plants.usda.gov/>	Free
International Plant Names Index	<http://www.ipni.org/index.html>	Free
HortiPlex Plant Database	<http://hortiplex.gardenweb.com/plants/>	Free
Ethnobotany database	<http://ukcrop.net/perl/ace/search/EthnobotDB>	Free
Plantas Medicinais	<http://www.ciagri.usp.br/planmedi/planger.htm>	Free, Brazil
Economic Botany	<http://www.econbot.org/home.html>	Subscription
Journal of Chinese Medicine	<http://www.jcm.co.uk/>	Subscription, pay per view
Chemical Abstracts	<http://www.cas.org/>	Subscription
BIOSIS	<http://www.biosis.org/>	Subscription
MEDLINE	1.<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed> 2. <http://medline.cos.com/>	1. free 2. Subscription
EMBASE	http://www.embase.com/	Free
AGRICOLA	<http://agricola.nal.usda.gov/>	Free
PUBMED	<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed>	Abstracts, Free
NCBI	<http://www.ncbi.nlm.nih.gov/>	Free global search engine in multiple areas of biology and science
Bergey Trust	<http://www.bergeys.org/resources.html>	Free. For microorganisms, culture collections and databases
Journal of Ethnopharmacology	<http://www.elsevier.com/locate/jethpharm>	Subscription
Pharmaceutical Biology	<http://www.szp.swets.nl/szp/frameset.htm?url=%2Fszp%2Fjournals%2Fpb.htm>	Subscription
Fitoterapia	<http://www.sciencedirect.com/science/journal/0367326X>	Subscription
Journal of Natural Products	<http://pubs.acs.org/journals/jnprdf/>	Subscription
Journal of Nutrition	<http://www.nutrition.org/>	Subscription
Phytochemistry	<http://www.sciencedirect.com/science/journal/00319422>	Subscription, pay per view
Phytotherapy Research	<http://www3.interscience.wiley.com/cgi-bin/jhome/12567>	Subscription, pay per view
Planta Medica	<http://www.thieme.de/plantamedica/>	Subscription
Indian Journal of Traditional Knowledge	<http://niscair.res.in/ScienceCommunication/sci.asp?a=topframe.htm&b=leftcon.asp&c=ResearchJournals/rejour/rejour1.htm&d=test1>	India
Medicinal and Aromatic Plants	<http://niscair.res.in/ScienceCommunication/sci.asp?a=	Bi-monthly,
Abstracts	topframe.htm&b=leftcon.asp&c=AbstractingJournals/abstracting_journals.htm&d=test2>	International Abstracts
Wikipedia	<http://en.wikipedia.org/wiki/Main_Page>	Free encyclopaedia

100 Named journals are drawn from WIPO (2005) Handbook of Industrial Property Information and Documentation: Minimum Documentation under Rule 34.1 (B)(III) of the regulations under the Patent Cooperation Treaty (PCT). Location: <http://www.wipo.int/scit/en/standards/pdf/04-02-01.pdf>.

Annex 2: IPC Formula Matrix by Sector and Area of Technology

Notes:

1. Use the main indicators to interrogate activity within a sector (i.e. A01H for agriculture). Alternatively combine the main indicators with indicators for a technology area (i.e. A01H or C12N15/82). Indicators can also be combined to review only patent documents that contain both classifiers i.e. A01H1 and C12N15/82 for genetic engineering for plants.

2. Patent databases will frequently vary in the way that classifiers can be used. For example at the USPTO classifier codes must be at least four characters in length (use the truncation mark $ i.e. A61K$). This will also capture all subsidiary documents. Where conducting searches on the group level i.e. A61K35 or A61K36 for ethnobotanicals plants use icl/(A61K035$ or A61K036$). If combining the search with other classifiers remove the "/". If in doubt, consult the help page of the relevant database. Experimentation will frequently be necessary.

	Main Classifiers	**Organic Chemistry**	**Combinatorial Technology***	**Biochemistry/ Biotechnology**	**DNA**	**Genetic Engineering**	**Enzymology**	**Tissues/ Stem Cells/ Plant Meristems**	**Genomics**	**Proteomics**	**Nanotechnology**	**Bioinformatics**
Agriculture	A01H	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	A01H1 C12N15/82	C07K C12N9 C12P C12Q	A01H4 C12N5 C12N5/05 C12N15/82	C12N C12P C12Q	C07H C12N C12Q G01N G06F	B82B	C12Q1/68 C12N G01N G06F
Genotype	A01H1	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15/82	C07K C12N9 C12P C12Q	A01H4 C12N5 C12N5/05 C12N15/82	C12N C12P C12Q	C07H C12N C12Q G01N G06F	B82B	C12Q1/68 C12N G01N G06F
Phenotype	A01H3	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15/82	C07K C12N9 C12P C12Q	A01H4 C12N5 C12N5/05 C12N15/82	C12N C12P C12Q	C07H C12N C12Q G01N G06F	B82B	C12Q1/68 C12N G01N G06F
Tissue Culture	A01H4	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15/82	C07K C12N9 C12P C12Q	C12N5/04	C12N C12P C12Q	C07H C12N C12Q G01N G06F	B82B	C12Q1/68 C12N G01N G06F
Animals	C12N15/06 C12N15/85	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15/85	C07K C12N9 C12P C12Q	C12N5/06	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82B	C12Q1/68 C12N G01N G06F
Biocides	A01N	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82B	C12Q1/68 C12N G01N G06F
Foodstuffs	A23L	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82B	C12Q1/68 C12N G01N G06F
Dental	A61K6	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82B	C12Q1/68 C12N G01N G06F
Cosmetics	A61K8	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	A61K8/66 C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82	C12Q1/68 C12N G01N G06F
Ethnobotanicals	A61K35 A61K36	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82B	C12Q1/68 C12N G01N G06F

	Main Classifiers	Organic Chemistry	Combinatorial Technology*	Biochemistry / Biotechnology	DNA	Genetic Engineering	Enzymology	Tissues/ Stem Cells/ Plant Meristems	Genomics	Proteomics	Nanotechnology	Bioinformatics
Pharma-ceuticals	A61K31	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5 C12N5/06 C12N5/08	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51 B82	C12Q1/68 C12N G01N G06F
Industrial Chemistry	C07 C08 C09 C11	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Organic Dyes	C09B	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Paints/ Varnishes	C09D	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Natural Resins	C09F	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Glues and adhesives	C09H C09J	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Fats, oils, waxes	C11B	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Perfumes	C11B9	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Fatty acids	C11C	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F
Detergents	C11D	C07C C07D C08H C08L	C40B	C12N C12P C12Q C12S	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5	C12N C12P C12Q	C07H C12N C12Q G01N G06F	A61K9/51B 82B	C12Q1/68 C12N G01N G06F

Annex 3: International Patent Portfolio *Lepidium meyenii* or Maca

Patent No.	Title	Inventor	Applicant	Patent Family	Legal Status	Documents
1. US6878731	Imidazole alkaloids from Lepidium meyenii and methods of usage	Cui Baoliang (US); Zheng Bo Lin (US); He Kan (US); Zheng Qun Yi (US)	Assignee: Pure World Botanicals (US)	1. AU2003265433 A1 - 2004-03-03 2. CN1684680 A - 2005-10-19 3. EP1536787 A2 - 2005-06-08 4. US6878731 B2 - 2005-04 12 US2004034079 A1 - 2004-02-19 5. WO2004016216 A2 - 2004-02-26 WO2004016216 A3 - 2004-04-29 6. US2005171081 A1 - 2005-08-04	1. no. 2. no 3. yes 4. yes 5. yes 6 . no	1. - 2. - 3. yes 4. - 5. yes 6. -
2. US6552206	Compositions and methods for their preparation from lepidium	Zheng Bo Lin (US); He Kan (US); Shao Yu (US); Zheng Qun Yi (US)	Assignee: Pure World Botanicals (US)	1. AU3864900 A - 2000-09-21 2. CA2362858 A1 - 2000-09-08 3. EP1180006 A2 - 2002-02-20 EP1180006 A4 - 2004-06-16 4. US6267995 B1 - 2001-07-31 5. US6428824 B1 - 2002-08- 06 US2002061341 A1 - 2002-05-23 6. US6552206 B1 - 2003-04-22 US2003068388 A1 - 2003-04-10 7. US2002042530 A1 - 2002-04-11 8. WO0051548 A2 - 2000-09-08 WO0051548 A3 - 2001-11-15	1. no 2. no 3. yes 4. yes 5. yes 6. yes 7. no 8. yes	1. - 2. - 3. yes 4. - 5. - 6. - 7. - 8. yes
3. US6428824	Compositions and methods for their preparation from lepidium	Zheng Bo Lin (US); Kim Calvin Hyungchan (US); Wolthoff Stephen (US); He Kan (US); Rogers Lingling (US); Shao Yu (US); Yi Zheng Qun (US)	Assignee: Pure World Botanicals (US)	As for No. 2 above	-	-
4.US6267995	Extract of Lepidium meyenii roots for pharmaceutical applications	Zheng Bo Lin (US); Kim Calvin Hyungchan (US); Wolthoff Stephen (US); He Kan (US); Rogers Lingling (US); Shao Yu (US); Zheng Qun Yi (US)	Assignee: Pure World Botanicals (US)	As for No. 2 above	-	-
5. US6093421	Maca and antler for augmenting testosterone levels	Deluca Daryll (US); Sparks William S (US) +1	Biotics Research Corp (US); Deluca Daryll (US) + 2	1. AU7390200 A - 2001-03-26 2. CA2403271 A1 - 2001-03-08 3. EP1263448 A1 - 2002-12-11 EP1263448 A4 - 2003-04-02 4. JP2003523945T T - 2003-08-12 5. US6093421 A - 2000-07-25 6. WO0115713 A1 - 2001-03-08	1. no 2. yes 3. yes 4. no 5. no 6. yes	1. - 2. - 3. yes 4. - 5. - 6. yes
6. US6444237	Herbal composition for enhancing sexual response	Heleen, Pamela, A (US)		1. US6444237 B1 - 2002-09-03	1. yes	1. -
7. US6803060	Composition to boost libido	Rejes, J (US)		1. US6803060 B2 - 2004-10-12 US2002068728 A1 - 2002-06-06	1. no	1. -
8. US6737085	Apocynum venetum extract for use as antidepressant	Nishibie Sansei (JP); Sasaki Tsutomu (JP); Seo Shujiro (JP); Butterwek, V (DE).		1. JP2002201139 A - 2002-07-16 2. US6737085 B2 - 2004-05-18 US2002090403 A1 - 2002-07-11	1. no 2. no	1. - 2. -
9. US6368617	Dietary supplement	Hastings, C (US) et. al	Reliv' International Inc (US)	1. US6368617 B1 - 2002-04-09	1. yes	1. -
10. US20060034897	Delivery system for two or more active components as part of an edible composition	Boghani; Navroz (US); Gebreselassie; Petros; (US)		1. US2005112236 A1 - 2005-05-26 2. US2005214348 A1 - 2005-09-29 3. US2005220867 A1 - 2005-10-06 4. US2005260266 A1 - 2005-11-24 5. US2006034897 A1 - 2006-02-16 6. WO2005051427 A1 - 2005-06-09	1. no 2. no 3. no 4. no 5. no 6. yes	1. - 2. - 3. - 4. - 5. - 6. -
11. US20060018867	Cosmetic composition and production thereof	Kawasaki; Yuji; et al. (JP)	Chisso Corp	1. EP1604647 A1 - 2005-12-14 2. JP2005350454 A - 2005-12-22 3. US2006018867 A1 - 2006-01-26	1. yes 2. no 3. no	1. yes 2. - 3. -
12. US20060004026	Compositions for ameliorating attention -deficient/hyperactivity disorder	Kumagai; Tomoko; et al. (JP)		1. CA2417837 A1 - 2003-01-29 2. CN1212836C C - 2005-08-03 CN1449283 A - 2003-10-15 3. EP1393725 A1 - 2004-03-03 EP1393725 A4 - 2006-03-08 4. JP2002363074 A - 2002-12-18 5. MXPA03001060 A - 2003-05-27 6. US2006004026 A1 - 2006-01-05 7. WO02100393 A1 - 2002-12-19	1. no 2. no 3. yes 4. no 5. no 6. no 7. yes	1. - 2. - 3. yes 4. - 5. - 6. - 7. yes

Patent No.	Title	Inventor	Applicant	Patent Family	Legal Status	Documents
13. US20050181083	Diet food product	Takagaki, Kinya; et al. (JP)		1. JP2004242663 A - 2004-09-02 2. US2005181083 A1 - 2005-08-18	1. no 2. no	1. - 2. -
14. US2005036954	Combination of tooth-paste, a chemical agent and natural herbs for improving sexual performance	Zuckerman, A (US)		1. US2005036954 A1 - 2005-02-17	1. no	1. -
15. US20050143340	Adenosyl-cobalamin fortified compositions	Collins, Douglas A		1. US2003018009 A1 - 2003-01-23 2. US2005143340 A1 - 2005-06-30 3. WO03000010 A2 - 2003-01-03 WO03000010 A3 - 2003-05-01	1. no 2. no 3. yes	1. - 2. - 3. yes
16. US20050053678	Methods and compositions for betel nut chewing gum	Gow, R.(US); Pierce, J (US); Sypert, G (US)		1. AU2002343538 A1 - 2003-10-20 2. AU2002353829 A1 - 2003-10-20 3. AU2003282700 A1 - 2004-04-23 4. BR0213120 A - 2004-12-28 5. CA2462661 A1 - 2003-04-10 6. CA2486480 A1 - 2003-10-16 7. CN1592618 A - 2005-03-09 8. CN1625408 A - 2005-06-08 9. EP1467726 A2 - 2004-10-20 10. JP2005504817T T - 2005-02-17 11. JP2005526105T T - 2005-09-02 12. US7001620 B2 - 2006-02-21 US2004071794 A1 - 2004-04-15 13. US2003099756 A1 - 2003-05-29 14. US2004072897 A1 - 2004-04-15 15. US2004081664 A1 - 2004-04-29 16. US2004202738 A1 - 2004-10-14 17. US2005037025 A1 - 2005-02-17 18. US2005053678 A1 - 2005-03-10 19. US2005069596 A1 - 2005-03-31 20. US2005089584 A1 - 2005-04-28 21. US2005089591 A1 - 2005-04-28 22. US2005118293 A1 - 2005-06-02 23. WO03028662 A2 - 2003-04-10 WO03028662 A3 - 2003-08-07 24. WO03084512 A1 - 2003-10-16 25. WO03084558 A1 - 2003-10-16 26. WO2004030684 A2 - 2004-04-15 WO2004030684 A3 - 2004-09-23 27. WO2004091644 A1 - 2004-10-28 28. WO2005039612 A1 - 2005-05-06 29. WO2005041997 A1 - 2005-05-12	1. no 2. no 3. no 4. no 5. no 6. no 7. no 8. no 9. yes 10. no 11. no 12. no 13. no 14. no. 15. no 16. no 17. no 18. no 19. no 20. no 21. no 22. no 23. yes 24. yes 25. yes 26. yes 27. yes 28. yes 29. yes	1. - 2. - 3. - 4. - 5. - 6. - 7. - 8. - 9. yes 10. - 11. - 12. - 13. - 14. - 15. - 16. - 17. - 18. - 19. - 20. - 21. - 22. - 23. yes 24. yes 24. yes 26. yes 27. yes 28. no 29. no
17. US20050008690	Multi-phase, multi-compartment capsular delivery apparatus and methods for using same	Miller, F (US)		1. AU2003220689 A1 - 2003-10-27 2. CA2481486 A1 - 2003-10-23 3. EP1499303 A2 - 2005-01-26 4. JP2005528383T T - 2005-09-22 5. US2003194428 A1 - 2003-10-16 6. US2003194429 A1 - 2003-10-16 7. US2003194430 A1 - 2003-10-16 8. US2003194431 A1 - 2003-10-16 9. US2005008690 A1 - 2005-01-13 10. WO03086267 A2 - 2003-10-23 WO03086267 A3 - 2003-12-18 WO03086267 B1 - 2004-04-29	1. no 2. no 3. yes 4. no 5. no 6. no 7. no 8. no 9. no 10. yes	1. - 2. - 3. yes 4. - 5. - 6. - 7. - 8. - 9. - 10. yes
18. US20040265400	Compositions for enhancing sexual responsiveness	Barone, F. Jr (US); Jacobsen, C (US); (US); Chumenko, K (US);		1. US2004265400 A1 - 2004-12-30 2. WO2004071437 A2 - 2004-08-26 W9O2004071437 A3 - 2005-04-28	1. no 2. yes	1. - 2. yes
19. US20040202738	Methods and compositions of areca catechu	Gow, R (US).; Pierce, B (US); Pierce, J (US); Birdsall, W (US)		1. AU2002343538 A1 - 2003-10-20 2. AU2002353829 A1 - 2003-10-20 3. AU2003282700 A1 - 2004-04-23 4. BR0213120 A - 2004-12-28 5. CA2462661 A1 - 2003-04-10 6. CA2486480 A1 - 2003-10-16 7. CN1592618 A - 2005-03-09 8. CN1625408 A - 2005-06-08 9. EP1467726 A2 - 2004-10-20 10. JP2005504817T T - 2005-02-17 11. JP2005526105T T - 2005-09-02 12. US7001620 B2 - 2006-02-21 US2004071794 A1 - 2004-04-15 13. US2003099756 A1 - 2003-05-29 14. US2004072897 A1 - 2004-04-15 15. US2004081664 A1 - 2004-04-29 16. US2004202738 A1 - 2004-10-14 17. US2005037025 A1 - 2005-02-17	1. no 2. no 3. no 4. no 5. no 6. no 7. no 8. no 9. yes 10. no 11. no 12. no 13. no 14. no 15. no 16. no 17. no 18. no	1. - 2. - 3. - 4. - 5. - 6. - 7. - 8. - 9. yes 10. - 11. - 12. - 13. - 14. - 15. - 16. - 17. - 18. -

Patent No.	Title	Inventor	Applicant	Patent Family	Legal Status	Documents
				18. US2005053678 A1 - 2005-03-10 19. US2005069596 A1 - 2005-03-31 20. US2005089584 A1 - 2005-04-28 21. US2005089591 A1 - 2005-04-28 22. US2005118293 A1 - 2005-06-02 23. WO03028662 A2 - 2003-04-10 WO03028662 A3 - 2003-08-07 24. WO03084512 A1 - 2003-10-16 25. WO03084558 A1 - 2003-10-16 26. WO2004030684 A2 - 2004-04-15 WO2004030684 A3 - 2004-09-23 27. WO2004091644 A1 - 2004-10-28 28. WO2005039612 A1 - 2005-05-06 29. WO2005041997 A1 - 2005-05-12	19. no 20. no 21. no 22. no 23. yes 24. yes 25. yes 26. yes 27. yes 28. yes 29. yes	19. - 20. - 21. - 22. - 23. yes 24. yes 25. yes 26. yes 27. yes 28. yes 29. yes
20. US2004137131	Maca products and their uses	Bobrowski, P (US)	-	1. US2004137131 A1 - 2004-07-15	1. no	1. -
21. US20040071825	Agglomerated granular protein-rich nutritional supplement	Lockwood, C (US);		1. AU2003287150 A1 - 2004-05-04 AU2003287150 A8 - 2004-05-04 2. US2004071825 A1 - 2004-04-15 3. WO2004034986 A2 - 2004-04-29 WO2004034986 A3 - 2005-01-20	1. no 2. no 3. yes	1. - 2. - 3. yes
22. US20030180414	Method of controlling release of bitterness inhibitors in chewing gum and gum produced thereby	Gudas, V (US); Reed, M.(US); Schnell, P (US); Tyrpin, H (US); Witkewitz, D (US); Greenberg, M (US); Wolf, F (US);	(Family members assigned to Wrigley W M Jun Co (US)	113 patent family members for Australia, Brazil, Canada, China, Germany, Europe (EP), Japan, Mexico, Poland, Russia, United States, PCT - WO (14)	-	For WO and EP
23. US2003077296	Sense Enhancing Topical Gel	Denton M and Hurst G (US)		1. US2003077296 A1 - 2003-04-24	1. no	1. -
24. US20030099689	Dietary formulations including peptides	Dabrowski, K (S); Lee, Kyeong-Jun (US);	Ohio State Research Foundation (US)	1. US2003099689 A1 - 2003-05-29	1. no	1. -
25. US20030018009	Adenosyl-cobalamin fortified compositions	Collins, D (US);		1. US2003018009 A1 - 2003-01-23 2. US2005143340 A1 - 2005-06-30 3. WO03000010 A2 - 2003-01-03 WO03000010 A3 - 2003-05-01	1. no 2. no 3. yes	1. - 2. - 3. yes
26. US20030104076	Process for preparing dry extracts	Berkulin, W (US); Theissing, Karl-Hans (US);		1. CN1582144 A - 2005-02-16 2. EP1443909 A1 - 2004-08-11 3. JP2005515174T T - 2005-05-26 4. PL368307 A1 - 2005-03-21 5. RU2004117089 A - 2005-04-10 6. US6753017 B2 - 2004-06-22 7. US2003086982 A1 – 2003-05-08 US2003104076 A1 - 2003-06-05 8. WO03039515 A1 - 2003-05-15	1. no 2. yes 3. no 4. no 5. no 6. yes 7. no 8. yes	1. - 2. yes 3. - 4. - 5. - 6. - 7. - 8. yes
27. US20020127285	Rhodiola and uses thereof	Xiu, R (US);		1. US6399116 B1 - 2002-06-04 2. US2002127285 A1 - 2002-09-12	1. no 2. no	1. - 2. -
28. WO03053146	Composition and Method for improving sexual desire and overall sexual activity	Haygood Don Perry (US)	Herturn LL Arizona Ltd LIAB (US);	1. AU2002232687 A1 - 2003-07-09 2. WO03053146 A1 - 2003-07-03	1. no 2. yes	1. - 2. yes
29. WO03047610	Composition and method to increase female sexual desire and sexual satisfaction	Haygood Don Perry (US)	Herturn LL Arizona Ltd LIAB (US); Haygood Don Perry (US)	1. AU2002227225 A1 - 2003-06-17 2. WO03047610 A1 - 2003-06-12	1. no 2. yes	1. - 2. yes
30. JP2005143397	Method for producing root vegetable tablet, and the resultant root vegetable tablet	Hirate Masao	Sanshin Unyu KK	1. JP2005143397 A - 2005-06-09	1. no	1. -
31. JP2005000033	Food	Indo Haruko	Shinbijuumu KK	1. JP2005000033 A - 2005-01-06	1. no	1. -
32. JP2004224784	Esthetic clinic for infertility using Lepidium Meynii WALP	Yamazaki Misuzu		1. JP2004224784 A - 2004-08-12	1. no	1. -
33. JP2004000171	Functional food containing Maca	Ogawa Hiroshi; Mitsunaga Toshiro (+1)	Towo Corp	1. JP2004000171 A - 2004-01-08	1. no	1. -
34. JP2000319120	Cosmetic composition including vegetable extract having moisture retaining property	Toki Masako; Kondo Mitsuko; (+1)	Ichimaru Pharcos Inc	1. JP2000319120 A - 2000-11-21	1. no	1. -
35. JP2002161043	Skin Care Preparation	Hirano Atsushi	TS AASU KK	1. JP2002161043 - 2002-06-04	1. no	1. -
36. JP2002034507	Health Assisting Food	Koide Kazuhiko	Wandaa KK	1. JP2002034507 A - 2002-02-05	1. no	1. -
37. JP2001354526	Hair restoration or hair tonic	Nakazawa Nobuhiko, Nakai Yoshiaki	Nakazawa Nobuhiko, Nakai Yoshiaki	1. JP2001354526 - 2001-12-25	1. no	1. -
38. JP2001348334	Nutrition Supplement	Yamada Tsuyoshi	Astrim KK	1. JP2001348334 A - 2001-12-18	1. no	1. -

Patent No.	Title	Inventor	Applicant	Patent Family	Legal Status	Documents
39. JP2001136920	Vitality Promotion food and method of producing the same	Ogino Motohei; Aisaka Asako	Shiyaburon KK	1. JP3557548B2 B2 - 2004-08-25 JP2001136920 A - 2001-05-22	1. no	1. -
40. JP2001039854	Skin preparation for external use	Mitsuma, T	Sanko Busan KK	1. JP2001039854 A - 2001-02-13	1. no	1. -
41. JP8012565	Skin external preparation	Komazaki Hisayuki; Shibata Yuki; Yagi Eiichiro; Naganuma Masako; Fukuda Minoru.	Shiseido Co. Ltd.	1. JP8012565 A - 1996-01-16	1. no	1. -
42. WO2005094860	Agent Improving Peripheral Blood Flow	Yoshida Yuji (JP); Kiso Yoshinobu (JP); Matsumoto Yuta (JP)	Suntory Ltd (JP); Yoshida Yuji (JP); Kiso Yoshinobu (JP); Matsumoto Yuta (JP)	1. JP2005281272 A - 2005-10-13	1. yes	1. -
43. WO2005094859	Agent improving moisture retention function of skin	Yoshida Yuji (JP); Kiso Yoshinobu (JP);	Suntory Ltd (JP); Yoshida Yuji (JP)	1. JP2005281271 A - 2005-10-13	1. yes	1. -
44. WO2005095573	Alcoholic Dring [Drink] Containing Maca Extract	Matsumoto Takehiro (JP); Kato Megumi (JP)	Suntory Ltd (JP); Matsumoto Takehiro (JP); Kato Megumi (JP)	1. JP2005312430 A - 2005-11-10	1. yes	1. -
45. WO2005072684	Process for Producing Maca Extract	Kato Megumi (JP); Suwa Yoshihide (JP);	Suntory Ltd (JP); Kato Megumi (JP); (+4)	1. WO2005072684 A1 - 2005-08-11	1. yes	1. -
46. WO2004052123	Zinc-Rich Foods having effect of preventing diabetes	Kojima Yoshitane (JP) and Yoshikawa Yutaka (JP) + 3	Arita Junichi (JP); Kojima Yoshitane (JP) + 4	1. AU2003271099 A1 - 2004-06-30 2. JP2004201675 A - 2004-07-22 3. WO2004052123 A1 - 2004-06-24	1. no 2. no 3. yes	1. - 2. - 3. yes
47. CN1615965	Maka nano liposome and its preparing method	Wang Kemin (CN); Tan Weihong (CN); (+1)	University of Hunan (CN)	1. CN1615965 A - 2005-05-18	1. no	1. -
48. CN1416734	Anti-fatigue health food	Chen Wenjun (CN)	Chen Wenjun (CN)	1. CN1416734 A - 2003-05-14	1. no	1. -
49. WO2004112742	Maca extract and cosmetic composition containing such an extract	Piccardi Nathalie (FR) and Piccirilli Antoine (FR)	Expanscience Lab (FR);Piccardi Nathalie (FR) +3	1. FR2856298 A1 - 2004-12-24 2. WO2004112742 A2 - 2004-12-29 WO2004112742 A3 - 2005-02-24	1. no 2. yes	1. - 2. yes
50. FR2834718[101]	Active substances for use in cosmetic and/or pharmaceutical products, obtainable from the fermentation of plant components and/or plant extracts	Moussou, P (FR); Danoux, L(FR); Pauly, G (FR)	Cognis Corporation, (US) and (FR)	1. AU2003205571 A1 - 2003-07-30 2. EP1461059 A1 - 2004-09-29 3. FR2834718 A1 - 2003-07-18 FR2834718 B1 - 2004-12-24 4. US2005089499 A1 - 2005-04-28 5. WO03059368 A1 - 2003-07-24 PCT/EP03/00066 January 7, 2003	1 2. yes 3 4 5. yes	1. - 2. yes 3. - 4. - 5. yes

Annex 3: International Patent Portfolio *Lepidium meyenii* or Maca (Continued)

Patent No.	Title	Inventor	Applicant	Patent Family	Legal Status	Documents
Lepidium (illustration only)						
WO2005063274	Methods and Compositions to Enhance Endogenous IGF. Production and their uses.	Bobrowski, P (US)	Santerra Pharmaceuticals Inc (US); Bobrowski, P (US)	1.WO2005063274 A1	1. yes	1. no
p-methoxybenzyl isothiocyanate (illustration only)						
US4183925	7-Aminophenylacetamido DELTA..sup.3 -cephem antibacterial agents and method of use	Baxter and Braham,	Pfizer (1980)	39 members	1. no	1. -
US4144240	Substituted mercapto-thiadiazole compounds	Baxter and Braham.	Pfizer (1979)	39 members	1. no	1. -
US4080451	Cephalosporin derivatives	Baxter and Braham.	Pfizer (1978)	39 members	1. no	1. -
methoxybenzyl isothiocyanate (illustration only)						
US5859015	N-heterocyclic piperazinyl and H-heterocyclic piperazinonyl inhibitors of farnesyl-protein transferase	Graham, Samuel L (US); Williams, T (US)	Merck	1. US5859015 A - 1999-01-12	1. yes	1. -

101 This patent was located through the USPTO patent publications and subsequent identification in esp@cenet. The patent number is listed based on the priority number (FR20020000423)

Annex 4

Draft Coding Matrix for Patent Assessment

This coding matrix has been developed to assist in the use and further development of quantitative and qualitative assessment criteria for the analysis of international patent portfolios. This may be used or modified as researchers see fit.

Species/Genus: **Patent Publication Number:**
Inventor: **Application? (Y=1, N=0)**
Applicant/Assignee: **Grant? (Y=1, N = 0)**
Filing Date: **Grant Date:**

Title: (insert)
Abstract: (insert)

1. Institution Details:

Who is engaged in patent activity in relation to biodiversity and traditional knowledge?

Category	Yes (=1)	Category	Yes (=1)	Country Code
1. Individual(s)		4. State		
2. Company		5. Other		
3. PRO				

Notes: a) PRO stands for Public Research Organisation i.e. University, Alumni association, non-profit research organisation; b) Country code refers to the country of residence of the applicant(s); c) Two letter country codes are provided as part of the PCT Applicants Guide and can be downloaded via WIPO. Location: <http://www.wipo.int/pct/guide/en/gdvol1/annexes/annexk/ax_k.pdf>

2. Application Route:

Through what routes are applicants seeking patent protection?

	Country Code		Country Code		Regional Code	International Code (WO)
Publication Country		Priority Country		Instruments		

3. Patent Family:

Does the application involve claims in multiple jurisdictions? How many patents are in force?

	Yes (=1)	No (=0)	Number of members	Legal Status (Y=1, N=0)	EPO Documentation (Y=1, N=0)
Patent Family?					
			Patents in Force?		

Notes: For coding patent families see the chart below.

3. Sector, Type and Scope:

1. In what sectors of activity does the patent fall?
2. At what levels are claims being constructed?
3. Do patents involve more than one type of species or organism or their components?

	Agriculture	Biocides	Foodstuffs	Dental
Main Classifiers	A01H	A01N	A23	A61K6
Coding	Yes = 1	Yes = 1	Yes = 1	Yes = 1
Component				
Variety				
Species				
Genus				
Family				
Class				
Multiple				
	Cosmetics	**Ethnobotanicals**	**Pharmaceuticals**	**Industrial Chemistry**
	A61K7 & A61K8	A61K35 A61K36	A61K31	C07, C08, C09, C11
Coding	Yes = 1	Yes = 1	Yes = 1	Yes = 1
Component				
Variety				
Species				
Genus				
Family				
Class				
Multiple				

4. Technology Indicators:

What is the main area of technology into which the patent falls?

Area	Raw Extracts or Ingredients	Organic Chemistry	Combinatorial Technology	Biochemistry or Biotechnology
Main Classifiers	A23 A61K35	A61K31, C07, C08, C09, C11	C40B	C12N to C12S
Coding	Yes = 1	Yes = 1	Yes = 1	Yes = 1
Area	**DNA**	**Genetic Engineering**	**Enzymology**	**Tissues Stem Cells Meristems**
Main Classifiers	C07H	C12N15	C07K C12N9 C12P C12Q	C12N5
Coding	Yes = 1	Yes = 1	Yes = 1	Yes = 1
Area	**Genomics**	**Proteomics**	**Nanotechnology**	**Bioinformatics**
Main Classifiers	C12N C12P C12Q	C07H C12N C12Q G0IN	A61K9/51 B82B	C12Q1/68 C12N G0IN G06F
Coding	Yes = 1	Yes = 1	Yes = 1	Yes = 1

Note: Where the patent falls outside these broad categories add further details. See the coding matrix in Annex 2.

4) Disclosure:

1. Do patent applicants disclose the origin(s) or source(s) of the biodiversity and/or traditional knowledge involved in the patent application?
2. Is any evidence provided of consent or benefit-sharing agreements or arrangements?

	Yes = 1	No=0	Notes:
IPLC			
Country			
Countries			
Region			
Source Collection			
Benefit-sharing			

Note: IPLC stands for Indigenous Peoples or Local Communities

5) Eligibility:

	Yes = 1	No=0	Notes:
New (prior art)			
Inventive Step (non-obvious)			
Industrial Applicability			

6) Implications:

Does the patent application or grant possess substantive human rights, ethical, social, scientific, economic, environmental or legal implications?

Category	Yes=1/No=0	Category	Yes = 1/ No = 0
Human Rights		Scientific	
Ethical		Economic	
Social		Environmental	
Legal			
a) Customary Law			
b) National Law			
c) Regional			
d) International			

Notes: Customary law refers to the customary laws of indigenous peoples and local communities.

7) Reasoning:

Where the assessment of the patent document results in a positive score i.e. under eligibility or implications explain the reasoning under the relevant category heading (expand as needed).

Patent Family Coding Matrix

Notes:

Two letter country codes are provided as part of the PCT Applicants Guide and can be downloaded via WIPO.

Location: <http://www.wipo.int/pct/guide/en/gdvol1/annexes/annexk/ax_k.pdf>

A = Application(s) Numbers
G= Patent Grant(s) Numbers

Code	A	G	Code	A	G	Code	A	G	Code	A	G
AD			BW			EP			ID		
AE			BY			ER			IE		
AF			BZ			ES			IL		
AG			CA			ET			IN		
AI			CD			FI			IQ		
AL			CF			FJ			IR		
AM			CG			FK			IS		
AN			CH			FO			IT		
AO			CI			FR			JM		
AP			CK			FR			JO		
AR			CL			GA			JP		
AT			CM			GB			KE		
AU			CN			GC			KG		
AW			CO			GD			KH		
AZ			CR			GE			KI		
BA			CS			GH			KM		
BB			CU			GH			KN		
BD			CV			GL			KP		
BE			CY			GM			KR		
BF			CZ			GN			KW		
BG			DE			GQ			KY		
BH			DJ			GR			KZ		
BI			DK			GS			LA		
BJ			DM			GT			LB		
BM			DO			GW			LC		
BN			DZ			GY			LI		
BO			EA			HK			LK		
BR			EC			HN			LR		
BS			EE			HR			LS		
BT			EG			HT			LT		
BV			EH			HU			LU		

Patent Family Coding Matrix (Continued)

A = Application(s) Numbers
G= Patent Grant(s) Numbers

Code	A	G	Code	A	G	Code		G
LV			OM			SY		
LY			PA			SZ		
MA			PE			TC		
MC			PG			TD		
MD			PH			TG		
MG			PK			TH		
MK			PL			TJ		
ML			PT			TL		
MM			PW			TM		
MN			PY			TN		
MO			QA			TO		
MP			RO			TR		
MR			RU			TT		
MR			RW			TV		

Code	A	G	Code	A	G	Code		G
MS			SA			TW		
MT			SB			TZ		
MV			SC			UA		
MW			SD			UG		
MX			SE			US		
MY			SG			UY		
MZ			SH			UZ		
NA			SI			VA		
NA			SK			VC		
NE			SL			VE		
NG			SM			VG		
NL			SM			VN		
NO			SN			VU		
NP			SO			WO		
NR			SR			YE		
NZ			ST			ZA		
OA			SV			ZM		
						ZW		

The Peruvian Society for Environmental Law (SPDA) is a non for profit civil organization funded in 1986 which works in Environmental Law and Policy. SPDA is organized in four Programs: Conservation; International Affairs and Biodiversity; Environmental Management and Policy and Public Interest Defense.

SPDA provides legal and technical assistance and consultancy services, executes specific projects and promotes and disseminates Environmental Law through its information and capacity building activities.

The Andean Amazon Biopiracy Prevention Initiative is a two year long project in its first phase. It is supported by the *International Development Research Centre* (IDRC) of Canada. The Initiative web page is: http://www.biopirateria.org

The objectives of this project are to prevent and confront biopiracy in relation to the regions biological resources and traditional knowledge. In order to achieve this, a series of activities are proposed at the national, regional and international levels. These include: strengthen the *National Commission for the Prevention of Biopiracy in Peru*, initiate the conformation of similar working groups in Brazil, Ecuador, Colombia and Venezuela, assign research papers, organize a regional biopiracy meeting, coordinate actions and strategies among partner institutions in these countries, coordinate actions with the *Andean Community* and the *Organization of the Amazon Cooperation Treaty*, among others.

SPDA thanks IDRC for its continued support to this Initiative.

Peruvian Society for Environmental Law

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