

Bioprospecting in Practice: A Case Study of the Suriname ICBG Project and Benefits Sharing under the Convention on Biological Diversity.

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1. Overview

a. Introduction

The purpose of this case study is to present a project in Suriname which demonstrates how bioprospecting can promote the conservation of biological diversity. Bioprospecting – the exploration of biodiversity for commercially valuable genetic and biochemical resources – has been seen as a potentially powerful tool for conservation.² However, it is clear that initial expectations about the ability of bioprospecting to have a significant impact on natural resource and economic development policy decisions were largely theoretical.³ In addition, bioprospecting, regardless of its contribution to biodiversity conservation, raises complex questions about linkages between traditional knowledge and developed country intellectual property protection regimes.⁴ Yet the fact remains that there is a large and growing market for products developed from genetic resources, and thus bioprospecting activities, in one form or another, are likely to continue.⁵

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² Walter V. Reid et al. *A New Lease On Life*, in *Biodiversity Prospecting: Using Genetic Resources For Sustainable Development* (Washington, DC: WRI, 1993).

³ Cf. R David Simpson., *Biodiversity Prospecting: Shopping the Wilds is Not the Key to Conservation*, Resources, (Washington, DC: RFF, 1997).

⁴ Darrell Posey, *Intellectual Property Rights: Just Compensation for Indigenous Knowledge*, *Anthropology Today*, (August 1990). See also Francesca Griffo & David Downes, *Agreements for Pharmaceutical Research on Biodiversity: a Checklist of Issues and Principles* in *Valuing Local Knowledge: Indigenous People and Intellectual Property Rights* (Steven Brush & Doreen Stabinski, 1996).

⁵ See David Downes & Chris Wold, *Biodiversity Prospecting: Rules of the Game*, Bioscience, (1994).

The Convention on Biological Diversity, signed by more than 150 nations at the Earth Summit in June 1992, affirms States' sovereign rights over their own biological resources and encourages the equitable sharing of the benefits arising from the utilization of genetic resources.⁶ The Convention provides a broad framework for the manner in which bioprospecting activities should take place.⁷ In particular, it highlights how the conservation of biological diversity depends not only on the sustainable use of those resources but also on the equitable sharing of benefits which result from that use. Unless the benefits generated are equitably shared among the different stakeholders, source countries will find little incentive to conserve their biological diversity.

Various governments and conservation organizations have proposed using bioprospecting as a tool for conservation in part because of the tremendous economic and health benefits which can come from the development of plant-derived drugs. The use of the Rosy Periwinkle, *vinca rosea*, of Madagascar for treating Hodgkin's disease and childhood leukemia, quinine for malaria, and curare as a muscle relaxant for certain types of surgery are three well-known examples.⁸ Of the top 150 prescribed drugs in the U.S. in 1993, 57% contained at least one major active compound that was derived, directly or indirectly, from biological sources.⁹

Traditional ethnobotanical knowledge has recently received increased attention as a potentially valuable resource in the drug discovery process.¹⁰ For example, Shaman Pharmaceuticals is a U.S.-based company which concentrates exclusively on ethnobotanically used plants. Medicines derived from plants originally used by indigenous peoples have an annual world market of \$43 billion, and about three quarters of plant-derived pharmaceutical drugs have the same or related use as they first did in traditional medical applications.¹¹ However, the chief commercial beneficiaries of genetic and biochemical resources found in developing countries have been developed countries, and pharmaceutical products based on traditional medicine have returned less than .0001 % of their profits to the local plant users who assisted preservation, research and discovery efforts.¹² While there is little financial incentive to these communities to maintain their medicinal practices, their own survival may depend on it. Indeed, one recent estimate states that 80% of the developing world relies on traditional medicines for primary health care.¹³ To help assure that indigenous communities maintain an opportunity for development without rejection of their traditional practices, it is necessary to secure their rights to these resources and to compensate them for the benefits derived from access to biological resources and knowledge.

This study examines a variety of innovative benefit-sharing mechanisms implemented in Suriname and demonstrates how they can be used in connection with bioprospecting to promote

⁶ Convention on Biological Diversity, 31 I.L.M. 818 [hereinafter Biodiversity Convention]

⁷ See article 1 through 18, Biodiversity Convention, *supra*.

⁸ Norman R. Farnsworth, *Screening Plants for New Medicines*, in Biodiversity Prospecting, *supra* note 2, at 83.

⁹ Francesca Griffo and Joshua Rosenthal, *Biodiversity and Human Health*, (Washington, DC: Island Press, 1997).

¹⁰ Mark Plotkin, *The Outlook for New Agricultural and Industrial Products from the Tropics*, in E.O Wilson, *Biodiversity*, 106 (Washington, DC: 1988).

¹¹ Posey, *supra* note 4, at 14.

¹² *Id.*

¹³ Jitendra Srivastava, John Lambert, and Noel Vietmeyer, *Medicinal Plants: a Growing Role in Development, Agriculture and Natural Resources Department, Agriculture and Forestry Systems*, (Washington, DC: The World Bank, 1995).

biodiversity conservation. First, the inventory associated with collection of samples can help increase knowledge of the fauna and flora of the region, and to preserve indigenous knowledge about their medicinal uses. Educational opportunities for scientists and students in source countries emphasize the benefits of intact forest ecosystems and the study of natural sciences, ethnobiology, and biotechnology. As the value of these resources becomes ever more apparent, the incentive to protect them increases on a local, national and international scale. Second, the sharing of pharmaceutical technology and equipment can provide source countries with the opportunity to increase the economic value of their resources, thereby promoting potential alternatives to the unsustainable use of the forests. Third, bioprospecting projects can contribute to the dissemination of traditional medicines beyond the traditional boundaries of a village or community as well as to the growing world trade of dietary supplements.

b. Main Actors Involved

The International Cooperative Biodiversity Group (ICBG) is a U.S. government funded program sponsored by the National Institutes of Health (NIH), the National Science Foundation (NSF), and the United States Agency for International Development (USAID).¹⁴ In 1993, the ICBG awarded a grant to five different institutions which submitted a joint project proposal for Suriname. The program is led by Dr. David Kingston of the Virginia Polytechnic Institute and State University (VPISU), a state-funded university in the United States. The other participants include Conservation International (CI), an international non-governmental conservation organization; Bedrijf Geneesmiddelen Voorziening Suriname (BGVS), a pharmaceutical company owned by the Surinamese government; the Missouri Botanical Gardens (MBG), an American botanical research institution; and Bristol-Myers Squibb Pharmaceutical Research Institute (B-MS), an American pharmaceutical company.¹⁵ Each institution carries out a specific role in the Suriname ICBG program including, botanical and ethnobotanical collections and inventory, extraction, screening, chemistry, and drug development. The formation of this group illustrates the international cooperation called for by the CBD in Article 5 (with international conservation organizations), Article 10(e) (between governmental authorities and the private sector), and Article 18(5) (through joint research and joint ventures).

The Suriname ICBG group works with local tribal people to conduct some of the bioprospecting activities. The majority of the local participants are Bushnegros, or Maroons, who are descendants of runaway African slaves that escaped Dutch plantations on the coast over three hundred years ago and settled along the river in central Suriname. Six distinct Maroon tribes live in the interior and depend on their extensive knowledge of forest resources for their survival. When the Maroons first fled into the forest, they experimented with medicinal uses for the plants, and through a process of trial and error identified plants which were effective for various illnesses. They based their experiments in part on their memories of the healing traditions and plants in their native Africa and on information learned from Amerindians in Suriname's interior. This knowledge has developed into a rich and expansive understanding of the medicinal qualities of

¹⁴ Griffo, *supra* note 8. See also Original Request for Applications: RFA:TW-92-01, Released June 12, 1992. International Cooperative Biodiversity Groups Program, National Institutes of Health, National Institute of Mental Health, National Science Foundation, U.S. Agency for International Development.

¹⁵ ICBG Proposal: "Biodiversity, Utilization, and Conservation in Tropical America" to the National Institute of Health. Project Period: 9/30/93 to 9/29/98. Principal Investigator: Dr. David Kingston, VPISU, Blacksburg, VA.

Suriname's forest plants. A strong relationship between the ICBG and the Saramaka Maroons can serve as a basis for the successful preservation of the knowledge, innovations and practices of these tribal communities, and can also influence the promotion of a wider application of customary uses of biological resources, as called for by Articles 8(j) and 10(c) of the Convention.

c. Ecosystem

The Republic of Suriname has one of the highest percentages of tropical forest cover in the world with nearly 90% of the total area covered by forests. Indeed, 14,855,000 ha of tropical forest gives Suriname nine times the forest cover of Costa Rica. Suriname, which is about the size of the New England region of the U.S., is home to a number of ecological life zones and therefore a wide variety of biodiversity, including 674 species of birds, 200 species of mammals, 130 species of reptiles, 99 species of amphibians, and roughly 5,000 species of plants.¹⁶ By conducting bioprospecting in biologically rich Suriname, the ICBG project promotes the identification, assessment, and in-situ conservation of biological diversity in accordance with Articles 7 and 8 of the CBD.

d. The Benefit-Sharing Arrangements and Expected Results

In Suriname, the ICBG program is designed to promote drug discovery while conserving both biological and ethnobotanical knowledge.

The linking of the various participants is facilitated through a series of oral and written agreements. First, a Letter of Intent between the Granman of the Saramaka tribe and CI staff embodies the fiduciary relationship existing between CI and the Saramaka people.¹⁷ The Granman is the Paramount Chief of the Saramaka tribe, representing more than 17,000 Maroons living in villages along the Suriname River. In the Letter of Intent, the Granman granted his permission to CI to begin ethnobotanical research in cooperation with the Saramaka people. This consent was given on the condition that CI would represent the interests of the Saramaka people in the execution of the project. The Letter of Intent also established the foundation for the ongoing relationship between the Saramaka Maroons and CI, which is based on informed consent, as required by Article 15 of the CBD. Renewal of consent by the Saramaka people is also done periodically through formal discussions with representatives of the tribe. Just as CI explained the research project, its objectives, the requirements, the potential benefits, and the intentions of the participants in order to receive initial permission to begin the project, CI also made sure that informed consent was obtained from each participating shaman before a collection expedition began.

The responsibilities of CI, B-MS, BGVS, VPISU and MBG are laid out in the International Cooperative Biodiversity Grant Research Agreement.¹⁸ This Agreement, which was executed in September 1993, specifies each participant's rights to the licensing and royalties of any drug products that result from the project. The design of such concrete mechanisms, which are

¹⁶ See Russell A. Mittermeier et al., Conservation Action Plan For Suriname, (Suriname: STINASU, CI, LBB, WWF, University of Suriname, 1990).

¹⁷ INTENTIEVERKLARING, Asindopo, May 14, 1994. Signed by Paramount Chief Songo Aboikonie, Stan Malone, CI Director Guianas Program, Hermes Libretto, District Commissioner for the Brokopondo Region

¹⁸ Contract between CI, B-MS, BGVS, VPISU and MBG, signed on September 1993.

intended to compensate tribal communities for their contribution to drug development, may lead to direct economic benefits in the form of royalties. It may also strengthen the growing international legal regime which recognizes indigenous people's rights over their genetic resources.

The most immediate benefits of the bioprospecting activities, however, come not from the contract which guarantees future royalties, but instead from the up-front compensation, information, training, and technology transfer given in connection with the implementation of the project. Some of these benefits come from activities that are an integral part of the drug development process, for example the knowledge gained from the identification of forest taxonomy and training Surinamese university students and faculty in biotechnology and extraction. Other benefits are derived from related projects that are intended to ensure development, conservation, and sustainability, which include the training of Surinamese people in plant collection and identification techniques, ethnobiology, and management. The Forest People's Fund, which is described in detail below, is a trust capitalized with a grant from B-MS. This up-front compensation provides immediate benefits to the tribal communities of Suriname by funding small-scale, sustainable economic development and health projects that are designed and proposed by the communities themselves. Non-monetary forms of compensation, such as the sharing of data and the transfer of technology, are aimed at both the local communities and the national government and were designed to add value to their resources. With technical assistance, "gene-rich" countries may be able to develop sustainable industries based on their biodiversity. The project can also broaden the use of traditional medicines where modern medicine is unavailable or unaffordable.

e. Time Frame

The development of a drug, from the initial collection of plant samples to the marketing of an approved product, takes between ten and twenty years. Benefit sharing mechanisms channeling royalty revenues therefore demand a long-term view on the part of all participants. To address the immediate needs of some participants and encourage the involvement of different stakeholders, it is essential that upfront compensation ensures that some benefits accrue to the host-country immediately.

The ICBG awarded the Suriname project funding for five years in the end of 1993. Early in 1994, the Letter of Intent between CI and the Saramaka Maroons was executed, and B-MS pledged the start-up money for the Forest People's Fund. The Suriname-ICBG has applied for another five year grant which will fund the continuation and expansion of the bioprospecting efforts to include agrochemistry.

2. Description of the Context

The Republic of Suriname (formerly Dutch Guiana) is located in the northern part of South America, between Guyana and French Guiana. The second of the Guianas in size and population, it has a human population of approximately 400,000 in an area of 166,000 square kilometers, making it one of the least densely populated tropical countries in the world. Furthermore, 95% of the population is concentrated in the capital city of Paramaribo, and small towns of the coastal region. Only about 5% of the population lives in the interior, most of it in small scattered villages

along the three major rivers.¹⁹

Suriname maintains a relatively vast tropical forest, a resource that is increasingly threatened throughout the world. The pressures that normally threaten tropical forests, such as migratory populations and intense forest resource demand, were minimal in Suriname until recently. However, in 1993, Suriname invited Asian investors to explore possibilities for establishing multi-million hectare logging concessions in the country's interior. By mid-1994, at least five proposals were on the table and in negotiation: one from a Malaysian investor, two from Indonesian logging consortia, and two from state-owned Chinese enterprises.²⁰ Although these large scale concessions were ultimately turned down, the government continues to grant logging concessions of 150 thousand ha or less.

From a constitutional standpoint, Suriname is a parliamentary democracy, and has recently emerged with renewed political stability and support for sustainable development policies. A new biodiversity plan outlines these policies, but until now the country's regulation of genetic resources has been limited to a permitting system which is required for flora and fauna collection and export, but not for export of extractions.²¹ The design of a project in Suriname which promotes the pursuit and exchange of biological information, while attempting to adequately compensate the source country and its local communities, may thus serve as an example for other similarly situated countries.

3. Purpose/Objectives of the Benefit-sharing Arrangements

The purpose of the Suriname ICBG project is to promote environmental, economic, scientific, political, and cultural sustainability through bioprospecting. The project thus shares with the CBD the recognition, as expressed in Article 1 of the Convention, that conservation must be achieved in connection with sustainable use and equity. The primary goals are to record and secure the value of tribal knowledge, to develop the identification and documentation of Suriname biodiversity and the capacity for doing so, to increase local capacity for pharmaceutical research and production, to develop commercial drugs from plant extracts, and to compensate tribal communities through a trust fund endowed with immediate payments as well as a portion of future royalties. Under this approach, bioprospecting can advance the CBD's goals and, hopefully, the fundamental objective of protecting genetic resources. These mechanisms are in accordance with Article 11 of the CBD, which calls for "economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity."

The first goal is to record and secure the value of tribal knowledge. The botanical knowledge of

¹⁹ SURINAME PLANATLAS: prepared by the National Planning office of Suriname (SPS), Regional Development and Physical Planning Department (HARPRO) with Technical Assistance of: Organization of American States (OAS), Executive Secretariat for Economic and Social Affairs, Department of Regional Development (DRD), (Washington DC: 1988).

²⁰ Nigel Sizer and Richard Rice, *Backs to the Wall in Suriname: Forest Policy in a Country in Crisis*, at 1, (Washington, DC: WRI, 1995).

²¹ National Strategy for the Sustainable Use and the Conservation of Biological Diversity in Suriname: Draft - January 1998 - Subproject of project # RLA/92/G32 - Amazonian Cooperative Treaty.

the Maroon people is rapidly disappearing as young people move away in search of work and the population become more dependent on western medicine. In many ways, the Suriname ICBG project is a race against time to record the hundreds of years of medicinal learning that is stored in the minds of shamans, some of whom are more than 80 years old. Article 8(j) of the Convention on Biological Diversity directs the Parties to “preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity.” Article 10(c) requires the Parties to “protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.” The importance of these objectives was starkly reinforced when one of the original eight shamans to participate in the project died after working with a collection team for only a week. With no written record of his knowledge and no apprentice, this knowledge died with him.

An emphasis on the sovereign right of Suriname to control access to its resources, combined with a mechanism by which the country allows for access to these resources, creates an incentive for protection as recognized by Article 15. The agreement to grant royalty proceeds to Suriname confirms the nation’s sovereign control over its natural resources and contributes to the fair and equitable sharing of the benefits from drug development, in accordance with Articles 8(j) and 19(2) of the Convention.

The second goal, to build local capacity for pharmaceutical production, increases Suriname’s ability to benefit from its biological resources. Suriname’s communities, students, and scientists benefit from research and training, as required by Article 12; access to and transfer of technology, as required by Article 16; the exchange of information, as required by Article 17; and technological and scientific cooperation, as required by Article 18 of the Convention. By giving Suriname and its indigenous communities a greater role in the drug development process, the value of biodiversity, traditional knowledge, and genetic resources becomes more apparent – giving them an incentive to preserve this traditional knowledge and use their resources sustainably.

The third goal, to develop commercial drugs from plant extracts, helps to demonstrate the economic value of natural resources. With an annual world market worth billions of dollars for plant-derived drugs, pharmaceutical companies have an incentive to ensure the conservation of these resources, while their recognition and compensation of tribal contributions can set ethical standards in the private sector. Because there is no cure for so many diseases, and because some cures become ineffective as pathogens develop resistance to them, the development of a commercial drug also serves a perpetual need in human health -- the proliferation of new medicines.

The fourth goal is to attempt to create a long-standing conservation financing institution. The Forest People Fund aims to ensure up-front benefits from bioprospecting go to Suriname and its tribal communities. It is also intended provide a well established structure to channel potential future royalties.

An examination of the lessons learned from the implementation of this project and benefit-sharing mechanisms thus furthers the investigation of traditional forms of knowledge relating to sustainable development, as called for in Decision III/14 paragraph 3 of the third meeting of the

Conference of the Parties. The project in Suriname also highlights the implementation of measures for access to genetic resources, as sought by Decision III/15 paragraph 2(a), as well as the implementation of incentives, including those which lead to benefit-sharing, as called for by Decision III/18 paragraph 7.

4. Process for Establishing the Arrangements

Although CI-Suriname had been active in conservation and development projects prior to the ICBG project, the relationship that has since developed with the Saramaka Maroons has not only given CI-Suriname a greater appreciation of local needs and problems, but also enabled trust to develop between the community and CI staff members. As environmental and development concerns arise in the tribal community, the Saramaka people have sought advice and assistance from CI-Suriname. Further, as a result of the success of this project and a number of other smaller conservation projects instituted by CI, the Saramaka Tribe has indicated an interest in formulating a larger, more comprehensive program to promote development while ensuring the conservation of its natural resources.

The Saramaka Tribe's participation in this project was formally requested in May 1994, when a "gran Krutu" (important meeting) was held in the village of Asindopo, residence of the Paramount Chief, or Granman, of the Saramaka Tribe. Representatives at the meeting included the Paramount Chief, tribal captains of the Saramaka people, representatives of CI-Suriname, and the Surinamese District Commissioner and District Secretary of the Sipaliwini District. The meeting provided a forum for which the aims, duration, and focus of the ICBG project could be discussed. After three days of discussion and negotiation, the Granman created and signed a letter of intent to work on the project with CI for a trial period of one year.

One month later, CI's representatives returned to Asindopo and held a series of meetings with the village leaders. During these meetings, the elders chose the initial eight participating shamans. At the same time, on-site interviews were conducted with tribal communities, traditional healers, and the academic community to gain input regarding the type of compensation sharing and distribution mechanism which would most effectively provide fair remuneration as well as incentives for the conservation of biological diversity and sustainable growth. Attorneys with expertise in natural resource agreements involving less developed countries relied on these interviews to assist CI in the determination of a framework for distributing royalties which would be acceptable to all parties.

By the end of the first year, most of the project's preliminary goals had been accomplished. VPISU and BGVS had established the capacity for plant extraction in Suriname, MBG had carried out numerous general botanical collections, and CI had collected the first ethnobotanical samples. On, July 4th, 1995, the Granman and village captains agreed to continue the project and signed a cooperative agreement permitting CI-Suriname to pursue sample collection and conservation initiatives in their communities for the next ten years.

5. Content and Implementation of the Arrangements

The search for medicinal properties in plants is an all encompassing process that involves numerous steps and a variety of roles for each of the different participants. VPISU as the

Principal Investigator is responsible for the overall coordination of the project, and also for performing cancers screens, and isolating active compounds. CI-Suriname carries out ethnobotanical collections, documentation of traditional knowledge, and conservation initiatives. MBG collects specimens for both floristic inventory and drug discovery, using botanical collection methods, and provides training in botanical collecting techniques for herbarium staff and university students. BGVS performs extraction and carries out in-country screening, and B-MS is responsible for the majority of screening and drug development. Throughout this process, a series of required procedures elucidate and ensure the various participants' rights and responsibilities.

The project's benefit-sharing mechanisms vary in their formality and structure. Royalty benefits are derived directly from the development of a drug, and the distribution of any royalty is governed by the ICBG Research Agreement, and the Statement of Understanding. Other benefits result from efforts to ensure that the bioprospecting activity is sustainable, ecological, and equitable. Many of these benefits are realized through the Forest People's Fund. Finally, other benefits come more indirectly from the cooperation and relationships arising out of the project, such as heightened community awareness, the development of geographic information systems (GIS) and other biodiversity databases.

a. Implementation of the ICBG Agreement

(1) Collection

The ICBG Research Agreement designates the duties of each participant in the collection, preparation, and screening of the plants. As stated previously, MBG is responsible for random botanical collections and CI is responsible for ethnobotanical collections. While random botanical samples can be collected more quickly than ethnobotanical samples, the parties to the Suriname ICBG believed that ethnobotanically collected specimens could provide more active compounds. Thus both forms of sample collection have been used to increase the overall likelihood of success. Further, another goal of the project is to compare the "hit rates" of these sample collection processes to verify whether ethnobotanically collected samples do indeed provide a higher "hit rate".²² The group has since found that conducting a scientifically viable study is difficult, in part because of the large number of ethnobotanical collections necessary to establish a statistically valid sample base for comparison to the screen. An additional reason is that screens at BMS are constantly changing (on an average of every three months). Matters are further complicated by disagreements within the scientific community about the definition of a "hit" and the fact that there are no uniform screening methods for ethnobotanically collected samples.

Random botanical collection is a process by which the collectors gather a wide variety of plant species, without regard to any known uses of the plants. The goal is to obtain a comprehensive sampling from each of the different areas in Suriname. MBG has trained students from the University of Suriname and members of tribal communities in "random" botanical collection techniques, and employs them in amassing the specimens.

CI is responsible for collections using ethnobotanical knowledge (traditional use of plants). The

²² "Hit rate" refers to that percentage of samples which show biological activity in a given series of chemical screens. Mark Plotkin, announcement at ICBG press conference (Dec 7, 1993).

ethnobotanical collections take place with the Saramaka Maroon tribe located along the Suriname River. All field operations are coordinated by Surinamese ethnobotanists trained under this project and assisted by community members who have also been trained in ethnobotany.

Over the course of the last four years, CI-Suriname collecting teams have traveled to the Saramaka region every other month, for approximately three weeks at a time. At the onset of each expedition, the Granman must be updated on the project and grant permission to continue the ethnobotanical research. The collectors then contact the shaman with whom they will be working on the expedition and formally request permission to work with him. To date, twenty-four shamans have been involved in this project.

Each shaman has his own medicinal “garden” outside of the village. Within this “garden” and in the forest surrounding the villages, the shaman directs the collecting team to specific plants and describes their various medicinal uses. Using a field collection form developed specifically for the project, the team records information about the area where the sample is found, the portions of the plant utilized and the habitat, soil, visibility, abundance, and local names of the plant. Also recorded is detailed ethnobotanical information including biographical data on the shaman, which diseases the plant is used to treat, how the medicine is prepared, and the dosage, method of application and side effects of its use. All information collected is put into a conservation database and GIS at the CI-Suriname office in Paramaribo.

Initially 500 grams of roots, bark, twigs and leaves of each plant was collected (resulting in approximately 200 grams per sample of dried material). After discussion in the second annual meeting, it was determined that smaller samples would be sufficient for the extraction process which lead to the current sample size of 100 grams. After drying, specimens are placed in cotton bags and sent to CI-Suriname in Paramaribo.

(2) Encoding and Distribution

To guard against the possibility of corporate partners seeking resupply of samples showing activity from other countries, and to keep confidential whether a sample is of random botanical or ethnobotanical origin, an encoding system was developed. This coding system prevents the pharmaceutical companies from having access to the ethnobotanical information during the initial screening process. Although this may slow down the initial screening process, the parties agreed that securing the traditional information was worth the tradeoff. Coded plant samples are deposited at the BGVS lab for extraction and distribution to ICBG partners in the United States. Further, three voucher specimens of each plant collected are deposited into the National Herbarium of Suriname.

(3) Extraction

The coded samples are sent to BGVS, the state-owned pharmaceutical company in Paramaribo. The samples are prepared for BGVS at the Center for Agricultural Research (CELOS), a scientific agricultural research foundation based at the University of Suriname. At CELOS, the dried samples are ground and mixed first with ethyl acetate and then with methanol to begin the extraction process. After evaporation, they are put into 200 mg. plastic vials. One of each of the vials is sent to VPISU and to B-MS for screening, and the rest is stored at CELOS and BGVS to

be used in future tests and screening.

To date they have processed more than 3,000 plant extracts. Although most of the remedies used by the Saramaka are combinations of plants, sometimes using as many as 15 different ingredients, all of the testing so far has been done on extracts from single plants. However, CELOS has begun looking at mixtures of plant extracts, some of which have registered hits where their individual components did not.

(4) Screening and Fractionation

B-MS is obligated to test all the samples for anticancer and anti-infective activity. B-MS has the right to apply any other tests to the extracts, but must provide VPISU and BGVS a confidential written list of the therapeutic areas in which extracts will be screened. Every three months, B-MS sends a confidential written notice to VPISU indicating whether extracts are “active” or “inactive.” VPISU sends copies of each notice to BVGS, CI-Suriname, and MBG. Within a defined time period from the receipt of an extract, B-MS must declare whether or not it has a continuing interest in the extract. If B-MS expresses no interest, B-MS loses its exclusivity of use over the sample and the extract becomes part of a pool of samples that can be offered to other potential partners.

As a result of the encoding system, B-MS, BGVS, and VPISU do not initially receive information regarding the identity, description, locale, and traditional uses, if any, of the plant. If a party is interested in acquiring more samples of a specific plant for retesting, they must notify BGVS with the code number, and if the plant is an ethnobotanical collection, BGVS notifies the CI-Suriname project coordinator. The collection team then goes back to the shaman, and with his help, they collect in the same area, a challenge that often proves difficult. However, this method ensures that B-MS cannot look for additional samples elsewhere and that Suriname and its local people are compensated for their contributions.

If an extract shows activity, it must then undergo fractionation, which is the process of isolating the biologically active substances from the sample. B-MS, BGVS, or VPISU are each responsible for performing fractionation, depending upon the number and types of screens in which an extract shows activity. More than one of the parties can carry out fractionation if all of the parties agree. CI-Suriname has agreed to release the plant names to VPISU and/or B-MS when or as soon as possible after the extract is requested for fractionation studies. CI must also obtain permission from the shaman before this information is released, pursuant to the ICBG Agreement and to the CBD’s requirements for informed consent.

(5) Confidentiality and Third Party Use

All participants must obtain written consent from VPISU before making extracts available to any third party. If BGVS is to provide extracts to a third party, VPISU must also receive notice that B-MS, VPISU and BGVS are no longer interested in the extract. VPISU may provide extracts to third parties, but must notify B-MS in writing if B-MS has not yet screened the extract.

The ICBG contract also guarantees confidentiality, so as to protect the potential profits of all parties should a drug be developed. The parties may not share information, results and data from

the project for five years after the contract terminates, unless the recipient of the information already has legal access to it. The contract also requires that each party be able to review a manuscript prior to its publication and that all parties be jointly credited.

(6) New Developments in the ICBG Agreement

While the discovery of any drug could potentially facilitate conservation and development in Suriname, the ICBG participants recognized screening for anti-malarial activity was a high priority for Surinam and one which B-MS could not accommodate. The Walter Reed Army Institute of Research (WRAIR) has agreed to begin testing those plants used by the Saramaka people as a treatment for malaria. To effect this new component, a series of side agreements have been negotiated to accompany the principle ICBG agreement. VPISU has signed a confidentiality agreement with WRAIR, and a separate agreement between BVGS and VPISU provides for the supply and testing of extracts by outside screeners. The same royalty provisions which exist in the main agreement apply to any resulting drug developments.

In addition, the Suriname ICBG is examining the possibility of screening for other therapeutic areas, including tuberculosis and leishmaniasis. Similar side agreements will detail particular issues regarding confidentiality and the parties' responsibilities.

b. Mechanisms for Sharing Benefits

The appropriate design of mechanisms for benefit-sharing is one of the most important factors for the success of the project. Each participant contributes essential skills, knowledge, and capacities to the project, and if the benefits of bioprospecting are not equitably shared, there is little incentive for cooperation and conservation. Because the parties have different interests, it is necessary that the benefit-sharing mechanisms be multifaceted. The mechanisms in the Suriname ICBG project include a long-term Research Agreement which controls the ownership, licensing, and royalty fee structure for any potential drug developments; a Statement of Understanding between the Granman, CI-Suriname, and BGVS which further defines the parties' intentions regarding the distribution of royalties among Surinamese institutions; a trust fund (the Forest People's Fund) capitalized in part with upfront payments; and, the transfer of technology and other forms of non-monetary compensation to Suriname.

(1) Ownership of Inventions, Licensing, and Royalties

In addition to designating each participant's responsibilities in the bioprospecting process, the ICBG Research Agreement governs the means by which the benefits from inventions, or patentable products, are to be distributed. The contract requires all parties to report inventions to a designated official of each party. The parties are obligated to discuss the subject invention and to determine inventorship and ownership of the invention according to the importance of each scientific contribution to its development. Decisions regarding inventorship and ownership are made according to United States Patent Law.²³

²³ The U.S. Supreme Court has held that a discovery of some new, natural product is not patentable. See American Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1 (1931). Also, any patent issued must meet three criteria outlined by Congress in the Patent Act. First, a patent must be either a new and useful invention or any new and useful

The ICBG contract provides that where the product is a result of collaborative work with the shaman, the patent shall be filed for joint ownership. This provision affirms a legal right of the tribal people of Suriname which has often gone unrecognized, (i.e., that their contribution must be fully disclosed in a patent application). Where B-MS is one of the joint partners of the patent, B-MS has agreed to pay all costs of patenting and prosecuting patent violations.

B-MS alone has the option to obtain an exclusive, worldwide, royalty-bearing license to any invention produced from the ICBG collaboration in which they are involved. If the option to license by B-MS is not exercised within a one (1) year period starting on the date that the first patent application was filed, or if the parties cannot reach an agreement on suitable license terms within six (6) months of B-MS exercising its option, then the sole or joint owners of the invention are free to license their rights in the invention to other parties. The owners of the invention must first inform B-MS of their offer and allow B-MS a 30 days period to decide whether to acquire the right to the invention under the terms that have been offered to the third parties.

The terms of the license, which include fees and specific royalties, must be negotiated in good faith between B-MS and the owners of the invention. Licensing rights within the ICBG agreements are allocated to all inventors, and if there is joint ownership of an invention between a shaman and B-MS, then both parties will negotiate the licensing provisions and control the use of the invention.

Considerations for calculating the royalty include the type of patent claims granted, potential product sales, the level of development and potential costs of subsequent research and development, marketing exclusivity available to B-MS, the competitive impact of related market products, and the extent of the contribution of ethnobotanical knowledge or uses. The agreement applies to plant-based inventions as well as to analogs of natural products, which are synthetic or semi-synthetic. As a result, fees payable by B-MS are reduced as the scientific differences between lead compound and the natural product increases. The amount to be given to Suriname is calculated by means of a decimal fraction (Suriname Factor). The Suriname Factor is multiplied by the royalty rate, which is kept confidential among the parties.

The agreement also stipulates that, should B-MS find the need to obtain a patent license and to pay royalties to a fourth party in any country in order to make, use or sell a resulting product, then B-MS is entitled to deduct from the royalties due, half of the costs or royalties paid by B-MS to the fourth party, provided that the aggregate of such offsets will not reduce the royalty payable to Suriname by more than 50%.

Royalties are payable for the life of the patent, or in the case where there is no patent, for 5 years after the first commercial sale. If a third party acquires rights to the product, that party becomes responsible for the royalties which B-MS would otherwise have had to pay. B-MS is responsible

improvement of an existing invention. Second, an invention may not have been previously known, used, or patented by others in the U.S., nor described in any publication more than one year prior to the patent application. Third, an invention must be distinct from all prior art, such that it would not have been obvious to a person having ordinary skill in the field. *See* 35 U.S.C. §102 (1988).

for all accounting and book-keeping of royalty statements. CI and the licensor may select an independent certified accountant to verify the accuracy of these accounts.

(2) Statement of Understanding

A “Statement of Understanding” between the Granman of the Saramaka people, CI-Suriname, and BGVS details the division of future royalties allocated to Suriname. The Understanding consists of two payment structures according to whether the drug is derived from ethnobotanical collections. The various Surinamese institutions to receive royalty payments are the Forest People’s Fund (FPF), BGVS, the Foundation for Nature Preservation in Suriname (STINASU) -- a non-profit organization responsible for the management of national parks, the National Herbarium of Suriname, the Suriname Forest Service, and CI-Suriname. In addition, a portion of money is set aside for future institutions that evolve from the increased bioprospecting activities.

<u>Derived From Ethnobotanical Collections</u>		<u>Derived From Random Collections</u>	
FPF	50%	FPF	30%
BGVS	10%	BGVS	10 %
STINASU	5%	STINASU	10%
National Herbarium	10%	National Herbarium	10%
Forest Service	5%	Forest Service	10%
CI-Suriname	10%	CI-Suriname	10%
Future Institutions	10%	Future Institutions	20%

(3) Forest People’s Fund

While the ICBG contract and the Statement of Understanding govern the means by which future financial gains from bioprospecting are to be distributed, a separate trust fund was established to ensure that the tribal communities would benefit immediately from the access granted to their forest resources. The fund compensates these communities for their ethnobotanical contributions to the ICBG project, creates conservation incentives, finances sustainable management projects, provides research and training exchanges, and supports other socially and environmentally sound projects.

The Forest People’s Fund was established in 1994 with a \$50,000 contribution from B-MS, followed by another \$10,000 donation in 1996. The Forest People’s Fund Foundation is headquartered in Paramaribo, Suriname, and administers the Forest People's Fund according to the Foundation’s by-laws. These by-laws were written by the Surinamese participants and are governed by the laws of Suriname.

The by-laws require the Board to meet at least four times a year and whenever deemed necessary to manage the fund's day-to-day operations, finances, and handle legal arrangements. The Board of Directors is comprised of five members, including two representatives at large, two representatives from CI, and one who is nominated by BGVS. One Amerindian and one Maroon must fill the position of the members at large. CI's representatives are the President of CI, based in Washington, and the director of CI-Suriname. Richene Libretto, a District Representative of the people to Suriname’s central government for the interior and part-Maroon, is the current

representative of BGVS. Paul Abena is the representative of the Maroon communities and Armand Karwafodi is the representative of the Amerindian communities. Each member is limited to a five-year term and may cast one vote in the Board's decisions.

The main activity of the Board of Directors is to review project proposals. Any tribal person in Suriname, community or foundation that has an idea for a project can submit a proposal. CI-Suriname staff are available to assist interested parties in their project design and proposal. The Board then determines whether to grant funding according to whether the project advances the purpose of the fund, which is to “stimulate residents of the interior and related living persons who contribute to and participate in the preservation and long-term protection of biodiversity and to provide them with social, educational, and economic assistance.”

Money and supplies are mostly allocated to communities through their leaders or village foundations, such as Afinga, a grassroots organization based in Asindopo. Afinga was organized in August 1994 and was named for the founder of the original Bushnegro village of Lan Te Wei. The group, which has approximately 35 members, 30 of whom are women, was formed to develop and manage sustainable development projects which receive money from the Forest People's Fund.

c. Benefits Realized

A formal evaluation methodology is currently being developed by the ICBG, in order to assess the overall viability of bioprospecting projects and to compare the various ICBG programs. Presently, the Suriname project is required to report semi-annually to the ICBG, detailing the specific aims and subsequent accomplishments of each participant for that period. The report is filed by Dr. David Kingston, the Principal Investigator of the project. As funding must be approved annually, these reports serve as important assessments of the achievements of the project.

In addition, there is an annual meeting of the ICBG Suriname project at which the participants report their various activities and coordinate future plans. They also communicate more informally on a regular basis, assessing various difficulties and adjusting their plans accordingly. These formal and informal mechanisms for evaluation have revealed that the Suriname ICBG project has made considerable accomplishments in the advancement of sustainable development and biodiversity conservation regardless of the sometimes significant challenges encountered during the project.

First, drug development is well underway. Since the beginning of the project, 961 samples have been collected and submitted to BGVS for extraction. BGVS, in turn, has sent a total of 2688 extracts and 87 resupplies to B-MS. In the spring of 1996, the Granman granted permission to the Suriname ICBG to release for publication the name of a plant in which two new molecules have been discovered of scientific, but not of commercial value.

While the chemical results and efficacy of many of the plants collected are not yet available, the advances made over the course of the past four years are undeniable. Through the development of the ICBG Research Agreement activities, the Forest People's Fund, a Shaman's Apprentice Program (in which members of the younger generation within the tribal community are learning

the knowledge of the shaman), and other related projects, the Suriname ICBG program has made headway in advancing the issue of international intellectual property rights for local people. Though the project takes place in a cultural and legal setting that is unattuned to the concept of protecting community knowledge and natural products, the ICBG project has highlighted the importance of indigenous contributions and the need for compensation.

(1) Benefits from the ICBG Research Agreement Activities

Although the development of a drug often takes ten or more years, benefits from the bioprospecting activities have already been realized by local communities and by the country as a whole. There have been many direct benefits to the communities that are involved in bioprospecting, including employment, equipment and training. Among these benefits are employment and regular incomes for shamans, field collectors, and other support staff for the collecting team when they are based in the village.

The project has led to employment and important training and technology transfer in Paramaribo as well. Mr. Etienne Moniz, of BGVS, is employed to act as the liaison officer between the project and the Suriname government and is responsible for permits and other legal access issues that are necessary to make the project run smoothly. Dr. Henk Tjon A. Joe and Dr. J.H. Wisse are employed to manage the extraction and screening operations at CELOS.

Two employees of the National Herbarium of Suriname have spent seven weeks of training each at the Missouri Botanical Garden. Ten Surinamese botanists have been employed and trained in collecting, vouching, and drying of the plant samples. In addition, Dr. Tjon A. Joe and his assistant traveled to VPISU in 1996 for training in chemistry and screening techniques.

At a national level, the project is making an important contribution toward building Suriname's national botanical inventory and increasing botanical knowledge of certain areas of the interior. Before the National Herbarium was founded by the Forest Service in July 1947, most of the botanical samples that were collected on expeditions to the interior were shipped to botanical gardens in Utrecht, London or New York. As a result, the botanical garden in Utrecht has about 100,000 samples of flora from Suriname while the National Herbarium in Paramaribo has only about 27,000. Several of the plants collected thus far in the project have been species which were previously unrepresented in the National Herbarium. Improvements made to the Herbarium include air conditioner replacement, roof repair, and the provision of additional offices, storage space and basic supplies, including new computers, books, journal subscriptions and herbarium supplies.

The project has also given Suriname global exposure. Even if a medicine does result from the project, there could be interest in further exploration and exploitation of Suriname's forests. For that reason, it will be important for Suriname to update its forestry legislation and develop clear guidelines about how to manage genetic resources. There is currently a working group within the government to draft a national biodiversity plan that will address these issues.²⁴ The observations, information, and experience gained through the ICBG project have helped the government formulate its policies.

²⁴ See supra note 19.

(2) Benefits from the FPF

The Forest People's Fund further supports local communities in the interior of Suriname in projects involving community development, biodiversity conservation, and health-care. To date, the FPF has funded five major projects, including three sponsored by Afinga. The first project organized by Afinga was designed to transport people and goods bound for Paramaribo by boat to Ajonía, the furthest village accessible by road from Paramaribo. This project facilitated travel for people living in the interior while avoiding the creation of new roads, which cause environmental damage in the forest. A sewing project, organized by Afinga, acquired sewing machines and material to make clothes, and an agricultural project, also organized by Afinga, helped to buy machetes, pickaxes and chain saws. CI-Suriname's assistance was requested by the community to provide training on how to use this equipment and additional leadership and organizational training.

Another FPF project involved a visit of tribal leaders from Suriname, both Maroon and Amerindian, to Belem, Brazil, to observe various types of community-based development projects. During this trip, the Granman of the Saramaka Tribe met his father for the first time. The father had emigrated to Brazil shortly after his son was born. In 1995, Maroon and Amerindian tribal leaders met in Asindopo, the first time in Suriname's history that all the tribal leaders had gathered together. The fifth FPF-sponsored project was a 1996 meeting of Amerindian leaders held to work out problems among the various communities. The FPF paid the participants' transport costs to the meeting site in a village near the coast. Most recently, the FPF supported the purchase of new sports equipment for one of the villages.

(3) Shaman's Apprentice Program

While the project has raised the community's overall awareness and interest in the value of their ethnobotanical knowledge, the Shaman's Apprentice Program specifically addresses the preservation of their practices. The program matches young community members to work with shaman and learn their ethnobotanical knowledge. The shaman and their apprentices are also invited to participate in various training sessions, for example in plant collecting, pressing, and drying techniques. The project has brought a new pride and interest in this medicinal heritage among the youth of the communities and a desire to preserve cultural traditions.

(4) Benefits Derived from Related Projects

CI is working on a GIS component of the project in Paramaribo. Using data from an atlas of Suriname, CI-Suriname has created maps with data on the country as a whole, including rivers, rainfall, protected areas, and forest concessions. Then, with the data collected by the bioprospecting teams, smaller regional maps of the specific areas in which CI works have been created, marking cultivated areas, soil types, and locations of specific kinds of plants collected. A second table includes biographical information about the shamans involved in the project, including their therapeutic specialties. The Surinamese government has requested the use of the GIS to plan their strategy for the sustainable development of interior.

In the spring of 1996, a public presentation and panel discussion about ethnobotanical medicine

was hosted by CI-Suriname in Paramaribo. During the summer of 1997, a management course for community-based NGOs was held in three villages. In addition, CI-Suriname participated in the annual Tourism Fair in Paramaribo, providing information about the ICBG project, the importance of maintaining traditional knowledge of medicinal plants, and ecotourism opportunities for villages participating in the project. CI has also sponsored workshops for Forest Service and other government personnel. At the request of the hospital director, a medicinal plants garden will be built on the grounds of the University Hospital in Paramaribo.

Finally, the ICBG in Suriname is focusing on the identification of products which can be used as the base for small, extractive industries at the community and family level. Potential products will be analyzed in detail to determine their viability as part of a sustainable marketing project.

6. Policy, Legislative and Administrative Context

Although the U.S. Federal Government is not a direct party to the ICBG agreement, the support of the government has been essential to the successful operation of the project. Their involvements include funding, policy guidance, easing local fears regarding project goals as well as assisting and raising the project profile within the Suriname government.

The government of Suriname requires a permit for the collection and export of plants. BGVS obtained the permit for the ICBG project, subject to particular conditions, and the exercise of the rights granted under permit are subject to supervision by the Ministry of Natural Resources. The permit requires that three plant specimens be deposited with the National Herbarium and that the ICBG report to the Head of the Forest Service and Director of the Department of Health on the scientific and economic feasibility of developing the botanical materials into pharmaceutical products. Also, collection must take place with the written permission of the owner and/or manager of the land and must respect the rights of the inhabitants. These restrictions illustrate the government's commitment to conservation and development and mostly reiterate obligations already taken by the participants. The right given to Forest Service employees to supervise the collection activities ensures that lower levels of government are also involved.

As mentioned above, the project is limited to angiosperms, or flowering plants. Therefore, the government of Suriname has the opportunity to evaluate the benefits of bioprospecting as an approach to biodiversity conservation and development while only applying one sector (angiosperms) of their biodiversity to the project for a limited time period. The incremental nature of the government's commitment makes the project seem less of a risk, thereby encouraging cooperation. By providing immediate assistance to the government for a specific project, the participants further strengthen their relationship with the government. For example, CI-Suriname is assisting the Malaria Task Force of the Ministry of Health, including a donation of \$2500.

7. Impact on Conservation

Some immediate and long-term benefits of bioprospecting to the environment are already apparent. The Suriname project has increased the knowledge of the flora of the region, helped prevent the loss of traditional knowledge of plant-derived medicines, provided educational opportunities for Surinamese scientists and students that emphasize the benefits of intact forest

ecosystems, and promoted sustainable economic development in Suriname's interior.

While the ICBG project has as one of its primary objectives the conservation of biodiversity, it is important to ensure that the bioprospecting activities themselves do not threaten the environment. First, only flowering plants which are not known to be endangered are collected. Because many plants used ethobotanically are cultivated and/or relatively common, the risk that endangered plants will be taken is more likely to occur during random botanical collections. In many places, escalating consumer demand is resulting in the indiscriminate harvest of wild plants. Plant collectors are thus instructed in collection techniques which ensure sustainability, and may only collect plants of which there are a sufficient number present. Should a drug be developed which requires the input of raw material, it will be important for the participants to ensure a sustainable harvest.

The project has already produced immediate conservation benefits. Plant inventory information and specimens provided to the National Herbarium and to MBG have helped the identification and documentation of Suriname's biodiversity, which at the beginning of the project was the least documented in all of South America after Bolivia.²⁵ The Shaman's Apprentice Program and CI-Suriname's community awareness activities have dramatically increased local interest in conservation and the preservation of indigenous knowledge. Growing interest and support within the national government is also apparent. Recent rejection by the Government of certain timber concession proposals may also be seen as a conservation benefit that the ICBG has promoted.

The project has also laid the groundwork for future conservation benefits. Not only do the projects funded by the FPF demonstrate to the local communities that there are immediate benefits to cooperative bioprospecting efforts, the money also helps establish economic activities which can be alternatives to the unsustainable use of forest resources. In-country plant collection and extraction, and the concomitant training and technology transfer, also foster the development of sustainable resource use.

8. Policy Relevant Conclusions: Lessons Learned and Replicability

a. Lessons learned

The ICBG-Suriname project has learned some valuable lessons about the design of appropriate benefit-sharing mechanisms. While the potential profits from drug development are enormous, and initial expectations were high, it has become apparent over the course of this project that the actual chances of a drug being developed is relatively low. Therefore in order for bioprospecting to be successful, other benefit-sharing mechanisms that provide immediate incentives have become even more important. While there have been some difficulties, these mechanisms are evolving as the project continues. For example, challenges have arisen with regards to the operation of the Forest People's Fund. Many local communities have expressed a desire for more guidance and a more structured process for how to submit proposals to the FPF. CI-Suriname is addressing these problems, and despite the difficulties, the fund has already supported a variety of community initiated projects.

²⁵ See supra note 13.

Another important lesson demonstrated by the project is that if bioprospecting is to promote biodiversity conservation, the source-country must be given the opportunity to participate in bioprospecting, including access to the means by which they can add value to these resources. However, the nation's right to participate is negligible unless certain crucial needs of its inhabitants are addressed. If the people's basic necessities are unmet, they will have little incentive to abide by the rules for protecting the natural resources.

An additional requirement to the success of bioprospecting is ensuring smooth relations and communication among all participants. Each party in the project has different needs, a different agenda, and a unique contribution to make. Even when each participant is adequately compensated, successful cooperation requires clear communication, reliability, honesty, and trust by all. In the case of the Suriname ICBG, initiating trust between the parties, particularly between the corporate and private sectors, was a challenge that has taken almost the full duration of the project.

The time frame for drug production highlights the fact that long-term relationships among the participants are important. Also, the long-term outlook, patience, and foresight of the source-country government and the parties are essential.

Finally, it should be recognized that the ethical and legal basis for many of the benefit-sharing mechanisms stems from the Convention on Biological Diversity's recognition of each nation's sovereign right to control access to its resources. The project in Suriname demonstrates that, for the present at least, land and resource rights are essential to both income generation and conservation.

b. Transferability of the Experience

The design of the ICBG-Suriname project is unique among bioprospecting projects. In many respects, the program was tailored to the particular conditions of Suriname and of the Maroon communities involved.

For example, the healing traditions of the Maroons in Surinam is different from those of the Amerindians. Whereas the Amerindians have shared medicinal knowledge among each other, the Maroons only pass the knowledge down matrilineally and each family has its own specialty or group of illnesses that they focus on. If a person is afflicted with a certain type of illness, he/she must visit the shaman in the family that specializes in that illness. Further, the Maroons guard their knowledge closely, and information is traditionally passed on verbally. Therefore, they are hesitant to share their knowledge with outsiders and to have the information documented in writing.

The customs and practices of the tribal communities involved in bioprospecting will greatly affect the design of a project, and any bioprospecting project must be tailored to fit the particular conditions of the country and communities involved in the project. However, many of the mechanisms developed in this project can provide inspiration and ideas for new bioprospecting projects and the lessons learned in Suriname could potentially benefit future bioprospecting projects everywhere.

c. Policy Advice

Many countries are just beginning to design policy strategies which focus on the development, sale, and export of genetic resources. As governments implement the Convention, they should ensure that benefit-sharing principles are incorporated into national legislation. Such guidelines for bioprospecting should take into account the experience developed in a number of countries where bioprospecting projects have been developed. A study of the Suriname project shows that, properly carried out, bioprospecting activities could serve as (1) economic incentives to protect, rather than destroy, biodiversity; (2) have the potential to bring revenues and technological capacity to developing countries; and (3) could provide a mechanism for avoiding perceived inequities of the past in which scientists and corporations used the biological diversity and knowledge of indigenous peoples without professional acknowledgment and financial compensation.²⁶ Among the prerequisites for a successful bioprospecting project are careful customization to the particular conditions of the country and communities involved, the active participation of local and national stakeholders, and the design of equitable compensation mechanisms.

²⁶ Ian Bowles, David Downes, Dana Clark & Marianne Guérin-McManus, *Economic Incentives and Legal Tools for Private Sector Conservation*, (Washington, DC: Conservation International, 1996).