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"[I]f agriculture is in trouble, Africa is in trouble."[1]

INTRODUCTION

Agriculture is pivotal in the lives of many Africans. In southern Africa, approximately eighty percent of the population is engaged in subsistence farming.[2] Yet the agricultural output in many African countries is inadequate to meet local needs.[3] Food security in the region is negatively affected by a number of past and present, and internal and external, factors that include weather conditions, the colonial footprint, internal conflict, international trade obligations, market reform, and the impact of HIV/AIDS on community structure and livelihood. Many countries in the region are ultimately forced to rely upon

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1. Donald L. Sparks, *Economic Trends in Africa South of the Sahara*, *in* AFRICA SOUTH OF THE SAHARA 2003 11, 18 (Katharine Murison ed., 32d ed. 2003) (quoting the World Bank) (internal quotations omitted).

2. The majority of the labor force in developing Africa is employed in agriculture, and typically agriculture can account for between thirty percent and eighty percent of GDP. *See id.* at 18-19.

3. Although agricultural output unquestionably needs to be improved in southern Africa, the sad reality is that often domestic agricultural output is adequate to meet local needs. The output, however, is bound up in commercial farming where much of the product is exported and, as many families lack the economic power to purchase food, particularly in rural areas, they remain hungry. Consider for example the plight of thousands of seasonal fruit pickers who live in poverty in the prosperous Western Cape, South Africa. *See* Andries du Toit, *Hungry in the Valley of Plenty*, MAIL & GUARDIAN, April 15 to 21, 2005, at 28; *see also* Michael R. Taylor & Jerry Cayford, *American Patent Policy, Biotechnology, and African Agriculture: The Case for Policy Change*, 17 HARV. J.L. & TECH. 321, 328-29 (2004).

food aid from international sources to feed their citizens.[4]

Part of the solution to food insecurity proffered in recent years is the use of modern biotechnology[5] in agriculture.[6] This solution has received a mixed response in southern Africa,[7] and in some countries the stance against genetically modified food is so strong that even pervasive droughts and endemic hunger were (almost) not enough to entice acceptance of genetically modified food aid from the United States in 2002.[8] On the

4. Heads of state and governments throughout the world have pledged their commitment to achieve food security and to eradicate hunger "with an immediate view to reducing the number of undernourished people to half their present level no later than 2015." *Rome Declaration on World Food Security*, *in* ROME DECLARATION ON WORLD FOOD SECURITY AND WORLD FOOD SUMMIT PLAN OF ACTION 1, 1 (1996); *see also* United Nations Millennium Declaration, G.A. Res. 55/2, ¶ 19, U.N. Doc. A/RES/55/2 (Sept. 18, 2000).

5. Article 3 of the Cartagena Protocol defines modern biotechnology as:

> [T]he application of: (a) In vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (b) Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection.

SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY, CARTAGENA PROTOCOL ON BIOSAFETY TO THE CONVENTION ON BIOLOGICAL DIVERSITY 4 (2000) [hereinafter CARTAGENA PROTOCOL].

6. The use of biotechnology in agriculture and manufacturing is commonplace and established: biotechnology has been used for centuries to produce plant hybrids, foodstuffs and other products (such as fermentation in the making of beer and the processes used in making cheese and yogurt). Modern biotechnology, on the other hand, refers to new and controversial techniques which involve the transfer of genes between species (genetic engineering/genetic modification) in a manner and at a speed not previously possible. *See* IQBAL PARKER ET AL., A NATIONAL BIOTECHNOLOGY STRATEGY FOR SOUTH AFRICA 1-3 (2001). For example, the International Rice Research Institute (IRRI) is involved in research and development into drought-resistant varieties of rice, and the Swaminathan Foundation in India is developing salt-tolerant rice varieties. The University of Cape Town is conducting research into the development of maize which is resistant to the African endemic maize streak virus and which is tolerant to drought. Nevertheless, there is a counterargument that modern biotechnology in agriculture is not necessarily a useful tool in the fight against hunger and poverty, and that, *inter alia*, it can result in monocultures and soil erosion. *See* Cédric Cabanne, WIPO-UPOV Symposium on Intellectual Property Rights in Plant Biotechnology (Oct. 24, 2003), http://www.upov.int/en/documents/Symposium2003/.

7. *See* Briefing, Service Centre for Development Cooperation, The TRIPS Agreement: Patenting of Genetic Heritage and Food Security (Aug. 2003) (stating that it is unclear "whether the cultivation of genetically modified varieties is suited for the conditions of developing countries").

8. Although Zambia stood by its rejection of the genetically modified

other hand, South Africa, although not plagued by food insecurity, but driven by industrial forces, has largely embraced genetically modified food crops.[9] Either way, countries in Africa are moving forward in regulating modern biotechnology.[10]

Resistance to the full-scale deployment of modern biotechnology in agriculture is twofold. The predominant objection is based upon environmental, human, and animal health and safety concerns.[11] These concerns are widely documented[12] and have resulted in the drafting of numerous policy documents and legal instruments at national, regional, and international levels. The second issue is that of control and ownership of plant genetic resources and private intellectual property rights in the products and processes of

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crops, Lesotho, Malawi, and Mozambique eventually relented and accepted some 60,000 tons of U.S. genetically modified food aid. *See* Taiwo A. Oriola, *Consumer Dilemmas: The Right to Know, Safety, Ethics and Policy of Genetically Modified Food*, SING. J. LEGAL STUD. 514, 514-15 & n.1 (2002). Zimbabwe, an exporter of unmodified crops, agreed to accept U.S. genetically modified maize on the condition that it would be allowed to mill the maize (at its own cost) such that farmers would subsequently be incapable of replanting it, and thus avoid the contamination of local crops. *See id*. at 515 n.1.

9. By 2000, some 350,000 hectares had already been planted with genetically modified crops. *See* ELFRIEDA PSCHORN-STRAUSS & RACHEL WYNBERG, THE SEEDS OF NEO-COLONIALISM: GENETIC ENGINEERING IN FOOD AND FARMING 1 (Mark Butler & David Hallowes eds., 2002). More recently the South African government appears to be exercising some caution: In early 2005, it was reported that the government rejected an application from Dow Agrosciences to run field trials of GM maize in South Africa. *See Bid to Test GM Maize in SA Gets Thumbs Down*, CAPE TIMES, Jan. 31, 2005. More recently, the South African government has placed a moratorium on genetically modified maize imports into South Africa while the Department of Trade and Industry studies the implications of such imports. *See Praise for GM Maize Ruling*, NEWS24.COM, Oct. 28, 2005, http://www.news24.com/News24/South_Africa/News/0,,2-7-1442_1825155,00.html.

10. The African Centre for Biosafety has documented many of the attempts to regulate biotechnology. *See* African Biosafety Laws & Comments, http://www.biosafetyafrica.net/biosafety_laws_and_comments.htm (last visited Feb. 16, 2006).

11. *See* Oriola, *supra* note 8, at 545-55 (outlining environmental and public health concerns about potential adverse effects on biological diversity, genetic resources, and human health).

12. *See, e.g.*, African Centre for Biosafety, http://www.biosafetyafrica.net/ (last visited Feb. 16, 2006); Biowatch South Africa, http://www.biowatch.org.za/ (last visited Feb. 16, 2006). *See generally* Jeffrey M. Smith, SEEDS OF DECEPTION: EXPOSING INDUSTRY AND GOVERNMENT LIES ABOUT THE SAFETY OF THE GENETICALLY ENGINEERED FOODS YOU'RE EATING (2003).

modern agricultural biotechnology.[13]

It is the latter, the control and ownership of plant genetic resources and the ownership of intellectual property rights in respect to plant genetic resources, which informs the thesis of this article. It is common knowledge that the global intellectual property rights prescribed by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)[14] conflict with the principles of the Convention on Biological Diversity (CBD),[15] in particular as they relate to indigenous knowledge, and the control, access, and benefit-sharing in plant genetic resources.[16] Many African countries have signed both TRIPS and the CBD and are now attempting to reconcile the provisions in domestic law. In doing so, the principles of the CBD and its associated instruments should not, and indeed need not, be compromised.

The article will, in Part I, give a very broad, historical overview of agriculture on the African continent. Part II will inform the reader of international and regional environmental law and intellectual property law instruments which aim to regulate the control and ownership of plant genetic resources and related biotechnological processes. Part III will then consider domestic law (and the influence, in domestic law, of the international instruments discussed in Part II) in southern Africa, and particularly in South Africa. To conclude, Part IV will review a case study of genetically modified cotton in South Africa which illustrates the current regulatory framework.

13. *See* Andrew T. Mushita & Carol B. Thompson, *Patenting Biodiversity? Rejecting WTO/TRIPS in Southern Africa*, 2 GLOBAL ENVTL. POL. 65 (2002).

14. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex IC, 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994) [hereinafter TRIPS Agreement].

15. Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818 [hereinafter Convention on Biological Diversity].

16. *See* CATHERINE MONAGLE, CTR. FOR INT'L ENVTL. LAW & WORLD WIDE FUND FOR NATURE, BIODIVERSITY & INTELLECTUAL PROPERTY RIGHTS: REVIEWING INTELLECTUAL PROPERTY RIGHTS IN LIGHT OF THE OBJECTIVES OF THE CONVENTION ON BIOLOGICAL DIVERSITY (2001); Sunita K. Sreedharan, *Reconciling TRIPs with the Convention on Biological Diversity – Indian Perspective*, BUSINESS BRIEFING: PHARMAGENERICS 2004, at 39-41 (2004).

I. A BIRTHRIGHT OF ABUNDANCE AND A CULTURE OF SHARING

Africa has an abundance of diversity: diversity of biological resources, as well as diversity of culture. It is estimated that Africa, home to more than 2000 different ethnic groups,[17] holds at least a quarter of the world's biological diversity.[18] Over centuries, African communities developed sophisticated agricultural practices, practices differing from those of other world regions. As Devlin Kuyek explains:

> In sub-Saharan Africa, farming began in Ethiopia between the 4th and 6th millennia BC. Not long after, migrating pastoral peoples took their agricultural practices to the rich, open lands of what is now Kenya and Tanzania. In West Africa, the cultivation of millet began in Mauritania at around 1000 BC, while rice cultivation began in the Niger River Valley about a century later. At the same time, communities in the West African forests started cultivating yam and oil palm. Relative to other regions of the world, African farmers were slow to take up sedentary agriculture practices. There were good reasons for this. For one, they didn't need to. African communities generally had access to an abundance of land and could gather the plants they needed for food and medicine by foraging. And, secondly, for large parts of Africa, environmental conditions made continuous, intensive agricultural production very difficult.[19]

Access by local communities to the rich diversity of biological resources in Africa served as a shield against the recurring human and environmental calamities to which Africa is prone. The relationship between African communities and Africa's biological diversity was a mutually beneficial one: the innovative agricultural practices helped to conserve and sustain biodiversity.[20] Indigenous communities classify,[21] use,

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17. *See* MARIAM MAYET, SECURING SUSTAINABLE LIVELIHOODS: IMPERATIVES UNDERPINNING THE DEVELOPMENT OF AN APPROPRIATE REGIME TO PROTECT COMMUNITY RIGHTS TO BIODIVERSITY 2 (2000).

18. DEVLIN KUYEK, GENETIC RESOURCES ACTION INT'L, INTELLECTUAL PROPERTY RIGHTS IN AFRICAN AGRICULTURE: IMPLICATIONS FOR SMALL FARMERS 11 (2002). South Africa alone is home to about ten percent of the world's plant biodiversity, and is home to one of the six floral kingdoms of the world (the Cape Kingdom). *See* Michael Kidd & Mariam Mayet, *Access to Genetic Resources in South Africa*, *in* AFRICAN PERSPECTIVES ON GENETIC RESOURCES: A HANDBOOK ON LAWS, POLICIES, AND INSTITUTIONS GOVERNING ACCESS AND BENEFIT-SHARING 231 (Kent Nnadozie et al. eds, 2003); Petro Terblanche, *Case Study: San/CSIR Hoodia Benefit-Sharing Model*, *in* FOOD SECURITY AND BIODIVERSITY: SHARING THE BENEFIT OF PLANT GENETIC RESOURCES 61 (2003), *available at* http://www.syngentafoundation.com/2004_review/World_Food_Day04.pdf.

19. KUYEK, *supra* note 18, at 2.

20. *See* MAYET, *supra* note 17. Systems for conservation include "home

store, nurture, and cultivate a multitude of plant species.[22] The knowledge acquired by African communities over the centuries is held collectively,[23] but in recent years we have seen the increasing value of indigenous knowledge in the global trading market.[24] The idea that knowledge is capable of private ownership is alien to and "culturally inappropriate"[25] for indigenous communities in Africa which are characterized by their communal approach to the use and management of plant genetic resources.[26]

Oral traditions and agricultural practices of African communities were directly, and indirectly, in the line of fire of the colonial powers after the "scramble for Africa" in the nineteenth century, which consolidated European interest and influence in Africa that had existed since the mid-fifteenth century European maritime explorations.[27] Customary laws and traditions gave way to colonial law,[28] and artificial

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gardens, seed banks, and sacred groves." *Id.*

21. *See* Mushita & Thompson, *supra* note 13, at 74.

22. As explained by Kuyek:

> The Suazi of Swaziland, for instance, nurture and use about 200 plant species, and the Tembe Thonga of southern Africa regularly use 106 species for their daily needs. The Kpelle women in Liberia maintain over 100 varieties of rice [and] . . . [i]n southern Africa, women are reported to store seed of 10 ecotypes of sorghum and pearl millet at a given period in their homestead granaries.

See KUYEK *supra* note 18, at 2.

23. Knowledge is generally acquired through membership of a community, and measures are in place for the reciprocal exchange of information among communities. *See Traditional African Concepts of Access*, *in* AFRICAN PERSPECTIVES ON GENETIC RESOURCES, *supra* note 18, at 25, 27.

24. The financial rewards, of course, accrue to the corporation exploiting the resource. It is estimated that "[a]bout 75 percent of active ingredients in pharmaceuticals come from plants in Southern countries." Mushita & Thompson, *supra* note 13, at 73. Mushita and Thompson provide the following examples from Africa: the rosy periwinkle of Madagascar (exploited by Eli Lilly to develop drugs for testicular cancer and childhood leukemia), an Ethiopian crossbred barley (which previously saved the California crops from yellow dwarf virus), and a West African berry (which contains a plant protein 2000 times sweeter than sugar). *See id.*

25. MONAGLE, *supra* note 16, at 15.

26. *See Traditional African Concepts of Access*, *supra* note 23.

27. *See* Richard Brown, *European Colonial Rule in Africa*, *in* AFRICA SOUTH OF THE SAHARA, *supra* note 1, at 26, 26.

28. Legal systems in Africa are predominantly rooted in British common law, French civil law, or Roman-Dutch civil law, and at the time of colonization, colonial authorities were dismissive of indigenous legal systems. *See generally id.* at 26-28.

geographical boundaries created disharmony for local communities. One such example is the Fulani in West Africa:

> [T]he Fulani in West Africa . . . traditionally keep their livestock in more arid areas during the wet season, where forage quality is relatively high. In the dry season, when water becomes scarce in the north, they move their animals further south to more humid areas, where the livestock can graze the crop residues in harvested fields and the still-green grass in low-lying areas along streams and rivers. These herds are important sources of manure for arable farming and thus help to maintain a cycle of cooperation and interdependence between the pastoral and farming communities. However, this particular system of resource use, amongst so many others, was disturbed by the drawing of national boundaries by colonial powers during the 19th and early 20th centuries.[29]

In many instances, sweeping changes to land use patterns were implemented by the colonial authorities. Communities were prohibited from cultivating certain crops without authorization or outside of designated territories and were cut off from their hunting and pastoral grounds, ultimately leading to a "reduction in the use and subsequent loss of local varieties, and the disruption of traditional farming systems that had evolved and adapted to the local environments over the centuries."[30]

African communities were dealt a further blow by the so-called "Green Revolution"[31] in the 1970s. The Green Revolution was the global "industrialization" of agriculture:

> [The industrialization] started from the supply of biochemical technologies not market demand, contributed little to agricultural output and increased government debt. . . . [It] showed little respect for the knowledge of African farmers and their proven capacities to expand and adapt production to meet changing market conditions or for the varied ecologies of African countries.[32]

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29. *See Traditional African Concepts of Access*, *supra* note 23, at 29.

30. *Id.*

31. Advocates of genetically modified crops, in fact, liken the potential of genetic modification to the Green Revolution. *See* STEPHEN GREENBERG, AFRICAN CENTRE FOR BIOSAFETY, GLOBAL AGRICULTURE AND GENETICALLY MODIFIED COTTON IN AFRICA 8-11 (2004).

32. Gavin Williams, *Reforming Africa: Continuities and Changes*, *in* AFRICA SOUTH OF THE SAHARA 2003, *supra* note 1, at 3, 5. The Green Revolution, in a different context, had transformed the production of grain in Asia, although resulting in what is effectively a monoculture:

> In India, over 75 percent of total rice production uses less than 10 percent of the 30,000 varieties of rice available. In Bangladesh, with 22 percent of the rice areas planted to modern varieties, 62 percent of those are from one maternal parent. The current world food supply is highly vulnerable.

Mushita & Thompson, *supra* note 13, at 75.

The technology transferred to the developing South during the Green Revolution consisted of high yielding seed varieties, irrigation systems, and chemical (fertilizer and insecticide) inputs from the developed North. Although higher yields may well have been reached in some instances, the negative effect of the pesticide use is still being felt in Africa today,[33] as is the social and economic impact of the Green Revolution, an ill-suited and expensive exercise for small-scale farmers which often resulted in the displacement of farm-laborers and the marginalization of ill-resourced farmers.

The formal freedom from colonial rule has not been successful in transforming the lives of many African people. The United Nations classifies forty-nine countries as least developed, thirty-four of which are found in Africa south of the Sahara.[34] External and internal factors have held Africa's potential at bay; disparities in income and inequality remain as access to power and the means to material wealth often entice those in power to move away from their stated agenda.[35]

II. PLANT GENETIC RESOURCES IN THE GLOBAL AND REGIONAL CONTEXT

In the past, plant genetic resources for food and agriculture were generally considered to be the "common heritage" of humankind. Likewise, the technologies used to improve seeds and plants were generally in the public domain.[36] Farmers and public research institutions that developed improved seeds would share the fruits of their labor, and seeds would be saved for exchange, sale, and cultivation.[37] This is no longer so as biotechnology companies clamber for intellectual property protection for their products and processes. That private

33. *See* GREENBERG, *supra* note 31, at 10.

34. *See* Sparks, *supra* note 1, at 12.

35. *See* Williams, *supra* note 32, at 4-5.

36. A thread running through the diverse range of indigenous communities in Africa is that which relates to ownership of property: the concept of individual ownership of property is alien. Hence, land and genetic (and biological) resources are communal in nature. *See Traditional African Concepts of Access*, supra note 23, at 27-28.

37. It is estimated that ninety percent of food production in sub-Saharan Africa is based on seeds saved for cultivation. *See* Service Centre for Development Cooperation, *supra* note 7; *see also* Mushita & Thompson, *supra* note 13, at 72.

companies are winning in their fight to assert ownership over plant genetic resources is evident from the decision of the Canadian Supreme Court in *Monsanto Canada, Inc. v. Schmeiser*.[38]

The recent availability of plant and biotechnology patents[39] in many countries has been accompanied by a rise in the commercial value of plants and seeds[40] and a shift in the balance of biotechnological research and development from the public sector to private biotechnology entities.[41] Private seed

38. [2004] S.C.R. 902 (Can.). In the *Schmeiser* case, Schmeiser had not purchased Roundup Ready canola nor had he obtained a license to plant Roundup Ready canola. *See id.* at 902. Tests, however, revealed that of Schmeiser's 1998 canola crop, some ninety-five to ninety-eight percent was Roundup Ready canola. *See id.* at 907. Schmeiser suspected that the seed had either blown onto his property from neighboring fields or fallen from passing trucks. *See* Bernard Shaw, *Monsanto Wins Patent Case on Plant Genes*, N.Y. TIMES, May 22, 2004, at C1. Nevertheless, Monsanto brought an action against Schmeiser for patent infringement. *See* Schmeiser, [2004] S.C.R. at 907. The majority (5-to-4) in the Canadian Supreme Court upheld the patent on the basis that protection extended to the genes and modified cells that made up the plant (rather than the plant itself). *See id.* at 909. Moreover, it found that Schmeiser "used" the patented gene and cell through the saving and planting of the seed and the harvesting and selling of the plants containing the patented cells and genes, thus infringing the patent. *See id.* at 918. The dissent, relying on the unpatentability of higher life forms and the availability of *sui generis* protection under the Plant Breeders' Rights Act, would have allowed Schmeiser's appeal. *See id.* at 919-27.

39. Modern bio-techniques have received patent protection in the United States since the 1980s. *See* Diamond v. Chakrabarty, 447 U.S. 303 (1980) (deciding by a marginal majority (5-to-4) that a strain of bacteria, genetically engineered to consume oil, could be patented); *Ex parte* Hibberd, 227 U.S.P.Q (BNA) 443 (Bd. of Pat. App. & Int. 1985) (expanding the scope of what the Patent and Trademark Office considered patentable biotechnologies from microorganisms to genetically modified plants); *see also* TRIPS Agreement, *supra* note 14, at art. 27 (requiring members of the WTO to make available patents for any inventions in all fields of technology and specifically requiring either patent or *sui generis* protection for plant varieties); Taylor & Cayford, *supra* note 3, at 345. *But see* Harvard Coll. v. Canada (Comm'r of Patents), [2002] 4 S.C.R. 45 (Can.) (drawing the line at the patentability of "higher life forms" and holding that "oncomice" are not patentable). Used for cancer research, an oncomouse is a genetically altered mouse produced by injecting a cancer-producing gene, the oncogene, into a fertilized mouse egg. The oncomouse has been held patentable in much of Europe, Sweden, and the United States. *See generally* Kirin-Amgen, Inc. v. Hoechst Marion Roussel Ltd, [2004] UKHL 46 (U.K.) (discussing the extent—and limits—of protection available to biotechnological product patents and, in particular, a "product-by-process" claim).

40. *See* Service Centre for Development Cooperation, *supra* note 7 (estimating that in 2003 the annual value of seed trade was thirty billion dollars).

41. *See* Taylor & Cayford, *supra* note 3, at 406 (stating that in the United

companies have clamped down on the rights to save, share, exchange, and sell seeds produced from cultivation,[42] a sobering thought given the pressure[43] developing countries are under to implement systems for the protection of intellectual property rights in terms of their obligations as World Trade Organization (WTO) members.[44] Protection of higher life forms by way of patent is, in any event, fraught with conceptual difficulties:

> Because higher life forms can reproduce by themselves, the grant of a patent over a plant, seed or non-human animal covers not only the particular plant, seed or animal sold, but also all its progeny containing the patented invention for all generations until the expiry of the patent term. . . . [G]ranting the patent holder exclusive rights that extend not only to the particular organism embodying the invention but also to all subsequent progeny of that organism represents a significant increase in the scope of rights offered to patent holders. It also represents a greater transfer of economic interests from the agricultural community to the biotechnology industry than exists in other fields of science.[45]

Plant genetic resources for food and agriculture are the subject of numerous international instruments. The CBD, reinforced by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR),[46] vests control and access to genetic resources with national governments of the country of origin.[47] On the other hand, the TRIPS

States "[o]f the 2,247 agricultural biotechnology patents that were issued from 1975 to 1998, 525 were issued or assigned to universities or public institutions, 812 were issued or assigned to small firms or individuals, and 970 were issued or assigned to corporations").

42. *See, e.g.*, Monsanto Canada, Inc. v. Schmeiser, [2004] S.C.R. 902 (Can.); *GM Company Sues Soy "Seed Saver" for Piracy*, CAPE TIMES, Jan. 20, 2005.

43. Although strictly speaking, patents are only enforceable in the issuing country, the United States is nonetheless able to put pressure on developing countries to adopt strong intellectual property regimes. *See generally* Taylor & Cayford, *supra* note 3, at 365 (identifying at least three ways in which U.S. foreign policy exerts pressure: "implementation of the TRIPS Agreement, support for international harmonization and strengthening of patent law beyond what is required by TRIPS, and the use of trade agreements and trade sanctions to both protect U.S. intellectual property overseas and promote adoption of strong intellectual property regimes in other countries").

44. *See* Mushita & Thompson, *supra* note 13.

45. CANADIAN BIOTECHNOLOGY ADVISORY COMM., PATENTING OF HIGHER LIFE FORMS AND RELATED ISSUES 12 (2002).

46. International Treaty on Plant Genetic Resources for Food and Agriculture, Nov. 3, 2001 [hereinafter ITPGR].

47. *See* Convention on Biological Diversity, *supra* note 15.

Agreement, which harmonizes intellectual property rights, obliges some form of intellectual property protection for plant species, thereby creating a mechanism for privately-owned control of access to genetic resources.[48] Although African countries are under pressure to implement, in domestic law, strong intellectual property rights akin to that of countries such as Canada and the United States, such rights, in many instances, appear to be inappropriate for Africa. In addition, implementation of these rights is not required by international law, as will be explained below.

Countries in southern Africa are members of the WTO and are also signatories to the CBD[49] and its Cartagena Protocol on Biosafety.[50] In addition, southern African countries are likely to sign the ITPGR. South and southern Africa are therefore obliged to implement the provisions of the TRIPS Agreement as well as the principles in the CBD and the Cartagena Protocol.[51] A discussion of significant aspects of these major international and regional instruments follows.

A. THE CBD AND ASSOCIATED INTERNATIONAL ENVIRONMENTAL LAW INSTRUMENTS

The CBD came into effect in December 1993, and has as its objectives the conservation of biological diversity, and the sustainable use and fair and equitable sharing of the benefits arising out of the use of genetic resources.[52] The CBD also recognizes "that economic and social development and poverty eradication are the first and overriding priorities of developing countries."[53]

On environmental and biosafety issues, the Cartagena Protocol on Biosafety provides an international regulatory framework for the "environmentally sound" application of

48. *See* TRIPS Agreement, *supra* note 14.

49. The CBD was signed by 150 government leaders at the 1992 Rio Earth Summit. *See* Convention on Biological Diversity, *supra* note 15.

50. *See* CARTAGENA PROTOCOL, *supra* note 5.

51. Mushita & Thompson, *supra* note 13 (considering the debate about intellectual property, particularly in agriculture, in southern Africa and the alternative approach to TRIPS—the African Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources, encompassing the principles of the CBD and acknowledging and protecting farmer and local community rights).

52. *See* Convention on Biological Diversity, *supra* note 15, at art. 1.

53. *Id.* at pmbl.

biotechnology insofar as it prescribes levels of protection for the transfer, handling, and use of living modified organisms resulting from modern biotechnology.[54] Moreover, a party may take into account socio-economic considerations, especially with regard to indigenous and local communities in reaching a decision on import under the protocol.[55]

The CBD deals incisively with indigenous knowledge and requires that members, subject to national legislation:

> [R]espect, 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 and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practice.[56]

On the issue of control, the CBD provides that "States have . . . the sovereign right to exploit their own resources."[57] It is therefore up to individual states to regulate access to genetic resources.[58] The CBD requires that access shall be subject to the "prior informed consent"[59] of the country providing such resources and "shall be on mutually agreed terms."[60] Member states are required also to implement legislative, administrative, or policy measures that have "the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources . . . upon mutually agreed terms."[61]

The flipside of access to plant genetic resources is access to and transfer of technology, particularly biotechnology. The CBD provides that parties shall implement measures to provide access to and transfer of technology, particularly to developing countries that provide the plant genetic resources, including technology protected by patents and other

54. *See* CARTAGENA PROTOCOL, *supra* note 5, at art. 1.
55. *See id.* at art. 26.
56. Convention on Biological Diversity, *supra* note 15, at art. 8(j).
57. *Id.* at art. 3.
58. *See id.* at art. 15(1).
59. *Id.* at art. 15(5).
60. *Id.* at art. 15(4).
61. *See id.* at art. 15(7).

intellectual property rights, subject to national legislation and international law.[62]

Additional safeguards with respect to plant genetic resources specifically for food and agriculture are put in place by the ITPGR, which is closely linked to the CBD.[63] The ITPGR seeks to regulate the conservation and sustainable use of plant genetic resources specifically for agriculture and food security, as well as the fair and equitable sharing of the benefits arising out of such use through a multilateral system of access and benefit-sharing.[64] One of the crucial differences between the CBD and the ITPGR is the reliance, in the CBD, on individually negotiated bilateral agreements between parties,[65] whereas the ITPGR establishes a multilateral (worldwide) system of exchange of plant genetic resources, even though the multilateral system only applies to listed crops. [66]

The ITPGR prohibits intellectual property rights over material obtained through the multilateral exchange, although it does not necessarily prohibit intellectual property protection over derivatives thereof.[67] The international agreement requires member states to protect traditional knowledge with regard to plant genetic resources for food and agriculture, and to protect the rights of farmers to save, use, exchange, and sell farm-saved seed or propagating material, subject to national law.[68] As mentioned above, insofar as access to and control over plant genetic resources are concerned, the agreement establishes a multilateral system of access and benefit-sharing covering the plant genetic resources for food and agriculture listed in Annex I to the agreement.[69]

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62. *See* Convention on Biological Diversity, *supra* note 15, at pmbl.

63. *See* ITPGR, *supra* note 46, at art. 1.2.

64. *See id.* at art. 1.1. The treaty lists numerous crops covered under the multilateral system, including oat, beet, chickpea, citrus, coconut, carrot, yams, strawberry, sunflower, barley, sweet potato, lentil, apple, cassava, banana, rice, beans pea, rye, potato, eggplant, sorghum, wheat, and maize. *See id.* at annex I.

65. *See generally* Convention on Biological Diversity, *supra* note 15.

66. *See* ITPGR, *supra* note 46, at pmbl. (explaining that "states may mutually benefit from the creation of an effective multilateral system for facilitated access to a negotiated selection of . . . resources").

67. *See id.* at art. 12.3(d).

68. *See id.* at art. 9.

69. *See id.* at pt. IV (establishing the multilateral system of access and benefit-sharing).

B. THE TRIPS AGREEMENT

The TRIPS Agreement was signed after the CBD entered into force and has a very different agenda. TRIPS is motivated by international trade and economic law and aims to reduce impediments to international trade by requiring member states to provide adequate (universal) standards of trade-related intellectual property rights.

The TRIPS Agreement is silent on indigenous knowledge, thereby leaving the door open to the abuse and misappropriation of traditional and indigenous knowledge,[70] unless its provisions are interpreted subject to the CBD and its associated agreements. The problem is in foreign domestic law environments where countries are not signatories to the CBD, for example the United States or where patent offices do not actively evaluate patents. A recent encouraging development in the European Patent Office saw the patent office, after a ten-year challenge, uphold a decision to revoke a patent previously granted on a fungicidal product derived from the seeds of the Neem tree (*Azadirachta indica*), an indigenous tree in India, where the fungicidal properties of the tree had been public knowledge for centuries.[71]

Insofar as plant genetic resources are concerned, Article 27 of TRIPS obligates member states to provide for the patenting of any inventions, whether product or process, "in *all* fields of technology, provided they are new, involve an inventive step, and are capable of industrial application."[72] Although members may exclude from patentability plants, animals, and biological processes for the production of plants and animals, members must provide for the protection of plant varieties either by

70. *See generally* MONAGLE, *supra* note 16, at 6. Patents that have relied upon misappropriated indigenous knowledge include one granted to a Texas company over rice derived from traditional "Basmati rice" and a patent granted to the University of Wisconsin over a sweet substance derived from berries of a plant (*Pentadiplandra brazzeana*) from Gabon. *See id.*

71. *See* Vir Singh, *India Wins Seminal Case Against Patent Relating to Traditional Indian Knowledge*, 69 PAT. TRADEMARK & COPYRIGHT J. 543 (2005). A patent that had been granted to the U.S. Department of Agriculture and the firm W.R. Grace for a method of extraction of oil from the Neem tree was revoked by the European Patent Office. *See* Decision Revoking European Patent No. 0436257 (Feb. 13, 2000). Nonetheless, at least one Neem tree patent remains in force in the United States. *See* Margo A. Bagley, *Patently Unconstitutional: The Geographical Limitation on Prior Art in a Small World*, 87 MINN. L. REV. 679, 680-82 (2003).

72. TRIPS Agreement, *supra* note 14, at art. 27(1) (emphasis added).

patent or by an effective *sui generis* system.[73] A proliferation of patents appears to have come about in recent years,[74] frustrating access to information required, not only for commercial purposes, [75] but also for public interest reasons.

One of the objectives of the TRIPS Agreement is the transfer and dissemination of technology.[76] TRIPS anticipates that this objective will take place via the protection of intellectual property rights,[77] although TRIPS does contain flexibilities for access to technology.[78] But what TRIPS gives, TRIPS, or at least pressure from developed world trading partners,[79] takes away: "Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner."[80] Members may "adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are

73. *See id.* at art. 27(3)(b). One such *sui generis* system is that which is protected under the International Union for the Protection of New Varieties of Plants (UPOV), based on the International Convention for the Protection of New Varieties of Plants, Dec. 1, 1961 (revised on Nov. 10, 1972, Oct. 23, 1978, and Mar. 19, 1991), *available at* http://www.upov.int/en/publications/conventions/1961/act1961.htm.

74. *See* Taylor & Cayford, *supra* note 3, at 406 (documenting databases on the issuance of patents that indicate "[t]he number of patents in . . . two classes [(Chemistry: Molecular Biology and Microbiology; Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes)], closely related to plant biotechnology, has increased almost ninefold since 1981."). According to Taylor and Cayford, "[i]n the same amount of time, overall utility patents per year slightly more than doubled." *Id.*

75. *See id.* at 349 (explaining that proliferation of patents results in a so-called "patent thicket" around biotechnology, making access to technology difficult and expensive). A patent thicket is "an overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees." *Id.* (quoting Carl Shapiro, *Navigating the Patent Thicket: Cross-Licenses, Patent Pools, and Standard-Setting*, *in* INNOVATION POL'Y & THE ECON. 119, 120 (Adam Jaffe et al. eds., 2001)).

76. *See* TRIPS Agreement, *supra* note 14, at art. 7.

77. *See id.*

78. *See id.* at arts. 8, 30-31, 40, 66.

79. *See* Taylor & Cayford, *supra* note 3, at 371 (asserting that "the United States uses its current leverage in trade negotiations, as well as trade sanctions and tariff benefits, to press observance of U.S. intellectual property rights in other countries and to seek adoption of patent regimes that go beyond what is required by TRIPS").

80. TRIPS Agreement, *supra* note 14, at art. 30.

consistent with the provisions of . . . [the TRIPS] Agreement."[81] Members may also provide for compulsory licenses in certain circumstances.[82] These provisions arguably give TRIPS the flexibility to ensure a level of protection of indigenous or local communities and plant genetic resources comparable to the CBD. The reality, however, is that this protection will not happen because of uneven trading powers, the limited resources available to Africa,[83] and the fact that Africa appears to be easily seduced by technology.

Article 27(3)(b) of the TRIPS Agreement, which requires intellectual property protection for plant varieties, provides for a review of the provision four years from the date of entry into force. This scheduled review is now overdue.[84] The submissions from the African Group in this regard can be summarized as follows:

- There is a likelihood that the intellectual property protection required for plant varieties could negatively impact food security and exacerbate poverty.[85]
- There is a lack of international mechanisms to deal with the misappropriation of genetic resources and traditional knowledge from developing countries.[86]
- The patenting of life forms is abhorrent to African tradition and culture.[87]

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81. *Id.* at art. 8.

82. *See id.* at art. 31 (explaining that in some instances, members may allow for the use of "the subject matter of a patent without the authorization of the right holder," as long as certain provisions enumerated of the TRIPS Agreement are respected).

83. Many African countries do not have properly functioning intellectual property regimes, and are not in a position to sway the balance in favor of their communities' best interests.

84. *See* Taking Forward the Review of Article 27.3(b) of the TRIPS Agreement – Joint Communication from the African Group, at 1, WTO Doc. IP/C/W/404 (June 26, 2003) [hereinafter Review of Article 27.3(b)] (noting that the review was to have been finalized by December 2002).

85. *See id.* at 3-4 (warning that although the "legitimate rights of commercial plant breeders should be protected, these should be balanced against the needs of farmers and local communities").

86. *See id.* at 4-5 (cautioning against a "wait and see" attitude and urging the WTO to seek its own measures to protect against the misappropriation of genetic resources and traditional knowledge). In light of its various concerns, the African Group has drafted a Decision on Traditional Knowledge containing its recommended measures, which it urges the WTO to adopt. *See id.* at 6-9.

87. *See id.* at 2 (noting that these "patents are contrary to the moral and

The African Group implores its members not to derogate from the provisions of the CBD and the ITPGR, and it also encourages its members to explore ways to accommodate these environmental law instruments.[88] To this extent, the African Group favors the adoption by African states of the African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources (African Model Law),[89] particularly in relation to a *sui generis* system for the protection of plant varieties.[90]

Insofar as regulating indigenous knowledge and access to plant genetic resources is concerned, the African Group discusses the potential use of Article 29 of the TRIPS Agreement to modify rights and obligations created by the substantive provisions of TRIPS.[91] Article 29, titled "Conditions on Patent Applicants," provides for disclosure of information by the applicant. The African Group suggests adding the following provision: "Members shall require an applicant for a patent to disclose the country and area of origin of any biological resources and traditional knowledge used or involved in the invention, and to provide confirmation of compliance with all access regulations in the country of origin."[92]

In addition to the international instruments dealt with above, there are a number of regional arrangements that could influence domestic law. Regional arrangements arise out of bodies such as the African Union (AU) (formerly the Organization for African Unity (OAU)),[93] as well as geographically defined organizations such as the Southern African Development Community (SADC)[94] and the Economic

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cultural norms of many societies in Members of the WTO . . . [and many Members] consider patents on life forms to be contrary to the fabric of their society and culture, and to be immoral").

88. *See id.*

89. *See* Review of Article 27.3(b), *supra* note 84, at 2-3.

90. *See id.* at 3.

91. *See id.* at 6.

92. *Id.* at 6; *cf.* Patents Amendment Bill, 2005, Bill 17B-05 s. 2 (GA) (containing similar provisions).

93. *See* African Union, African Union in a Nutshell, http://www.africa-union.org/root/au/AboutAu/au_in_a_nutshell_en.htm (last visited Feb. 25, 2006).

94. Angola, Zambia, Malawi, Namibia, Botswana, Zimbabwe, Mozambique, South Africa, Lesotho, Swaziland, Democratic Republic of Congo, United Republic of Tanzania, and Mauritius are members of the

Community of West African States (ECOWAS).[95] A number of English-speaking African countries, excluding South Africa, are also members of the African Regional Industrial Property Organization (ARIPO).[96] A protocol adopted in 1982 allows the ARIPO office to grant patents and register designs on behalf of its member states.[97] Its provisions, however, are flawed because the office lacks appropriate resources, and its staff lacks the requisite skills and expertise.

The former OAU drafted two model laws—the African Model Law and the OAU Model Law on Safety in Biotechnology. These model laws have the potential to have an impact on the domestic regulation of biotechnology, indigenous knowledge, control, access, and benefit-sharing in plant genetic resources.

C. THE AFRICAN MODEL LAW

The African Model Law provides Africa with "a legislative means to overcome the inequities of TRIPS,"[98] and acknowledges that local communities possess certain rights over their biological resources and the technologies that have evolved over generations and are *a priori* rights of a collective nature that take precedence over rights based on private

SADC. *See* Southern African Development Community, SADC Profile, http://www.sadc.int/english/about/profile/index.php (last visited Feb. 20, 2006).

95. ECOWAS was formed in 1975 and has fifteen countries on its current membership list: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. *See* Economic Community of West African States, http://www.ecowas.info (last visited Feb. 20, 2006).

96. There are currently fifteen members of ARIPO: Botswana, the Gambia, Ghana, Kenya, Lesotho, Malawi, Mozambique, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe. *See* African Regional Industrial Property Organization, Membership and Advantages, http://www.aripo.wipo.net/membership.html (last visited Feb. 20, 2006). ARIPO is intended for the "study and promotion of and co-operation in industrial property matters." Agreement on the Creation of the African Regional Industrial Property Organization (ARIPO), Dec. 9, 1976, pmbl., *available at* http://www.wipo.int/clea/doc_new/en/zz/zz001en.html. The objectives of ARIPO include the promotion of "the harmonization and development of the industrial property laws, and matters related thereto, *appropriate to the needs of its members and of the region as a whole*." *Id.* at art. III(a) (emphasis added).

97. *See* Protocol on Patents and Industrial Designs Within the Framework of the African Regional Industrial Property Organization (ARIPO), Dec. 10, 1982, § 1, *available at* http://www.wipo.int/clea/docs_new/en/zz/zz004en.html.

98. Mushita & Thompson, *supra* note 13, at 77.

interests.[99] The African Model Law seeks to implement the relevant provisions of the CBD[100] and applies to biological resources in both *in situ* and *ex situ* conditions, derivatives of biological resources, community knowledge and technologies, local and indigenous communities, and plant breeders.[101] Access to such biological resources, knowledge, or technologies of local communities is granted by submitting an application for prior informed consent and a written permit.[102] The application to the National Competent Authority[103] must disclose the full details of the project for which the resource is required, including the purpose for which access to the resource is requested, the risks to biological diversity, and the proposed mechanisms and arrangements for benefit-sharing.[104] The sharing of benefits based upon customary practices of local communities does not apply to "any person or persons not living in the traditional and customary way of life."[105]

Prior informed consent is also required from the concerned local community, including its female members.[106] An access permit is granted through a signed written agreement among the three parties: the National Competent Authority, the community or communities concerned, and the applicant or collector.[107] The contents of this tripartite agreement are regulated by Article 8 of the African Model Law. Specifically,

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99. *See* African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources (2000), pmbl. [hereinafter African Model Law], *available at* http://www.grain.org/brl_files/oau-model-law-en.pdf.

100. *See id.* (stating that "there is a need to implement the relevant provisions of the Convention on Biological Diversity").

101. *Id.* at art. 2(1). The legislation, however, does not affect the "traditional systems of access, use or exchange of biological resources." *Id.* at art. 2(2)(i).

102. *See id.* at art. 3(1).

103. The "National Competent Authority is the entity authorized by the State to supervise and watch over the implementation of one or more of the components of the present law." *Id.* at art. 1.

104. *See* African Model Law, *supra* note 99, at art. 4. A formula for "benefit-sharing" is provided for by Article 12 of the African Model Law. In addition to a share of the actual earning derived from the biological resource or knowledge, a "permit fee" is also payable, in advance, based on "whether or not the collection is to be used for commercial purposes, and the number of samples, the area of collecting, the duration of collection and whether or not the collector is granted exclusive rights." *Id.* at art. 12(1).

105. *Id.* at art. 2(3).

106. *See id.* at art. 5(1).

107. *See id.* at art. 7(2).

the agreement requires the collector to contribute financially to the efforts of the state and communities concerned in the regeneration and conservation of the biological resource. The collector may only apply for intellectual property protection of the biological resource, or parts or derivatives thereof, or for community knowledge or technology with the additional prior informed consent of the original providers. Article 9 then goes on to provide that patents over life forms and biological processes will not be recognized and cannot be applied for, but does provide for plant breeders' rights.

The African Model Law recognizes and protects community rights,[108] farmers' rights,[109] and plant breeders' rights,[110] and calls into question the suitability of intellectual property protection systems, particularly patent law, for developing countries where the main concern is often to secure food and to fight poverty.[111]

D. THE OAU MODEL LAW ON SAFETY IN BIOTECHNOLOGY

The OAU Model Law on Safety in Biotechnology, influenced by the Cartagena Protocol on Biosafety, seeks to harmonize existing legislation in the area of biosafety. To that end, it provides a framework of biosafety regulations designed to protect Africa's rich biodiversity, along with animal and human health, from the risks inherent in modern biotechnology.[112]

The OAU Model Law on Safety in Biotechnology contains strict regulations concerning the "import, export, transit, contained use, release and placing on the market of any GMO [Genetically Modified Organism] and a product of a GMO, whether it is intended . . . for use as a pharmaceutical, for food,

108. *See id.* at pt. IV.

109. *See* African Model Law, *supra* note 99, at pt. V.

110. *See id.* at pt. VI.

111. *See* Mushita & Thompson, *supra* note 13, at 79-80 (explaining that biodiversity, including indigenous plants, serves as a vital source of food and medicine for the poor, and that the need to protect related intellectual property rights is often, at most, a secondary priority). *See generally* ULF ANDERFELT, INTERNATIONAL PATENT-LEGISLATION AND DEVELOPING COUNTRIES (1971).

112. MARIAM MAYET, WHY AFRICA SHOULD ADOPT THE OAU AFRICAN MODEL LAW ON SAFETY IN BIOTECHNOLOGY 1 (2003), *available at* http://www.biosafetyafrica.net/_DOCS/CommentBiosafetyModelLaw.pdf.

feed or processing."[113] Decisions in this regard must be based on the precautionary principle contained in the CBD. The OAU Model Law also views "public participation and access to information as important and indispensable components of environmental governance."[114]

The regional arrangements, the two model laws drafted by the former OAU, align with the provisions of the CBD and associated law instruments rather than with the provisions of the TRIPS Agreement. We shall now consider the route followed in domestic law in southern Africa, in particular South Africa.

III. DOMESTIC LAW IN SOUTH AND SOUTHERN AFRICA

Earlier forms of statutory protection for intellectual property in southern African domestic law merely aimed to extend the protection afforded to colonial proprietors of intellectual property. For example, in Botswana the now-repealed Patents and Designs Protection Act[115] aimed to "provide for the protection in Botswana of inventions the subject of patents subsisting in the United Kingdom or in the Republic of South Africa."[116] Some African countries, which are now members of ARIPO, simply had no industrial property legislation, though non-statutory provisions were usually made for unlawful acts relating to intellectual property rights.[117]

Although the idea of individual ownership of intellectual property is antithetical to traditional African society and customary practices, intellectual property laws nonetheless remained on the statute books after colonial rulers transferred power to their African successors. African societies' disfavor of private intellectual property rights is, however, illustrated by the activity, or rather inactivity, at industrial property offices in Africa generally.[118] Nonetheless, Africa is duty-bound to

113. *Id.* at 3.

114. *Id.* at 9.

115. Chapter 68:02, The Laws of Botswana, Revised Edition 1997. The Patents and Designs Protection Act commenced on March 11, 1955 and has now been replaced by the Industrial Property Act 14 of 1996, *available at* http://www.tralac.org/pdf/Industrial_Property_Act_Botswana.pdf.

116. Patents and Designs Protection Act of 1955, pmbl.

117. T.D. BURRELL, BURRELL'S SOUTH AFRICAN PATENT AND DESIGN LAW § 1.19.2 (3d ed. 1996) (stating that Ethiopia is an example of one such country).

118. Statistics from the U.N. Development Program and U.S. Patent Office reflect that in 2001, 2.5 technology patents per one million people in South Africa, where a fairly sophisticated intellectual property regime is in place,

implement and enforce the intellectual property rights prescribed by the TRIPS Agreement.[119]

In South Africa, a plethora of policy documents and legislation relating to plant genetic resources for food and agriculture is in place that appears, on the surface at least, to comply with the major tenets of both the TRIPS and CBD agreements. Of significance, and considered below, are the Patents Act 57 of 1978, the Plant Breeders' Rights Act 15 of 1976, the Genetically Modified Organisms Act of 1977, and the National Environmental Management: Biodiversity Act 10 of 2004. It is also useful to consider applicable provisions of the South African Constitution, as all laws in South Africa must be interpreted in a manner consistent with the Bill of Rights contained in the Constitution (and international law must be considered when interpreting the Bill of Rights).[120]

A. CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA ACT 108 OF 1996 (CONSTITUTION)

The Bill of Rights[121] in the Constitution of South Africa provides that everyone has a right of access to sufficient food and water,[122] the right to an environment that is not harmful to health or well-being, and the right to environmental protection, for the benefit of present and future generations, through sustainable development and use of natural resources that also promotes economic and social development.[123] The Bill of Rights also protects cultural associations.[124]

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compared with twenty-five in Australia and 779 in South Korea. *See* Alla Katsnelson, *South Africa Fights Low Patent Rate*, NATURE.COM, Oct. 14, 2004, http://www.nature.com/news/2004/041018/full/bioent834.html. Intellectual property generally is not a priority in Africa. In Angola, for example, in twenty-nine years only thirty trademarks were registered over Angolan industrial products. *See* Press Release, Angola Press Agency, Angola Struggling to Make Inroads into Intellectual Property (Sept. 17, 2004), *available at* http://www.tralac.org/scripts/content.php?id=2919.

119. *See* TRIPS Agreement, *supra* note 14, at art. 41(1) (stating that members must provide enforcement mechanisms against infringements of the TRIPS Agreement). Developing countries were given an extended period of time to amend domestic law to comply with the TRIPS Agreement. *See id.* at art. 65(2).

120. *See* S. AFR. CONST. 1996 art. 39.

121. *Id.* at arts. 7-39.

122. *See id.* at art. 27(1)(b).

123. *See id.* at art. 24.

124. *See id.* at art. 31.

In addition, the Constitution provides that "no one may be deprived of property except in terms of law of general application, and no law may permit arbitrary deprivation of property."[125] Although property is specifically not limited to land,[126] the scope of the property clause is otherwise unclear and could possibly include immaterial property rights. However, in *In re Certification of the Constitution of the Republic of South Africa, 1996,*[127] the Constitutional Court held, in response to an objection raised regarding the failure to recognize a right to intellectual property, that it was not necessary to mention intellectual property separately as a universally accepted fundamental right in view of the fact that a right to intellectual property is "rarely recognised in regional conventions protecting human rights and in the constitutions of acknowledged democracies."[128] The objection was dismissed.[129] The Constitution goes on to provide that:

> Property may be expropriated only in terms of law of general application
>
> a. for a public purpose or in the public interest; and
>
> b. subject to compensation, the amount of which and the time and manner of payment of which have either been agreed to by those affected or decided or approved by a court.[130]

Public interest includes "reforms to bring about equitable access to all South Africa's natural resources."[131] If, indeed, intellectual property is constitutionally protected, it is certainly possible to regulate "expropriation" for the public good. It is argued that the principles of "deprivation" and "expropriation" apply to the vertical relationship between the state and property owners rather than between private individuals.[132] These relationships and the nuances relating to plant genetic resources have yet to be tested in terms of the Constitution.

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125. *Id.* at art. 25(1). The law of general application is sufficiently broad to refer to statutory law, common law, and customary law.

126. *See* S. AFR. CONST. 1996 art. 25(4)(b).

127. 1996 (4) SA 744 (S. Afr.).

128. *Id.* at 799 (internal citation omitted).

129. *See id.* at 800.

130. S. AFR. CONST. 1996 art. 25(2). Expropriation is a form of deprivation for which compensation is received. *See* P.J. BADENHORST, BILL OF RIGHTS COMPENDIUM § 3FB4 (1998).

131. S. AFR. CONST. 1996 art. 25(4)(a).

132. BADENHORST, *supra* note 130, § 3FB16.

B. PATENTS ACT 57 OF 1978 (PATENTS ACT) AND THE PATENTS AMENDMENT BILL OF 2005

The Patents Act provides that a patent may be granted for any new invention involving an inventive step and which is capable of being used or applied in trade, industry, or agriculture.[133] A patent shall not be granted, however, "for any variety of animal or plant or any essentially biological process for the production of animals or plants, not being a micro—biological process or the product of such a process."[134] Microbiological processes and the resultant products are patentable.[135] While not protected by the Patents Act, certain plant varieties[136] may be protected in terms of the Plant Breeders' Rights Act 15 of 1976.

For the purposes of establishing the scope of the "essentially biological process" exclusions, the Guidelines for Examiners in the European Patent Office are likely to be persuasive:

> The question whether a process is "essentially biological" is one of degree depending on the extent to which there is technical intervention by man in the process; if such intervention plays a significant part in determining or controlling the result it is desired to achieve, the process would not be excluded. To take some examples, a method of crossing, inter-breeding, or selectively breeding, say, horses, involving merely selecting for breeding and bringing together those animals having certain characteristics would be essentially biological and therefore unpatentable. On the other hand, a process of treating a plant or animal to improve its properties or yield . . . would not be essentially biological since although a biological process is involved, the essence of the invention is technical; the same could apply to a method of treating a plant characterized by the application of a growth-stimulating substance or radiation. The treatment of soil by technical means to suppress or promote the growth of plants is also not excluded from patentability.[137]

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133. *See* Patents Act 57 of 1978 s. 25(1).

134. *Id*. at s. 25(4)(b).

135. *See id.* Microbiology is defined as "the study of single-celled organisms too small to be observed with the naked eye. Classically, this field has included the study of algae and protozoa." R. WILLIAMS & E. LANSFORD, ENCYCLOPEDIA OF BIOCHEMISTRY (1st ed. 1967), *quoted in* BURRELL, *supra* note 117, § 1.26.7 n.310.

136. The variety must be one of a plant species prescribed in the regulations to the Plant Breeders' Rights Act, although it is possible to apply to have a plant added to the prescribed list. *See* Kidd & Mayett, *supra* note 18, at 239.

137. BURRELL, *supra* note 117, § 1.26.7 (emphasis added).

The provisions of the Patents Act, read together with the Plant Breeders' Rights Act 15 of 1976, appear to comply with the relevant provisions of the TRIPS Agreement. Insofar as compliance with the provisions of the CBD[138] regarding indigenous knowledge, control, and access to plant genetic resources is concerned, it is necessary to consider the proposed amendments to the Patents Act contained in the Patents Amendment Bill, the object of which is to "empower the registrar of patents to refuse or revoke a patent which is based on biological material, [and to] refuse, revoke or invalidate a patent which is based on prior knowledge associated with such materials."[139] Once amended, the Patents Act will "require an applicant for a patent to furnish information relating to any role played by an indigenous biological resource, a genetic resource or traditional knowledge or use in an invention."[140] More specifically, the Bill amends the Act by inserting the following provisions:

> (3A) Every applicant who lodges an application for a patent . . . shall . . . lodge with the registrar a statement in the prescribed manner stating whether or not the invention for which protection is claimed is based on or derived from an indigenous biological resource, genetic resource, or traditional knowledge or use.
>
> (3B) The registrar shall call upon the applicant to furnish proof in the prescribed manner as to his or her title or authority to make use of the indigenous biological resource, genetic resource, or of the traditional knowledge or use if an applicant lodges a statement that acknowledges that the invention for which protection is claimed is based on or derived from an indigenous biological resource, genetic resource, or traditional knowledge or use.[141]

These amendments bring the Patents Act in line with the National Environmental Management Biodiversity Act, which incorporates the provisions of the CBD and the Bonn Guidelines regarding benefit-sharing schemes in relation to genetic resources and traditional knowledge used in patent inventions.[142]

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138. *See also* National Environmental Management: Biodiversity Act 10 of 2004.

139. Memorandum on the Objects of the Patents Amendment Bill s. 4.1(a), Patents Amendment Bill, 2005, Bill 17B-05 (GA).

140. Patents Amendment Bill, 2005, Bill 17B-05 pmbl. (GA).

141. *Id. a*t s. 2.

142. *See generally* National Environmental Management: Biodiversity Act 10 of 2004 s. 83.

C. PLANT BREEDERS' RIGHTS ACT 15 OF 1976 (PLANT BREEDERS' ACT)

The Plant Breeders' Act provides "for a system whereunder plant breeders' rights relating to varieties of certain kinds of plants may be granted and registered"[143] and essentially corresponds with the model offered by the International Union for the Protection of New Varieties of Plants (UPOV), hence meeting South Africa's obligations arising out of Article 27(3)(b) of the TRIPS Agreement.

The Plant Breeders' Act does not require the prior informed consent of affected communities and does not provide for material transfer or benefit-sharing agreements.[144] A plant breeder's right is granted for twenty-five years with respect to vines and trees and twenty years for everything else.[145] During the currency of the protection, a license is required for:

> (a) production or reproduction (multiplication);
>
> (b) conditioning for the purposes of propagation;
>
> (c) sale or any other form of marketing;
>
> (d) exporting;
>
> (e) importing;
>
> (f) stocking for any of the purposes referred to in paragraphs (a) to (e),
>
> of –
>
> (i) propagating material of the relevant variety; or
>
> (ii) harvested material, including plants, which was obtained through the unauthorized use of propagating material of the relevant variety.[146]

However, where a person has procured propagating material of a protected variety in a legitimate matter, it shall not be an infringement to resell the propagating material or any plant or product derived from the propagating material, or to use or multiply the propagating material in the development of a different variety.[147] Neither is it an infringement to use the propagating material for *bona fide* research or private or non-commercial purposes,[148] nor where the person who

143. Plant Breeders' Act 15 of 1976 pmbl.
144. *See generally* Plant Breeders' Act 15 of 1976.
145. *Id.* at s. 21.
146. *Id.* at s. 23(1).
147. *See id.* at s. 23(6)(a)-(c).
148. *See id.* at s. 23(6)(d)-(e).

acquires the material is a farmer who uses harvested material obtained on land occupied by him from the propagating material for purposes of propagation, provided that the harvested material shall not be used for propagation by any person other than that farmer.[149] Sections 26 and 27 of the Plant Breeders' Act provide mechanisms and principles for the application for and granting of a compulsory license to deal with a protected plant variety where the holder of a plant breeder's right has unreasonably refused to grant a license or has imposed unreasonable conditions.

D. GENETICALLY MODIFIED ORGANISMS ACT 15 OF 1997 (GMO ACT)

The GMO Act is the key biosafety law in South Africa, and on its face, is not concerned about indigenous knowledge and control and access to plant genetic resources. Instead, the GMO Act seeks:

> To provide for measures to promote the responsible development, production, use and application of genetically modified organisms; to ensure that all activities involving the use of genetically modified organisms (including importation, production, release and distribution) shall be carried out in such a way as to limit possible harmful consequences to the environment; to give attention to the prevention of accidents and the effective management of waste; to establish common measures for the evaluation and reduction of the potential risks arising out of activities involving the use of genetically modified organisms; to lay down the necessary requirements and criteria for risk assessments; to establish a council for genetically modified organisms; to ensure that genetically modified organisms are appropriate and do not present a hazard to the environment; and to establish appropriate procedures for the notification of specific activities involving the use of genetically modified organisms; and to provide for matters connected therewith.[150]

What is of concern, and ultimately impacts control and access to plant genetic resources, is the lack of public participation and lack of access to information provided for by the GMO Act.[151] This is exacerbated by the lack of regulations with respect to labeling of genetically modified products.[152]

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149. *See id.* at s. 23(6)(f).

150. Genetically Modified Organisms Act 15 of 1997 pmbl.

151. *See* MARIAM MAYET, CRITICAL ANALYSIS OF PERTINENT LEGISLATION REGULATING GENETIC MODIFICATION IN FOOD AND AGRICULTURE IN SOUTH AFRICA 20-39 (2001).

152. Labeling of foodstuffs is currently regulated by the Foodstuffs, Cosmetics and Disinfectants Act 54 of 1972 s. 5.

Numerous decisions taken under the GMO Act have been subjected to appeal,[153] and the lack of access to information has, on at least one occasion, resulted in litigation in the High Court of South Africa. In *Trustees for the Time Being of the Biowatch Trust v. Registrar: Genetic Resources*,[154] Biowatch South Africa, a small environmental organization, approached the High Court to compel the government to disclose information about genetically modified crops entering South Africa and being grown in South Africa.[155] Although Biowatch was largely successful in the application, a costs order was granted against Biowatch in favor of Monsanto,[156] an action that could potentially cripple the organization, notwithstanding the fact that it had been Monsanto's choice to be joined in the litigation.

Amendments to the GMO Act have been proposed to incorporate provisions of the Cartagena Protocol on Biosafety.[157] The amendments have, however, been criticized for a failure, again, to allow for adequate public participation and information sharing, and also for failing to adopt a policy in line with the precautionary approach.[158]

E. NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT 10 OF 2004 (BIODIVERSITY ACT)

One of the objectives of the Biodiversity Act is "to give effect to ratified international agreements relating to

153. For example, in 2004's *Trustees for the Time Being of the Biowatch Trust v. Syngenta Seed Co. (PTY)*, Biowatch South Africa lodged an unsuccessful appeal with the Appeal Board, in terms of the GMO Act, against a decision of the Executive Council for GMOs granting authorization to Syngenta Seed to import, release, and conduct field trials pertaining to Bt 11 maize in South Africa under particular conditions. *See* Melanie Gosling, *Biowatch Loses Appeal Against GM Maize Company*, MERCURY, Dec. 27, 2004, *available at* http://www.themercury.co.za/index.php?fSectionId=283&fArticleId=2355874.

154. No. 23005/2002 (High Ct. S. Afr. (Transvaal Provincial Div.) Feb. 23, 2005).

155. *See id.* at 10-20.

156. *See id.* at 61-65.

157. Genetically Modified Organisms Amendment Bill, 2004, Bill 26848 pmbl. (GA).

158. *See* JERRY BOLTINA, PORTFOLIO COMM. ON AGRIC. AND LAND AFFAIRS, SUBMISSION ON GENETICALLY MODIFIED ORGANISMS AMENDMENT BILL 1-3 (2005).

biodiversity which are binding on the Republic."[159] Accordingly, the Biodiversity Act aims to provide for the "sustainable use of indigenous biological resources; [and] the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources."[160] From the subsequent wording of the Biodiversity Act it would appear that the "international agreements" referred to include both the CBD and the ITPGR.

Chapter 6 of the Biodiversity Act deals with bioprospecting, access, and benefit-sharing related to indigenous biological resources.[161] Specifically excluded from the operation of Chapter 6 are: (1) genetic material of human origin, (2) any exotic animals, plants, or other organisms,[162] and (3) indigenous biological resources listed in terms of the ITPGR.[163]

Persons who wish to "engage in bioprospecting involving any indigenous biological resources" or "export from the Republic any indigenous biological resources for the purpose of bioprospecting or any other kind of research" are required to obtain a permit.[164] The authority that issues the permit is required to protect any interests that the following stakeholders may have in the bioprospecting project:

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159. *See* National Environmental Management: Biodiversity Act 10 of 2004 s. 2(b).

160. *Id.* at pmbl. Bioprospecting involves "any research on, or development or application of, indigenous biological resources for commercial or industrial exploitation, and includes – (a) the systematic search, collection or gathering of such resources." *Id.* at s. 1.

161. "Indigenous biological resources" is defined to include "(i) any living or dead animal, plant or other organism of an indigenous species; (ii) any derivative of such animal, plant or other organism; or (iii) any genetic material of such animal, plant or other organism." *Id.* at s. 1. When used in relation to bioprospecting, indigenous biological resources include the above "whether gathered from the wild or accessed from any other source, including any animals, plants or other organisms of an indigenous species cultivated, bred or kept in captivity or cultivated or altered in any way by means of biotechnology; and any cultivar, variety, strain, derivative, hybrid or fertile version [derived therefrom]." *Id.* at s. 80(2)(a)(i-ii). When used in relation to bioprospecting, indigenous biological resources also include "any exotic animals, plants or other organisms, whether gathered from the wild or accessed from any other source which, through the use of biotechnology, have been altered with any genetic material or chemical compound found in any indigenous species or any [other indigenous resources]." *Id.* at s. 80(2)(a)(iii).

162. Except those referred to in section 80(2)(a)(iii) of the National Environmental Management: Biodiversity Act 10 of 2004.

163. *See id.* at s. 80(2)(b).

164. *Id.* at s. 81(1).

> (a) A person, including any organ of state or community, providing or giving access to the indigenous biological resources to which the application relates; and
>
> (b) an indigenous community ——
>
> (i) whose traditional uses of the indigenous biological resources to which the application relates have initiated or will contribute to or form part of the proposed bioprospecting; or
>
> (ii) whose knowledge of or discoveries about the indigenous biological resources to which the application relates are to be used for the proposed bioprospecting.[165]

In the event that a stakeholder has an interest, a permit may be issued only if the applicant has disclosed all material information to the stakeholder and thereafter obtained the prior consent of the stakeholder.[166] In addition, the applicant and the stakeholder must enter into a material transfer agreement regulating access to the resources, and a benefit-sharing agreement that the stakeholder share in future benefits derived from the bioprospecting.[167] The Minister responsible for national environmental management must approve the material transfer and benefit-sharing agreements.[168] The principles for benefit-sharing and material transfer agreements are set out in the Biodiversity Act.[169]

One example of a benefit-sharing model in South Africa is the agreement—entered into before the Biodiversity Act became operative—between the San communities and the Council for Scientific and Industrial Research (CSIR) with respect to the indigenous Hoodia cactus that has chemical properties useful for fighting obesity.[170] For centuries, indigenous communities have chewed on the Hoodia leaf as an appetite suppressant.[171] Since 1986, the CSIR has filed worldwide patents with respect to a method of obesity control that uses the chemical composition of the Hoodia plant and has subsequently negotiated a benefit-sharing agreement with the owners of the traditional knowledge. This agreement stipulates that the CSIR will pay the San eight percent of the

165. *Id.* at s. 82(1)(a-b).
166. *See id.* at s. 82.
167. *See id.* at s. 82(2)(b).
168. *See* National Environmental Management: Biodiversity Act of 2004 s. 82(2)(c).
169. *See id.* at ss. 83-84.
170. *See* Terblanche, *supra* note 18, at 61-62.
171. *See id.* at 61.

payments it receives from its licensee(s)[172] and six percent of all royalties the CSIR receives once the drug is commercially available.[173]

South Africa was the first country on the African continent to grow genetically modified crops and accordingly, fairly sophisticated legislation, such as that discussed above, has resulted. The legislation however has proved to be ineffective in protecting vulnerable communities and the environment. This is illustrated in the case of genetically modified cotton grown in South Africa.[174]

IV. A CASE IN POINT: GENETICALLY MODIFIED COTTON IN SOUTH AFRICA

Cotton crops can withstand harsh climates, making cotton a useful cash crop for farmers in Africa. After the United States and Uzbekistan, Africa is the third largest cotton export region in the world,[175] and is therefore a target for genetically modified cotton plants.[176] South Africa is currently the only African country to allow the commercial planting of genetically modified cotton,[177] although field trials are being conducted in other parts of Africa, including Egypt, Mali, and Burkina Faso.[178]

It must be asked, who are the true beneficiaries of genetically modified cotton crops in South Africa? Much of the uptake of genetically modified crops in South Africa is in commercial agriculture, although small-holder farmers are

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172. The UK-based botanical pharmaceutical company Phytopharm is one such licensee. *See id.*

173. *See id.* at 62.

174. *See* ELFRIEDA PSCHORN-STRAUSS, BIOWATCH SOUTH AFRICA, BT COTTON AND SMALL-SCALE FARMERS IN MAKHATHINI – A STORY OF DEBT, DEPENDENCY, AND DICEY ECONOMICS, *available at* http://www.grain.org/research/btcotton.cfm?id=100 (last visited Feb. 25, 2006). India and China farmers have followed suit. *See id.*

175. *See* GREENBERG, *supra* note 31, at 4.

176. The purported benefit of Bt cotton is that the need for insecticides should decrease because the insecticide is built into the genetic structure of the plant. *See id.* This should result in reduced cost to the farmer and reduced environmental damage.

177. *See* PSCHORN-STRAUSS, *supra* note 174. It is estimated that eighty percent of the cotton grown in South Africa is genetically engineered. ELFRIEDA PSCHORN-STRAUSS, BIOWATCH SOUTH AFRICA, BRIEFING NO. 2: WHAT IS SOUTH AFRICA DOING ABOUT GENETICALLY ENGINEERED CROPS? 1 (2004), http://www.biowatch.org.za/pubs/briefings/2004/briefing02.pdf.

178. *See* GREENBERG, *supra* note 31, at 20-21.

being encouraged to plant genetically modified crops. This encouragement came after a "successful" pilot project in Makhathini that has been touted by multinational agribusinesses throughout Africa and beyond.[179]

Although it is assumed that biotechnology in agriculture would be introduced predominantly through public institutions and processes,[180] this is not necessarily so. In 1997, the Bt cotton plant, sold as Bollgard®, was introduced to the Makhathini Flats in northern Kwa-Zulu Natal by Monsanto and Delta Pine, supported by public institutions such as the Department of Agriculture, and supported financially by Vunisa Cotton, a private company, and the Land Bank, a government bank.[181] It would appear from the report by Elfrieda Pschorn-Strauss that the biosafety trials, which should have been conducted two or three years before the release of the plant to farmers, were conducted almost simultaneously with its release.[182] Nevertheless, the Makhathini project was hailed a success[183] and was used not only as a means to put pressure on other African countries to adopt genetically modified crops,[184] but also as a moral justification for United States action against the European Union. The argument is that Europe's cautious approach toward genetically modified food has a detrimental effect on Africa's potential to fight poverty and food insecurity.[185] The "success" however was

179. Biowatch reports that "[i]n the 2001/2002 season 300 large-scale farmers produced 95% of the crop, while 3000 small-scale farmers on the Makhathini Flats in Northern KwaZulu Natal and in the south-eastern part of Mpumalanga produced the remaining 5%." ELFRIEDA PSCHORN-STRAUSS & CRISTINE JARDINE, BIOWATCH SOUTH AFRICA, BRIEFING NO. 3: GENETICALLY ENGINEERED COTTON: HIGH RISKS, LOW RETURNS 1 (2004), http://www.biowatch.org.za/pubs/briefings/2004/briefing03.pdf.

180. *See* Taylor & Cayford, *supra* note 3, at 335.

181. PSCHORN-STRAUSS & JARDINE, *supra* note 179, at 3. Vunisa Cotton, established by Clark Cotton, serves as an agent for seed and agrochemical companies in the area and also buys back cotton from the farmers after harvest. *See id.*

182. *See* PSCHORN-STRAUSS, *supra* note 174.

183. Reports by the genetic modification industry indicate that the cotton yields of the small-holder farmers increased dramatically by up to 220%. *See* PSCHORN-STRAUSS, *supra* note 174. What the reports fail to indicate, among much else, is the artificial level of support and the package of inputs that accompanied the seeds. *See id.*

184. Pressured countries include Uganda, Zambia, and Zimbabwe. *See id.*

185. *See id.* A Makhathini farmer has even been used in argument by the United States in its action at the WTO against the European Union's labeling

short-lived, as subsequent floods and droughts left farmers with staggering debt.[186] By all accounts the Makhathini project is now in tatters.

Farmers were encouraged to purchase Monsanto's Bollgard® seed on the basis that the crops would increase the farmers' yields and would require reduced insecticide spraying.[187] Additional inputs into the Makhathini project included a donation from Monsanto of $10,000 to the Ubombo Farmers Association for the purchase of farming equipment in 2001.[188]

Farmers who purchased the expensive seed were required to sign a Monsanto Technology Agreement, in terms of which they undertook to:

- Use the seed for planting a commercial crop for only one season;
- Plant a refuge as part of the insect resistance management strategy;
- Not supply any seed containing Bollgard® to any third party;
- Not use or provide seed containing Bollgard® to anyone for crop breeding, research, or seed production;
- Not ratoon any Bollgard® cotton;
- Allow Monsanto agents to inspect the growers' fields to ensure that the correct refuge areas have been planted.[189]

Pschorn-Strauss ascertained, during a 2001 survey of twelve farmers who planted Bollgard®, that they did not understand the contracts they had signed.[190] It is even reported that "farmers understand their contracts to mean that in the case of a crop failure, the seed will be replaced."[191]

Only one of the twelve farmers told Pschorn-Strauss that he had been fully apprised of the terms of the contract; five of the twelve were aware of the need to plant refuges and only three had done so.[192] One of the concerns is that responsibility

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restrictions for genetically modified products. *See id.*

186. PSCHORN-STRAUSS & JARDINE, *supra* note 179, at 3.

187. *See* PSCHORN-STRAUSS, *supra* note 174.

188. *See id.*

189. *Id.*

190. *See id.*

191. *See id.*

192. *See id.* Moreover:

for monitoring and risk assessment is not adequately addressed by the government in South Africa.[193] The current legislative framework would probably allow seed companies to escape liability for damage.

In addition to the environmental concerns,[194] the Makhathini project raises numerous socio-economic concerns.[195] At the center of the socio-economic concerns is the cost of accessing genetically modified crops. The poverty gap between farmers who are able to afford the technology and those who are not[196] is likely to widen, and the farmers who are able to access genetically modified crops could become trapped in a debt-cycle that is far worse than the debt-cycles already experienced by farmers growing non-genetically modified crops.[197]

Access to land is an additional socio-economic and political concern in post-apartheid South Africa. Currently much of the area under discussion is predominantly owned by the state and is held in trust by the Minister of Land Affairs until such time as it is redistributed to the inhabitants of the area. One of the issues is whether the land should be redistributed as freehold land or whether it should become communal land. The outcome could have major implications for current inhabitants. Pending the outcome of these deliberations, inhabitants are

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> The industry has recognised the real possibility of resistance developing and has made it a contractual requirement that users of Bt crops plant refuges of non-GE varieties to ensure that a sub-population of insects is not exposed to Bt toxin. This sub-population will not develop any resistance and will pass on the non-resistant gene, diluting the resistant genes coming from insects that have been exposed to and survived Bt toxin.

PSCHORN-STRAUSS & JARDINE, *supra* note 179, at 4.

193. PSCHORN-STRAUSS & JARDINE, *supra* note 179, at 3.

194. There is growing evidence that the benefits, or effectiveness, of genetically engineered cotton crops decreases over time. In Australia, for example, one study reports that the pesticide benefits of Monsanto's genetically engineered Ingard cotton varieties steadily declined from one season to the next: "Average use of insecticide . . . was 52% less in 1996/1997 (season of Ingard introduction), 44% less in 1997/1998, and only 38% less in 1998/1999." *Id.*

195. *See* PSCHORN-STRAUSS, *supra* note 174.

196. Small loans in South Africa are inordinately expensive. The microlending industry in South Africa does not adequately address the needs of small businesses and enterprises and is currently under review. It is likely that a new National Credit Bill will replace the existing legal infrastructure.

197. *See* PSCHORN-STRAUSS, *supra* note 174.

reluctant to commit to the land on a long-term basis.

Since the introduction of genetically engineered cotton, it is reported that the number of cotton varieties available to farmers has decreased (and available varieties are predominately genetically engineered[198]), production has fallen, the cost has increased, many jobs have been lost, and spinners have expressed dissatisfaction with the quality of cotton now being produced.[199]

CONCLUSION

Attempts to control and regulate access to genetic resources must be seen in light of the history and context of agriculture in Africa: "Genetic resources at the local, national, and international levels, play a critical role in the lives of all Africans. The most obvious aspect of this is food."[200]

Africa should be cautious in its approach to modern biotechnology applications in agriculture for it may not hold the solutions that Africa seeks. Rather, an introspective approach to agriculture is necessary. Namely, agriculture in Africa needs to be considered in the broader historical, social, economic, and political context of the continent. While it might be difficult to influence global policy to prevent the anomalies, such as the misappropriation of indigenous knowledge, occurring in developed countries, at least domestic law in Africa can remain true to the interests of its communities and the principles of international environmental law. To some extent the law in South Africa mirrors the principles of the CBD, while still implementing the provisions of TRIPS. The law in South Africa, however, has major pitfalls, insofar as public participation, awareness (for example, labeling), and the best interest of its people are concerned.

It should not be forgotten that it is the genetic resources of indigenous plants themselves, and not access to global markets, which can provide Africa with food security and traditional medicine.[201] Domestic legislative measures with respect to

198. For 2002, it is indicated that genetically engineered seed accounted for seventy-five percent of the market: Bt cotton (thirty-five percent), RR cotton (ten percent), and stacked varieties (thirty percent). *See* PSCHORN-STRAUSS & JARDINE, *supra* note 179, at 3.

199. *See id.*

200. *See The Significance of Genetic Resources in Africa*, *in* AFRICAN PERSPECTIVES ON GENETIC RESOURCES, *supra* note 18, at 9, 23.

201. Mushita & Thompson, *supra* note 13, at 80.

indigenous knowledge and control and access to plant genetic resources must respect this fact. In short, the provisions of the CBD and the ITPGR should shield Africa against undue pressure for domestic legislation to comply with the letter of the law contained in the TRIPS Agreement.