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INDIGENOUS PEOPLES'
BIODIVERSITY NETWORK

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COPs... and Robbers Transfer-Sourcing Indigenous Knowledge

Pirating Medicinal Plants

Synopsis: Pharmaceutical companies don't want to study rare plants. They want to test the most commonly-used species. The valuable medicinal plants are those with the longest track record in the most locations. In a survey of almost one thousand medicinal plant uses around the world, most of the pharmacologically- (and commercially) interesting species are employed in more than one community, and often, in several countries. This is great news for BioPirates, who can move benevolently from place to place in search of the best deal. It is bad news for the South, and for indigenous peoples, whose knowledge is increasingly usurped by Northern corporations. In this paper, the Indigenous Peoples' Biodiversity Network and RAFI conclude that the Biodiversity Convention must be restructured into a strong multilateral framework facilitating South-South cooperation, or the COPs will be overrun by the robbers.

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The Indigenous Peoples' Biodiversity Network

RAFI Occasional Papers are usually based on original research and data collection undertaken directly by RAFI staff. This *COPS and Robbers* issue, prepared for the first meeting of the COPs (Conference of the Parties to the Convention on Biological Diversity, Bahamas, 28 November - 9 December, 1994) has been researched and written in collaboration with the Indigenous Peoples' Biodiversity Network (IPBN). Most of the information on commercial interest in specific plant species, as well as the medicinal uses of these species, has been provided by the Network and its coordinator, Alejandro Argumado of Cultural Survival - Canada.

The Indigenous Peoples' Biodiversity Network is an association of indigenous peoples in all regions of the world who have expressed a common interest in nurturing and developing biological diversity at the eco-system, species, and genetic levels for their own benefit, and for that of humankind.

The IPBN is an active information clearing house of and for indigenous peoples working to protect their knowledge and to insure that they benefit from their bio-cultural innovations. IPBN is active in indigenous knowledge and intellectual property issues, and strongly promotes the protection of indigenous peoples cultural integrity. Networking allows IPBN members to increase their common efforts and to speak with a clear voice on issues of policy.

Almost one thousand medicinal plant uses have been reviewed. Each plant species is presently identified by one or more transnational pharmaceutical enterprises as being the subject of investigation. The Indigenous Peoples' Biodiversity Network and RAFI have determined not to cite specific medicinal plants in relation to particular indigenous peoples. While much of the information is available from a number of other published sources, this compilation could encourage the very biopiracy we are anxious to prevent.

COPs ... and Robbers
Transfer-Sourcing Indigenous Knowledge
and
Pirating Medicinal Plants

Medicinal plants and microbials from the South contribute at least \$30 billion a year to the North's wealthy pharmaceutical industry according to RAFI in a recent study published by UNDP. Can the Biodiversity Convention help indigenous communities and countries to benefit from their own medical genius? The South's Biodiversity is certainly "Green Gold", but unlike the stuff in the ground, Green Gold gets around. BioPirates often have their choice of countries and of indigenous communities to take from. The question for COPs, meeting in the Bahamas, is whether or not the Biodiversity Convention will remain a multilateral endorsement for BioPirates to bargain bilateral deals that neither countries nor COPs can police, or whether it can become a strong multilateral framework for South-South cooperation and South-North benefit.

The (all too) Movable Feast

While the Biodiversity Convention's Conference of the Parties (COPs) convenes in the Bahamas to consider ways by which the South can benefit from plant conservation, local Bahamian healers may be making their own calculations on the market value of one plant - *Nopalea*. Used in a medicinal preparation to treat boils, the *Nopalea* genus is something of a miracle worker. Traditional herbalists also recommend parts of the plant as an expectorant; for the treatment of tuberculosis; and to fend off diarrhoea. *Nopalea* can also heal wounds. At least one prominent pharmaceutical enterprise thinks the plant warrants investigation. When the company brought its researchers together at the end of August, 1994, *Nopalea* was square on the agenda. Some of the folks around the board table could smell commercial opportunity. Maybe a bilateral contract with local healers in the Bahamas? A little "up-front" money and then a deal on royalty sharing if a new drug makes it into world markets?

Or, maybe not. The catch is that *Nopalea* is the wandering kind. Over the centuries, its footloose ways have taken it to Turkey where it is also used for diarrhoea and dysentery. In Mexico, *Nopalea* is used against inflammations, and Chilean healers find the plant effective on tumours. In Lesotho, they eat *Nopalea* as a fruit. If the Bahamas or Turkey or Chile or Mexico or Lesotho, don't want to strike a deal on the commercial use of the plant, the company can always fall back on what their researchers call "Amerindians" in the United States who have variously used the plant for sore eyes, headaches, and (COPs delegates take note) insomnia. There are even records of early European colonists in Appalachia using the plant, and two other company accounts of the plant medicinally employed "elsewhere". If folks in the Bahamas want to make money on *Nopalea*, they need to talk to indigenous communities stretching from the Southern Cone to Southern Africa. As is almost always the case with biological resources, the dream of windfall profits is illusory. The Saranahua of Peru have known this for sometime. For them, *Nopalea* is a hallucinogen.

The COPS don't just have to worry about robbers in the Bahamas. Consider the famous agreement between Costa Rica's InBio and Merck, the giant multinational pharmaceutical house. According to the 1991 deal, Costa Ricans will get a royalty slice of the Merck profit pie for any biomaterials their parataxonomists pull out of the rainforest. But what if Merck decides to commercialise *Simarouba Glauca*? Costa Ricans use the plant to fight malaria and amoebiasis. But Mexicans use the same plant for the same purposes as well as dyspepsia and general fevers. In nearby El Salvador, *S. Glauca* is used for Saturday night drinking and (conveniently) to clear up tummy aches. Along with some of the aforementioned uses, healers in the Dominican Republic like the plant for colic and gonorrhoea, and Haitians use it for everything from rheumatism to soap.

Nopalea is an anti-diarrhetic in Turkey and a hallucinogen in Peru. Its' side-effect may be insomnia in the Bahamas.

Cash 'n Carry?

There are, of course, regions where the biodiversity is so profound and the innovative experiences of indigenous communities so deep, that it would seem to make sense for a large pharmaceutical enterprise to strike a "generic" bargain with local healers for joint research over a long period. One such area is arguably the Choco region on the Pacific Coast of Colombia. Choco lands average 400 species of trees and 800 vertebrates per hectare and the people have a proud medical research tradition. BioPacífico, a non-profit joint effort by UNDP, WWF, and the Colombian Ministry of the Environment, hope to work with the Choco to develop local markets for medicinal plants and to explore overseas commercialization as well. As BioPacífico officials point out, over 3,000 of the world's antibiotics are made from bacteria found in tropical rain forests such as that in Choco.¹

True enough. One of the most commercially successful antibiotics the world has ever known, erythromycin, came to market in 1952 after Filipino researchers made it available to Eli Lilly. Lilly acknowledged the Filipino contribution by naming their patented drug after the province from which the discovery was made - Iloilo. Despite continuing protests from Philippine officials and local healers, however, the pharmaceutical transnational has refused to share any of its profits - reported to run to billions of dollars - with the people who brought forward the invention². How will indigenous communities benefit when companies do not need to acknowledge the source of the germplasm they receive?

Simarouba also made drug company "to do" lists, but nobody should hold their breath waiting for the funds to flow.

These are not isolated examples. Ethiopians for example, use a relative of the Bahamas' little money machine, *Nopalea Ficus-Indica*, as a medicine for leprosy. The same plant species shows up on herbal lists from South Africa to Argentina to China, Spain, Italy, the USA, Haiti, and Mauritius. Healers commend its use for sores, spasms, sunburns, calluses, corns, diarrhea, diabetes, as a decongestant, and for measles and kidney problems in Sicily, tumours in Haiti and Mauritius, and to beat back piles in China.

Problems can arise even when the valued plant species stays reasonably close to home. Ethiopians also use another plant, *Securidaca Longipedunculata*, as a purgative. So do Ghanaians, who like the plant for rheumatism, a variety of venereal diseases you don't even want to think about, and morning-after headaches. The plant has still other uses in Sierra Leone, Togo, Angola, Zimbabwe, and Botswana, as well as Senegal, Nigeria, and Guinea. If Merck, Glaxo, or a little biotech boutique like Shaman Pharmaceuticals comes calling, who gets the royalties - or how will the monies, if any, be divided?

ForShaman

And Shaman Pharmaceuticals is coming to call. Indeed, it is one of the most vocal and visible of a swarm of transnationals attracted to the sweet honey - and easy pickings - of indigenous knowledge of medicinal plants.

With its corporate competitors, Shaman has invited traditional healers and ethnobotanists to advise them on the pharmacological merits of at least 145 plant species. The Indigenous Peoples' Biodiversity Network and RAFI have compiled as many of these corporate lists as they have been able to obtain, to develop a picture of the nature and scope of the pharmaceutical industry's interest in indigenous knowledge and medicinal plants.

Almost one thousand (986) indigenous medical uses are under investigation involving the 145 species. Despite the avowed commitment of some of the companies, such as Shaman Pharmaceuticals, to the recognition of - and compensation for - indigenous knowledge, barely six percent (58) of the uses studied are ascribed to a named community. Often, the community is only identified as "Amerindian" or "Creole". In almost 20% (193) of the 986 uses noted, the origin of the technology was given neither as an indigenous community nor even as a country, but simply as "multiple sources" or "elsewhere". When the time comes to commercialize a new plant-based pharmaceutical, it will be entirely up to corporate goodwill whether a company credits an indigenous community's contribution.

To date, although Shaman and friends have won some patents and many others are pending, there is little evidence of this goodwill, aside from rumours of providing a cow for one community, and fly-past medical assistance for another.

U.S. patent 5,211,944 issued in May, 1993 may be a case in point. Shaman claims its patented product produces a powerful antiviral agent that can be used in making *proanthocyanidin polymers* that can be used to combat influenza, herpes, and some respiratory ailments. The company isolated the agent from "a *Croton* or a

BioPirates are looking at more than 145 medicinal plant species. In less than 6% of the cases, corporate lists identify the name of an indigenous community that has provided information

Calophyllum plant species" which it says can now be "chemically synthesized" - meaning no more need for biomaterials from the originating community. In fact, there is no mention whatever of any indigenous people, although Shaman does allow that the plant species involved is a "weed" in at least seven Central and South American countries. The question for the New Age, politically-correct, capitalists at Shaman is, how can a plant employed for medicinal purposes be called a "weed"? ForShaman, it's all in the eyes of the patent holder.

According to Shaman Inc., the promising medicinal plant, Calophyllum, is a "weed" available in at least 7 countries

Mighty Murky Merck

In 1991-93, Merck paid Costa Rica's InBio (a non-governmental organization) U.S.\$1,135,000 (over the two years of the agreement) for 10,000 biological accessions gathered by local parataxonomists. The partners agreed on an undisclosed royalty sharing formula, thought to be in the range of 2-3%.

Costa Rica's rainforests are estimated to hold 5-7% of the world's remaining Biodiversity³. If this deal were widely replicated, the South's biodiversity could all be auctioned off for about \$10 million per annum. Merck's sales in 1991 were \$8.6 billion, while Costa Rica's GNP that year was \$5.2 billion.⁴ Merck's research budget in 1991 was roughly \$1 billion. Indeed, Merck has three drugs with sales in excess of \$1 billion each. Given that pharmaceutical companies invest an average of \$231 million on

research for each new drug, the discovery charge for one single new drug arising from the deal is barely loose change⁵. The deal required Costa Rica to provide Merck samples at an average payment of \$113 per sample⁶. Non-commercial plant collection costs often run to \$400 a sample for crop species. For Merck, the Costa Rica contract was a cheap labour and money-saving propaganda exercise. If, twenty years from now, Merck disputes the origin of a plant-derived active ingredient (was it really El Salvador?) the country's capacity to appeal to the international courts is mostly theoretical. Merck has more patent lawyers than all of Costa Rica. *Beta selinene*, for example, can be extracted from tree leaves in Costa Rica, but tree-wise BioPirates know from published literature that the same material is available in Venezuela, Mexico, Brazil, Honduras - and the home turf of many pharmaceutical multinationals, U.S. controlled Puerto Rico. Pharmacologically-interesting *Iserfia* compounds appear to be in abundance in Costa Rica where high percentages of the active material have been recorded. Other samples, however, have been extracted from Colombia and Brazil, and another drug company notes six samples where the origin is simply "not given". Alkaloids from another plant species have been extracted from leaves in Costa Rica, but also from the bark of related species in Brazil, and from the trunk wood of yet another woody relative in Colombia.

Costa Rica's attractiveness for Merck, of course, is not merely its impressive, if nonexclusive, diversity, but also its political uniformity and the low visibility of complicating indigenous communities in that country - communities that could prove much more difficult in other parts of tropical America.

Transfer-Sourcing

Back in the 1970s, UNCTAD traced the profit trail of multinational drug companies across Latin America, Asia, and Europe. UN officials documented case after case of companies arbitrarily declaring their profits in whatever country they found most useful for tax or

political purposes. As pharmaceutical companies traded within their own subsidiaries (about 30% of all international trade in the Seventies was between subsidiaries of the same parent - the proportion is thought to have increased substantially since then), concepts such as cost, price, and profit were largely theoretical. Extractive mining companies operated the same way. Whether it was Orinoco ores or Andean tin and copper, the mining company proclaimed its profits either in Latin America or in the U.S.A. as convenient.

Transfer-pricing was the mainstay of foreign mining companies operating in Venezuela and Peru. Today's BioPirates can use transfer-sourcing for the new extractive industry

The new extractive industry is biomaterials and accompanying indigenous knowledge about them. As well as transfer-pricing, however, BioPirates can use a corporate trick unavailable to old-time dirt-diggers. BioPirates can use transfer-sourcing and claim they acquired their biomaterials from whatever country and community they can extract the best agreement.

In surveying close to one thousand examples of uses for 150 medicinal plant species, RAFI and the Indigenous Peoples' Biodiversity Network have discovered that a substantial majority of the species used medicinally by one indigenous community are also used, often for the same purpose, by another community and, for 35% of the plants, in at least one other country.

Consider *Amthurium tessmannii*, used as a contraceptive in Colombia by three different indigenous nations. Who among them should get the contract? The roots of *Anthurium uleanum* are used for headaches by two Panamanian communities. *Dipteryx odorata* is used by one indigenous community in Haiti and by another in Guyana/Brazil. While people in one community use the bark as an antipyretic, people in the other bathe their children in a solution containing parts of the plant. Again, who should benefit?

Although world attention appears to be fixated on Latin America, the search for new medicines is intense everywhere that indigenous knowledge has not been destroyed. *Emilia sonchifolia* may have originated in China. Today in India, the dried aerial parts of the plant are used as an astringent, whereas in Thailand, the same parts are used for asthma. When the whole plant is dried in Brazil, it combats fever, but in the Philippines it is used to remedy infant coughs and - back home in China (Taiwan) - *Emilia sonchifolia* is administered for liver disorders. In other parts of China, the plant's dried leaves are used for dysentery and fevers. (The same dried leaves are judged poisonous in Thailand.) Fresh leaf juice is applied externally to children's throats to ease tonsillitis in India - where *Emilia sonchifolia* is also employed for eye inflammation, night blindness, and sore ears. Thai's use the plant's dried roots as a back-up treatment for tuberculosis.

The three rules of Real Estate (Property) sales are said to be Location, Location, Location. For BioPirates, there is only one rule - the location can be anywhere as long as the pirate can claim intellectual property

Africa has a long and impressive list of medicinal plants based on local knowledge. *Securidaca Longepedunculata* is a tropical plant found almost everywhere in Africa. The dried bark and root are used in Tanzania as a purgative for nervous system disorders. One cup of root decoction is administered daily for two weeks. Throughout East Africa, the plant's dried leaves are used for wounds and sores, coughs, venereal disease, and snakebite. In Malawi, the leaves are used for wounds, coughs, bilharzia, venereal disease, and snakebite. The fresh leaves in Malawi cure headaches. The dried leaves act on skin diseases in Nigeria.

According to one pharmaceutical researcher, the root is used in "Bechuanaland" and "Rhodesia" for malaria, while the same part of the plant is used for impotence in "Tanganyika". (We can

only hope the drug company is a little more up-to-date medically than it is politically!)

Meanwhile, in Angola, the dried root is used as both a fish poison and (in botanical testimony to the power of love) as an aphrodisiac. The same dried roots have religious significance in Guinea-Bissau and are understood to have a psychotropic effect. The root bark is used for epilepsy in Ghana.

Stachytarpheta Jamaicensis - despite its limiting name - casts its net around the world. In Taiwan, the dried aerial plant is used for liver disease. In India, Malaysia, and the Bahamas, different parts of the plant are consumed (sometimes as a tea) to abort pregnancy. Indonesian women use the roots for the same purpose. Yet in Trinidad, the same leaves used for abortion in Malaysia are mixed into a tea to stimulate milk production among nursing mothers. African women take parts of the plant orally for dysmemorphia. Jamaican and Argentinean women use the entire plant as an emmenagogue, but Jamaican children take *Stachytarpheta Jamaicensis* to treat worms. In the West Indies generally, adults crush the leaves in a cloth to obtain a juice that is drunk over nine successive days to excise worms. In India, the leaves cure fevers, purulent ulcers, dysentery, and rheumatic inflammation.

Sometimes the old extractive industries are also the new bio-extractors. Maxus Petroleum of the United States is a case in point. As the drilling company stakes out a 120 km road through the heart of Ecuador's Yasuni National Park, it has contracted with the Missouri Botanical Gardens to catalogue the plants it encounters along the way. To date, 1,200 different species have been identified including 18 new to science and more important for transfer-sourcing, fully 200 species documented in the flora of neighbouring countries that can now also form a part of the so-called "sovereignty" of Ecuador. Here, once again, diversity is the spice of profit.

Not *Intellectual Property* but *Collectual Integrity*

Does this mean that there is no hope for local benefit from the conservation and enhancement of medicinal plants and other forms of biological diversity? No. The benefits to the South in general, and to indigenous communities in particular, should be great. But the economic returns will have to come through South-South cooperation.

As it is with crop germplasm, medicinal plants do not lend themselves to geographic or intellectual isolation. Rather than sanction bilateral, *beggar-thy-neighbour*, barter and bickering, the Biodiversity Convention must become the multilateral framework for South-South collaboration and South-North negotiation over access to - and development of - germplasm. When indigenous communities encounter the North's intellectual property regime, as lawyer, Patricia Cummings says, "a system of generosity is pitted against a system of greed". The solution is not to adopt intellectual property but to strengthen the community innovation capacity - the *collectual integrity* - of indigenous communities.

When indigenous peoples encounter patents, a system of generosity confronts a system of greed. Greed usually wins

There are already proposals coming forward at COPs for the development of a special protocol to the Convention to cover agricultural biodiversity. The protocol should be strongly supported. The logical negotiating process for this agricultural protocol is through the UN Food and Agriculture Organization (FAO) and its high-level Fourth International Technical Conference on Plant Genetic Resources which will be held in Leipzig, Germany in June, 1996. This negotiating process is already well-underway in the South and is being very efficiently served by an FAO Secretariat uniquely created for this specific purpose.

The Biodiversity Convention however, may have to address directly the issue of medicinal plants and other biomaterials related to pharmaceuticals, cosmetics, and specialty industrial products or processes. If this is the case, a number of critical principles and concerns arise.

GCDC: Germplasm Cooperation among Developing Countries (as the UNDP once called it) requires some basic operating principles and a common funding mechanism. The principles are obvious.

Intellectual Integrity: The intellectual integrity of indigenous and other rural peoples must be confirmed within the Biodiversity Convention. This includes the right of indigenous peoples, collectively, to benefit from their traditions and genius, and to be compensated for their ongoing role in conserving and creating useful biomaterials.

PICNIC: Intellectual integrity also means the right of indigenous communities to say "no" to BioPirates, or to legitimate bio-prospectors. While it is proper and necessary to upgrade international accords related to PIC (*prior informed consent*) for the collection of biomaterials and indigenous knowledge, it is urgent that the Convention also acknowledge the right of nations and communities not to consent. Indeed, the assumption should be that communities have *No Intention of Consenting* (NIC).

Moratorium: As tables in this paper indicate, biopiracy is reaching pandemic proportions. The number of known bilateral agreements, perhaps a small fraction of actual agreements, is growing exponentially throughout Africa, Asia, and Latin America. In the absence of a convincing global ethic or clear intention on the part of the international community, indigenous communities and national governments have every right and reason to declare a moratorium on further collecting and new agreements.

GCDC

Key Elements within the Biodiversity Convention

Fundamental Requirements:

- * **Intellectual integrity of indigenous knowledge**
- * **Acceptance of PICNIC**
- * **Moratorium on bilateral agreements unless and until effective multilateral mechanism comes into force**
- * **No intellectual property on biological (or pharmaceutical) products or processes without adequate and effective compensation for indigenous innovation**

Global Funding Mechanism:

- * **On the basis of one country - one vote (donors of funds and donors of germplasm)**
- * **Full and effective decision-making participation of indigenous peoples' organizations on all political, scientific, and administrative committees**
- * **Funds for conservation and development at all levels**
- * **Special additional funding for community innovation**
- * **Transparency & "Freedom of Information"**

This is both unfortunate and unavoidable. Once equitable institutional and financial mechanisms are operational and supported by a strong multilateral umbrella, the measured flow of germplasm could resume (within the context of PICNIC).

No Patenting: There is no reason, at any time, to permit the patenting of living products or processes. There is even less reason for the South to allow intellectual property over biomaterials, or pharmaceuticals synthesized from biomaterials, when their own medicinal plants and indigenous knowledge lies unprotected and pirated by pharmaceutical companies. The international community should frankly recognize that current patent systems do not, and will not, protect the interests of informal community innovators. Governments should either multilaterally, or, if necessary, unilaterally - halt the patenting of these essential materials and abrogate any existing patents they find detrimental to their national development or to the intellectual integrity of communities.

Specifically, GATT's TRIPS (Trade-Related Intellectual Property) provisions should be suspended as they relate to biomaterials and pharmaceuticals. Any similar regional agreement (such as NAFTA) should also have its patent provisions suspended.

Table 1 below offers an evaluation of the capacity of different users to manage and benefit from current intellectual property regimes (whether patents or Plant Breeders' Rights). Transnational enterprises manage these systems very well. Public sector research institutes (South or North) tend to be much less effective. Indigenous communities will almost always find these same systems culturally and ethically alien as well as politically and economically inaccessible.

Indigenous communities will find patents ethically alien and economically inaccessible

Participation: It would be utterly unacceptable for the North to argue, or for the South to accept, that financial support and its attendant decision-making - are a *foreign aid* activity and, therefore, that some voting structure other than one country - one vote is appropriate. Were there not a high commercial (and still higher social) value attributed to medicinal plants, for

example, the issue of funding for biodiversity would not arise. If the dominant corporate sector in the North were not convinced that funds allocated to biodiversity conservation would be more than matched by profits yielded from exploitation, there would be no funds. Therefore, the institutional mechanisms established by the Convention must recognize the minority contribution of the donors of funds, and the majority contribution of the donors of germplasm.

Indigenous Peoples: Equally, COPs and individual governments must recognize their own limitations with respect to indigenous communities and knowledge. International and regional indigenous peoples' organizations must receive financial support to ensure their full and effective participation in all decision-making fora that affect the conservation and use of biomaterials and indigenous knowledge. Political, scientific, technical, and administrative organs of the Convention must guarantee the effective membership of indigenous peoples' organizations at all times. Programme and project funds allocated at all levels must ensure that substantial financial resources are made available directly to the indigenous communities involved in projects, and not through intermediaries.

From Frying Pan to Friar

As it stands, the Biodiversity Convention is little more than a shameless approval of bilateral contractual agreements that will pit indigenous communities and countries against one another to attract the interest of multinational biotechnology enterprises. The growth industry stimulated by the current Convention will come in the employment of brokers ("honest" or otherwise) and "middlemen". This is a poor substitute for a healthy and viable multilateral treaty that firmly sets out the acceptable conditions for additional bilateral accords (where necessary at all).

The English playwright, Shakespeare, who filled his plays with plants poisonous and aphrodisiac, warns us of moving too quickly from the frying pan, with the account of one honest broker of medicinal plants, Friar Laurence, in *Romeo and Juliet*. The Friar offered Juliet the use of a medicinal plant to escape her enemies, but the result led only to death.

*Many for many virtues excellent,
None but for some, and yet all different.
Oh, mickle is the powerful grace that lies
In herbs, plants, stones, and their true qualities.
For naught so vile that on the earth doth live,
But to the earth some special good doth give;
Nor aught so good but, strained from that fair
use,
Revolts from true birth, stumbling on abuse.
Virtue itself turns vice, being misapplied,
And vice sometime's by action dignified.
Within the infant rind of this small flower
Poison hath residence, and medicine power.
For this, being smelt, with that part cheers each
part,
Being tasted, slays all senses with the heart.*
(*Romeo and Juliet*, II.iii.13-26).

Table 1: Comparative Advantages in Managing Systems of Greed

Issue	Transnational Enterprises	Public Sector Institutes	Indigenous Communities
<p><i>Inventor:</i> In Intellectual Property (IP) law, an inventor is a named individual or a group of named individuals.</p>	<p>Enterprises have contractual arrangements to ensure that named inventor(s) surrender all or most of their rights to the company.</p>	<p>Institutes can have similar arrangements with their research scientists, depending on their arrangements with governments.</p>	<p>IP law does not recognize the concept of community invention. The concept of an individual inventor is sometimes alien to communities, and can cause difficulties.</p>
<p><i>Invention:</i> With exceptions, most inventions are highly specific micro-improvements that may have macro-applications.</p>	<p>Enterprises generally invent to improve their own production and/or market, and secondarily to license their invention to competitors.</p>	<p>Institutes tend to have less targeted research goals. The products of their discoveries are not usually as patentable.</p>	<p>Communities often develop complex macro-technology inventions that may be applicable only in micro-markets, or situations highly specific to the community. This makes patenting more problematic.</p>
<p><i>Requirements:</i> Depending somewhat on the IP system, requirements for a patent claim include: 1. standards of consistency (uniformity and stability over time) 2. creativity (evidence of an "inventive step") 3. non-obviousness, or novelty.</p>	<p>Enterprises generally deal with micro-improvements, and find these criteria difficult, but manageable.</p>	<p>Institutes, for reasons of experience and finance, are often less able to manage these criteria.</p>	<p>Since these criteria have little or nothing to do with the actual use of an invention, communities will probably find the criteria difficult to meet.</p>
<p><i>Preparation:</i> Isolation, purification and description of biomaterial for the purpose of patent application is critical to the success of the application, and is technically arduous.</p>	<p>Enterprises have scientific personnel, laboratories and experience to meet technical demands easily.</p>	<p>Institutes may or may not have the necessary personnel and equipment. Many institutes lack experience.</p>	<p>Community expertise and experience is radically different from the technical requirements for patent claims. Communities would generally have to trust or pay others to undertake this work.</p>
<p><i>Advice/Cost:</i> Access to highly-specialized legal advice from patent lawyers on biomaterials, costs between \$US 20,000 - \$40,000 in different jurisdictions.</p>	<p>Enterprises have in-house legal departments and ready access to specialist consultants.</p>	<p>Institutes generally have little in-house legal capacity, and little easy or inexpensive access to legal expertise.</p>	<p>Communities can generally not afford or obtain either basic or specialist advice.</p>
<p><i>Applications/Cost:</i> Forms are complex and fee structures vary from country to country. Fees can range from a few hundred to a few thousand dollars.</p>	<p>Enterprises have no problem with high fees.</p>	<p>Institutes may find application fees onerous.</p>	<p>Communities may find even application fees too expensive, since they must be paid in advance of any anticipated royalties.</p>

RAFI and the Indigenous Peoples' Biodiversity Network - COPS... and Robbers: Medicinal Plants

Issue	Transnational Enterprises	Public Sector Institutes	Indigenous Communities
<p><i>Coverage:</i> There are no universal patents. Generally, biomaterials are patented in the USA, Europe and Japan. It is entirely legal to exploit someone else's patent in a country that does not register the patent.</p>	<p>Enterprises generally apply for patents in every feasible country, often applying in more countries than necessary.</p>	<p>Institutes often make the mistake of patenting only in their own country, or in one of the major markets. An interested competitor could exploit the institute's invention from a country that does not honour the patent.</p>	<p>Communities will probably find it difficult to manage multi-state patents, for language and financial reasons.</p>
<p><i>Deposit:</i> It is customary for biomaterials that are subject to patent claim to be deposited in an institution designated by the patent office. At the American Type Culture Collection (ATCC), the annual cost of deposit is about \$500.</p>	<p>Enterprises meet this obligation routinely.</p>	<p>Institutes can usually meet this obligation, though cost is often a consideration.</p>	<p>Some communities may be concerned that such deposit could lead to a misuse of their invention. Communities may also find the cost high.</p>
<p><i>Disclosure:</i> To obtain a patent, the inventor must disclose the full invention, so that others can duplicate the process/results.</p>	<p>Enterprises often establish a number of related patents ("patent families") to prevent full disclosure and maximize their opportunity for profit.</p>	<p>Institutes dedicated to public scientific exchange generally make full disclosure in a single patent claim, thus exposing themselves to "imitation".</p>	<p>Communities may risk exposing their macro-innovation in a single patent, and then find it the subject of numerous micro-patent claims by others.</p>
<p><i>Exemption:</i> In order to encourage Scientific investigation, IP laws attempt to encourage access to patented technologies for basic research.</p>	<p>Enterprises make use of this "research exemption" to "invent around" patented ideas.</p>	<p>Institutes often find that others are "inventing around" their patented inventions, while they are enjoined by enterprises not to infringe on company claims. (Concern over the patent on the Hepatitis C virus is a case in point.)</p>	<p>Communities generally view themselves as "sellers" and not "buyers" of inventions. Research exemptions strengthen the hand of buyers over sellers.</p>
<p><i>Maintenance:</i> In most countries, patents lapse if annual maintenance fees are not paid. These fees generally rise as the patent wears on.</p>	<p>Enterprises have no difficulty financing or administering their patents through their legal departments.</p>	<p>Inexperienced public institutes may allow patents to lapse, because of administrative oversight or cost concerns.</p>	<p>Communities may encounter language and cost problems in administering patents from year to year.</p>
<p><i>Licensing:</i> Strategies for licensing patents to others are central to the effective maximization of benefits from a patent.</p>	<p>Enterprises tend to "cross-license" to one another - across different industries and geographic markets. Those unable to offer multi-technology and multi-market opportunities will benefit less.</p>	<p>Institutes, often by definition, operate in a single industry segment, and have a limited capacity to negotiate with counterparts in other parts of the world.</p>	<p>Communities will likely find it difficult to judge the fairness of licensing proposals, and will not be able to offer "trades" with prospective partners.</p>

Issue	Transnational Enterprises	Public Sector Institutes	Indigenous Communities
<p><i>Infringement:</i> Since intellectual property falls under civil and not criminal law, it is up to the patent holder to police and defend its patents. This can be extremely expensive and time consuming. If patent holders are unable to defend their patents, others will transgress them with impunity.</p>	<p>Enterprises often adopt an aggressive posture in defending patents and using claims as a means of declaring their market "turf".</p>	<p>Institutes tend to have an institutional persona that mitigates against strong patent defense. Sometimes institutes accede to political pressure not to challenge the private sector.</p>	<p>Communities will likely find it almost impossible to monitor and confront patent infringements around the world.</p>

Biopiracy Update

The pace of piracy is increasing. Table 2 below offers an update of known contracts or reported incidents of private companies and public institutions seeking plants and indigenous knowledge around the world. There are undoubtedly many more examples than those cited here. The Indigenous Peoples' Biodiversity Network and RAFI are cooperating with GRAIN (Genetic Resources Action International) in Barcelona and Dr. Jack Kloppenburg Jr. of the University of Wisconsin in Madison, in maintaining an ongoing watch-list of such arrangements. The table below includes further information from other researchers, however, including Accion Ecologica of Ecuador, and Dr. Darrell Posey of Oxford. From time to time, RAFI will publish other updates of this list. RAFI is also seeking further details from the companies and communities involved.



**BIOPROSPECTING AND BIOPIRACY ACTIVITIES
RAFI's LIST OF COMPANIES/INSTITUTIONS AND INTERMEDIARIES**

Company/Organization and/or Intermediary	What Collecting?	Geographic Location	Use of Indigenous Knowledge/ Indigenous Peoples or Territories	Additional Information
Abbott Laboratories (USA) Adheron Corp. (USA)	microbes, plants marine bacteria and other organisms			US \$5 million research agreement w/ Univ. of Maryland
American Cyanamid	arid land plants for crop protection agents and pharmaceutical development	Mexico, Chile, Argentina	priority given to plants with rich ethnobotanical background	ICBG agreement with: Univ. of Arizona, Institute of Biological Resources of Buenos Aires, National Univ. of Patagonia, Catholic Univ. of Chile, National Univ. of Mexico, Purdue Univ., Louisiana State Univ.
AMRAD Corp. (Australian Medical Research and Development Consortium) Australia	drug discovery from marine organisms	Australia		Collaborating w/ Australian Institute of Marine Science
Andes Pharmaceuticals, Inc. (USA)	drug development from plants	Bolivia, Colombia, Ecuador, with plan to expand	using indigenous knowledge, specific collecting areas not known	claims intention to name individual healers as co-inventors on patents and will look for ways to compensate indigenous communities through representative organizations when knowledge collectively held
Biötics, Ltd. (UK)	plants	Africa, SE Asia, Nepal, China, Latin America	some ethnobotanical work	Intermediary firm that brokers genetic materials and conducts plant exploration; pays 50% of its royalties to supplier of plants in some cases
Boehringer Ingelheim	plants, microbes			agreements with Univ. of Illinois and New York Botanical Garden to obtain plants.
Bristol-Myers Squibb	insects and related species	Costa Rica-- dry tropical forests of Guanacaste Conservation		U.S. govt-supported ICBG agreement w/National Biodiversity Institute (InBio) of Costa Rica, Univ. of Costa Rica.

* This list was compiled by RAFI with assistance from Jack Kloppenburg, GRAIN, Acción Ecológica, and Darrell Posey. It is designed to be an ongoing survey of companies/intermediaries who are active in bioprospecting/biopyracy activities. It is by no means comprehensive or complete.

Company/Organization and/or Intermediary What Collecting? Geographic Location Use of Indigenous Knowledge/ Indigenous Peoples or Territories Additional Information

Bristol-Myers Squibb	rainforest plants w/ medicinal properties, especially <u>Ancistrociadus</u> (source of anti-HIV agent), and agents against malaria,	Cameroon (Korup forest range) and Nigeria (Oban Hills rainforest)	Ethnobotanical information from traditional medical practices will be used to prioritize collection of plants	U.S.govt.-supported ICBG agreements must include benefit sharing with source countries, but terms of agreement are not available to the public. Also participating: Walter Reed Army Institute of Research (US govt.), Smithsonian Institution, Univ. of Yaounde, World Wildlife Fund, Nature Conservancy, World Resources Institute, Shaman Pharmaceuticals
Bristol-Myers Squibb (USA)	fungi, microbes, plants, marine organisms			Ranked 2nd largest pharmaceutical corp. in USA. Contracts w/ third parties to collect specimens, including: Scripps Institute and Oncogen
Bristol-Myers Squibb (USA)	rainforest plants for drug development; non-medicinal plants for sustainable commercial harvest	Suriname	Ethnobotanical uses of plants by indigenous peoples to be documented. Specific terms of "Benefit sharing agreement" not made public. Conservation Intl. will set up "Shaman's Apprentice" programme, and indigenous peoples fund.	U.S.govt. supported ICBG agreement w/Virginia Polytechnic & State Univ. of Blacksburg, Missouri Botanical Garden, National Herbarium of Suriname, Bedrijf Geneesmiddelen & Conservation Intl.
Ecogen, Inc. (USA)	entomoparasitic nematodes for biocontrol agents	Malaysia		R&D agreement with Malaysian Reserach and Development Institute
Ecoscience Corp. (USA)	screening of soil samples for fungal strains to be used in pest control	China		Ecoscience will pay Chinese Institute Biological Control
Eli Lilly Co. (USA)	plants, algae			Major pharmaceutical corporation. Also has \$4 million equity investment in Shaman Pharmaceuticals. Recently purchased Sphinx Pharm.
Glaxo Group (UK)	plants, fungi, microbes, marine organisms	Asia, Latin America, possibly other areas		Has obtained materials from Kew Royal Botanical Gardens, Biotics Ltd., Univ. of Illinois, National Cancer Institute, contracts with Carnivore Preservation Trust to collect plants in Laos.

Company/Organization and/or Intermediary

Geographic Location

What Collecting?

Use of Indigenous Knowledge/ Indigenous Peoples or Territories

Additional Information

Instituto Nacional de Biodiversidad (InBio) Costa Rica	Costa Rica-- Guanacaste Park & other protected areas	plants, insects, microbes	Possibly collecting in Talamanca Indian reserve, unclear to what extent obtaining info. from indigenous peoples.	Private organization that has entered into high profile contracts with Merck, Bristol Myers Squibb, and possibly other major pharmaceutical companies.
International Marine Biodiversity Development Corp.	international waters	deep ocean research to collect exotic species for biotech applications		10-yr. research project undertaken with Russian Academy of Sciences,
Johnson & Johnson (USA)		novel chemical compounds		Funds chemical prospecting at Cornell University and training of scientists "from the South in prospecting"
Magainin Pharmaceuticals (USA)		African reptiles, marine fish & organisms		Developing human pharmaceuticals from African clawed frog and antibiotic steroid from dogfish shark
Marine Biotechnology Institute (Japan)	Micronesia	marine organisms		Consortium composed of Japanese govt. and 21 Japanese corporations
Maxus Ecuador, Inc. (subsidiary of Maxus Petroleum) USA	Ecuador-- primary tropical forest	1200 plant species have been gathered; 18 new to scientific world, 200 new species in Ecuador	Plant collection and inventory traverses Yasuni Natl. Park and Waorani Ethnic Reserve	Contracts with Missouri Botanical Garden for plant collection & inventory during construction of 120-km road in tropical moist forest.
Merck and Co. (USA)	Latin America	fungi, microbes, marine organisms, plants	indigenous knowledge from Urueu-wau-wau of Brazil; holds patent on anti-coagulant derived from their plant material	Major pharmaceutical corporation. Contracts with N.Y. Botanical Garden, MYCOsearch; high-profile contract with InBio of Costa Rica (made up-front payment of \$1.2 million)
Myco Pharmaceuticals (USA)	collecting worldwide	screening of fungi for drug development		Company will identify, develop and commercialize drug leads. Also developing screening technologies.
National Cancer Institute (U.S. government agency) USA	collecting worldwide	Plants, microbes, marine organisms. NCI's natural products repository contains over 500,000 samples collected primarily in Africa, Asia and Latin America	uses indigenous knowledge to identify some materials	Contracts w/ Univ. of Illinois to collect in Southeast Asia; Missouri Botanical Garden collects in Africa; N.Y. Botanical Garden collects in Latin America. Marine organisms collected by Coral Reef Research Found. in Indo-Pacific. Microbes collected by various organizations.

Company/Organization and/or Intermediary What Collecting? Geographic Location Use of Indigenous Knowledge/ Indigenous Peoples or Territories Additional Information

New York Botanical Garden (USA)	everything	worldwide, special focus on Latin America	one of leading centres for ethnopharmacology and ethnobotany research--uses indigenous knowledge to collect	NY Botanical Garden contracts with many private companies for collection of bio-materials. Personnel prominent in the field.
NPS Pharmaceuticals, Inc.	Animals, insects (especially spider and scorpion toxins)	Madagascar		Malagasy govt. has given NPS exclusive rights to research animal resources for medical uses.
Parcelsian Inc. and Pacific Liaisons (USA) joint venture	plants, food	China	focusing on traditional medicinal plants	Pacific Liaisons has provided more than 1000 samples of traditional Chinese medicinal compounds to a major US pharmaceutical company. Will also launch in-house screening.
Pfizer, Inc. (USA)	plants	USA	plant collection based partly on existing ethnobotanical leads	3-yr., \$2 million research collaboration with N.Y. Botanical Garden
Pharmacogenetics (USA)	natural products for drug development	Latin America	hopes to rely entirely on leads from indigenous peoples in identifying plants; interested in developing line of cosmetics based on indigenous peoples' products and uses	Company founded 1993; partly-owned by non-profit Pan American Development Foundation, a non-profit organization that works with rural and indigenous groups in L.A. Will use these connections to organize plant collection and identification activities.
Pharmagenesis (USA)	plants	Asia	focus on traditional medicinal plants--especially Chinese	
PharmaMar (Spain)	bioactive materials from marine environment to develop drugs for cancer and AIDS	worldwide		PharmaMar researchers travel aboard the ships of Pescanova, one of the largest fishing fleets in the world.
Phytera, Inc. (USA)	plants	worldwide		Specializes in plant cell technology, holds one of world's largest plant cell collections. Uses technology to provide large quantities of a compound from small tissue sample.

Company/Organization and/or Intermediary	What Collecting?	Geographic Location	Use of Indigenous Knowledge/ Indigenous Peoples or Territories	Additional Information
Phyton Catalytic, Inc. (USA)	plants	agreements in Africa, Asia, Europe, Americas		Focuses on production and supply of plant-derived compounds through cell culture
PhytoPharmaceuticals Corp. (subsidiary of ESCAgenetics, Inc.) USA	plants	negotiating agreements w/ institutes in Brazil, China, Africa, India, E. Europe		Will acquire plant samples from collaborating institutes. Collaborators will retain rights on drugs developed from plant materials collected and receive royalties.
Research Corporation Technologies (USA)	bacteria	Latin America		Brokering bacteria with nematocidal and antifungal properties isolated from Costa Rican soil sample.
Rhone-Poulenc Rorer (France)	microbes, plants, marine organisms			Samples obtained from Univ. of Hawaii, Beijing Medical Univ., Shangha Medical Univ., Tianjin Plant Institute
Sabinsa Corp. (USA)	plants	India	focus on plants with established medicinal uses in Indian cultures	New company hopes to broker/introduce botanical and pharmacological resources of India to North America. Will develop, process and market standardized extracts of Indian plant materials.
Shaman Pharmaceuticals (USA)	plants for drug development	Latin America, Africa, Asia	Shaman's strategy is to identify promising plants by using indigenous knowledge; traditional healers are primary informants. Shaman has non-profit Healing Forest Conservancy to facilitate reciprocal flow of benefits and support conservation.	Shaman has had remarkable success in identifying potentially valuable drug leads based on indigenous knowledge. Has received 2 patents on drugs in clinical trials (anti-fungal and anti-viral). Strategic alliances with Eli Lilly, Merck, and Inverni della Beffa of Italy.
SmithKline Beecham (USA)	microbes, plants, marine organisms			In-house collectors; also obtains materials through Biotics, Kew Royal Botanical Gardens, Univ. of Virginia, Scripps Institute of Oceanography, Morris Arboretum, MYCOsearch.

Company/Organization and/or Intermediary	What Collecting?	Geographic Location	Use of Indigenous Knowledge/ Indigenous Peoples or Territories	Additional Information
Sphinx Pharmaceuticals (subsidiary of Eli Lilly) USA	fungi, algae, plants, marine organisms			Has obtained materials from Biotics.
Sterling Winthrop (USA)	microbes, plants, marine organisms			Has obtained materials through Mississippi State Univ., Brigham Young University, N.Y. Botanical Garden
Syntex Laboratories	microbes, plants			Has obtained materials from the Chinese Academy of Sciences
Upjohn Co. (USA)	microbes, plants			Major pharmaceutical corporation. Has obtained materials through the Shangai Institute.
Xenova Ltd. (UK)	microorganisms and plants; has in-house collection of 23,000 live microorganisms (lichen, bacteria, fungi), and in labs of collaborators	worldwide		Alliances with Genentech, Warner-Lambert Co., Genzyme and Suntory Ltd., and other academic institutions.

* This list was compiled by RAFI with assistance from Jack Kloppenburg, GRAIN, Acción Ecológica, and Darrell Posey.

Endnotes:

1. Colombia-Environment: Project to Cultivate Medicinal Plants, Inter Press Service, May 20, 1994.
 2. Philippines-Medicine: Who Really Discovered Erythromycin? Inter Press Service, November 9, 1994.
 3. This estimate is found in Christopher Joyce, "Western medicine men return to the field", BioScience v42 p399(5), June, 1992 and also in Josephine R. Axt, M. Lynne Corn, Margaret Lee, David M. Ackerman, "Biotechnology, Indigenous Peoples and Intellectual Property Rights" CRS Report for Congress, April 16, 1993. p.12.
 4. Dagmar Mussey, "J&J, Merck Ready First Euro-Brand", Advertising Age, October 26, 1992, p.1. and Costa Rican data from PC-Globe 5.0.
 5. DeMassi, J., Hansan, R.W., Grabowski, H.G., and Lassagna L., (1991) "Costs of Innovation in the Pharmaceutical Industry", Journal of Health Economics 10, p.107.
 6. Josephine R. Axt, M. Lynne Corn, Margaret Lee, David M. Ackerman, "Biotechnology, Indigenous Peoples and Intellectual Property Rights" CRS Report for Congress, April 16, 1993. p.12.
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