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## \*167 FARMERS' RIGHTS AND OPEN SOURCE LICENSING

### ABSTRACT

The TRIPS treaty requires that WTO members offer patent or *sui generis* protections for plant life. Yet, many developing countries oppose intellectual property for plant life because, for those nations, plant IP has proven to be financially, environmentally, and socially detrimental. The farmers' rights movement has grown out of such opposition and is an effort on the part of interest groups and developing countries to afford subsistence farmers control over farming methods and compensation for their contribution to the world's biodiversity. Developing nations and farmers' rights groups have spearheaded multiple treaties aiming to curtail plant monopoly rights; however, the treaties have been ineffective and the growing strength of plant monopolies in developed countries is unlikely to wane. Meanwhile, farmers need a solution that allows them to maintain control over their farming practices, preserve traditional cross-breeding methods, and receive compensation for their contribution to the state of the art of crop varieties. Open source provides such a solution. An open-source regime protecting farmer-developed plant varieties would utilize intellectual property and copyleft-inspired seed wrap licenses to generate a pool of plant species that farmers could freely grow, improve, and market. Open source programs would further farmers' rights by protecting farmer-developed resources from predatory monopolization and by providing an entity through which farmers can share information and have a voice in agriculture-related policy-making. Additionally, open source pools would act to conserve biodiversity and promote environmentally-friendly farming by encouraging farmers to cultivate plant varieties adapted to local climates and disease instead of using mass-produced seed and treating heavily with pesticides.

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## \*170 I. INTRODUCTION

In 1994, Larry Proctor purchased a bag of mixed dry beans from a market in Sonora, Mexico.<sup>1</sup> He took the bag of beans home with him to Montrose County, Colorado, where he picked out the yellow colored beans, planted them, and allowed them to fruit. For a few seasons, Proctor harvested the beans from the best plants and replanted them. Then, in 1996 Proctor declared his beans an “invention,” named them “enola” (after his wife) and applied for U.S. intellectual property rights on the plant<sup>2</sup>--a plant variety certificate<sup>3</sup> and a U.S. utility patent.<sup>4</sup> In 1999, with his plant variety certificate and his utility patent in hand, Proctor’s agro company, Pod-Ners LLC, immediately started enforcement actions.<sup>5</sup> The company sent out cease and desist letters to importers of Mexican beans and U.S. farmers growing Mexican yellow beans, notifying them of its intellectual property and warning them of the need to pay royalties for importation or farming of the bean. Pod-Ners soon took action, preventing Mexican farmers from exporting the bean to the United States unless royalties were paid<sup>6</sup> and filing infringement actions against U.S. farmers selling the bean domestically.<sup>7</sup>

Ultimately, thousands of Mexican farmers who had been cultivating variations of the bean for generations and depended on export revenue were economically affected.<sup>8</sup> The \*171 patent was eventually challenged successfully in a decade-long legal battle initiated by several third party groups, including the International Center for Tropical Agriculture (CIAT).<sup>9</sup> In July of 2009, after nearly ten years of economic damage to farmers, the Federal Circuit ruled that Pod-Ners’ patent was invalid as obvious.<sup>10</sup> However, despite the invalidity determination regarding the patent, farmers continue to feel the effects of the enola bean saga because Pod-Ners still owns a Plant Variety Protection Certificate for the bean, and is still engaged in legal battles asserting its relevant intellectual property rights.<sup>11</sup>

To be clear, Pod-Ners did not engage in any legally questionable activity by obtaining and defending the patent. Proctor and Pod-Ners fully disclosed the origin of the bean and the process by which the bean was cultivated.<sup>12</sup> Further, the patent office was not negligent in allowing the enola bean patent, as the legal issues surrounding the patentability were complicated, with valid legal arguments going both ways.<sup>13</sup> Moreover, Pod-Ners did not act unreasonably or abnormally in asserting its intellectual property as business tools. Finally, the enola bean incident is not an isolated one. For decades, entities have been systematically monopolizing plant resources that have been developed by farmers, many of whom are located in developing countries, thereby interfering with farmers’ profits and their rights to continue developing their own resources.<sup>14</sup> “It is no exaggeration to say that the \*172 plant genetic resources received as free goods from the Third World have been worth untold *billions* of dollars to advanced capitalist nations.”<sup>15</sup>

Western countries, and especially the United States, have sweeping intellectual property regimes that do not sufficiently account for farmer-developed prior art. Thus, farmers who wish to protect their plant genetic resources (PGRs) from becoming the intellectual property of agro-companies should not rely on the outcome of *Pod-Ners* to prevent the usurpation of their resources. Instead, a solution needs to be devised to proactively safeguard farmers’ plant developments. This article argues that the best way to achieve this is to utilize open source licensing to create pools of intellectual property rights that

protect farmer resources.

This article proceeds as follows. Part I discusses the issues and goals of the farmers' rights movement and presents the rising controversy between advocates of breeders' rights and advocates of farmers' rights. Part II addresses the three most current and controversial treaties relating to farmers' and breeders' rights--the Convention on Biological Diversity (CBD), the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)--and why international agreements are unlikely to supply a remedy for farmers' rights issues. Part III begins by surveying, classifying, and analyzing the existing proposals for advancing the goals of farmers' rights and discusses why the open source solution is the most viable. This part then describes how open source is being implemented in the field of plant resources and how those existing efforts, while ground-breaking and valuable, fall short of protecting farmers' innovations. Finally, the third part of this paper concludes by outlining the current nascent discussion of open source as it applies to farmers' rights. Part IV builds on that current discussion by offering a detailed analysis of how an open source regime might be implemented to protect farmers' innovations and allow farmers greater leeway to practice traditional plant-breeding methods and develop useful plant breeds. Appendix A provides a model license.

## II. THE FARMERS' RIGHTS AGENDA: THE REASONING AND THE SIGNIFICANCE

A divergence of interests regarding plant monopoly rights, and intellectual property rights in general, exists between the developed nations of the northern hemisphere and the developing and least developed nations in the equatorial and southern regions.<sup>16</sup> Developed \*173 nations, such as the United States, the European countries, and Japan, have vested interests in promoting strong plant monopoly rights because they are a large source of revenue and their companies invest heavily in plant research and innovation.<sup>17</sup> Less-developed nations, despite often having more plant genetic diversity at their disposal, typically favor keeping plant resources in the public domain--preferring protection for traditional knowledge and farmers' rights over monopoly rights for private interests.<sup>18</sup>

The common distaste for plant monopoly rights in less-developed nations stems from both heritage and experience. Nations that oppose plant monopoly rights typically have a strong common heritage culture, where knowledge of farming and cultivation techniques and plant varieties have been shared by communities and passed down through generations; individual monopolization of that knowledge and tradition is thus seen as wrong.<sup>19</sup> Further, plant monopoly rights interfere with traditional farming practices because they prevent farmers from freely collecting, saving, exchanging, and replanting seeds. Finally, as most of the world's biodiversity is located in developing nations in the equatorial region,<sup>20</sup> developed nations have been exploiting and monopolizing the resources of less-developed nations for decades,<sup>21</sup> often at the expense of the less-developed nation.<sup>22</sup>

### *\*174 A. The Farmers' Rights Movement*

Farmers' rights is both an ideal and a movement that began to take hold in the 1980s. It grew out of the dissatisfaction of a number of groups regarding the waning power of farmers to control farming methods and the lack of compensation for their contributions to plant genetic diversity.<sup>23</sup> The main focus of the movement is to recognize and restore autonomy to rural and subsistence farmers, many of whom are located in developing nations.<sup>24</sup> To that end, the movement seeks recognition that most of the world's crop germplasm<sup>25</sup> has resulted from thousands of years of selective breeding by farmers,<sup>26</sup> and a revolution of law that allows farmers to continue making a valuable contribution.<sup>27</sup> According to The Farmers' Rights Project, "realizing Farmers' Rights means enabling farmers to maintain and develop crop genetic resources as they have done since the dawn of \*175 agriculture, and recognizing and rewarding them for this indispensable contribution to the global pool of genetic resources."<sup>28</sup>

The major issues of farmers' rights have been summarized as

- (i) the right to grow, improve, and market local plant varieties and their products; (ii) the right to access improved plant varieties and plant or exchange farm-saved seeds of commercial varieties for planting and exchange; (iii) the right to be compensated for the use of local plant varieties in the development of new commercial products by third parties; and (iv) the right to participate in decision-making processes related to acquiring, improving, and using PGRs.<sup>29</sup>

## ***B. The Problems that Initiated the Movement***

### ***i. The Plant Monopoly Rights Thicket***

Monopoly rights for plant life is an issue with a tumultuous history.<sup>30</sup> As such, reward for ingenuity in the realm of plant life developed differently than reward for mechanical or chemical ingenuity.<sup>31</sup> Consequently, the phrase “intellectual property” is not necessarily appropriate for describing the gamut of monopoly regimes governing plant and plant-related inventions.<sup>32</sup> While traditional intellectual property rights are granted by some countries to cover plant resources,<sup>33</sup> different regimes have been developed to reward plant innovation.

**\*176** Plant resource protection is a tangled web of overlapping legal mechanisms emanating from different international and national governing bodies.<sup>34</sup> Numerous treaties set different minimum standards and have disparate goals for domestic plant monopoly rights.<sup>35</sup> Though WTO member states do not have the option of keeping plant resources in the public domain,<sup>36</sup> state protection regimes are as varied as treaty agreements permit. Some nations disfavor monopoly rights for plant resources and skate the line of minimum protections, while other nations implement strong monopoly protections and give minimal credence to treaties requiring restraint for environmental or social reasons.<sup>37</sup> In general, developed nations typically have aggressive plant monopoly systems granting expansive rights. Meanwhile, developing nations tend to have less aggressive or functionally nonexistent plant monopoly regimes.

The United States may have the most expansive protection scheme for agricultural biotechnology in the world, offering both patent and *sui generis* protection mechanisms.<sup>38</sup> Thus, it serves as a good example for examining the extent to which resources can be monopolized. Between Plant Patents,<sup>39</sup> Plant Variety Protection Certificates,<sup>40</sup> Utility Patents **\*177** for plants,<sup>41</sup> and various state trade secret and contract provisions,<sup>42</sup> the United States offers a plethora of protection methods. The various means of federal and state protection for **\*178** plant resources can be used simultaneously, to the extent that they are available for any particular invention.<sup>43</sup> Further, monopoly rights covering valuable resources are sought in multiple jurisdictions around the world. Thus, dense thickets of United States and foreign monopoly rights have developed around many of the most useful, and therefore valuable, plant resources.<sup>44</sup>

While monopoly rights may generally encourage innovation, when an area becomes heavily monopolized, innovation becomes stifled.<sup>45</sup> Plant monopoly rights gridlock farmer innovation, and PGR development in general, in two ways. First, plant monopoly rights prevent numerous innovators from entering heavily monopolized areas because developers cannot afford to pay the licensing fees necessary to enter into a densely monopolized area.<sup>46</sup> The “golden rice” battle is a well-known example of that. Golden rice is vitamin a-enhanced rice developed by the Swiss Federal Institute of Technology to confront the vitamin A deficiency that was plaguing populations in developing countries, causing infant mortality **\*179** and childhood blindness.<sup>47</sup> Distribution of the crops to needy populations was nearly blocked because the university had trouble negotiating licenses needed to market the invention. The vitamin A rice infringed on roughly seventy patents and proprietary rights held by thirty-two different entities.<sup>48</sup> Fortuitous circumstances and social pressures pushed the large agro-companies to donate intellectual property licenses and other resources to the project so that the life-saving crop could enter the market, but not all PGR developments benefit from such generosity.<sup>49</sup>

Second, plant monopolies stifle innovation by decreasing available plant biodiversity and plant variety development, which is typically done via farmer cross-breeding.<sup>50</sup> The various federal and state monopolization methods have effectively prohibited farmers who plant commercial plant varieties from saving seed or further developing the varieties.<sup>51</sup> Further, some sustenance crops like corn, wheat, and rice, have been so heavily monopolized that it has become difficult for farmers to avoid planting commercial crop varieties.<sup>52</sup>

### ***ii. Breeders’ Rights Overpowering Farmers’ Rights***

Breeders’ rights refer to the body of rights conferred by intellectual property and *sui generis* protections for plant materials--breeders’ rights refer to plant monopoly rights. In the international political arena, breeders’ rights are primarily espoused by developed nations who have strong financial interests in agribusiness.<sup>53</sup> Agribusiness is a multi-billion dollar, **\*180** worldwide industry that relies heavily on plant monopoly rights.<sup>54</sup> Proponents of breeders’ rights argue that the negative

effects of plant monopolies borne by particular communities are far outweighed by the beneficial effect of innovation-driving monopoly rights.<sup>55</sup>

Balancing the rights of farmers and those of breeders is difficult, as both agendas have compelling support. Breeders' advocates rightfully point out that the financial motivation of monopoly rights has led innovative plant breeders to devise breeds that meet the demands of the global community, increasing the availability, efficiency, and nutritional value of food and medicinal products.<sup>56</sup> Large agricultural companies and research institutions, through both for-profit and nonprofit endeavors, have been instrumental in solving problems faced by farmers in developing countries.<sup>57</sup> Additionally, plant patent and *sui generis* plant regimes benefit the public fund of knowledge by incentivizing the divulgence of inventions by enabling disclosures, instead of keeping them as trade secrets.

Breeders' rights advocates argue that monopoly rights are the most effective way to drive development.<sup>58</sup> When the U.S. Congress was considering whether to develop patent protection for plants, Thomas Edison famously stood before Congress and pled that \*181 "nothing that Congress could do to help farming would be of greater value and permanence than to give the plant breeder the same status as the mechanical and chemical inventors now have through the patent law."<sup>59</sup>

Since 1930, plant monopoly rights have, for the most part, gained protection equal to mechanical and chemical inventions,<sup>60</sup> but the prophecy of Edison's statement has proved debatable. On the one hand, it cannot be denied that breeders' rights have fostered agribusiness<sup>61</sup> and encouraged development of beneficial products.<sup>62</sup> On the other hand, the economic and agricultural progress has disproportionately benefitted developed nations and been detrimental to less-developed ones.<sup>63</sup> Further, persuasive arguments link plant monopoly rights to environmental damage and degradation of plant diversity.<sup>64</sup> Thus, there has been a considerable backlash against plant monopolies by a number of groups, including advocates of farmers' rights.<sup>65</sup>

Farmers' rights advocates rightly argue that breeders' rights constructs are a source of inequity, systematically appropriating plant resources and potential revenue away from developing countries and restricting the rights of farmers to continue their invaluable craft. However, the thrust of farmers' rights advocacy is not to eliminate the intellectual propertization of plant resources.<sup>66</sup> Instead, the movement seeks to grant farmers' what they deserve--compensation for their creation and conservation of plant resources and the freedom to continue their craft without hindrance. "Farmers' rights thus act as a counterweight to plant breeders' rights, compensating the upstream input providers who make downstream innovations possible."<sup>67</sup>

\*182 The concept of farmers' rights has been formally recognized in international law since 1989, when it was acknowledged in an Agreed Interpretation of the International Undertaking on Plant Genetic Resources.<sup>68</sup> Although the concept of farmers' rights enjoys vocal support from the developing world and several subsequent treaty endeavors, breeders' rights maintain dominance in the international political arena and continue to encroach on farmers' rights.<sup>69</sup> A fitting example of the dominance of breeders' rights is the "enola bean" situation. Despite the fact that Mexican farmers have been cultivating the yellow bean for centuries and that it is a staple in the Mexican diet, two U.S. administrative agencies knowingly granted intellectual-property rights on the bean that could be used to block imports of the bean from Mexico.<sup>70</sup>

### ***C. Common Ground Between Farmers' Rights and the Movements for Preservation of Biodiversity and Traditional Knowledge, and Against Biopiracy***

The goals of the farmers' rights movements are intimately tied with those of larger, well-known movements, such as the movements for the preservation of biodiversity and traditional knowledge, and the movement against biopiracy. Progress towards the goals of the farmers' rights movement corresponds with advancement towards the goals of the other movements.

#### ***i. Biodiversity***

Issues of biodiversity, the variability of life forms,<sup>71</sup> are closely linked to those of farmers' rights. In fact, it is said that "Farmers' Rights are a precondition for the maintenance of crop genetic diversity."<sup>72</sup> Landraces, or traditionally developed crops, are an essential part of maintaining biodiversity because they promote development of natural cross-breeding and local variety adaptation.<sup>73</sup> For example, natural cross-breeding between wild plants and cultivated crops leads to the discovery and

maintenance of robust species.<sup>74</sup>

### **\*183 ii. Traditional Knowledge**

Farmers' knowledge is essentially a sub-set of traditional knowledge. Farmers' rights advocates seek to protect traditional farming practices of indigenous and local communities, such as seed-saving techniques, and to recognize and defend the heritage that created modern crop varieties.<sup>75</sup>

### **iii. Biopiracy**

Biopiracy refers to the practice by developed countries of extracting biological resources from developing countries. Scholars have commented that the term biopiracy is inappropriately suggestive of systematic wrongdoing.<sup>76</sup> Whether or not this assertion is true, the term has acquired a useful meaning that is not shared by a more benign term. While certainly not all appropriations of natural resources from equatorial regions have created injustice, systematic appropriations of natural resources from equatorial countries to developed countries define historical relations and, as the rhetoric indicates, misappropriation continues to occur.<sup>77</sup> "Nearly every crop of significant economic importance ... originated in what is now called the Third World," yet the populations in those regions have never benefitted from those developments as Western corporations have.<sup>78</sup>

A major aspect of biopiracy, or biological resource extraction, has been crop-related. "Agricultural productivity in the capitalist core remains fundamentally dependent on constant infusions of plant materials from the Third World."<sup>79</sup> Specifically, advancement in crop production in the "gene-poor" developed nations requires utilization of crop species developed by farmers in the "gene-rich" developing countries.<sup>80</sup> The farmers' rights movement developed to respond to misappropriation of farmer-developed resources, and to deal with the consequences that arise, such as the usurpation of the farmers' ability to continue developing the resources.

## **III. CURRENT INTERNATIONAL AGREEMENTS GOVERNING PLANT MONOPOLY AND FARMERS' RIGHTS**

Most nations are party to one or more significant treaties establishing standards for both plant monopoly regimes and recognition of farmers' rights. The most pertinent modern international agreements are the Convention on Biological Diversity (CBD), The Agreement \*184 on Trade Related Aspects of Intellectual Property Rights (TRIPS), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).<sup>81</sup>

### **A. The Convention on Biological Diversity (CBD)**

The CBD was adopted in 1992 at the U.N. Conference on Environment and Development in Brazil.<sup>82</sup> Spawned by a desire to find common ground between the agendas of developing and developed nations,<sup>83</sup> and heavily influenced by progressive environmental agendas,<sup>84</sup> the CBD was the first binding international agreement to address concerns about the conservation and equitable utilization of biological resources.<sup>85</sup> The objectives of the CBD, a binding agreement between 193 states,<sup>86</sup> are:

[1] the conservation of biological diversity, [2] the sustainable use of its components and [3] the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.<sup>87</sup>

The CBD approaches plant biological materials as sovereign property and espouses the view that the best approach to world biological preservation is to encourage countries to develop their own programs and measures to preserve the resources within their borders.<sup>88</sup>

\*185 While the CBD recognizes states' sovereign rights to govern and exploit the biological resources within its own borders, the treaty charges signatories with "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."<sup>89</sup> Since

ecosystems are interdependent and interjurisdictional, the treaty obligates nations to make efforts to conserve and sustain natural resources within their borders.<sup>90</sup>

Inevitably, the duties and burdens of preservation fall disproportionately on the biologically rich nations, which are also predominantly developing nations lacking in financial and institutional resources. Thus, to assist the developing, diversity-rich states in meeting their obligations of conservation and sustainability, the CBD mandates that developed member nations provide financial support and share benefits with developing member states, especially the states from which the developed nations extract resources.<sup>91</sup> The treaty encourages private bilateral contracts between member nations, where corporate or government entities exploiting biological resources contract with the states or locals from which the resource is extracted.<sup>92</sup> Thereby, the exploiting party should provide compensation for the resource and a promise to share the benefits that arise from developing the material.<sup>93</sup>

The CBD does not explicitly address farmers' rights; however, its third objective--equitable sharing of biological resources by assuring appropriate access to appropriate parties--and many of its provisions, encompass ideals and goals of the farmers' rights movement. Specifically, Article 15, *Access to Genetic Resources*, and Article 16, *Access and Transfer of Technology*, address the goals of the farmers' rights movement<sup>94</sup> by providing guidelines for agreements specifying the terms of biological resource sharing.<sup>95</sup> Moreover, Article 8(j), *Traditional Knowledge, Innovations, and Practices*, further establishes support for the third and fourth elements of the farmers' rights agenda, the right to compensation and the right to participate in PGR policy. Article 8(j) requires that states

respect, 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 practices.<sup>96</sup>

Thus, the agreement indirectly recognizes farmers' rights by recognizing that subnational groups, such as indigenous and local communities, have a right to profit from the local resources they utilize and develop.

The CBD has had limited success in preventing the uncompensated appropriation of plant genetic resources by corporations and developed nations from developing nations.<sup>97</sup> Multiple reasons have been put forward for the treaty's failure in that respect. Undoubtedly, the CBD's requirements of benefit sharing have been vastly overshadowed by the intellectual property mandates of TRIPS. The convention does not address how domestic intellectual property rights are to be treated or integrated into the framework, other than to demand that **\*187** member nations individually resolve any potential conflicts.<sup>98</sup> Further, critics point out that the treaty has given too much control to the states and has failed to sufficiently recognize the ownership rights of the individual communities who have utilized and developed resources for generations.<sup>99</sup> Such critics argue that Article 8(j) does not effectively vest any property rights in subnational groups because the entire treaty is framed through the lens of state sovereignty, thereby only recognizing the property rights of the state.

Finally, the United States has refused to become a member of the CBD, and thus has refused to cooperate in its mission.<sup>100</sup> Although the United States signed the agreement shortly after President Clinton took office in 1993, Congress never ratified it. From the time of the treaty's negotiation, the United States voiced its discomfort with the potentially limitless amount of funding and technology that the CBD could obligate the United States to divert to developing countries.<sup>101</sup> The United States had concerns about the open-ended financial commitments mandated by the treaty, primarily that of Article 20 requiring developed members to "provide new and additional financial resources to enable developing country Parties to meet the agreed full incremental costs to them of implementing measures which fulfill the obligations of this Convention." Also of great concern to the United States is the impact of Article 16, *Access and Transfer of Technology*, on its interest in maintaining the intellectual property rights to biotechnologies that U.S. constituents develop from extracted foreign resources.<sup>102</sup> That Article instructs developed nations to provide favorable terms for developing nations in bilateral PGR-sharing agreements.<sup>103</sup> It also instructs that "both access **\*188** to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention."

## ***B. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)***

The TRIPS agreement, administered by the WTO and signed by 125 states in 1994, establishes a minimum standard for state intellectual property regulations.<sup>104</sup> In contrast to the CBD, TRIPS was largely driven by the interests of developed nations in being able to secure their technologies worldwide.<sup>105</sup> TRIPS requires that states offer either patent or *sui generis* rights for plant resources.<sup>106</sup> Article 27, Section 2 allows member states to exclude from patentability that which is “necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment.”<sup>107</sup> However, Section 3 of the same Article clarifies that “[m]embers shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof.” Accordingly, states which deny patentability to plant life under Section 2 must offer an equivalent *sui generis* protection.<sup>108</sup> Therefore, while states have leeway in the method of implementing intellectual protection for plant resources, WTO member states are not permitted to refrain from offering plant monopoly rights.

TRIPS arguably reversed much of the progress made by the CBD towards the goals of farmers’ rights.<sup>109</sup> First, TRIPS detracts from the “sovereign rights” approach taken by the CBD because TRIPS requires that states offer plant monopoly rights. Thus, member states are not free to govern and exploit their PGRs in furtherance of their own policies, as Article 3 of the CBD requires, if the state’s policies support open access to PGRs. To the contrary, TRIPS Article 27 forces WTO members, including developing countries, to provide monopoly protection over its own PGRs to foreign entities.<sup>110</sup> The treaty ignores the fact that plant monopoly rights do not materially benefit some states and that the populations of some states view plant-life as common heritage.<sup>111</sup> Second, TRIPS shifts focus away from the equitable benefit sharing required by CBD and towards aggressive protection of monopoly rights. TRIPS specifies enforcement requirements, thereby forcing \*189 member nations to offer domestic procedures through which foreign entities can pursue infringement actions to thwart unauthorized use of their intellectual property.<sup>112</sup>

Unlike the other international agreements addressing plant monopoly rights, TRIPS is supported by the coercive mechanisms of the WTO.<sup>113</sup> Article 64 adopts the Dispute Settlement Understanding (DSU) bodies and procedures of the WTO, which exercises enforcement through trade sanctions. Thus, if a member state fails to fully comply with the requirements of TRIPS, other member states may bring an action against it, forcing the non-compliant nation to become TRIPS compliant or suffer sanctions.<sup>114</sup> Developed nations are able to, and do, utilize the WTO dispute resolution procedure to force developing nations to comply with TRIPS.<sup>115</sup>

### ***C. International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)***

The ITPGRFA is in harmony with, and in furtherance of, the mission of the CBD.<sup>116</sup> The ITPGRFA, administered by the United Nations Food and Agriculture Organization (FAO), is a binding agreement, which took effect in June 2004.<sup>117</sup> It seeks to ensure food security by promoting sustainable agriculture and the sovereign rights of states over the plant resources within their borders.<sup>118</sup> Its objectives are linked to those of the CBD;<sup>119</sup> however, the ITPGRFA focuses on preservation and sustainable development as it relates to the narrower topic of “plant genetic resources for food and agriculture.”<sup>120</sup> The purpose of establishing the treaty to supplement the CBD was twofold. First, ITPGRFA memorializes international commitment to farmers’ rights, which was not specifically \*190 mentioned in the CBD or any prior treaty.<sup>121</sup> Second, the treaty creates a “Multilateral System” to open up access to sixty-four staple crops for research, breeding, and crop development.<sup>122</sup> Though the issues addressed in the ITPGRFA are timely and its intentions genuine, the treaty has largely been unsuccessful thus far at furthering the goals of farmers’ rights.<sup>123</sup> The open-access system attempted by the treaty ultimately fails to establish a useful pool of open PGRs because the treaty lacks the strong mandatory language and the aggressive provisions necessary to stand up against the demanding provisions of TRIPS and the market forces created by plant monopoly rights.

ITPGRFA specifically regards farmers’ rights by recognizing that member nations have a “responsibility for realizing Farmers’ Rights.”<sup>124</sup> Article 9, which is exclusively dedicated to farmers’ rights, provides that states:

should ... take measures to protect and promote Farmers’ Rights, including:

(a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture;

(b) the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and

(c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

Among a number of other provisions aimed at improving farmers' rights, Article 5.1 requires states to "[p]romote or support, as appropriate, farmers and local communities' efforts to manage and conserve on-farm their plant genetic resources for food and agriculture." Additionally, Article 6.2 states that measures "may" include "strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests."

For several reasons, ITPGRFA has failed to effectively advance farmers' rights issues. This is because the treaty does not provide a strong mandate in furtherance of the rights.<sup>125</sup> Each of the provisions regarding farmers' rights is either made optional, or is heavily qualified. Article 9, the Farmers' Rights provision, exemplifies the treaty's weakness because it does not establish any mandatory protections for farmers. Instead, it qualifies its requirements, stating that each member "*should, as appropriate, and subject to its national legislation, \*191* take measures to protect and promote Farmers' Rights." Thus, Article 9.2 is practically no more than three good recommendations for states who wish to provide for farmers' rights. Further, Article 9 wavers on the most contentious farmers' rights issue--"the right to access improved plant varieties and use farm-saved seed of commercial varieties for planting and exchange."<sup>126</sup> It states, "[n]othing in this Article shall be interpreted to limit any rights that farmers have to save, use, exchange, or sell farm-saved seed/propagating material, *subject to national law and as appropriate.*"<sup>127</sup> Thus, the treaty leaves member states with the option of protecting farmers' rights to save seed, and no nation has effectively developed such a safe haven.<sup>128</sup> Another major shortcoming of the treaty is that it fails to create a working definition of "farmers' rights", and therefore fails to establish beneficiaries of the rights or create an explicit means for furthering their rights.<sup>129</sup> Finally, like its predecessor, the CBD, ITPGRFA overemphasizes state sovereign control over PGRs and fails to establish rights at a subnational level--for example at local farming communities.<sup>130</sup> Article 9, discussing farmers' rights, states "the responsibility for realizing Farmers' Rights, as they relate to plant genetic resources for food and agriculture, rests with national governments."<sup>131</sup> Thus far, no states have adopted measures that holistically further the farmers' rights objectives.<sup>132</sup>

A second purpose of ITPGRFA was the establishment of the Multilateral System for "facilitat[ing] access to plant genetic resources for food and agriculture, and [sharing], in a fair and equitable way, the benefits arising from the utilization of these resources, on a complementary and mutually reinforcing basis."<sup>133</sup> The system aims to further farmers' rights and thwart erosion of crop genetic diversity by creating "a pool of genetic resources that are available to everyone"<sup>134</sup> as resources for PGR development. Annex I enumerates sixty-four **\*192** crops and forages, which together account for 80 percent of all human consumption,<sup>135</sup> that are incorporated into the benefit sharing program, the germplasm for which is held in government and international seed banks around the globe.<sup>136</sup> The incorporated plants are to be shared between government entities and with private parties using the Standard Material Transfer Agreement (SMTA) devised in furtherance of the treaty.<sup>137</sup> Article 6.2 of the SMTA, which repeats Article 12.3(d) of the treaty, aims to prevent monopoly rights encumbrances on the Annex I list by prohibiting recipients of the germplasm from "claim[ing] any intellectual property or other rights that limit the facilitated access to the Material ... or its genetic parts or components, in the form received from the Multilateral System."<sup>138</sup>

Just like the farmers' rights provisions of ITPGRFA, the Multilateral System falls short of making a significant contribution to farmers' rights. The Multilateral System provisions suffer from the same problems as the farmers' rights provisions--lack of mandatory strength and lack of precision. For example, Article 12, establishing the facilitated benefit aspect of the Multilateral System, wavers on the critical issue of intellectual property rights. The ban on intellectual property rights established in Article 12.3(d) is weak for a number of reasons. First, it limits itself to the material "in the form received from the Multilateral System." This leaves open the option of obtaining intellectual property over any modified version of the Annex I material.<sup>139</sup> Thus, the SMTA does not provide the strong **\*193** viral<sup>140</sup> license necessary to effectively keep the Annex I crops and forages open and available for innovation.<sup>141</sup> Second, neither the treaty nor the SMTA define "genetic rights or

components,” leaving the clause open to narrow interpretation or disregard.<sup>142</sup> Finally, the treaty ultimately fails to maintain open access because its requirements are all qualified by the intellectual property requirements of TRIPS and relevant national laws.<sup>143</sup> Thus, in countries granting strong monopoly rights, and where patent thickets threaten innovation, the Multilateral System has the least force.

The benefit-sharing program established by the treaty and the SMTA attempts to compensate for the lax ban on monopoly rights over the Annex I materials. Nevertheless, while the treaty and the SMTA discuss benefit sharing through technology, information, and monetary means,<sup>144</sup> they fail to articulate sufficient details about how the benefits should “flow” to the farmers in order to make the system effective. Article 13.3 of ITPGRFA attempts to ensure that benefits from the resources in the Multilateral System “flow primarily, directly and indirectly, to farmers in all countries, especially in developing countries, and countries with economies in transition, who conserve and sustainably utilize plant genetic resources for food and agriculture.” Where parties monopolize a product derived from Annex I material, the SMTA requires that the recipient pay 1.1%<sup>145</sup> of the sales \*194 of the commercialized product into the trust account established by the Governing Body of the ITPGRFA.<sup>146</sup> However, the benefit-sharing program has a number of flaws and is unlikely to succeed as a compensation method for farmers.<sup>147</sup> First of all, “identifying the contribution of a specific resource within the complex pedigree of an improved crop variety poses a major obstacle in determining who, and how much, will share in the commercialized benefits.”<sup>148</sup> Thus, determining who the deserving contributors are and valuing their contribution is a difficult and expensive process that detracts from the effectiveness of the fund.<sup>149</sup> Secondly, the fund is likely to go bankrupt because the required contribution amount is so low and the costs to properly administrate the fund are quite high.<sup>150</sup> A rough estimate by the Berne Declaration, a Swiss NGO, calculates that the contributions to the fund do not even cover its administrative costs.<sup>151</sup>

Finally, it needs to be mentioned that the United States has failed to ratify the ITPGRFA, and thus is not one of the 123 nations that are currently bound by the treaty’s \*195 provisions.<sup>152</sup> The failure of the United States to effectuate its signature is unsurprising, especially in light of the United States’ nonparticipation in the CBD. However weakly the ITPGRFA asserts the rights of farmers against those of breeders, the United States has thus far been unwilling to participate in this international effort. The United States’ uncompromising support for expansive monopoly rights poses yet another challenge to the treaty’s successful advocacy for farmers.

#### ***D. Conclusions***

As this section establishes, international agreements have here-to-date failed to effectively promote farmers’ rights. Neither the bilateral sharing system established by the CBD, nor the multilateral sharing system created by ITPGRFA, has succeeded in promoting the rights of farmers against the ever-increasing body of breeders’ rights. Additionally, further agreements on the matter have been stalled by the polarized debates over intellectual property between developed countries, especially the United States.<sup>153</sup> Given the shortcomings of the agreements thus far, it is clear that international mandates cannot make progress on pressing farmers’ rights issues.

### **IV. THE DEMAND FOR OPEN ACCESS TO PLANT RESOURCES AND AN EXPLORATION OF SOLUTIONS**

The issues espoused by advocates of open access to plant resources—including farmers’ rights advocates, environmental groups, and NGOs and lobby groups supporting agrarian and indigenous communities—are persuasive. The growing number of people disadvantaged by, and dissatisfied with, the current legal regime of plant monopoly rights cannot be ignored.<sup>154</sup> Problems caused or exacerbated by plant monopoly rights—impingement on the rights of farmers, biopiracy, degradation of biodiversity, and other environmental concerns—are in some instances severe and in desperate need of a remedy.<sup>155</sup> However, as the analysis of Part II shows, plant monopoly rights have become firmly entrenched in international law, and are unlikely to recede as a result of the lobbying efforts of public interest groups and less-developed nations. Further, plant monopoly rights provide benefits that would be lost were they to be significantly confined or eliminated.<sup>156</sup> Thus, a balance must be struck whereby certain plant resource developments can be monopolized for private gain, while others are shielded from monopolization and are kept freely available as sources of plant variety innovation.

\*196 This section first examines a number of the solutions that have previously been proposed to remedy the conflict between farmers’ rights and plant breeders’ rights. Next, this section explains why solutions utilizing open source licensing methods are the most viable and likely to succeed. Finally, after explaining how and why open source monopoly pooling is a

promising method of providing much-needed progress towards farmers' rights, this section concludes by examining the current discussion regarding open source plant regimes and highlighting what remains to be examined.

### *A. Classifying Solutions and Examining the Pros and Cons*

Multifarious solutions have been proffered by political advocates, academics, and nonprofits for incorporating farmers' rights and environmental concerns into the fabric of plant monopoly rights.<sup>157</sup> Solutions generally support one of two ideas: (1) keeping farmer-developed plant resources in the public domain, or (2) utilizing intellectual property, *sui generis* rights, or some other private rights regime to protect farmer-developed resources.

#### *i. Public Domain Solutions: Establishing Farmer-Developed Resources as Prior Art*

The Multilateral System established by the ITPGRFA aims at maintaining the Annex I material housed in seed banks in the public domain. To the extent that the treaty and the SMTA prevent parties from "claiming" intellectual property rights over the material in participating seed banks, the System creates a pool of public domain resources. Other solutions that make efforts to enter farmer-developed resources permanently into the public domain involve tabulating and publishing farmers' plant varieties and methods, thereby making the farmers' resources unpatentable prior art.<sup>158</sup> Data collections and publications on farming practices and farmer-developed plant varieties could be used to challenge the novelty of patent applications or in patent invalidation proceedings. Public domain solutions are backed by the traditionally held view that plant development and farming practices are common heritage, and as such, should not be monopolized.

While dissenters to plant monopoly rights have valid concerns, public domain solutions will not effectively prevent the usurpation of farmers' rights for three reasons.<sup>159</sup> The first reason is that most plant monopoly regimes do not currently account for farmer-developed prior art.<sup>160</sup> Success of a public domain system requires that national monopoly regimes recognize farmer-developed resources as important prior art and incorporate the aforementioned databases and publications into prior art searches.<sup>161</sup> Thus, an effective public domain system would require a widespread change in the way that developed nations perform prior art searches.<sup>162</sup>

The second reason for the failure of public domain solutions to protect farmers' rights is that they fail to protect improvements of farmer-created resources. Even if thorough and up-to-date publications tabulating farmer-developed resources are created, and domestic plant monopoly regimes incorporate the publications into prior art searches, farmers would still face equivalent problems. While a particular resource in the database of farmer developments would be protected in the public domain, improvements or derivatives of that resource would not. Entities that utilize plant monopoly rights could surround farmer inventions in monopoly rights by creating and patenting derivatives and variants of the farmers' inventions. Thus, the farmers or communities that create a valuable resource would likely find themselves paralyzed and unable to further develop their resource because improvements and useful derivatives of the resource have been completely monopolized. In fact, databases and publications of farmer knowledge might only exacerbate the problem because companies seeking to fill a certain need could simply search a database to locate a resource, instead of searching farming communities across the globe.

The third pitfall of public domain solutions is that they do not present any means of compensating farmers for their contributions to the state of the art. The notion of monetary compensation for contribution of ideas is somewhat antithetical to public domain solutions because it inhibits the free exchange of ideas.<sup>163</sup> However, ideas placed in the public domain are not safe from the effects of monopolization and often become infertile resources for development. Thus, when farmers' resources are contributed to the public domain--left open to usurpation free of charge--farmers are potentially deprived of any form of compensation, intellectual or monetary.

#### *ii. Solutions that Utilize Monopoly Rights: Using What is Available vs. Developing Anew*

Solutions that utilize monopoly rights to protect farmer-developed resources are more effective than public domain solutions at furthering the ideals of farmers' rights because the systems are not subject to the same problems. Monopoly-rights solutions generally fall into one of two categories. These solutions either (1) amend current domestic monopoly systems, essentially creating *sui generis* monopoly systems, to address farmer-derived resources or traditional knowledge in general,

or (2) utilize current domestic monopoly systems by creating ways to integrate farmer-developed resources into protectable form.

#### **a. Creating a Monopoly System to Protect Farmers' Rights**

Proponents of solutions in the first category tend to believe that protection of farmers' rights requires "a completely new system"<sup>164</sup> or, at least, a reworking of the current system to include "informal knowledge."<sup>165</sup> This is an erroneous conclusion. While some forms of traditional knowledge might require a change in intellectual property rights, protection of farmer-developed resources is most effectively accomplished by utilizing current plant monopoly regimes. Solutions requiring amendment of current monopoly regimes or development of new regimes are impractical. Creating *sui generis* systems to handle traditional knowledge, including farmer-developed resources, would require extensive buy-in from developed and developing countries. Developed countries would have to be willing to forego some of their current plant monopoly rights for the benefit of traditional farming communities and developing countries.<sup>166</sup> However, the United States' abstention from CBD and ITPGRFA, as well as the overriding power and pro-monopoly-rights content of TRIPS, prove that developed nations have strong agendas with respect to plant monopoly rights and are not willing to sacrifice much to accommodate the needs of developing nations.<sup>167</sup> Thus, \*199 solutions that require a change in monopoly regimes are unlikely to gain widespread adoption and commitment, especially from developed nations, and would be ineffective at promoting the goals of farmers' rights.

#### **b. Using Available Monopoly Systems to Protect Farmers' Rights**

Developing private organizational mechanisms that utilize current law is a more tenable solution than encouraging and creating new law, especially on an international scale. Thus, the best option for accomplishing the goals of farmers' rights is to incorporate farmer-developed resources into the fabric of current plant monopoly rights. At first glance, the objectives of monopoly regimes seem antithetical to those of the farmers' rights movement. Specifically, monopoly rights are exclusionary, giving the holder of the monopoly the right to exclude others, while farmers' rights require open access to plant resources.<sup>168</sup> However, monopoly rights and farmers' rights are not incompatible. While the two make strange bedfellows, they are compatible if the holder of a monopoly right does not exercise his right to exclude and grants free access to the resource. As detailed in the next section, this can be accomplished through open source agreements.

### ***B. Open Source Licensing: The Most Viable Solution for Farmers' Rights***

The ideals and devices of the open source software movement are well-suited for developing a solution to problems faced by farmers. Though open source licenses were originally devised to address problems for software developers created by copyrights, they can, and have been, adapted to address issues created by other monopoly rights. In recent years, academics have been studying and writing about the application of open source to biotechnology and plant development. In many ways, biotechnology development can be analogized to software development; thus, it lends well to the open source model.<sup>169</sup> As Janet Hope puts it, there is

an irresistible analogy between software and molecular biotechnology. Both technologies have enormous potential to help solve some of humanity's most pressing problems and enrich all of our lives .... Both industries are highly concentrated: the software industry is characterized by a near monopoly, while the pharmaceutical and agricultural industries, currently the main users of biotechnological innovations, are dominated by oligopolies.<sup>170</sup>

#### **\*200 i. Open Source Licenses Generally**

The fundamental principle of the open source software movement, espoused by the Free Software Foundation<sup>171</sup> and Open Source Initiative (OSI),<sup>172</sup> is that the best way to promote technological evolution is by making state-of-the-art creations available to and modifiable by as many people as possible.<sup>173</sup> Thus, open source licenses must allow free distribution of source code and cannot prevent modifications or derivative works.<sup>174</sup> The open source regime is an effective way of making resources for innovation freely available to anyone.

Open source licenses grant permission to use, develop, and distribute an IP-protected work free of charge. In the software context, open source licenses make software and source code available for modification and redistribution with a promise that the author will not assert a copyright to the work. Some licenses, called copyleft licenses, go further by extending their terms to downstream users, requiring contributors to open source projects to forgo enforcement of intellectual property rights to their contribution.<sup>175</sup> Copyleft licenses require that all modifications and derivative works be made freely accessible and unencumbered by intellectual property or contract restrictions other than those created by the accompanying open source license.<sup>176</sup>

Open source licenses utilize the power of intellectual property laws to protect and maintain a body of open material. Open source licenses essentially invert the monopoly rights granted to the author/inventor of the intellectual property--making the creation **\*201** openly and freely available to the public, instead of privately controlled, while maintaining the legal restrictions that prevent others from seeking monopoly rights covering the creation. The latter is what differentiates open source material from material that is in the public domain: open source material cannot be monopolized for private gain.

## *ii. Current Implementations of Open Source Licensing for Plant Resources*

Open source biotechnology projects are harder to establish than the open source software projects because patents and *sui generis* monopoly rights are much more difficult to obtain than copyrights. Grounding the open source license in copyright does not hamper software projects because copyrights automatically attach to any “original works of authorship”;<sup>177</sup> thus, obtaining copyrights on the code in an open source project does not add any time or cost to the project. Open source projects concerning biological material, on the other hand, are not as easily grounded in intellectual property.<sup>178</sup> In addition to being harder to obtain, patents are harder to maintain. Thus, open source plant projects must invest a large amount into obtaining monopoly rights of contributors, or else the projects must be supported by contributors who have the funding to obtain monopoly rights for their contributions and then dedicate those monopoly rights to the open source project.

The development of open source regimes for plant resources has already begun. There are groups currently implementing open source licensing for plant development material, but they primarily serve the research community and have yet to develop a method for targeting and incorporating farmer-developed resources. One of the largest and most well-known open source biology operations is established and maintained by Cambia. Cambia is an Australia-based, multi-national, nonprofit institute focused on encouraging innovation in the area of life sciences by developing a system in which all of the group’s research and the research of its partner organizations is freely available to anyone who wants to use it.<sup>179</sup> Cambia has three major projects in furtherance of its mission: Patent Lens, a free public resource for navigating the worldwide patent system;<sup>180</sup> Initiative for Open **\*202** Innovation (IOI), an international project to build on Patent Lens by creating a cyber-infrastructure to help navigate the intellectual property landscape in the areas of health, agriculture, environment, and energy;<sup>181</sup> and BiOS, an open source licensing program for agricultural-enabling technologies.<sup>182</sup> Through its BiOS initiative, Cambia has created some initial varying licenses tailored for the transfer of knowledge and/or materials for plant-related research and development.<sup>183</sup> The Cambia BiOS open source licenses for plant-related resources are copyleft licenses because they require that any downstream transfer of the open source-licensed materials and the improvements to those materials be accompanied by the same BiOS agreement that accompanied the original material.<sup>184</sup> Further, licensees are not permitted to assert IP rights to derivative or improved products against other open source licensees. The licenses are weak copyleft because, with some exceptions,<sup>185</sup> they allow the licensee to commercialize improvements or derivatives of open source materials without **\*203** contributing the developments back to the open source pool<sup>186</sup> as long as they do not assert monopoly rights in a way that prevents other licensees from innovation.<sup>187</sup> For-profit institutions that utilize Cambia-supported materials in their research or product development are required to pay a fee (ranging from US \$5000 to US \$150,000, depending on the size of the commercial entity).<sup>188</sup> In place of paying the fee, the for-profit entity can transfer intellectual property rights to the Cambia pool, and for-profit entities that cannot afford to pay the fee can pay with in-kind support that works to expand the Cambia pool.<sup>189</sup>

## *iii. Open Source Groups Have Yet to Include the Farmer*

Professor Keith Aoki argues that “farmers’ rights advocates have the potential to evolve into what the open source software movement has become.”<sup>190</sup> But an open source regime does not exist, specifically one tailored to incorporating plant breeds

developed by farmers, especially subsistence farmers. While Cambia’s licenses serve the research community well and achieve their purpose of encouraging innovation by making research tools more accessible to small and mid-size research entities, the Cambia projects focus on open source tools for the scientific community, not farmers. Further, the BiOS licenses are geared towards the needs of lab-bound researchers, not farmers. Thus, another open source scheme needs to be devised to help farmers, especially subsistence farmers, maintain the ability to create new plant breeds to meet the needs of their community through \*204 crossbreeding or other traditional methods without the risk of restrictions by corporation-owned intellectual property.

#### *iv. The Current Discussion Regarding Open Source for Farmers*

Keith Aoki explains that an open source PGR model would:

help ensure that farmers in particular local situations would be able to develop and cultivate plant varieties adapted to local climate, soil, and other conditions.

...

[A]n open source PGR model would also serve as a means of spreading risk and sharing costs among farmers, ‘farmers’ rights’ groups, and other smaller entities involved in the agricultural sector.<sup>191</sup>

Discussions by Aoki and a few others have provided the impetus for developing an open source plant regime to benefit farmers.<sup>192</sup> However, the literature thus far has only \*205 broadly considered the appropriateness of an open source regime for farmers. Academic discussion has yet to be generated regarding how open source regimes could be implemented to advance farmers’ rights goals. For instance, current literature has not considered how open source regimes for farmer-resources could be structured or funded, or how they could channel benefits to farmers. Moreover, the literature has yet to explore how copyleft licensing could be applied to benefit farmers.

## **V. A DETAILED LOOK AT THE CHALLENGES AND BENEFITS OF DEVELOPING AN OPEN SOURCE SYSTEM FOR PLANT RESOURCES**

Had the Mexican yellow bean been developed by farmers in Sonora and guarded by an open source steward, the “enola” saga could have been prevented.<sup>193</sup> As described in previous sections, an open source regime for farmer-developed resources would utilize existing intellectual property rights to prevent usurpation and would maintain those resources open and available for research and further development via an open source license. This section builds on the current literature regarding open source plants by looking at exactly how open source regimes for farmer-developed resources can be implemented. Specifically, this section examines how an open source consortium could be structured, what sort of open source licenses could be used to maintain the pool of rights (such as a draft seed wrap license, included in Appendix A), and how this system would benefit the farmer.

### ***A. The Challenges and Proposed Solutions***

The most fundamental aspect of an open source consortium is its pool of intellectual property. Therefore, an open source consortium that protects farmers must hold the intellectual property rights over the farmers’ resources that are necessary to prevent their misappropriation. An effective open source pool will hold intellectual property in multiple countries for each of its important resources. As such, tailoring the open source software regime to the needs of farmers faces a number of hurdles. The first challenge is obtaining the necessary intellectual property rights. Intellectual property rights over farmer-developed resources, namely patent and *sui generis* rights, require a substantial investment, as the intellectual property is expensive to obtain, monitor, and enforce. Since farmers typically do not have the resources or the ability to obtain intellectual property rights, the rights must be obtained at an organizational level. Further, an effective open source plant regime needs to

minimally burden the farmers, who can be assumed to have few resources and lack legal sophistication and knowledge in the areas of intellectual property and licensing regulations. The second challenge to creating an open source regime is creating an appropriate open source license and attaching that license to the resources in the protected pool.

### *i. Obtaining Intellectual Property Rights for Farmer-Developed Resources*

A system that effectively protects the resources of the world's subsistence farmers needs to minimize the burden on farmers. The system cannot require legal sophistication or a large monetary investment from the farmers. Thus, an organization must be formed to fund and oversee the acquisition and maintenance of monopoly rights--an open source "steward." Farmers would deposit samples of their crops with the steward each season, either by sending seed, plant material, or both. The deposits would be accompanied by documentation, such as the crop location, the farmer's development methods (including the origin of the seed), and a description of the qualities that the farmer observes in the plant.

Stewards, as the receivers of the farmer-developed plant resources, would be charged with integrating farmers' contributions into appropriate monopoly regimes. Upon receiving a farmer-developed resource (e.g., seed, plant material, a plant development method), the steward would study the resource to determine how, if at all, the resource can be protected under available monopoly regimes. Stewards would facilitate the acquisition of intellectual property rights in the appropriate jurisdictions, utilizing the most appropriate monopoly laws to afford the best chance at protecting the farmer's resource. Projects like Cambia's Patent Lens and IOI,<sup>194</sup> which are free public resources for navigating the worldwide patent landscape, would be extremely useful for stewards because they would provide a cost-effective tool for making a quick initial assessment of how well the right can be protected. If the resource is not protectable because it infringes on a non-open source monopoly right, the steward would notify the farmer so that the farmer could make an informed decision about whether to develop a new resource, or risk infringement action.

Aside from the intellectual property-related benefits that farmers would receive from stewards, contributing farmers or communities could receive plant materials or problem-solving assistance from the steward. Of course, stewards would distribute materials under a copyleft open source license.<sup>195</sup> Thus, anyone could have free access to the steward's materials, conditioned upon their contribution of improvements back to the steward.

### *ii. Creating an Effective Seed Wrap License*

An effective system for protecting farmer-developed resources would also utilize contract laws to increase the number of resources available in the open source pool. This licensing system would have farmers utilize material transfer agreements (MTAs) to accompany any transfers of the seed or material that they have sent to the steward. MTAs are common in developed nations because they allow companies to control how their seed is used via contract law.<sup>196</sup> These licenses have been appropriately referred to as "seed wrap" licenses because they are binding upon the performance of opening the seed packaging.<sup>197</sup> Like a "shrink wrap" license regularly used on software products, the seed wrap license would be binding upon the opening or use of the resource to which it was attached. Thus, the license must express clearly and immediately to the receiver that by opening the package, or using the enclosed material, the receiver agrees to the terms of the license. The seed wrap licenses for open source consortium farmers would be inspired by and tailored after copyleft open source software licenses.<sup>198</sup> Thus, the terms of the seed wrap license would have the licensee agree not to seek monopoly rights over the resource, or any derivative thereof, or transfer the property to any other entity who does not agree to the terms of the same seed wrap license.

#### **a. The Optimal Seed Wrap**

Appendix A contains an example license illustrating a seed wrap license containing the provisions to create an effective copyleft seed wrap license. The best copyleft software license model for the seed wrap license is probably the GPLv3 license<sup>199</sup> because it contains provisions that address and dispel potential problems with the acquisition and assertion of patent rights over the open source material.<sup>200</sup> An effective copyleft seed wrap license could be quite simple, as its main goal is to simply notify the licensee that the licensed seed is part of a specified open source consortium, that the license extends to any plant product or derivative of that seed, and that no one may assert intellectual property rights over the material, or any portion of the material, or any modified version of the material, against any contributor to the specified open source

consortium.

An effective seed wrap license for farmers' resources would need to present the following information. The preamble of the seed wrap license would state the purpose of the \*208 license--to prevent the plant variety embodied in the seed from becoming proprietary--and name the open source consortium to which the seed belongs. The binding provisions of the seed wrap license would need to contain strong copyleft statements that specify how and when the license must be attached. Specifically, the provisions would need to mandate that all transfers of the open source plant material, and derivatives of that plant material, be accompanied by the license.<sup>201</sup> Additionally, in order to keep modified versions of open source varieties in the protected pool, the license would need to mandate that the licensee deposit the modified version with the steward.

Further, the license would also contain binding provisions that specifically address patents. The license would prohibit the assertion of intellectual property rights against any contributor to the open source consortium, or any party that uses the material in a non-proprietary way.<sup>202</sup> Thereby, the license would require the user to dedicate any intellectual property rights over the material, or any version of the material, to the cause of the open source consortium. The seed wrap license would need to address the instance where a contributor knowingly contributes a patented plant variety.<sup>203</sup> For example, a license covering an open source corn variety would need to address the circumstance where a contributor knowingly cross-bred the open source variety with a commercially-monopolized \*209 variety.<sup>204</sup> Such a provision would aim to prevent contamination of the resources in the open source pool with non-open proprietary materials.

## **b. The Optimal Implementation of the Seed Wrap**

To minimize the burden on the farmer of implementing the seed wrap license, and to maximize the effectiveness of the open source pool, the open source regime would be best implemented by entire communities of farmers. A relevant farming community might be based on physical proximity, or based around a particular crop. Farmers in a community are likely to exchange resources, such as seed; therefore, communal involvement increases the likelihood of success of the seed wrap license and the open source consortium as a whole. Community members would each contribute and maintain their resources under the same agreement. In this way, they would be more likely to attach the license properly to all material transfers and be familiar with its terms, restrictions, and benefits. Additionally, community implementation would maximize the effectiveness of the license and the purity of the open source pool because it could work to incorporate and protect the resources that might be shared and mutually developed by more than one farmer in a community. Finally, communal licensing would help ensure the purity of the resources by eliminating the risk of contamination of the open source pool by natural cross-pollination with a non-open material.<sup>205</sup>

### **iii. If the Seed Wrap Fails**

The copyleft open source license would reduce the threat of intellectual property rights over farmer resources; however, the seed wrap license would not, by itself, be a sufficient long-term solution for protecting the farmers' resources, as it would only be binding on those parties that agreed to the seed wrap license. As plants replicate and spread themselves through natural channels, licenses would not be able to account for all the ways in which, parties could obtain, improve upon, and patent the open source material. Thus, the steward would need to engage in active monitoring of intellectual property applications to detect applications that might interfere with farmers' rights. To the extent that a steward identifies applications or issues rights derived from the open source material, the steward could intervene or oppose the approval of the rights by revealing information to the administering body, challenging the novelty or obviousness of the application.

### **\*210 iv. Structuring the Steward**

Stewards would function as seed banks and repositories for farming and plant-breeding information, or they could partner with gene banks that could store the consortium's plant material. Stewards would be local, national, or regional, or they could focus on a particular type of climate or crop. Optimally, a steward would receive collections from, and have specialized knowledge about, a particular crop, region, or climate, and would be a specialized benefactor to farmers in that area or climate. An example of a climate-based organization is International Center for Tropical Agriculture (CIAT).<sup>206</sup> CIAT, which is an agricultural research center and gene bank that focuses on plant-life and hunger issues in the tropics, led the successful intervention effort in the enola bean patent case.<sup>207</sup>

Stewards would be nonprofit, non-governmental organizations (NGOs) incorporated in an appropriate nation that would be chosen based on the location of contributors or favorable governing law. To be successful, the steward would need to maintain a positive connection and detailed communication with the farmers to fully understand and appropriately protect the farmers' pool of resources. Effective stewards would need to appreciate the challenges that their contributors face, such as weather, terrain, and disease issues, and be aware of the solutions that the farmers are working towards. Thus, stewards should be governed in a way that would encourage and facilitate contributor involvement. A detached corporate entity with a board comprised of benevolent members from developed countries may face difficulties in garnering appropriate farmer involvement. Such a detached corporate governance structure would face unnecessary obstacles, including lack of trust from farmers, information asymmetries, and higher communication costs.

A more effective and efficient governance structure would involve steward boards comprised of officers appointed from various groups or entities that have a stake in the steward's success. While boards may include appointees from western benefactors, they would also include representatives from contributing farming communities and partner organizations, such as seed banks. Importantly, the board members would represent a broad group of parties that have a vested interest in the success of the stewards' open source mission, thereby reducing the risk of self interested board members abandoning the open source licensing program and asserting the patents for profit. Similarly, to reduce the risk of a hostile takeover by an outside entity or an internal faction with divergent interests, the board should be self-perpetuating--having members appointed by the aforementioned interested entities, rather than being member-elected.<sup>208</sup>

**\*211** While contributing farmers would not vote to elect board members, they should be given an individual stake in the entity and the ability to exercise some amount of control over the entity. Therefore, it might be appropriate to structure the steward to give contributors a vote on major policy issues and corporate actions. Contributor voting rights would logically be based on the quantity and value of individual farmer's contributions.

#### ***v. Financing an Open Source Stewardship***

Stewards could support themselves by standard nonprofit means (such as government and private grants and donations) and, like Cambia, by charging fees to large farmers or commercial entities that create and/or sell products from the stewards' pool of resources.<sup>209</sup> Additionally, stewards might form a symbiotic and mutually profitable relationship with gene banks, research organizations, or universities. For example, Cambia works in partnership with Queensland University of Technology (QUT).

While sustaining a nonprofit consortium is feasible by the means listed, starting a consortium would require a large initial investment. Such an investment would have to come from a government or a private foundation. Cambia, for example, has been successful at obtaining such start-up grants from private foundations. Cambia, in partnership with QUT, recently procured a \$3 million grant from the Bill & Melinda Gates foundation to launch its IOI project.<sup>210</sup>

#### ***B. An Example: Applying the Proposal to the Mexican Yellow Bean Case***

The enola bean fiasco could have been prevented if the bean farmers who sold Proctor the beans had been contributors to an open source consortium. As contributors, the bean farmers would have deposited their beans with the steward and the steward would have applied for appropriate intellectual property rights in at least Mexico and the United States, because those were the primary markets for the beans. The steward probably would have sought utility patent rights over the material because utility patents afford the broadest form of protection. Further, the bag of beans sold to Proctor would have displayed or been **\*212** accompanied by a copyleft seed wrap license. The license would have notified Proctor of the open source protection over the beans. Thus, Proctor would have been on notice before he chose to cultivate the beans, that he was contractually obligated never to assert intellectual property rights over the beans against any party that was compliant with the license. Thus, Proctor would have been free to cultivate and improve the beans, and sell his crop in any location; however, by doing so he would incur an obligation under the seed wrap license to inform the consortium of his improvement and send them a material deposit. Moreover, the license could even have allowed Proctor to obtain intellectual property rights to his improved beans, though the terms of the seed wrap license would have prevented him from asserting those rights against any party unless those parties violated the terms of the open source contract by seeking competing monopoly rights for private gain.

The enola bean example underscores the importance of communal implementation of the license. Proctor originally purchased a bag of mixed beans in a market in Sonora. Those exact beans may have come from one or many farmers, but the cultivation of those multiple bean varieties was likely the work of many farmers. Thus, for the steward to have been enabled to maximize protection of the bean varieties in the mixed bag, and for the seed wrap license to attach to all the varieties in the bag, each of the cultivating farmers would have had to be a contributor to the same open source consortium.

The open source solution proposed here would prevent situations like the enola bean debacle in at least three ways. First, had the bag of beans that Proctor purchased been accompanied by a copyleft seed wrap license, Proctor would probably either have chosen not to cultivate the beans at all, or to cultivate the beans but not seek intellectual property for his product. Second, if Proctor had sought proprietary rights for the beans, the rights would have been denied for lack of novelty or obviousness because the open source consortium would have already filed for rights over the bean varieties in the bag. Further, if for some reason the Patent and Trademark Office or the Department of Agriculture had not recognized the unprotectability of Proctor's cultivation, then the steward could have alerted the agencies to the lack of novelty and obviousness by initiating *inter partes* interference or opposition proceedings.<sup>211</sup> Third, and finally, if Proctor had managed to obtain intellectual property rights over his cultivation of the yellow bean and had proceeded to assert those rights as he did in 1999, the steward could have initiated a reexamination hearing (as CIAT did) *and* the steward could have sued Proctor and Pod-Ners for patent infringement and breach of contract. By cultivating, growing, and selling the Mexican yellow bean, Proctor would have violated the steward's patent over the material. Likewise, by asserting intellectual property rights over the material, Proctor and Pod-Ners would have violated the terms of the seed wrap license.

### ***C. The Benefits of an Open Source Solution: Everybody Wins***

In an open source plant regime, both farmers and stewards would benefit. Farmers would benefit because the steward would protect their work against monopolies that could infringe on their freedom to farm: the ability to create plant varieties to suit local needs, and \*213 save, replant, and sell seed.<sup>212</sup> The steward would benefit because it would have an ever-larger pool of resources with which it could raise money and exercise power. This pool of resources governed by the steward gives the steward leverage, as an interest group, to lobby on behalf of farmers or pursue companies that are infringing on the steward's open source pool.

The open source solution is ideal for addressing the issues of farmers' rights because it offers a viable solution that can coexist with any monopoly rights regime. Further, open source regimes offer all the benefits of other solutions without the pitfalls.

#### ***i. Accomplishing the Goals of Farmers' Rights***

Farmer utilization of open source licensing pools will accomplish the four main goals of the farmers' rights movement.<sup>213</sup> First, open source collections offer farmers a method of establishing a pool of local resources that farmers can "grow, improve, and market."<sup>214</sup>

Second, this solution allows farmers "the right to access improved plant varieties and plant or exchange farm-saved seeds of commercial varieties."<sup>215</sup> While farmers might never be able to save and exchange *all* commercially available seed without fear of infringement actions, open source pools would offer a wide variety of improved seed that farmers could freely access, plant, save, and exchange.

Third, open source regimes offer a way for farmers to be compensated for "the use of local plant varieties in the development of new commercial products by third parties."<sup>216</sup> The main goal of open source systems is not to provide monetary compensation to individual farmers, but such a compensation system would not be out of the question.<sup>217</sup> Instead, farmers and farming communities would be compensated by having free access to all open source plant resources, including any improvements made on resources they contribute, and access to the knowledge-base of the consortium. Thus, if a third party utilized the farmers' contribution to create a commercial product, the farmers would be free to reproduce the commercial product.<sup>218</sup>

Fourth, and finally, open source regimes grant farmers "the right to participate in decision making processes related to

acquiring, improving, and using PGRs.<sup>219</sup> Farmers could collectively exercise control over the pool of resources to which they contribute by \*214 participating in the governance of the steward.<sup>220</sup> Moreover, the open source steward would be the entity through which individual farmers or communities would participate in national and international policy making.

### *ii. Open Source Solutions Coexist with Current Monopoly Rights*

The open source solution offers a good compromise between the interests of developed nations favoring strong monopoly rights and developing countries that prefer to keep plant resources in the public domain.<sup>221</sup> The solution can coexist with strong monopoly rights and it offers plant breeders a choice of developing resources as part of an open source community or developing resources for private monopolization.

Open source regimes do not require any changes to state or international monopoly law because they utilize existing monopoly protection. As such, upholding open source licenses would not change a state's compliance with the minimum standards for plant monopoly rights established by Article 27 of TRIPS.<sup>222</sup> States that encourage open source regimes would promote compliance with CBD and ITPGRFA because open source plant pools are in the spirit of the objectives of both treaties.<sup>223</sup> With respect to CBD, open source regimes satisfy Article 8(j) by offering an effective way for states to "respect, 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."<sup>224</sup> The open source solution is also in furtherance of Article 16(5) of CBD because it offers a way for states to show that their domestic laws "do not run counter to [CBD's] objectives."<sup>225</sup>

### *iii. Exploring the Benefits of Open Source Plant Pools*

Open source plant breeding offers the benefits of public domain solutions without the drawbacks. Open source methods satisfy the goals of public domain solutions--to prevent farmers' resources from being monopolized and make them freely accessible.

Like public domain solutions, open source methods incorporate farmer-developed resources into prior art to protect them from monopolization or biopirating.<sup>226</sup> In fact, open source solutions incorporate the resources into prior art more successfully than public \*215 domain solutions. Because open source materials are protected by domestic monopoly rights, they are already included in prior art searches.<sup>227</sup>

Like material that is in the public domain, open source inventions and material are freely accessible to anyone. Therefore, open source protections do not offend the traditional view that plant development and farming practices are common heritage.

Open source materials are shielded from the monopoly-swamping problems that occur with public domain materials. Monopoly-swamping cannot occur because open source-protected materials are guarded by an arsenal of intellectual property rights and a copyleft open source license. Thus, they cannot be monopolized without violating the monopoly rights and licenses surrounding the open source material. In other words, open source materials can be used and improved by anyone, but cannot be made exclusive by anyone.<sup>228</sup>

Finally, unlike public domain solutions, open source regimes offer a method and means for compensating farmers for their contribution to the state of the art of plant resources. The purpose and goal of the open source plant steward would be to provide its contributing farmers with protection and resources.<sup>229</sup> While monetary compensation for farmers would not have to be the aim of open source regimes, if monetary compensation programs were appropriate, stewards would be in a good position to create them. Stewards could tailor compensation regimes to cater to local needs because they would have control over the monopoly rights to the farmers' inventions and have records of farmers' contributions, including who made the contributions and the value of the contributions. Therefore, unlike the benefit-sharing system established by ITPGRFA, a steward-run benefit sharing system would be able to channel compensation to the correct farmers and in the correct proportions.<sup>230</sup>

## **VI. CONCLUSION**

Plant monopoly rights are infringing on farmers' freedoms to continue their traditional farming practices--their right to save seed, their right to control their farming methods, their right to compensation for their contribution to the state of the art, and even their right to cultivate their local varieties. Open source plant regimes offer a promising solution to the problems plaguing farmers by utilizing intellectual property laws to liberate, instead of entrap farmers. The open source solution allows entities with resources to incorporate the work of farmers into a pool of monopoly rights, which guarantee the farmer's work is protected from predatory monopolies. Open source stewards would serve \*216 as information resources for farming communities. Finally, open source pools would add to the richness of plant varieties available to open source farmers, and, in turn, would be excellent conservators of biodiversity.

## \*217 APPENDIX A

### OPEN SOURCE MATERIAL TRANSFER AGREEMENT<sup>231</sup>

This Open Source Material Transfer Agreement ("License") is between XX Open Source Consortium ("Steward") and You regarding the contents of the packaging to which this agreement is attached ("This Material").

#### Background

This Material is part of XX Open Source Consortium ("Steward").

Steward seeks to ensure common access to the tools of plant-related innovation, to promote the development and improvement of these tools, and to make such developments and improvements freely accessible to both academic and commercial parties. Information about Steward can be found at [www.XX.org](http://www.XX.org).

The origin and properties of This Material have been documented and incorporated into Steward's intellectual property portfolio.

#### BY OPENING OR USING THIS MATERIAL YOU AGREE TO THE TO THE TERMS OF THIS LICENSE.<sup>232</sup>

In return for the use of this material and Steward's royalty-free grant to you of the right to use any intellectual property for This Material without threat of assertion, you agree:<sup>233</sup>

You shall not assert any intellectual property rights, including patents or *sui generis* rights to This Material, or any derivatives of This Material, in any way, against any others that have agreed to these conditions.<sup>234</sup>

You shall not accept any license or third-party grant of rights conflicting with Section 1 hereof.<sup>235</sup>

You shall attach this license in a visible manner to all items transferred to a third party that are part of, or result from, This Material or any modification of This Material, including crop, seed, germplasm, and genetic information.

\*218 You shall not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing this plant variety or any version of it.<sup>236</sup>

You shall deposit any modified versions of This Material with Steward according to the instructions made available at [www.xx.org/deposit\\_instructions](http://www.xx.org/deposit_instructions).

You shall not convey a protected invention, material, or plant variety, when the corresponding invention, material, or plant variety is not available for anyone to make, use, and sell, free of charge and able to be subject to the terms of this license.<sup>237</sup>

If You violate Section 6 hereof, You shall either (1) cause the corresponding invention, material, or plant variety to be so available, (2) arrange to deprive the rights owner of the benefit of the protection for this particular plant variety, or (3) arrange, in a manner consistent with the requirements of this license, to extend a license to the protected invention, material, or plant variety to downstream recipients.<sup>238</sup>

## Footnotes

- <sup>a1</sup> J.D., Marquette University Law School, 2010; B.S., Electrical Engineering, Georgia Institute of Technology, 2003. I am grateful to Professor Michael O’Hear for providing invaluable guidance and thought-provoking feedback on several drafts of this paper. I would also like to thank Professor Cali Murray and Professor Irene Calboli for helping me formulate the ideas for this paper.
- <sup>1</sup> *In re POD-NERS, L.L.C.*, 337 F. App’x 901, 901 (Fed. Cir. 2009); Danielle Goldberg, *Jack and the Enola Bean*, TRADE & ENVTL. DATABASE (Dec. 2003), <http://www1.american.edu/TED/enola-bean.htm>.
- <sup>2</sup> Goldberg, *supra* note 1.
- <sup>3</sup> *See infra* note 40 (explaining the Plant Variety Protection Certificates).
- <sup>4</sup> *See infra* note 41 (explaining utility patents for plants).
- <sup>5</sup> Proctor was granted both forms of intellectual property, which he promptly assigned to his company Pod-Ners LLC. U.S. Patent No. 5,894,079 (filed Nov. 15, 1996) (issued Apr. 13, 1999); U.S. Plant Variety Certificate No. 9700027 (issued Jun. 30, 1999).
- <sup>6</sup> Sangeeta Shashikant & Asmeret Asghedom, *The ‘Enola Bean’ Dispute: Patent Failure & Lessons for Developing Countries*, THIRD WORLD NETWORK (Aug. 12, 2009), [http://www.twinside.org.sg/title2/intellectual\\_property/info.service/2009/twn.ipr.info.090801.htm](http://www.twinside.org.sg/title2/intellectual_property/info.service/2009/twn.ipr.info.090801.htm); *Mexican Bean Biopiracy: U.S.-Mexico Legal Battle Erupts over Patented ‘Enola’ Bean*, RURAL ADVANCEMENT FOUND. INT’L (Jan. 15, 2000) available at [http://www.etcgroup.org/upload/publication/339/01/geno\\_mexicanbean.pdf](http://www.etcgroup.org/upload/publication/339/01/geno_mexicanbean.pdf) (POD-NERS is demanding royalties of six cents per pound on the yellow beans entering the U.S. from Mexico.); Hank Lohmeyer, *Delta Seed Producers Stand Behind Patent*, DELTA CNTY. INDEP. (July 9, 2008), [http://www.deltacountyindependent.com/index.php?view=article&id=2925:delta-seedproducers-stand-behind-patent&option=com\\_content&catid=34:delta&Itemid=72](http://www.deltacountyindependent.com/index.php?view=article&id=2925:delta-seedproducers-stand-behind-patent&option=com_content&catid=34:delta&Itemid=72). Lohmeyer presents Pod-Ners’ view of the case: “Any company with a protected agricultural product can request that border agents make inspections of similar products coming into the country, and Pod-Ners did so in 2000.” Lohmeyer, *supra* note 6.
- <sup>7</sup> Goldberg, *supra* note 1; *Yellow Bean Patent Owner Sues 16 Farmers and Processors in U.S.*, ETC GRP. (Dec. 17, 2001), <http://www.purefood.org/patent/yellowbean121801.cfm>.
- <sup>8</sup> Goldberg, *supra* note 1. The yellow bean is a staple in the Mexican diet. “98% of surveyed Mexicans in the Northwest region eat the yellow bean ‘Azufrado’ bean.” Shashikant & Asghedom, *supra* note 6. These reports, and others, indicate that there was a 90% drop in Mexican exports of the yellow bean as a direct result of Pod-Ners’ actions. *Id.*; Goldberg, *supra* note 1 (reporting that the legal actions by Pod-Ners “caused economic damage to more than 22,000 farmers in northern Mexico who depend on these sales.”). *But see* Lohmeyer, *supra* note 6 (quoting Polly Proctor, business partner of Larry Proctor: “This has had absolutely no impact at all on the Mexican people.”).
- <sup>9</sup> ETC GROUP, *supra* note 7.
- <sup>10</sup> *In re POD-NERS, L.L.C.*, 337 F. App’x 901, 904 (Fed. Cir. 2009) (reasoning that the enola bean was “substantially the same” as a yellow bean called “Azufrado Peruano 87,” and that it would have been obvious to “[o]ne of ordinary skill in the art seeking to reproduce (and hopefully improve) the yellow beans that Proctor brought back from Mexico” to “[do] what he did ...”).
- <sup>11</sup> Carol Nottenburg, *Enola Bean Patent Controversy: Facts and Analysis*, Harvest Choice 8 (Dec. 15, 2009) available at <http://harvestchoice.org/files/Nottenburg%202009%CC20HarvestChoice%20--%20Enola%20Bean%20Controversy.pdf>.

- <sup>12</sup> U.S. Patent No. 5,894,079 (filed Nov. 15, 1996).
- <sup>13</sup> Gillian N. Rattray, *The Enola Bean Patent Controversy: Biopiracy, Novelty, and Fish-and-Chips*, 2002 DUKE L. & TECH. REV. 8, 19 (“[I]t remains to be seen if [sic] CIAT’s challenge to the Enola bean patent will be successful, as strong arguments lie on both sides”) (arguing that the bean meets the patentability requirements for novelty and nonobviousness). Nottenburg also discusses the legal issues surrounding the patentability of the enola bean. She argues that “it appears that the requirements for novelty were initially met for the enola bean patent” and the issues of obviousness were not straightforward. Nottenburg, *supra* note 11, at 3-5.
- <sup>14</sup> GRAHAM DUTFIELD, INTELLECTUAL PROPERTY, BIOGENETIC RESOURCES, AND TRADITIONAL KNOWLEDGE 52-56 (2004) (detailing issues involving hoodia, neem, and quinoa patents and reporting that hundreds of plant variety protection certificates have been awarded covering landraces that have been subject to little or no additional breeding); Michael Blakeney, *Bioprospecting and Biopiracy*, in INTELL. PROP. & BIOLOGICAL RESOURCES, MARSHALL CAVENDISH ACAD. PRESS 393, 395-402 (Burton Ong ed. 2004) (describing “biopiracy episodes,” including the 1998 Australian “biopiracy” episode, blight-resistant rice, enola beans, yacon, nuna beans, and Peruvian maca). For a list of some extraordinarily profitable PGR extractions made by U.S. entities, see *infra* note 21.
- <sup>15</sup> JACK R. KLOPPENBURG, JR., FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY 1492-2000 at 169 (2d ed. 2004).
- <sup>16</sup> S.K. Verma, *Plant Genetic Resources, Biological Inventions and Intellectual Property Rights: The Case of India*, in INTELL. PROP. & BIOLOGICAL RESOURCES, MARSHALL CAVENDISH ACAD. PRESS 10 (Burton Ong ed. 2004). For more information on the history of the north-south tensions surrounding plant monopoly rights, see KLOPPENBURG, JR., *supra* note 15, at 4-7 (giving an introduction to the social and environmental issues facing the expansion of plant monopoly rights); Chidi Oguamanam, *Intellectual Property Rights in Plant Genetic Resources: Farmers’ Rights and Food Security of Indigenous and Local Communities*, 11 DRAKE J. AGRIC. L. 273, 274-82 (2006) (discussing the evolutions of sentiment towards plant monopoly rights in the United States and in areas that practice traditional farming methods).
- <sup>17</sup> SUSETTE BIBER-KLEMM & THOMAS COTTIER, RIGHTS TO PLANT GENETIC RESOURCES AND TRADITIONAL KNOWLEDGE: BASIC LEGAL ISSUES AND PERSPECTIVES xxv (2006).
- <sup>18</sup> *E.g.*, MICHAEL HELLER, THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES 57 (2008).
- <sup>19</sup> Keith Aoki, *Malthus, Mendel, and Monsanto: Intellectual Property and the Law and Politics of Global Food Supply: An Introduction*, 19 J. ENVTL. L. & LITIG. 397, 409 (2004) [hereinafter Aoki, *Malthus*].
- <sup>20</sup> IAN WILLS, ECONOMICS AND THE ENVIRONMENT: A SIGNALING AND INCENTIVES APPROACH 321(2006). *See also* Food and Agriculture Organization of the United Nations, 1989: RESOL. 5/89, TWENTY-FIFTH SESSION OF THE FAO CONF., ROME (Nov. 1989).
- <sup>21</sup> *E.g.*, KLOPPENBURG, JR., *supra* note 15, at 167-69. Kloppenburg states:  
A Turkish landrace of wheat supplied American varieties with genes for resistance to stripe rust, a contribution estimated to have been worth \$50 million per year. The Indian selection that provided sorghum with resistance to green bug has resulted in \$12 million in yearly benefits to American agriculture. An Ethiopian gene protects the American barley crop from yellow dwarf disease to the amount of \$150 million per annum .... It is no exaggeration to say that the plant genetic resources received as free goods from the Third World have been worth untold billions of dollars to the advanced capitalist nations.  
*Id.*
- <sup>22</sup> Aside from the obvious detriments of biopiracy discussed in note 44, developing nations who do not have a history of supporting intellectual property are also harmed by being forced by international agreement to develop intellectual property systems that

primarily benefit foreigners. Amy E. Carroll, *NOT ALWAYS THE BEST MEDICINE: BIOTECHNOLOGY AND THE GLOBAL IMPACT OF U.S. PATENT LAW*, 44 AM. U. L. REV. 2433, 2465-69, 2471-73 (1995). Carroll concludes, in relevant part, that forcing less-developed nations to support patent systems, when those nations do not have any high-tech industries, is a net drain on those nations and primarily a benefit for foreigners—“[i]n light of the fact that foreign-owned patents mainly generate future royalties and profits for their foreign owners, these patents must be regarded as deductions from national wealth.”

<sup>23</sup> KIRK K. PATEL, *Farmers' Rights Over Plant Genetic Resources in the South: Challenges and Opportunities*, in INTELL. PROP. RTS. IN AGRIC. BIOTECHNOLOGY 95, 96 (2d ed. 2004). MASIPAG, a well-established and active farmers' rights organizations in the Philippines, began in the 1980s and was one of the earliest advocacy groups to form around the cause. Initially, MASIPAG's goal was “to revive and improve indigenous rice varieties that would not require imported inputs and generate appropriate technologies attuned to farmers' problems and needs.” MASIPAG has developed into an intricate network of farmers and scientists working together to develop rice varieties well-adapted to local conditions and encourage farm diversity and sustainable agriculture. MASIPAG, About Us, <http://masipag.org/> (Follow “About Us”) (last visited Mar. 4, 2010).

<sup>24</sup> MASIPAG, *supra* note 23; CARRY FOWLER, UNNATURAL SELECTION: TECHNOLOGY, POLITICS, AND PLANT EVOLUTION 201 (Gordon and Breach 1994).

<sup>25</sup> Germplasm is the genetic material that forms the physical basis of heredity and is transmitted from one generation to the next by means of germ cells. With respect to plants, the germplasm is the seed or other material from which plants are propagated.

<sup>26</sup> For a brief and general overview of the evolution of farmer contribution to modern plant cultivation, see Charles R. McManis & Eul Soo Seo, *The Interface of Open Source and Proprietary Agricultural Innovation: Facilitated Access and Benefit-Sharing Under the New FAO Treaty*, 30 Wash. U. J. L. & Pol'y 405, 409-19 (2009); KEITH AOKI, SEED WARS: CONTROVERSIES AND CASES ON PLANT GENETIC RESOURCES AND INTELLECTUAL PROPERTY 3-7, 9-25 (2008).

<sup>27</sup> KEYSTONE CTR., FINAL CONSENSUS REPORT OF THE KEYSTONE INTERNATIONAL DIALOGUE SERIES ON PLANT GENETIC RESOURCES: MADRAS PLENARY SESSION (Feb. 1990). The Keystone International Dialogue on Plant Genetic Resources addressed farmers' rights. *See id.* The Dialogue's report stated: Farmers' Rights recognizes that farmers and rural communities have greatly contributed to the creation, conservation, exchange and knowledge of genetic and species utilization of genetic diversity, that this contribution is ongoing and not simply something of the past, and that this diversity is extremely valuable. Yet, neither the market place nor current intellectual property systems have any way of assigning a value to this material.  
*Id.*

<sup>28</sup> The Farmers' Rights Project, a project initiated by Dr. Regine Andersen of the Fridtj of Nansen Institute of Norway in 2005, defines farmers' rights as “consist[ing] of the customary rights of farmers to save, use, exchange and sell farm-saved seed and propagating material, their rights to be recognized, rewarded and supported for their contribution to the global pool of genetic resources as well as to the development of commercial varieties of plants, and to participate in decision making on issues related to crop genetic resources.” *About Farmer's Rights*, FARMER'S RIGHTS, [http:// www.farmersrights.org/about/index.html](http://www.farmersrights.org/about/index.html) (last visited Jan. 23, 2010).

<sup>29</sup> PATEL, *supra* note 23, at 96; AOKI, SEED WARS, *supra* note 26, at 77.

<sup>30</sup> KLOPPENBURG, *supra* note 15, at 4-7 (giving an introduction to the social and environmental issues facing the expansion of plant monopoly rights); AOKI, SEED WARS, *supra* note 26, at 3-7 (giving a brief overview of plant breeding development in the last century and the environmental controversy surrounding modern farming methods). *See also* Oguamanam, *supra* note 16, at 274-82 (discussing the evolutions of sentiment towards plant monopoly rights in the United States and in areas that practice traditional farming methods).

<sup>31</sup> *Id.*

32 In addition to patent, trademark, and *sui generis* protections, plant breeders use trade secret and private contract law to expand their monopoly rights over plant varieties. See AOKI, SEED WARS, *supra* note 26.

33 “Plant resources” is used throughout to refer to plants and plant-development inventions, both traditional and modern industrial, including plant varieties, germplasm, genetic traits of plant varieties, and transformation technology (including methods, processes, and utilities for gene isolation and transfer). See *generally id.*

34 AOKI, SEED WARS, *supra* note 26, at 61-62, 90-97 (presenting an overview of international agreements and bodies regulating plant monopolies). Each of these international regulations is implemented by the various member-nations, often through multiple methods involving multiple government bodies. For an overview of the various protections that the United States offers for plant varieties, see *infra* notes 39-41 and accompanying text.

35 See *infra* Part III (examines the most pertinent treaties). The International Union for the Protection of New Varieties of Plants (UPOV) in 1961, was the first agreement on the subject. Since then, there have been a number of agreements that address plant monopoly rights, including the International Undertaking on Plant Genetic Resources (IUPGR) (a voluntary agreement adopted in 1983), the Keystone Dialogues (1989), the Convention on Biological Diversity (1992), the Agreement on Trade Related Aspects of Intellectual Property (TRIPS) (1995), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (2004). See International Convention for the Protection of New Varieties of Plants, Dec. 2, 1961, 33 U.S.T. 2703, [hereinafter UPOV]; International Undertaking on Plant Genetic Resources, Nov. 3, 2001-Nov. 4 2002, 2002 U.S.T. LEXIS 137 [hereinafter IUPGR]; Keystone International Dialogue Series on Plant Genetic Resources May 31- June 1991 [hereinafter Keystone Dialogues]; Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 143, [hereinafter CBD], available at <http://www.cbd.int/doc/legal/cbd-en.pdf>; Agreement on Trade Related Aspects of Intellectual Property, Apr. 15 1994, 33 I.L.M. 81 [hereinafter TRIPS], available at [http://www.wto.org/english/docs\\_e/legal\\_e/legal\\_e.htm#TRIPS](http://www.wto.org/english/docs_e/legal_e/legal_e.htm#TRIPS); International Treaty on Plant Genetic Resources for Food and Agriculture, Nov. 3, 2001, 2400 U.N.T.S. 303 [hereinafter ITPGRFA], available at <http://www.fao.org/legal/treaties/033te.htm>.

36 See *infra* Part III.B (providing information on relevant TRIPS requirements). See *generally* Part III (discussing the major treaties pertaining to plant monopolies and farmers’ rights).

37 See *infra* Part III (discussing treaties that attempt to restrict monopoly rights for plants).

38 Edmund J. Sease & Robert Hodgson, *Plants are Properly Patentable Under Prevailing U.S. Law and this is Good Public Policy*, 11 DRAKE J. AGRIC. L. 327, 329 (2006) (“[T]he United States was the first country to grant intellectual property rights to plant breeders”).

39 The Plant Patent Act (PPA) of 1930 offers patent protection for asexually reproduced plant varieties that are distinct, new, and not obvious. 35 U.S.C. §§ 161-64 (2010). Asexual plant reproduction is defined by the PTO as “the propagation of a plant to multiply the plant without the use of genetic seeds to assure an exact genetic copy of the plant being reproduced.” Examples of asexual plant reproduction methods include root cutting, grafting, layering, tissue culture, bulbs, rhizomes. Aside from sexually reproduced plants, the PPA excludes protection for tubers and plants “found in an uncultivated state.” *Id.* at § 163 (confers the twenty-year monopoly right to asexually reproduce, use, and offer for sale).

40 The Plant Variety Protection Act of 1970 (PVPA), 7 U.S.C. §§ 2321-2582 (2010), was established by Congress to supplement the PPA. As such, it specifically protects sexually reproduced or tuber-propagated plants. However, rights conferred through the PVPA are granted from the U.S. Department of Agriculture, not the PTO. The patent-like rights are obtained from the U.S.D.A. in the form of Plant Variety Protection Certificates (PVPC). PVPCs confer the “legal right to exclude others from reproducing, selling, importing, or exporting the protected variety” for up to twenty-five years. The requirements for obtaining a PVPC include showing that the plant variety is new, distinct, uniform, and stable. *Id.* at § 2402(1-4). Importantly, the rights conferred to plant breeders via PVPCs are subject to two exemptions: farmers’ privilege and research rights. The farmers’ privilege dictates that farmers who legally obtain and grow PVPC-protected plants cannot be prevented by the certificate owner from harvesting, saving, or replanting the seed. The research rights provision states that PVPC owners may not prevent researchers or competitors from using their protected plant for “plant breeding or other bona fide research,” which includes breeding that results in varieties that are not “essentially derived” from the protected plants, pesticide and herbicide research, comparative experimentation. *Id.* at § 2544; See

also Jim Chen, *The Parable of Seed: Interpreting the Plant Variety Protection Act In Furtherance of Innovation Policy*, 81 NOTRE DAME L. REV. 105, 126-31 (2005).

The scope of the farmers' privilege that is carved out in the PVPA has been the subject of much debate. The PVPA was designed to respect the practice of seed saving; however, breeders have sought to limit it as much as possible. The PVPA establishes the right of farmers to save their seed for the purposes of replanting or sale, as long as the farmers' "primary farming occupation is the growing of crops for sale for other than reproductive purposes." 7 U.S.C. § 2541 (1994). However, the act did not make clear how much seed a farmer could save for the purposes of sale. In *Asgrow Seed Co. v. Winterboer*, the Supreme Court narrowly interpreted the farmers' privilege provision of the PVPA to authorize farmers to sell "only such seed as he has saved for the purpose of replanting his own acreage." 513 U.S. 179, 185-86 (1995).

41 Utility patents protect the broadest scope of plant life, as they apply to sexually reproducing varieties and the seed produced by protected varieties. Therefore, utility patent owners can prevent farmers who plant patented seed from saving the seed for sale or replanting. Utility patents have been much more effective than plant patents for agriculture companies to profit from their inventions because they allow patent owners to dictate how the plant is used and prevent farmers from replanting harvested seed and breeding derivative plant varieties. Brian D. Wright, *Plant Generic Engineering and Intellectual Property Protection*, 8186 AGRIC. IN CAL. SER. 1-2 (2006). Since *Hibberd*, utility patent rights have been granted for plant species that are sexually reproduced (including those that have been derived through conventional breeding techniques) or genetically engineered, as long as they meet the requirements of patentability. *Id.* at 2 (citing *Ex Parte Hibberd*, No. 647-008, 1985 WL 71986 (B.P.A.I. Sept. 18, 1985)). Additionally, patents are granted for methods of plant breeding, and methods and tools for plant genetic manipulation. *Id.*

42 In addition to the federal mechanisms of plant variety protection, state-law mechanisms such as trade secrets, and private agreements such as licensing contracts, are used by breeders to further protect their plant resources. Elizabeth I. Winston, *What if Seeds Were Not Patentable?*, 2008 MICH. ST. L. REV. 321, 327-32 (2008). Trade secrets have been used since the early 1900s by plant breeders to protect the methods by which they develop their successful seed. Trade secret law is still commonly used in circumstances where patent protection is not an option, either because novelty has been lost, or the variety has not yet been sufficiently reduced to practice. Additionally, trade secret is often the protection of choice for breeder's parent seed lines because, unlike patent and *sui generis* rights, trade secret protection does not have a finite protection period and can last as long as the owner effectively maintains the secret. Elisa Rives, *Mother Nature and the Courts: Are Sexually Reproducing Plants and their Progeny Patentable Under the Utility Patent Act of 1952?* 32 CUMB. L. REV. 187, 192-95.

Private law is used to fill the gaps where public law has failed to provide the protection that breeders seek. Licensing agreements are one of many contractual mechanisms whereby plant breeders enforce monopoly rights beyond those granted by intellectual property law. *Id.* See also Jay P. Kesan, *Licensing Restrictions and Appropriating Market Benefits from Plant Innovation*, 16 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1081 (2006) (providing a thorough examination of the use of licensing to supplement federal monopoly rights, including the pros and cons of the licenses and specific examples of their use). For example, plant breeders with varieties protected by PVPCs often require purchasers to sign license agreements that waive the purchaser's rights under the research and farmers' exclusions. Such licenses, often referred to as "seed wrap" licenses (so named because of their similarity to shrink-wrap software licenses) or "bag-tag" licenses, are often used when transferring PVPC, trade secret, or patent protected plant material. These seed wrap licenses accompany the transfer or sale of seed from the breeder and their purpose is to strictly limit what the licensee-farmer can do with the plant and the plant products. The main objective of most seed wrap licenses is to prohibit farmers from saving and selling seed from the plant, thereby forcing the repurchase of seed from the corporation who owns the monopoly right on the plant. See MCKEE, VOORHEES & SEASE, P.L.C., *Seed Wrap License*, THE AGRIC. RES. CTR., [http://www.agmrc.org/business\\_development/operating\\_a\\_business/legal/articles/seed\\_wrap\\_license.cfm](http://www.agmrc.org/business_development/operating_a_business/legal/articles/seed_wrap_license.cfm) (last visited Feb. 6, 2011).

43 Wright, *supra* note 41, at 2.

44 HELLER, *supra* note 18, at 57.

45 *Id.* Heller's notion of the "tragedy of the anti-commons" is especially applicable here. *But see* McManis & Seo, *supra* note 26, at 418-19 (presenting the opposite view that "the benefits to farmers of patents on platform technologies such as transformation methods have outweighed the costs of the few possible holdups, by stimulating research on these technologies, which have led to major increases in efficiency").

46 HELLER, *supra* note 18, at 55.

47 *Id.*; Remigius N. Nwabueze, *What Can Genomics and Health Biotechnology Do for Developing Countries?*, 15 ALB. L.J. SCI. & TECH. 369, 394 (2005).

48 Nwabueze, *supra* note 47, at 394; HELLER, *supra* note 18, at 55.

49 One author suggests that such generosity may be short lived. *See* Nwabueze, *supra* note 47, at 394. Nwabueze writes: At the time of the research on golden rice, the biotech industry was having public image problems in Europe due to its promotion of genetically modified crops and, thus, was eager to shore up its social standing by demonstrating the potential benefits of biotechnology for impoverished countries. The golden rice presented this image-cleansing opportunity, which the biotech industry quickly exploited by the donation of patents needed for the development of the golden rice. In the end, the public sector (Swiss Federal Institute of Technology) was, by fortuitous circumstances, enabled to play its traditional role in the development of the golden rice.  
*Id.*

50 HELLER, *supra* note 18, at 57 (“[p]lant geneticists worry that agricultural biotech patenting is closing off a thousand-year-old tradition of hybridizing crops to improve health and nutrition.”).

51 *Id.* For example, utility-patent owners can prevent farmers who plant patented seed from saving the seed for sale, replanting, or cross-germinating to develop a new variety. *See, e.g.,* Wright, *supra* note 41, at 1-2.

52 KLOPPENBURG, JR., *supra* note 16, at 15.

53 *Id.* at 50 (“[t]he introduction of plants into America has been much more than a great service; it has been an absolute imperative, a biological *sine qua non* upon which rests the whole complex edifice of American industrial society.”).

54 The major world industry players are Monsanto, Pioneer, and Syngenta. The Financial Express, *Global Seed Industry Could Triple Soon to \$90-bn Plus: Study*, Apr. 1, 2002, [http:// www.financialexpress.com/printer/news/41986/](http://www.financialexpress.com/printer/news/41986/) (last visited Mar. 4, 2010). Monsanto is an American multinational company who is the largest producer of genetically modified (GM) seed. Monsanto, who invented the Round-Up herbicide in the 1970’s, is now famous for its Round-Up Ready™ line of patented seeds. *Company History*, MONSANTO, <http://www.monsanto.com/whowear/Pages/Monsanto-history.aspx> (last visited Mar. 29, 2011). Monsanto has received negative attention in the media over the last decade concerning its contribution to pollution, the negative health effects of its products (e.g. bovine growth hormone, health effects from pesticide exposure), its litigious practices against farmers, and its political lobbying practices. David Firstone, *Alabama Jury says Monsanto Polluted Town*, N.Y. TIMES, Feb.23, 2002, available at [http://query.nytimes.com/gst/fullpage.html? res=9804E2D8103EF930A15751C0A9649C8B63](http://query.nytimes.com/gst/fullpage.html?res=9804E2D8103EF930A15751C0A9649C8B63). Pioneer Hi-Bred International, a DuPont company, is also one of the largest producers of GM plant lines. *Who We Are*, PIONEER, <http://www.pioneer.com/home/site/about/business/who-we-are/> (last visited Mar. 29, 2011). Like Monsanto, Pioneer Hi-Bred is an American-founded international agricultural corporation. *Id.* Syngenta is the first and largest global agricompany, which arose in 2000 out of a merger between the agri-sectors of Novartis and AstroZenica. *Company History*, SYNGENTA, [http:// www.syngenta.com/en/about\\_syngenta/companyhistory.html](http://www.syngenta.com/en/about_syngenta/companyhistory.html) (last visited Mar. 4, 2010).

55 McManis & Seo, *supra* note 26, at 418-19; Edmund J. Sease & Robert Hodgson, *Plants are Patentable Under Prevailing U.S. Law and this is Good Public Policy*, 11 DRAKE J. AGRIC. L. 328-29, 347-48 (2006).

56 Sease & Hodgson, *supra* note 38, at 328-29, 347-48.

57 Ronald P. Cantrell et al., *The Impact of Intellectual Property on Non-profit Research Institutions and the Developing Countries They Serve*, 6 MINN. J. L. SCI. & TECH. 253, 270-71 (2004).

58 Development of plant genetic resources requires a large investment. Without the promise of financial return for successful invention, which is arguably the purpose of monopoly rights, companies would not take an interest in developing plant resources and progress would slow. *See* Burton Ong, *Harnessing the Biological Bounty of Nature: Mapping the Wilderness of Legal*,

- 59 Hearing on H.R. 11327 Before the House Comm. on Patents, 71st Cong. 3, at 2 (1930).
- 60 *See supra* notes 38-41 (detailing the forms of plant monopoly rights granted in the United States).
- 61 *See* KLOPPENBURG, JR., *supra* note 15 (explaining the international agribusiness).
- 62 *Id.*, at 5 (“[s]ince 1935, yields of all major crops in the United States have at least doubled, and at least half of these gains are attributable to genetic improvements.”).
- 63 *Id.* at 14-18. Carroll, *supra* note 22, at 2465-69, 2471-73.
- 64 AOKI, SEED WARS, *supra* note 26, at 22-35; McManis & Seo, *supra* note 26, at 409-11.
- 65 Ong, *supra* note 58, at 2. Within groups involved in the intellectual property community, there has been debate for decades over whether life forms should be patentable and, if so, to what extent they should be patentable. *Id.* at 2. The debate came into full force with the United States Supreme Court decision in *Diamond v. Chakrabarty*. 447 U.S. 303 (1980) (granting patentability of genetically-modified bacteria, classifying the invention as a “composition of matter” or a “manufacture” and stating that patents are intended by Congress to “include anything under the sun that is made by man”). Groups outside the intellectual property community who are weighing in on the debate regarding plant monopoly rights include environmental activist groups, and NGOs and lobby groups that support agrarian and indigenous communities. Ong, *supra* note 58, at 2.
- 66 Oguamanam, *supra* note 16, at 289 (“The concept of farmers’ rights taps into some of the underlying logic of intellectual property rights with the result that the relationship between the two concepts is a complicated one.”).
- 67 Lawrence R. Helfer, *Regime Shifting: The TRIPS Agreement and New Dynamics of International Intellectual Property Lawmaking*, 29 YALE J. INT’L L. 1, 37 (2004).
- 68 RES. 4/89, THE AGREED INTERPRETATION OF THE INT’L UNDERTAKING, Rome 1989, available at <ftp://ftp.fao.org/ag/cgrfa/Res/C4-89E.pdf>. Also, see the discussion of the history of farmers’ rights at: FAO PROVISIONAL AGENDA, ITEM 14, INT’L TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE, SECOND SESS. OF THE GOVERNING BODY 4-10, Rome 2007, available at <ftp://ftp.fao.org/ag/agg/planttreaty/gb2/gb2i6e.pdf>.
- 69 *See supra* Part III (explaining the relevant treaty endeavors) and Part II.B.2 (explaining the dominance of breeders’ rights).
- 70 *See supra* note 8 (explaining the importance of the yellow bean to the people of Senora); *See* the Introduction (explaining the patentability of the yellow bean).
- 71 BIBER-KLEMM & COTTIER, *supra* note 17, at 4.
- 72 *About Farmer’s Rights*, FARMER’S RIGHTS, <http://www.farmersrights.org/about/index.html> (last visited Jan. 23, 2010).
- 73 For a discussion and definition of landraces, see generally *Glossary of Traditional Knowledge Terms*, <http://www.traditionalknowledge.info/glossary.php>; BIBER-KLEMM & COTTIER, *supra* note 17, at 5.

74 BIBER-KLEMM & COTTIER, *supra* note 17, at 4-11.

75 *E.g.*, Oguamanam, *supra* note 16, at 288. *See also* ITPGRFA, *supra* note 35, at art. 9.1.

76 Ong, *supra* note 58, at 7 (“the notion of biopiracy evokes images of looting and plundering which may not be entirely appropriate given the nature of the subject matter involved”).

77 KLOPPENBURG, JR., *supra* note 15, at 167-69. *See supra* note 21 (listing several profitable misappropriations of farmer-developed crops created in developing countries and monopolized by western ago-companies) and *supra* note 14 (providing examples of problems caused by intellectual property over misappropriated plant resources).

78 KLOPPENBURG, JR., *supra* note 15, at 14.

79 *Id.*

80 *Id.* (“American crop plants are as immigrant in character as its population, and Europe’s crops are only slightly less so.”).

81 Large-scale international debates, negotiations, and agreements regarding plant monopoly rights essentially started in the 1960s with the International Union for the Protection of New Varieties of Plants (UPOV). Since the first UPOV convention was adopted in 1961--the first of a series of conventions (the latest being in 1991) which sought to unify and further intellectual property protection for plant varieties (UPOV, [www.upov.int/index\\_en.html](http://www.upov.int/index_en.html)) (last visited Feb. 3, 2011)--there have been a number of dialogs and conventions formed regarding plant variety protection. For the purposes of this paper, it is enough to examine only the international agreements that have currently worldwide effect (as opposed to regional agreements).

82 CBD, *supra* note 35.

83 The CBD was somewhat of a compromise between the rights regimes of the developed west and the International Undertaking on Plant Genetic Resources (IUPGR) of 1983, which was spearheaded by a group of developing nations. The IUPGR was non-binding and sought to assert opposition to plant monopolies and progress issues of “farmers’ rights”. The philosophy behind IUPGR was that plant resources are the “common heritage of mankind” and, thus, should not be monopolized. Therefore, IUPGR did not respect any plant monopolies and proffered the idea that knowledge regarding plant resources should be freely accessible. Keith Aoki & Kennedy Luvai, *Reclaiming “Common Heritage” Treatment in the International Plant Genetic Resources Regime Complex*, 2007 MICH. ST. L. REV. 35, 41 (2007), available at [http:// www.msulawreview.org/PDFS/2007/1/Aoki.pdf](http://www.msulawreview.org/PDFS/2007/1/Aoki.pdf).

84 BIBER-KLEMM & COTTIER, *supra* note 17, at 59-60.

85 *Id.* at 60. *See also* *History of Farmers’ Rights in the FAO*, FARMER’S RIGHTS, [http://www.farmersrights.org/about/fr\\_history\\_part5.html](http://www.farmersrights.org/about/fr_history_part5.html) (last visited Jan. 23, 2010).

86 List of Parties, CONVENTION ON BIOLOGICAL DIVERSITY, [http:// www.cbd.int/convention/parties/list/](http://www.cbd.int/convention/parties/list/) (last visited Feb. 18, 2011).

87 CBD, *supra* note 35, at 3.

88 *Id.* at 4-5. Article 3, titled “Principle”, states that:  
States have ... the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Further, Article 6 establishes the general scope of each member's duties for national preservation. It states:

Each Contracting Party shall, in accordance with its particular conditions and capabilities:

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and

(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

89 *Id.* at 4.

90 *Id.* at 4-8.

91 *Id.* at 13-14.

92 CBD, *supra* note 35, at 9-10.

93 *Id.* at 10. For example, Article 15.7 requires that Parties engage in contracts, which provide for "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. Such sharing shall be upon mutually agreed terms."

94 *See supra* Part II.A (listing the farmers' rights goals).

95 *Id.* at 9-11. For example, Article 16 addresses the first and second goals of farmers' rights, freedom to develop local varieties and access to commercial varieties, by specifying that "that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention." The Article instructs developed nations to provide favorable terms for developing nations, specifying that "developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed ...." Additionally, Article 15.7 addresses the third goal of farmers' rights, compensation, by requiring that "[e]ach Contracting Party shall take ... measures ... and, where necessary, through the financial mechanism established by Articles 20 and 21 with 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." Finally, Article 15.6 speaks directly to the fourth goal of farmers' rights, participation in decision making, by establishing that "[e]ach Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties." *Id.*

96 *Id.* at 6.

97 Murray Lee Eiland, *Patenting Traditional Medicine*, 89 J. PAT. & TRADEMARK OFF. SOC'Y 45, 50 (2007) ("As a whole the CBD has had limited impact as a template for further legislation. Few countries have met the minimum standards of protection."). *See also* Rebecca M. Bratspies, *The New Discovery Doctrine: Some Thoughts on Property Rights and Traditional Knowledge*, 31 AM. INDIAN L. REV. 315, 317-18 (2006/2007).

98 CBD, *supra* note 35, at 11 (requiring that states "ensure" that IP rights granted by their domestic laws are "supportive of and do not run counter to [the treaty's] objectives.").

99 Bratspies, *supra* note 97, at 328-30 (noting that "states often cannot be trusted to protect the interests of their citizens, particularly the interests of minority groups.").

100 Peter Jenkins, *The United States and the Convention on Biological Diversity*, The Defenders of Wildlife (Dec. 11, 2008), [http://www.defenders.org/resources/publications/programs\\_and\\_policy/international\\_](http://www.defenders.org/resources/publications/programs_and_policy/international_)

conservation/the\_u.s.\_and\_the\_convention\_on\_biological\_diversity.pdf (stating that “[o]nly four nations in the world are non-parties: Andorra, Iraq, Somalia, and the USA.”). Since the publication of this fact sheet, both Iraq and Somalia have acceded to the CBD, leaving the United States and Andorra as the only countries that are not members. *See* Theodore A. Feitshans, *TRIPS & the Protection of Intellectual Property in Biotechnology in the United States*, in *AGRIC. & INT’L TRADE: LAW, POL’Y & THE WTO* 165, 181-82 (Michael N. Cardwell, Margaret R. Grossman & Christopher P. Rodgers eds., 2003) (arguing that, despite its refusal to sign the CBD “[t]he USA has a long history of supporting [biological diversity] efforts.”).

<sup>101</sup> *Id.* at 182-88. Feitshans presents, as do many others, that the two primary reasons cited by the Bush Administration for refusing to sign the convention were “first about inadequate protection of intellectual-property rights and secondly that the financial assistance mechanism under the convention was vague and inadequate.” The United States signed the treaty under the Clinton Administration, but the treaty was never ratified. *See also* AOKI, SEED WARS, *supra* note 26, at 80.

<sup>102</sup> Feitshans, *supra* note 100, at 184. *See also supra* note 95 (explaining the technology sharing mandated by CBD in Article 16).

<sup>103</sup> CBD, *supra* note 35, at 10-11 (specifying that “developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed ...”).

<sup>104</sup> TRIPS, *supra* note 35.

<sup>105</sup> Aoki & Luvai, *supra* 83, at 50.

<sup>106</sup> TRIPS, *supra* note 35, at 331-32.

<sup>107</sup> *Id.* at 331.

<sup>108</sup> *Id.* at 331-32.

<sup>109</sup> AOKI, SEED WARS *supra* note 26, at 83-84. *See also* BIBER-KLEMM & COTTIER, *supra* note 17, at 79.

<sup>110</sup> TRIPS *supra* note 35, at 322 (establishing the national treatment principle, which requires that member nations treat citizens of other member nations at least as favorably as it treats its own nationals with regard to intellectual property protection).

<sup>111</sup> *See supra* Part II.A (describing how and why some nations wish to refrain from offering plant monopoly rights).

<sup>112</sup> TRIPS, *supra* note 35, at 338-45.

<sup>113</sup> Jose Felgueroso, *TRIPS & the Dispute Settlement Understanding: the First Six Years*, 20 *AIPLA Q. J.* 165, 172-73 (2002); BIBER-KLEMM & COTTIER, *supra* note 17, at 79.

<sup>114</sup> Felgueroso, *supra* note 113, at 178-80.

<sup>115</sup> *Id.* at 181-82. Additionally, as Felgueroso explains, “[d]eveloping countries might be disadvantaged when involved in a complaint related to the TRIPS agreement. Intellectual property matters are complex and many countries lack the human capital necessary to successfully present or defend a complaint involving the TRIPS agreement.” *See* Aoki & Luvai, *supra* note 83, at 56.

<sup>116</sup> ITPGRFA, *supra* note 35, at art. 1.1.

- <sup>117</sup> *Id.* at art. 4. The treaty came into force in 2004 and, to date, there are 123 signatories. The United States signed, but has not ratified the treaty. FAO, ITPGRFA Signatories, <http://www.fao.org/Legal/treaties/033s-e.htm> (last visited Jan. 23, 2010).
- <sup>118</sup> *Id.* at *General Obligations*. ITPGRFA is the successor to the International Undertaking on Plant Genetic Resources for Food and Agriculture (IUPGR), which was a non-binding treaty adopted in 1983 in an early attempt to combat erosion of crop biodiversity. *See* PATRICIA L. C. MARIN, PROVIDING PROTECTION FOR PLANT GENETIC RESOURCES: PATENTS, *SUI GENERIS* SYSTEMS, & BIOPARTNERSHIPS 46-61 (2002) (gives a detailed discussion of the IUPGR).
- <sup>119</sup> ITPGRFA, *supra* note 35, at art. 1.1 (stating that “[t]he objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security.”).
- <sup>120</sup> *Id.* at art. 3.
- <sup>121</sup> ITPGRFA is the first and only binding international agreement to recognize farmers’ rights. BIBER-KLEMM & COTTIER, *supra* note 17, at 284-86.
- <sup>122</sup> *See infra* notes 132-50 and accompanying text.
- <sup>123</sup> *E.g.* PATEL, *supra* note 23, at 98; BIBER-KLEMM & COTTIER, *supra* note 17, at xxv-xxvii & 285-86.
- <sup>124</sup> ITPGRFA, *supra* note 35, at art. 9.
- <sup>125</sup> AOKI, SEED WARS, *supra* note 26, at 87-90.
- <sup>126</sup> ITPGRFA, *supra* note 35, at art. 9; AOKI, SEED WARS, *supra* note 26 at 86; PATEL, *supra* note 23, at 97.
- <sup>127</sup> ITPGRFA, *supra* note 35, at art. 9.3 (emphasis added).
- <sup>128</sup> For a discussion of India’s attempt, but ultimate failure, to implement legislation and programs to effectively protect farmers’ rights against incursion from domestic IP laws, see AOKI, SEED WARS, *supra* note 26, at 86, n.113.
- <sup>129</sup> PATEL, *supra* note 23, at 98; AOKI, SEED WARS, *supra* note 62, at 86-87; BIBER-KLEMM & COTTIER, *supra* note 17, at 285-86. *But see* Oguanaman, *supra* note 16, at 277 (agreeing that “[t]he nature of farmers’ rights is not articulated in the text of ITPGRFA,” but arguing that “given the framework nature of the treaty, state parties’ responses in implementing its provisions through domestic legislation and policies have the potential to provide details of the nature and content of farmers’ rights.”)
- <sup>130</sup> Paul J. Heald, *The Rhetoric of Biopiracy*, 11 CORDOZO J. INT’L & COMP. L. 519, 540-41 (2003). *See also* ITPGRFA, *supra* note 35, at Preamble (“Recognizing that, in the exercise of their sovereign rights over their plant genetic resources for food and agriculture, states may mutually benefit from the creation of an effective multilateral system for facilitated access to a negotiated selection of these resources and for the fair and equitable sharing of the benefits arising from their use.”).
- <sup>131</sup> ITPGRFA, *supra* note 35, at art. 9.2.
- <sup>132</sup> BIBER-KLEMM & COTTIER, *supra* note 17, at xxv-xxvii.

- <sup>133</sup> ITPGRFA, *supra* note 35, at art. 10.
- <sup>134</sup> *Multilateral System*, The International Treaty on Plant Genetic Resources for Food & Agriculture, [http://www.planttreaty.org/mls\\_en.htm](http://www.planttreaty.org/mls_en.htm) (last visited Jan. 29, 2011). Further, Article 13.3 states “[t]he Contracting Parties agree that benefits arising from the use of plant genetic resources for food and agriculture that are shared under the Multilateral System should flow primarily, directly and indirectly, to farmers in all countries, especially in developing countries, and countries with economies in transition, who conserve and sustainably utilize plant genetic resources for food and agriculture.” ITPGRFA, *supra* note 35, at art. 13.3.
- <sup>135</sup> *Multilateral System*, *supra* note 134.
- <sup>136</sup> The germplasm is stored in seed banks that make up the Consultative Group on International Agricultural Research (CGIAR). *See generally Who We Are*, CGIAR, <http://www.cgiar.org/who/index.html>.
- <sup>137</sup> Food & Agric. Org. of the U.N., Report of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture, First Session, P12, FAO Doc. IT/GB-1/06/Report (June 16, 2006) [hereinafter SMTA], *available at* <ftp://ftp.fao.org/ag/agp/planttreaty/agreements/smta/SMTAe.pdf>
- <sup>138</sup> AOKI, SEED WARS, *supra* note 26, at 89-90 (discussing the continued grant of intellectual property rights to Annex I material). Citing Laurence Helfer, Aoki summarizes the battle that took place between the United States and developing countries over the language in article 12.3(d). Unsurprisingly, the United States demanded inclusion of the narrowing “in the form received” clause, and developing countries insisted on the “genetic parts or components” language. But, it should be noted that the United States never ratified the treaty, so it never became a member of the agreement. *Id.*
- <sup>139</sup> Further, a number of provisions in the treaty and in the SMTA implicitly or explicitly permit intellectual property rights over material. Article 6.9 of the SMTA explicitly permits obtainment of intellectual property covering products that incorporate CGIAR material, and only “encourages” that the patent holder deposit a sample of the patented material after the expiration of the patent. SMTA, *supra* note 137, at art. 6.9.
- <sup>140</sup> *See supra* Part III.C (describing viral and non-viral licenses), Parts IV and V (providing a discussion of the qualities of a license necessary to preserve open access to resources. Basically, a strong, viral open access license needs to prohibit the assertion of monopoly rights against downstream innovators). *But see* Muriel Lightbourne, *The FAO Multilateral System for Plant Genetic Resources for Food & Agriculture: Better than Bilateralism?*, 30 Wash. U. J.L. & Pol’y 465, 479, 503-04 (2009) (arguing that the intellectual property rights permitted by the Multilateral System may provide some basis for open access--e.g. research exceptions to patent rights and patent disclosure requirements).
- <sup>141</sup> Further, neither the treaty nor the SMTA define or expound on “genetic rights or components,” leaving the clause open to narrow interpretation or disregard. Indeed, the phrase has not had a significant impact, as patents covering “components” of Annex I material are commonly granted. ITPGRFA, *supra* note 35; SMTA, *supra* note 137.
- <sup>142</sup> Lightbourne, *supra* note 140, at 501-04. (listing examples of patentable subject matter that seemingly fall under the protective umbrella “genetic rights or components” and explains that “where such ‘components’ have been isolated from material accessed from the MLS, have shown a function, and have been protected by a patent, they will no longer be available without restrictions, unless the applicable patent law provides for a research exception.”).
- <sup>143</sup> Like the CBD, ITPGRFA emphasizes that PGRs are sovereign property. Both the treaty and the SMTA are replete with qualifications based on relevant international and national law. For example, Article 5 of the SMTA, establishing the “Rights and Obligations of the Provider,” states “[a]ccess to Plant Genetic Resources for Food and Agriculture protected by intellectual and other property rights shall be consistent with relevant international agreements, and with relevant national laws.” SMTA, *supra* note 137, at art. 5.

- <sup>144</sup> ITPGRFA, *supra* note 35, at art. 13, 17, 18; SMTA, *supra* note 137, at art. 6.7 and Annex 2.
- <sup>145</sup> The requirement in the SMTA is actually less than 1.1% because it is subject to a 30% reduction. The actual required amount is likely to be close to 0.77%, according to a report published by the Berne Declaration, a Swiss nongovernmental organization. François Meienberg, ACCESS AND BENEFIT-SHARING UNDER THE FAO SEED TREATY 5 (2006), available at [http://www.evb.ch/cm\\_data/ABS\\_under\\_the\\_ITPGR\\_engl\\_2\\_2\\_2\\_1.pdf](http://www.evb.ch/cm_data/ABS_under_the_ITPGR_engl_2_2_2_1.pdf).
- <sup>146</sup> SMTA, *supra* note 137, at art. 6.7 and Annex 2. Further, Article 6.8 “encourages” parties to contribute to the fund even if they make the commercialized material available without restriction for further research and breeding. *Id.* at art. 6.8.
- <sup>147</sup> McManis & Seo, *supra* note 26, at 458-60. *But see* CNN.COM, Feeding the Future: Saving Agricultural Biodiversity, Sept. 6, 2009, available at <http://www.cnn.com/2009/TECH/science/09/04/food.biodiversity/index.html> (last visited Jan. 29, 2011) (reporting that 11 communities have received monetary benefits from the ITPGRFA fund and interviewing the secretary of the treaty, Dr. Shakeel Bhatti); The International Treaty and Plant Genetic Resources for Food and Agriculture, Approval of the First Projects Under the Benefit Sharing Fund, U.N. Food and Agriculture Organization, Nov. 3, 2001, available at <ftp://ftp.fao.org/ag/agp/planttreaty/gb3/gb3i11e.pdf> (listing the first 11 approved pilot projects).
- <sup>148</sup> McManis & Seo, *supra* note 26, at 459 (quoting Stephen B. Brush, *Protecting Traditional Agricultural Knowledge*, 17 Wash. U. J.L. & Pol’y 59, 83 (2005)).
- <sup>149</sup> *Id.* at 459-60. McManis & Seo further point out that another significant unresolved issue is the extent to which the benefit-sharing obligation under the Multilateral System will be transferred through a chain of varieties. Neither the ITPGRFA nor the SMTA clearly indicates whether this obligation would continue through successive varieties, even if the actual proportion of the original germplasm constituting the new varieties produced inevitably decreases.
- <sup>150</sup> Meienberg, *supra* note 145, at 5.
- <sup>151</sup> *Id.* McManis and Seo analyze the financial future of the benefit-sharing program as follows:  
A rough and optimistic calculation may illustrate this point: ten years from now the global seed market (in U.S. dollars) will be worth some 30 billion dollars. Ten percent, or 3 billion dollars worth, of seed will have been bred with genetic resources from the multilateral system, of which, again, only 10% (\$300 million) are protected by a patent and thus subject to benefit sharing at 0.77%. The resulting 2.31 million dollars per year does not even cover the treaty’s administrative budget. The mountain has produced a molehill .... Having made available a large proportion of the plant genetic resources in the system these farmers now come away empty-handed.  
McManis & Seo, *supra* note 26, at 460.
- <sup>152</sup> Status of the ITPGRFA, <http://www.fao.org/Legal/treaties/033s-e.htm> (last visited Feb. 3, 2011).
- <sup>153</sup> PATEL, *supra* note 23, at 96.
- <sup>154</sup> *See supra* Part II.A-II.B.
- <sup>155</sup> *See supra* note 14 (giving examples of misappropriated plant resources). *See also* James O. Odek, *Bio-Piracy: Creating Proprietary Rights in Plant Genetic Resources*, 2 J. INTELL. PROP. L. 141 (1994).
- <sup>156</sup> Edmund J. Sease & Robert Hodgson, *Plants are Patentable Under Prevailing U.S. Law and this is Good Public Policy*, 11 DRAKE J. AGRIC. L. 327, 328-29 (2006) (arguing that plant monopoly rights positively impact innovation, the economy, and the available food and medicinal product supply).

- <sup>157</sup> See *supra* notes 35 and 118 (stating that, for example, the FAO attempted to set up a fund in the Keystone Dialogs, where western countries and the International Undertaking on Plant Genetic Resources (IUPGR) agreed to establish a fund to compensate farmers for their contribution to plant genetic resources. However, the fund never took off because of lack of contributions by private companies, who were supposed to voluntarily pay into the fund as they received profit from monopolizing plant resources).
- <sup>158</sup> E.g., Eiland, *supra* note 97, at 64-66 (discussing a traditional knowledge database that would allow patent examiners to identify what is not novel with reference to traditional knowledge).
- <sup>159</sup> Ikechi Mgbeoji, *Patents and Traditional Knowledge of the Uses of Plants: Is a Communal Patent Regime Part of the Solution to the Scourge of Bio Piracy?*, 9 IND. J. GLOBAL LEGAL STUD. 163, 168-169 (2001).
- <sup>160</sup> MANUEL RUIZ, CIEL, THE INTERNATIONAL DEBATE ON TRADITIONAL KNOWLEDGE AS PRIOR ART IN THE PATENT SYSTEM: ISSUES AND OPTIONS FOR DEVELOPING COUNTRIES, ¶¶ 19-20, at 5-6 (Oct. 2002), available at [http://www.ciel.org/Publications/PriorArt\\_ManuelRuiz\\_Oct02.pdf](http://www.ciel.org/Publications/PriorArt_ManuelRuiz_Oct02.pdf).
- <sup>161</sup> *Id.* at ¶19 (presenting that the problem relating prior art and traditional knowledge could be summarized as follows: “[a]lthough there is traditional knowledge being held and used by indigenous peoples ... and there are publications, databases, journals, periodicals, and other means through which traditional knowledge is being disseminated and made public, traditional knowledge has rarely been recognized and considered as forming prior art of the state of the art for the purposes of the patent system in general.” Farmer-developed resources are one form of traditional knowledge, and the statement by Ruiz could be extrapolated to apply to prior art searches for all forms of plant monopoly rights).
- <sup>162</sup> To some extent, the Multilateral System accomplishes this because it is backed by the ITPGRFA agreement. Thus, theoretically, to fully live up to their treaty obligations, member states would have to adapt their national laws to prohibit monopoly rights over the covered material. The problem is that only states that are bound by the treaty are bound to adapt their laws to account for the public domain resources.
- <sup>163</sup> Again, to some extent ITPGRFA addressed this problem by setting up a benefit-sharing program to cause monetary benefits to flow to less-developed countries. However, as was addressed in Part III *supra*, the benefit program does not have the mandatory structure necessary to force the flow of benefits. Further, the system is aimed at directing benefits to developing countries, not to the farmers or farming communities therein.
- <sup>164</sup> DUTFIELD, *supra* note 14, at 110 (“Effective positive protection [of farmers’ rights and traditional knowledge] is likely to require a completely new system, whose development will require the very active and committed participation of many governments.”).
- <sup>165</sup> Mgbeoji, *supra* note 159, at 174-75 (“There are no absolute or uniform standards or criteria worldwide for the patentability of inventions.” The WTO/TRIPS Agreement requirements are general and allow interpretive wiggle-room. Mgbeoji proposes that “indigenous people and affected states may profit from this interpretive gap and protect their ‘informal knowledge’ from misappropriation by promoting interpretations suitable to their aspirations.”).
- <sup>166</sup> See *supra* Part II.B (discussing the debate about plant monopoly rights between developing and developed countries).
- <sup>167</sup> See AOKI, SEED WARS, *supra* note 26, at 55-56. (“[I]t seems that the powerful nations of the developed world that happened to be TRIPS’ most ardent backers have had (and are still having) the last laugh as far as this intricate two-decade long dance over global intellectual property rights as far as PGRs are concerned.”).
- <sup>168</sup> See *supra* Part II.A (listing the main objectives of the farmers’ rights movement).

- <sup>169</sup> Margaret E.I. Kipp, *Software and Seeds: Open Source Methods*, 10.9 FIRST MONDAY (Sept. 5, 2005), available at <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1276/1196>. (“Both farmers’ rights movements and the open source community seek to ensure that the basic information of their profession (seeds and software) remains available. Both tend to use democratic methods to organise their work towards ... a common goal .... Leaders of both movements tend to be self-selected individuals who become dissatisfied with the growing commodification of information and take a stand against it.”).
- <sup>170</sup> JANET HOPE, *BIOBAZAAR: THE OPEN SOURCE REVOLUTION AND BIOTECHNOLOGY* 18-19 (Harvard U. Press 2008) [hereinafter HOPE, BIOBAZAAR].
- <sup>171</sup> Free Software Foundation (FSF) was the first open source community of developers. Established in 1985 by Richard Stallman, FSF favors copyleft licenses only and discourages licenses that allow modified versions to become proprietary. Richard Stallman and FSF developed GNU and Linux, the first open source operating system and kernel. *GNU History*, GNU OPERATING SYSTEM, [http:// www.gnu.org/gnu/gnuhistory.html](http://www.gnu.org/gnu/gnuhistory.html) (last visited Jan. 18, 2011).
- <sup>172</sup> Open Source Initiative (OSI) was a movement that developed in response to the opinion of some that FSF licenses were too restrictive. OSI is a larger movement, as it embraces and encompasses both copyleft and non-copyleft license schemes and is open to the idea that some movements allow for the creation of proprietary software. *The Open Source Definition*, OPEN SOURCE INITIATIVE, <http://www.opensource.org/docs/osd> (last visited Jan. 18, 2011).
- <sup>173</sup> *See id.*
- <sup>174</sup> *Id.*; *Open Standards Requirement for Software*, OPEN SOURCE INITIATIVE, <http://www.opensource.org/osr> (last visited Jan. 18, 2011).
- <sup>175</sup> Under copyleft licenses, contributors cannot enforce any IP rights against those who properly utilize the OS license. Thus, contributors to OS projects may not sell the modified OS software or attach any licensing or royalty fees to it. Further, they may not restrict downstream use of the software in any reasonably avoidable way, other than to guarantee that others do not obtain IP rights to the contributor’s work. *See GNU General Public License version 3 (GPLv3)*, OPEN SOURCE INITIATIVE (June 29, 2007), <http://opensource.org/licenses/gpl-3.0> [hereinafter GPLv3]; *Open Standards Requirements for Software- Rationale*, OPEN SOURCE INITIATIVE, <http://opensource.org/osr-rationale> (last visited Jan. 18, 2011).
- <sup>176</sup> *See General Public License version 2 (GPLv2)*, OPEN SOURCE INITIATIVE (JUNE 1991), <http://www.opensource.org/licenses/gpl-2.0.php> [hereinafter GPLv2]. *See also* OPEN SOURCE INITIATIVE, *supra* note 172.
- <sup>177</sup> 17 U.S.C. § 102(a) (2006).
- <sup>178</sup> *See* HOPE, BIOBAZAAR, *supra* note 170, at 142-49. In her book, Hope discusses the challenges that intellectual property has posed to biotechnological development and how the use of open source licensing can provide a solution and create open innovation.
- <sup>179</sup> *See* CAMBIA, <http://www.cambia.org/daisy/cambia/home.html> (last visited Jan. 23, 2011); Cambia’s 3D Vision, About Cambia, CAMBIA, [http:// www.cambia.org/daisy/cambia/about.html](http://www.cambia.org/daisy/cambia/about.html) (last visited Jan. 23, 2011).
- <sup>180</sup> Patent Lens, CAMBIA, [http:// www.patentlens.net/daisy/patentlens/patentlens.html](http://www.patentlens.net/daisy/patentlens/patentlens.html) (last visited Jan. 24, 2011). Patent Lens was developed to “to create transparency in the patent system” and to make information available for free about “whose patents are in force over what technology where.” Patent Lens aims to prevent people from “unwittingly infring[ing] patents they don’t know about, avoid[ing] areas of innovation in which they are entitled to be creative, or mak[ing] poor investments based on incomplete information about which rights are granted and who holds these rights.” Further, the Why Are We Doing This? FAQ explains: The Patent Lens informatics tools can assist the user to determine the boundaries of intellectual property constraints on deliverable innovations, and usable building blocks for future innovations. The key to the Patent Lens is that we are creating an integrated, worldwide, open source and open access resource that will allow

community-developed analytical tools, patent landscapes and decision support software to be created and shared. We want innovators worldwide to make better and more informed decisions.

*Id.*

181 About IOI, Initiative of Open Innovation, CAMBIA, [http:// www.openinnovation.org/daisy/ioi/about.html](http://www.openinnovation.org/daisy/ioi/about.html) (last visited Jan. 24, 2011). IOI is a new project that has just gotten underway thanks to generous grants from the Bill & Melinda Gates Foundation and the Lamelson Foundation.

182 BIOS Homepage, CAMBIA, <http://www.bios.net/daisy/bios/home.html>. (last visited Feb. 7, 2011). BIOS stands for Biological Innovation for Open Society. It is an initiative created by Cambia as a response to the increased unavailability of biological research and development tools due to enclosure of monopoly rights. Cambia’s BIOS project aims to “create and share new biological enabling technologies and platforms that can be used to deliver innovations. We develop new licensing and distributive collaboration mechanisms that have resonance with the open source software movement, but are tailored for biological innovation.” *Id.* The project is built around two major plant research tools: TransBacter, a method of transferring genes to plants, and GUSPlus, a way of monitoring where genes are and how they function. The project uses an open source license to transfer these materials to other researchers.

183 BIOS License for Plant Enabling Technologies Version 1.5, CAMBIA, [http://www.bios.net/daisy/bios/3530/version/default/part/AttachmentData/data/BiOS%20License%CC20and%CC20Tech%CC20Support%CC20Agreement%CC20version%C%1\\_5.pdf](http://www.bios.net/daisy/bios/3530/version/default/part/AttachmentData/data/BiOS%20License%CC20and%CC20Tech%CC20Support%CC20Agreement%CC20version%C%1_5.pdf) (last visited Feb. 7, 2011); BIOS Material Transfer Agreement for Seeds/Propagules, Version 1.0, CAMBIA, [www.bios.net/daisy/bios/3003.html](http://www.bios.net/daisy/bios/3003.html) (last visited Feb. 7, 2011); BIOS Technology Support and Materials Transfer Agreement, CAMBIA, <http://www.cambia.org/daisy/bios/3541/version/default/part/AttachmentData/data/Cambia%20PMET%CC20BiOS%C%agreement.pdf> (last visited Feb. 7, 2011).

184 See BIOS Material Transfer Agreement for Seeds/Propagules, *supra* note 183.

185 For example, the BIOS agreement regarding “plant enabling technologies” requires that downstream users to dedicate back any “Enabling Technology ... improving or increasing the effectiveness, efficiency, applicability, or value of the IP & Technology from which it is derived.” BIOS LICENSE FOR PLANT ENABLING TECHNOLOGIES, *supra* note 183.

186 See Cambia Draft PMET BIOS 2.0 agreement, art. 1 and art. 5, <http://www.cambia.org/daisy/bios/3541/version/default/part/AttachmentData/data/cambia%20PMET%CC20BiOS%C%agreement.pdf> (last visited Feb. 7, 2011). However, those provisions should be read while taking into account Cambia’s statement answering this question: “If the scientist creates a plant with trait X from the use of licensed Cambia materials and the university wishes to commercialize it, are we are obliged to provide Cambia with these materials and Cambia is free to distribute these materials to all other licensees including affiliates?” The answer was “No.” BIOS FAQs - BIOS-Compliant Licenses, CAMBIA, <http://www.bios.net/daisy/bios/2241.html> (last visited Feb. 7, 2011).

187 FAQs - BIOS Licenses & MTAs, [http:// www.bios.net/daisy/bios/3596.html](http://www.bios.net/daisy/bios/3596.html) (last visited Feb. 7, 2011) (“parties to all BIOS agreements explicitly respect proprietary rights but voluntarily set them aside for others who have agreed to share in the same way. We view this equitable sharing as an important safeguard for food and natural resources security and global public health.”). Thus, if PlantResearcherX was to use enabling technology or material licensed from Cambia to create a new plant variety, PlantResearcherX would not be required to provide Cambia with information regarding the new plant variety. See FAQs - BIOS Licenses & MTAs, <http://www.bios.net/daisy/bios/2241.html> (last visited Feb. 7, 2011). However, the BIOS license would prevent PlantResearcherX from asserting any IP rights against others who have agreed to the same open source licensing conditions.

188 BIOS Technology Support and Materials Transfer Agreement, Annex C, CAMBIA, <http://www.cambia.org/daisy/bios/3541/version/default/part/AttachmentData/data/Cambia%20PMET%CC20BiOS%C%agreement.pdf> (last visited Feb. 7, 2011).

189 *Id.*

<sup>190</sup> Keith Aoki, “Free Seeds, not Free Beer”: Participatory Plant Breeding, Open Source Seeds, and Acknowledging User Innovation and Agriculture, 77 Fordham L. Rev. 2275, 2300 (2009) [hereinafter Aoki, *Free Seeds*].

<sup>191</sup> *Id.* at 2303; AOKI, SEED WARS, *supra* note 26, at 115.

<sup>192</sup> Aoki has provided the most targeted discussion regarding open source and farmers’ rights. See Aoki, *Free Seeds*, *supra* note 190, at 2299-2310; AOKI, SEED WARS, *supra* note 26, at 114-22; K. Ravi. Srinavas, *The Case for Biolinuxes and Other Pro-Commons Innovations*, Sarai Reader 2002: The Cities of Everyday Life 321, 325-27, available at <http://www.sarai.net/publications/readers/02-the-cities-of-everyday-life/09biolinux.pdf>. Srinavas created an early discussion of “biolinuxes” as applied to plant breeding. His work describes what a biolinux could look like in the following way: A biolinux model for a new variety developed using participatory plant breeding will be as follows. The variety will be made available with a GPL or a similar document explicitly stating rights and claims. The varieties will be in the public domain or covered under plant breeders’ rights without restricting the rights of others to experiment, innovate, share the seeds or exchange seeds.

See Kipp, *supra* note 169, at 9-14; and K. Ravi. Srinavas, *Innovations, Commons and Creativity: Open Source, Biolinux, and Seeds*, WORLD ASS’N FOR CHRISTIAN COMM., available at <http://www.waccglobal.org/en/20031-intellectual-property-rights-and-communication/653-Innovations-commons-and-creativity--Open-Source-Bio-Linux-and-Seeds.html>; Janet Elizabeth Hope, *Open Source Biotechnology*, 60-62 (Dec. 2004) (unpublished Ph.D. dissertation, Australian National University) [hereinafter Hope, *dissertation*], available at <http://cgkd.anu.edu.au/menus/PDFs/OpenSourceBiotechnology27July2005.pdf>. Janet Hope’s significant contributions to the area of agricultural open source regimes have primarily focused on the development of open source research tools. However, Hope has discussed proposals for “participatory plant breeding (PPB)”--the idea of developing a system to include farmers in the development process. According to Hope, “[t]he principal objective of PPB is to create more relevant technology and more equitable access to technology in order to improve the service and delivery of crop improvement research to the poorest and most marginalized people and areas.” Hope, *Open Source Biotechnology*, 60-62. Hope further explains that farmers could be incorporated into the plant development process such that most research is conducted in farmers’ own fields with farmers and researchers working side by side. *Id.* The point is to introduce a user perspective into adaptive research, bringing users into the early stages of technology development as both researchers and decision makers who help set priorities, define criteria for success, and determine when an innovation is ready for release.

<sup>193</sup> See *supra* text accompanying notes 1-15 (discussing the enola bean story).

<sup>194</sup> See *supra* Part IV.B.ii and accompanying notes 179-80 (providing an explanation of Cambia’s programs).

<sup>195</sup> See *supra* Part IV.B.ii (defining and explaining copyleft).

<sup>196</sup> For an explanation of how MTAs are used in furtherance of private monopoly rights, see *supra* note 41.

<sup>197</sup> A typical seed wrap license appears on the packaging of the seed and has operative provisions to the effect: This product or the parental lines used in producing this product are protected under one or more patents. Purchaser agrees that it is granted a limited license thereunder only to produce forage, or grain for feeding or processing. Resale of this seed or supply of same seed to anyone, including Purchaser, for planting is strictly prohibited under this license. The open source seed wrap license would copy the form and binding function of the seed wrap license, but it would differ greatly in content. *Supra* note 42 (provides an explanation of seed wrap licenses).

<sup>198</sup> The copyleft terms mandate that verbatim copies and modified versions all be maintained and distributed with the same open source license. See *supra* Part IV.B.ii (describes copyleft licenses).

<sup>199</sup> GPLv3, *supra* note 175. GPLv3 is one of the strongest OSI-approved copyleft licenses. The copyleft terms mandate that verbatim copies and all modified versions be maintained and distributed with the same GPLv3 license. It is the most recently developed

GPL license and it is one of few open source software licenses that includes provisions preventing downstream contributors from exercising patent rights on their contributions against other contributors. The GPLv3 contains traditional software copyleft licensing provisions, as well as provisions that guard against assertions of patent rights that interfere with the “freedom” of the open source software.

200 The GPLv3 was released in response to the increasing number of software patents and issues that have arisen regarding open source software in patented inventions. Colin McGregor, *Interview with Richard M. Stallman*, FREE SOFTWARE MAG. (Jan. 23, 2008), [http://www.freesoftwaremagazine.com/articles/interview\\_with\\_richard\\_stallman](http://www.freesoftwaremagazine.com/articles/interview_with_richard_stallman). The preamble states, “[W]e wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.” *Id.* at Preamble and Provisions 10 and 11.

201 *See* GPLv3, *supra* note 175 at Provision 4. That section, entitled “Conveying Verbatim Copies” instructs the licensee (i.e. the user/contributor) that he “may convey verbatim copies of the Program’s source code ... provided that [he] conspicuously and appropriately publish[es] on each copy an appropriate copyright notice ... and give[s] all recipients a copy of this License along with the Program.” Provision 5, addressing “Conveying Modified Source Versions,” refers to the language in Provision 4, adding that modifications of the Program must be distributed with the same downstream license attachments. *See* GPLv3, *supra* note 175 at Provision 5. Furthermore, Provision 5 adds that modified versions must be conveyed with notice of modification and the date of modification. *Id.* Finally, Provision 5 reestablishes the scope of the copyleft license by stating, “You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This license will therefore apply ... to the whole of the work, and all its parts, regardless of how they are packaged.” *Id.*

202 Such a provision could closely mirror Provision 10 of the GPLv3. *See id.* Provision 10, which is titled “Automatic Licensing of Downstream Recipients,” specifies that “you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.” *Id.* at Provision 10.

203 *Id.* at Provision 11. Provision 11, titled “Patents,” addresses the instance where someone knowingly contributes work that is patented, whether the patent is held by the contributor or someone else. That provision states, in relevant part, “If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients.” *Id.*

204 Such a provision could closely mirror the language of Provisions 10 and 11 of the GPLv3.

205 Natural cross-pollination from windblown pollen poses a risk of unintentionally mixing proprietary varieties into other resources. Paul J. Heald & James Charles Smith, *Pollen Drift and the Bystanding Farmer: Harmonizing Patent Law and Common Law on the Technological Frontier*, 40 *ADVOCATE*, no. 1, Fall 2005/Winter 2006, at 2, 3, available at [http://digitalcommons.law.uga.edu/cgi/viewcontent.cgi?article=1001&context=lectures\\_pre\\_arch\\_archives\\_advocate](http://digitalcommons.law.uga.edu/cgi/viewcontent.cgi?article=1001&context=lectures_pre_arch_archives_advocate) (“For example, a genetically modified corn variety named ‘StarLink’ was planted in approximately one percent of cornfields in Iowa in 1998. By the year 2000, more than half of the fields in that state showed some signs of genetic contamination”). In *Monsanto Canada Inc. v. Schmeiser*, the Canadian Supreme Court determined that a farmer could be liable for patent infringement stemming from windblown pollen of a patent-protected variety. [2004] 1 S.C.R. 902 (Can.).

206 *About Us*, CIAT, <http://www.ciat.cgiar.org/AboutUs/Paginas/aboutus.aspx> (last visited Jan. 29, 2011).

207 CIAT is one of the original centers in the Consultative Group of International Agricultural Research (CGIAR) for the ITPGRFA Annex I materials. *See supra* note 136 (provides more detail about CGIAR).

208 Democratically elected boards carry the risk of allowing an insurgent minority to oust a nonprofit board and destabilize an entire organization. Dana Brakman Reiser, *Nonprofit Takeovers: Regulating the Market for Mission Control*, 2006 *BYU L. REV.* 1181,

1194-96. For example, in 2004 the Sierra Club, which has a member-elected board, faced a near-take over when an insurgent group of “animal rights and anti-immigrant activists” mobilized and almost garnered enough seats to control the Club’s national board. Brad Knickerbocker, *A ‘Hostile’ Takeover Bid at the Sierra Club*, CHRISTIAN SCI. MONITOR, Feb. 20, 2004, available at <http://www.csmonitor.com/2004/0220/p01s04-ussc.html>. Most nonprofits, at least in the United States, have self-perpetuating boards, meaning that they do not have members that vote to elect the board, because the self-perpetuating structure is more practical than internal democracy. Evelyn Brody, *Entrance, Voice, and Exit: The Constitutional Bounds of the Right of Association*, 35 U.C. DAVIS L. REV. 821, 860 (2002) (noting that “the typical nonprofit organization is a corporation that lacks members with power to vote for the board or on policy issues ....”). Not only do members fail to prevent board malfunction, Dana Brakman Reiser, *Dismembering Civil Society: The Social Cost of Internally Undemocratic Nonprofits*, 82 OR. L. REV. 829, 853 (2003), they are also costly, *id.* at 864, difficult to organize, *id.* at 859, and inhibit the flexibility and autonomy of nonprofits, *id.* at 846-47.

209 *See supra* Part IV.B.ii (discussing Cambia’s fee structure).

210 IOI Homepage, Initiative for Open Innovation, CAMBIA, <http://www.openinnovation.org/daisy/ioi/home.html> (last visited Jan. 24, 2011). *See supra* Part IV.B.ii (describing Cambia and its programs).

211 *See* 35 U.S.C. §§ 311-18 (2006) (U.S. *inter partes* patent reexamination procedures).

212 *See supra* Part II.B (discussing the problems that breeders’ rights have created for farmers).

213 *See supra* Part II.A. (listing the goals of the farmers’ rights).

214 *Id.*

215 *Id.* (the second goal of farmers’ rights).

216 *Id.* (the third goal of farmers’ rights).

217 *See infra* Part IV.C.iii (providing a brief discussion of the potential for monetary benefit-sharing through open source regimes).

218 The monopoly rights to the commercial product derived from farmers’ resources would be part of the open source pool. *See supra* Part IV.B.

219 *See supra* Part II.A (the fourth goal of farmers’ rights).

220 *See supra* Part V.A.iv (discussing steward governance structure and contributing farmer involvement).

221 *See supra* Part II.A and II.B.

222 TRIPS, *supra* note 101; *supra* Part II.B.

223 *See supra* Part II.B; CBD, *supra* note 35; ITPGRFA, *supra* note 35.

224 CBD, *supra* note 35, at art. 8(j).

225 *Id.* at art. 16(5); *supra* Part III.A.

226 *See supra* Part IV.A-B.

227 Open source materials are protected by domestic utility patents, plant patents, plant variety certificates, or whatever *sui generis* protection is appropriate. Therefore, standard prior art searches would find the open source material.

228 *See supra* Part IV.B. Technically, the steward ‘holds’ monopoly rights, but they do not use them to exclude anyone unless someone tries to assert a personal monopoly right against an open source contributor. *Id.*

229 *Id.*

230 *See supra* Part III.C (discussing the benefit-sharing system established by the ITPGRFA and its shortcomings).

231 This sample license is heavily based on and copies exact language from the following licenses: Cambia BiOs Material Transfer Agreement for Seeds/Propagules, version 1.0, [www.bios.net/daisy/bios/3003.html](http://www.bios.net/daisy/bios/3003.html); Cambia Draft PMET BiOS 2.0 agreement and BiOS Technology Support and Materials Transfer Agreement, CAMBIA, <http://www.cambia.org/daisy/bios/3541/version/default/part/AttachmentData/data/Cambia%20PMET%CC20BiOS%C%agreement.pdf>; GPLv3, *supra* note 175.

232 Cambia BiOS Seed MTA, *supra* note 236; BiOS Technology Support and Materials Transfer Agreement, *supra* note 236, at 4.

233 BiOS Technology Support and Materials Transfer Agreement, *supra* note 236, at 4.

234 *Id.*

235 Cambia Draft PMET BiOS 2.0 agreement, *supra* note 236, at 1.

236 GPLv3, *supra* note 175, at Provision 10, closely mirroring the language of that provision.

237 *Id.* at art. 11.

238 *Id.*