Seeds, Sovereignty, and the Vía Campesina: Plants, Property, and the Promise of Open Source Biology

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Contents **Page**

> *The seed has become the site and symbol of freedom in an age of manipulation and monopoly of its diversity. It plays the role of Gandhi's spinning wheel in this period of recolonization through free trade. The charkha (spinning wheel) became an important symbol of freedom because it was small; it could come alive as a sign of resistance and creativity in the smallest of huts and poorest of families.*
>
> *Vandana Shiva (1997: 126)*

Introduction

From the wheaten plains of Saskatchewan to the soy fields of Brazil's Matto Grosso, from the millet plots of Mali's Nyéléni to the rice paddies of Indonesia's Pampangan, the seed has indeed become a prominent symbol of the struggle against the neoliberal project of restructuring the social and natural worlds around the narrow logic of the market. More than a symbol, however, the seed is also the very object and substance of that contest. As both foodstuff and means of production, seed sits at a critical nexus where contemporary battles over the technical, social, and environmental conditions of production and consumption converge and are made manifest. Who controls the seed gains a substantial measure of control over the shape of the entire food system.

It therefore follows that if true "food sovereignty" is to be achieved, control over genetic resources must be wrested from the corporations and governments that seek to monopolize them and be restored to, and permanently vested in, social groups and/or institutions with the mandate to sustain them and to facilitate their equitable use. Vía Campesina has recognized this necessity, identifying "seeds as the fourth resource...after land, water and air" and declaring that "biodiversity should be the basis to guarantee food security as a fundamental non-negotiable right of all peoples" (Vía Campesina 2001: 48). That is, full realization of food sovereignty is predicated in no small part on the attainment of what we may term "seed sovereignty."

How, then, might Vía Campesina and its allies actually work toward achieving seed sovereignty in the current global, political-economic conjuncture? Those who believe that creation of "another world is possible" face the two strategic tasks implied by Vandana Shiva in the quote above: they must deploy both "resistance" and "creativity." That is, they must resist the project of neoliberalization *and* create space for construction of an alternative. It is critical to understand that these moments of resistance and creativity are linked and complementary strategies that must *both* be simultaneously pursued.

On the one hand, Vía Campesina must resist the concentration of corporate power in the life sciences industry, the extension of intellectual property rights (IPRs), the privatization of public science, the spread of genetically modified (GM) crops, the development of "Terminator" technologies, and the proliferation of bioprospecting/biopiracy. On the other, it must create space for the introduction and elaboration of alternatives such as farmers' rights, participatory plant breeding, a revitalized public science, the development of agroecology, and support for decentralized and community-based seed distribution and marketing.

It is my contention here that while resistance has often been effective, the creation of alternative spaces has been much less successful. Partly this is because it is generally easier to mobilize opposition to clear dangers and inequities than it is to imagine effective, practicable alternatives to a dominant and dominating system. But it also seems to me that the mechanisms that have been developed to address the inequities of such practices as bioprospecting have actually functioned to articulate farmers and indigenous peoples more closely to the existing market rather than to construct new and positive spaces for alternative action. In my view they have been insufficiently radical. Specifically, inasmuch as they have accepted the principle of *exclusion* – rather than *sharing* – as their constitutive basis, they have all proved inadequate even at defending, much less at reasserting or enlarging, peasant or community seed sovereignty.

I suggest that Vía Campesina and its allies should consider the potentials of "open source biology" (OSB) as a mechanism for simultaneously pursuing *both* effective resistance *and* the creation of a protected space into which practices and institutions with truly transformative capacity can be introduced and elaborated.

OSB is actually the analog in the biological sciences (including plant breeding) of the "free and open source software" movement (FOSS). The FOSS movement emerged in reaction to the

constraints imposed on software developers ("hackers") by their corporate employers (e.g., Microsoft). Finding their creativity, productivity, and contributions to the community limited by copyright and restrictions on exchange of software code, hackers used contract and copyright law to create a legal mechanism – the "General Public License" (GPL) – that allows them to enforce *sharing* rather than exclusion. Further, the provisions of the GPL are such that not only do they enforce sharing, they also effectively prevent the appropriation of code by companies that would use it for exclusive purposes.

The application of these principles to the biological sciences is deeply intriguing. A variety of analysts have begun to explore the possibilities offered by OSB. In what follows, I will examine how OSB might be concretely operationalized in the service of the development of seed sovereignty. I first review what seed sovereignty might specifically mean in the context of Vía Campesina's programmatic objectives. I then assess existing mechanisms for realizing those objectives and find them wanting. I go on to outline the derivation of OSB from the FOSS movement and to describe the construction and function of the GPL and its variants. I explain how a GPL for plant germplasm has been proposed, how its deployment could undergird the creation of a "protected commons" of farmers and plant breeders whose materials would be freely available and widely exchanged but would be effectively protected from appropriation by those who would monopolize them. Finally, I assess the differential prospects for adoption and implementation of OSB practices in the geopolitical North, the geopolitical South, and among indigenous peoples.

The Erosion of Farmers' Seed Sovereignty: The Privatization of Biodiversity

Until the 1930s, farmers in both the North and South enjoyed nearly complete sovereignty over their seeds. That is, they decided what seeds to plant, what seeds to save, and who else might receive or be allocated their seed as either food or planting material. Such decisions were made within the overarching norms established by the cultures and communities of which they were members. While these customary arrangements often recognized some degrees of exclusivity in access to genetic resources, they were largely open systems that operated on the bases of reciprocity and gift exchange rather than the market. Indeed, these customary arrangements usually functioned to stimulate and facilitate – rather than restrict – the wide dissemination of seed (Zimmerer 1996, Brush 2004, Salazar et al. 2007). The *sharing* of seed resulted in the continuous recombination of genetic material, which in turn produced the agronomic resilience that is characteristic of farmer-developed crop varieties and landraces. This historic creation and recreation of crop diversity not only fed particular communities and peoples but collectively constitutes the genetic foundation on which future world food production must be based.

Since the 1930s, farmers' sovereignty over seeds has been continuously and progressively eroded while the sovereignty of what is now a "life sciences industry" has been correspondingly enlarged. The development of inbreeding/hybridization in the 1930s first separated the farmer from the effective reproduction of planting material and created the opening needed for private capital to profit from the seed sector. Seed companies then used their growing influence to

obtain "plant breeders' rights" (PBR) legislation which conferred exclusive control over varieties in crops in which hybridization was not possible.

Subsequently, the seed industry has pursued both of these routes – technical and social – to further restrict farmers' access to seed to the confines of an increasingly narrow set of market mechanisms. The structures of science have been used to develop "Terminator" and "Transcontainer" technologies that genetically sterilize seed in order to prevent plant-back by farmers. Both national and international structures of governance – that is, institutions such as the World Trade Organization (WTO) and the Convention on Biodiversity (CBD) as well as national legislatures – have been used for the global elaboration of a set of intellectual property rights (IPRs) based on the principle of *exclusion*. By making saving of patented seed illegal, these arrangements are effectively an enclosure of farmers' practices as well as their seed.

These twin processes of commodification are enabled in important ways by two key features of the organization of knowledge production and accumulation in the plant sciences. First, the development of agronomically useful and novel (and therefore patentable) plant varieties has been predicated on access by breeders to the enormous pool of biodiversity that has been produced and reproduced by farmers and indigenous peoples. Systematic appropriation of landraces from farming communities by university and government scientists, their storage in genebanks controlled by governments, corporations and non-governmental organizations (NGOs), and their subsequent use in breeding programs is a practice of long standing. This privatization of biodiversity has increasingly been understood as a form of "biopiracy" insofar as no or insufficient benefits flows reciprocally to the communities and peoples who freely shared the collected materials as the "common heritage of mankind" (Shiva 1997, Mgbeoji 2006).

Second, the supplanting of classical crop breeding by transgenic methods, the progressive emasculation of public research institutions (e.g., universities, government facilities, the CGIAR system), and the subordination of their work to corporate objectives has resulted in an overwhelming focus on the development of genetically modified varieties (GMOs) (Knight 2003, Gepts 2004). The failure of public science to provide an alternative to corporate seeds has permitted the global dissemination of crop varieties that do not meet the needs of most farmers, that often cannot be legally saved, that reinforce the expansion of unsustainable monocultures, and that contaminate other varieties with proprietary transgenes (Rosset 2006, Quist and Chapela 2001).

Seed sovereignty has been gradually transferred from farmers and their communities to the boardrooms of the five transnational firms known as the "Gene Giants" for their domination of the US$17 billion annual global market for seeds. Once freely exchanged according to an ethic of *sharing*, access to seeds is now ruled by a set of legal mandates based on the principle of *exclusion*. Once bred by farmers to meet local needs, seeds are now genetically engineered by corporate scientists to the specifications of a globally distributed industrial agriculture geared not to feeding people but to feeding the corporate bottom line which, just now, means feeding cows and cars.

Vía Campesina and the Recovery of Seed Sovereignty: "No" to the Privatization of Biodiversity, But "Yes" to What?

These contours of the privatization of biodiversity have been widely recognized and extensively analyzed (see, e.g., Mooney 1979, Kloppenburg 1988/2004, Shiva 1997, Mgbeoji 2006, Mushita and Thompson 2007, Aoki 2008). Nor are these issues new to the peasants and farmers and indigenous peoples who are members of the organizations of which Vía Campesina is comprised and who, after all, have been for decades directly experiencing the effects of the privatization of biodiversity. The challenge is not so much to understand *what is happening*, but to determine *what is to be done* about it. If seed sovereignty is being lost, how can it be recovered?

Despite its affirmation of the centrality of the seed to peasant and farmer livelihoods, what we might call "seed sovereignty" has not yet been explicitly formulated by Vía Campesina or any of its affiliated organizations. Though it has begun to find sporadic usage in the movement's documents and discourse (e.g., in the report of the Women Seed Forum in South Korea, Vía Campesina 2008a), the term itself does not appear at all in the movement's key position paper on "biodiversity, biosafety and genetic resources (Vía Campesina 2001) or in its recent position paper on the Protocol on Biosafety and the Convention on Biodiversity (Vía Campesina 2008b). Given its rhetorical appeal and its conceptual complementarity to "food sovereignty," Vía Campesina may want to consider specifying what it means by "seed sovereignty" and to contemplate adopting the term as a convenient and resonant signifier for its objectives in regard to the constellation of issues associated with use and control of crop genetic resources.

What are those objectives? Below, are a selection of key statements taken from two of Vía Campesina's position papers: *The Position of Vía Campesina on Biodiversity, Biosafety and Genetic Resources* (Vía Campesina 2001) and the very recent *Position Paper on the Protocol on Biosafety and the Convention on Biodiversity* (Vía Campesina 2008b).

Table 1: Excerpts from Vía Campesina Position Papers

Resistance

- "oppose intellectual property over any form of life" (Vía Campesina 2001: 49)
- "avoid the patenting of our seeds by the transnational companies" (Vía Campesina 2001: 48)
- "the CGIAR, and all other organisations involved in agricultural research, avoid the patenting of knowledge, prevent the privatization of research, and the concentration of knowledge by the transnationals" (Vía Campesina 2001: unpublished section)
- "a moratorium be instituted on bioprospecting...until there are mechanisms to protect the rights of our communities and to prevent and control biopiracy" (Vía Campesina 2001: 48)
- "a moratorium be declared on the release and trade of transgenic organisms and their derived products (VC 2001: 51)."

Creativity

- "respect for and implementation of farmers' rights" (Vía Campesina 2001: 49)
- "Farmers' rights are eminently collective; they should therefore be considered as a different legal framework from those of private property and intellectual property" (Vía Campesina 2001: 49)
- "seeds are the collective inheritance of indigenous and farming communities: they do not belong to any private person, but it is the obligation of all to pass them on to future generations" (Vía Campesina 2008b)

- "confirm the right of farmers to save, use, exchange, and sell seeds reproduced on the farm" (Vía Campesina 2008b)
- "elevate to a universal principle the fact that genes, as the essence of life, cannot be owned." (Vía Campesina 2001: 49)
- "the right to define the control and use of benefits derived from the use, preservation, and management of the resources" (Vía Campesina 2001: 49)
- "the right to develop models of sustainable agriculture which protect biodiversity" (Vía Campesina 2001: 49)
- "applying research and technology more equitably" (Vía Campesina 2001: 48)
- "the right to appropriate technology, and the right to participate in designing it and to carry out research programs" (Vía Campesina 2001: 49)
- "support field-based conservation and participatory selection" (Vía Campesina 2008b)
- "establish a program for the commercialization and exchange of seeds within the organizations of Vía Campesina and the knowledge linked to it so as to establish an alternative market of seeds" (Vía Campesina 2001: unpublished section)

From these statements I have distilled a set of eight elements that, I suggest, represent the central features of what Vía Campesina might consider to be seed sovereignty (Table 2).

Table 2: Elements of Seed Sovereignty

Resistance
- prevent or impede the patenting of plant genetic material;
- prevent or impede bioprospecting/biopiracy;
- prevent or impede the use of farmer derived genetic resources in proprietary breeding programs;
- prevent or impede further development and deployment of GMOs.

Creativity
- develop a legal/institutional framework that recognizes farmers' collective sovereignty over seeds;
- develop a legal/institutional framework that allows farmers to freely exchange, save, improve, and sell seeds;
- develop an institutional framework in which farmers cooperate with plant scientists in the development of new plant varieties that contribute to a sustainable food system;
- develop a framework for marketing of seed that is not patented or use-restricted.

Of course Vía Campesina recognizes the need to oppose corporate efforts to extend IPRs, to appropriate and patent genetic resources, and to expand the deployment of GMOs. But what is most important about these position papers is that they move beyond a simple defensive stance – "no to the privatization of biodiversity" – and into the proactive posture of envisioning what they will say "yes" to, what they will work to *create*.

Seed sovereignty for Vía Campesina will be comprised of a set of linked features which together constitute a coherent and robust structure. The central and organizing feature of this structure is a commitment to institutionalized recognition of genetic resources as a broadly social product, a collective heritage of farming communities that is to be freely exchanged and disseminated for the benefit of all. Seed sovereignty therefore entails creation of a legally defined space in which sharing is unimpeded but is protected from appropriation by monopolists. Further, Vía Campesina envisions such a space as one in which farmers can continue to apply their local knowledge and ingenuity in the service of an agriculture that sustains not only their communities but the environment. In this, farmers are not expected to work alone. Vía Campesina looks to scientific institutions to cooperate in the enterprise of plant breeding and

improvement, albeit in a more equitable manner that embraces participatory engagement with farmers themselves and is directed to the production of diverse range of socially and environmentally appropriate plant varieties. Seeds of these varieties will be exchanged in a decentralized market composed of small-scale, community and cooperative enterprises rather than the global market that is the almost exclusive territory of the Gene Giants.

From Exclusion to Sharing: On Beyond Farmers' Rights

An encouraging feature of the past decade has been the emergence of a robust, globally distributed resistance to the ways in which capital has chosen to shape global agricultural markets, develop biotechnology, and construct IPRs (Schurman and Kelso 2003). With the collapse of the Doha Round over the issue of agricultural subsidies, the WTO has been profoundly destabilized and its capacity to impose the organizing framework of the global food system has been called into question. Widespread popular aversion to patents on life-forms and to such pernicious applications as "Terminator Technology" has been joined to concerns in the scientific community about growing limits on their own "freedom to operate" amongst the proliferating corporate "patent thickets." Farmers, indigenous peoples, and civil society advocacy groups have been working in the context of a diffuse but powerful social movement that has had success at slowing – though certainly not stopping – what has come to be broadly understood as the project of corporate "globalization" in agriculture. With the emerging crisis in environment, energy, and food production, we can anticipate growing resistance and the opening of space for the pursuit of "another world."

But if resistance activities have shown increasing numbers of people that "another world" is necessary, it becomes even more important to show them that another world is actually *possible.* In this *creative* arena, farmers and indigenous peoples and advocacy groups have not been notably successful in working toward seed sovereignty. The three principal avenues for this effort have been establishment of "farmers' rights" at the international level, proposals for various *sui generis* arrangements in national contexts, and the promulgation of a wide range of bilateral agreements between bioprospectors and target communities themselves.

Much of the affirmative action that has been pursued on genetic resources over the last twenty-five years has been undertaken under the rubric of the construct called "farmers' rights." Written into the 1989 "agreed interpretation" of the FAO International Undertaking on Plant Genetic Resources, farmers' rights were to have balanced breeders' rights by conferring on farmers and indigenous peoples a moral and a material recognition of the utility and value of the labor they have expended, and continue to expend, in the development and regeneration of crop genetic diversity. Alas, farmers' rights as they have appeared in international fora have been little more than a rhetorical sleight of hand, a means of diverting activist energies into prolonged discussions with the corporate/bureaucratic masters of passive-aggressive negotiation.

The final result of twelve years of talks in the FAO was, in 2001, approval of an International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (FAO 2001). The treaty acknowledges the rights of farmers to "save, use, exchange, and sell farm saved seed," but renders this a privilege "subject to national legislation," which is to say those rights are

subordinated to – and thus negated by – IPR legislation. The treaty requires any party requesting germplasm from the genebanks of the CGIAR/FAO multilateral system to accept a Materials Transfer Agreement (MTA) that prohibits claiming intellectual property rights on germplasm, but only "in the form received." That is, the material can be patented as soon as the recipient alters it through genetic manipulation, which after all is the express purpose for which the germplasm is being requested. The treaty does mandate payment of "an equitable share of the benefits" ultimately derived from use of the material and further states that they should "flow primarily, directly and indirectly, to farmers." But the MTA specifies no workable method for calculating the magnitude of those benefits, it specifies no enforceable mechanism for collecting those benefits, and it specifies no concrete means of directly rewarding any farmer or community. The prospects for any of these provisions being meaningfully implemented seem vanishingly small since, as of November 2007, the 115 governments that are parties to the treaty (including the USA and Canada) had failed even to find the US$4.9 million required to maintain the treaty's secretariat and core services (ETC Group 2007), much less do any monitoring or enforcement.

A second line of action has involved efforts to exploit an opening in the WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). Article 27.3(b) of TRIPS requires WTO member nations to offer some form of intellectual property rights in plants through patenting, PBR, or an "effective *sui generis* system." In theory this option provides nation states with an opportunity to shape legislation to protect the interests and needs of farmers and indigenous peoples and to craft IPR arrangements that respect and reward collective invention. In practice, many nations – often under pressure from the USA and other advanced capitalist nations – simply adopt a PBR framework rather than develop their own approach. Most states are more concerned to safeguard the *national* sovereignty over genetic resources conceded to them under the Convention on Biodiversity (CBD) than they are to institutionalize seed sovereignty in terms that Vía Campesina might find palatable. A number of nations, including Brazil, India, and the Philippines have passed or are considering laws that purport to provide a framework for "collective IPRs," but farmers and indigenous peoples have so far lacked the political power to make them substantially functional. Although over the past fifteen years a wide variety of proposals have been made for legal recognition of "traditional resource rights" and "community-based" or "informal" innovation (for summaries see Reid et al. 1993, Posey and Dutfield 1996, Marin 2002) few of these have been implemented and fewer still – and perhaps none – have borne any significant benefits.

With international and national-level institutions insufficiently attentive to their needs and rights, communities of farmers and indigenous peoples have in many cases turned to a third mechanism – direct bilateral arrangements – in an effort to establish rights over crop biodiversity, manage bioprospecting, and derive a flow of benefit from genetic materials. These have ranged from detailed and highly legalistic models typical of western patent law to frameworks that are more like a treaty than a contract (again, see, Reid et al. 1993, Posey and Dutfield 1996, Marin 2002). The parties to the agreements on the suppliers' side have been individual shamans, communities, and even whole peoples. The parties on the receiving end have been government agencies, companies, and individual scientists. Mediating the exchange have often been NGOs

and activist/advocacy groups. Whatever their form, all such agreements have purported to manage the exchange of genetic resources on a legitimate, equitable, and compensatory basis. The evidence produced by a number of assessments of these arrangements shows that not only have they failed to deliver any significant benefits, they have also frequently caused considerable social disruption and have too often actually been actively damaging to the contracting communities (Nigh 2000, Brown 2003, Hayden 2003, Greene 2004).

It should not be surprising that these three modalities have failed so completely. The existing IPR regime is a juridical construct shaped to serve particular interests. The problem is not that laws *can't* be crafted to recognize collective invention (after all, the corporation is itself a type of collective), the problem is that powerful social actors don't *want* to recognize community-based invention for the simple reason that doing so would raise their raw material and transaction costs. They therefore obstruct initiatives to establish such arrangements or, when forced to accept them, press for their dilution and their incorporation into the dominant system in a way that is minimally disruptive. Moreover, the collective character of the production of crop genetic resources and their wide distribution and exchange almost always makes appropriate allocation of "invention" to a person, to persons, to a community, to communities, or even to a people or peoples an impracticable – and often divisive – task (Kloppenburg and Balick 1995, Brush 2004). Even if some legitimate partner can be identified, it is difficult to see how peasants and indigenous peoples can provide informed consent to bioprospecting activities and construct exchange agreements adequately sensitive to their own interests. Further, the indeterminacy of the value of any material at the point of collection, the difficulty of distinguishing the magnitude of value added in subsequent breeding and marketing, and the imbalance of power between donor and collector render the flow of any material benefit via such instruments as access fees, licensing fees, and royalties uncertain at best.

Beyond these practical difficulties, there is a larger issue. The nature of property is called into question when some farmers and indigenous peoples reject the very notion of owning seeds or plants that they may regard as sacred or as a collective heritage (Hurtado 1999, Salazar et al. 2007). IPRs are actually a means of circumventing and obscuring the reality of *social* production and subsuming the products of social production under private ownership for the purposes of *excluding* others from use. How can they be anything but antagonistic toward social relations founded on cooperative, collective, multigenerational forms of knowledge production? Do not all three of the modalities reviewed above involve movement in the direction of the commodity form and articulation to the market? How useful is it for farmers and indigenous peoples and their allies to expend enormous amounts of energy, thought, and political capital establishing (maybe) their rights (partial and precarious) to exclude others from access to genetic resources that may legally be defined as "theirs" (whose?) so that they can sell them (for a pittance)? If another world is going to be possible, might its development not be facilitated more by the expansion of opportunities for humans to enact the principle of *sharing* than on the extension of the reach of the principle of *exclusion*?

That last statement sounds both idealistic and naive. But need it be? The regime of "common heritage" was characterized by widespread benefits from the free exchange of crop genetic materials worldwide. The legitimacy of this arrangement was called into question at the FAO in 1979 because, as it expanded globally, the seed industry had begun using IPRs to exclude others from access to their varieties for multiplication and breeding purposes. The problem was not that seed companies were obtaining and using crop genetic resources, or even that they were selling seed, but that they were restricting access to and preventing the use of materials that, as a matter of reciprocity, ought to have been shared. It is this failure of reciprocity and – with patenting, the elimination of the right to replant and to use for research, the loss of the *derivative right to use* – that is regarded as asymmetrical and therefore unjust. The inequitable nature of this practice has been compounded as corporations have used IPRs over genetic materials not just to accrue monopoly rents, but to actively undermine the independence of farmers and the integrity and capacity of public plant science. Significantly, the initial strategic response at the FAO in 1979 was not to make companies pay for genetic resources but to declare that what they claimed as proprietary lines were in fact part of common heritage. This position was deemed impractical by many and the debate was soon transformed from how to enlarge the commons to how make industry pay for its raw materials.

I was one of those who in the 1980s argued for what I now regard as a marketized and therefore misconceived and inadequate response (Kloppenburg 1988/2004, Kloppenburg and Kleinman 1987). The logical outcomes of that strategy are the flawed, compensationist modalities described above. Those modalities have neither protected farmers and indigenous peoples from biopiracy nor brought them any benefit, but have functioned mostly to legitimate and institutionalize their continued expropriation. The really radical route to reestablishing symmetry in flows of crop germplasm was not to arrange payment for access to genetic resources in addition to IPR lines, but to work for reconstitution of the commons for both types of germplasm. But I *was* correct, back in 1988, in my judgment that pulling the companies' breeding lines into the status of common heritage was not a workable approach, and that continuing to maintaining peasant landraces as a freely accessed mine for genetic resources was unjust. Is there a way out of this conundrum? Perhaps what is required is a mechanism for germplasm exchange that allows sharing among those who will reciprocally share, but excludes those who will not. What is needed is not recreation of the inadequate *open-access commons*, but creation of a "*protected commons*."

Such an approach would, I think, have considerable goodness of fit with Vía Campesina's own positions in regard to seed sovereignty (Tables 1 and 2). Vía Campesina insists on respect for and implementation of a version of farmers' rights that is considerably broader than that codified in the ITPGRFA and other fora. Especially, it demands that those rights should be enforced by a "different legal framework" from that of IPRs (Vía Campesina 2001: 49) and rejects any abrogation of those rights by the flawed "benefit sharing" arrangements characteristic of the extant, compensationist approaches to genetic resource exchange (Vía Campesina 2008). The movement knows what it needs to *resist*, but what can it *create* as an alternative?

I suggest that open source biology offers the means to establish and elaborate a protected commons for crop genetic resources. While it is no panacea, it represents a plausible mechanism for engaging in both resistance and creativity and for moving in concrete ways toward realization of all eight of the core elements (see Table 2) of Vía Campesina's goal of seed sovereignty.

Open Source Movements: From Software to Wetware (Biology)

Though it surely must sometimes seem so to them, farmers and peasants and indigenous peoples are not the only targets of what McMichael (1996: 31) calls "the globalization project" and what Hardt and Negri (2000) name simply as "Empire." However, the homogenizing and global ambitions of capital are not limited to food and agriculture, but are manifested across all social, economic, and biophysical spaces. They therefore call forth correspondingly broad forms of resistance and creative response. Farmers and peasants and indigenous peoples may find resources for their own actions in the struggles of others, and so it is with seeds and software.

Whatever the specific context, a central element of the neoliberal project is the appropriation of that which is shared and its transformation into an exclusive, commodified form. This process of "enclosure" was manifested originally and most famously in relation to land. However, enclosures are generated and proceed wherever and whenever capitalism confronts the shared spaces that are often referred to as "the commons" or "the public domain." Not only are enclosures not unique to land, they are not limited to what are conventionally understood to be "material" resources. Thus, both copyright and patent law have been developed to appropriate and commodify that resource upon which the contemporary economy increasingly depends: the ideas that are the product of human creativity.

In his book, *Free Culture: The Nature and Future of Creativity*, Lawrence Lessig (2004) describes the history of copyright law. He follows its transformation from a means for providing highly limited protection to individual authors to a corporate tool for severely restricting the uses to which copies can be put. Lessig is particularly concerned about the way in which extensions of the reach and term limits of copyright law impair the expression of the very creativity that intellectual property arrangements are allegedly intended to induce. At a time when the rapid development of digital and information technologies opens the possibility of expanding and democratizing the range of creators and creations, corporations are working hard to prevent others from building on and transforming the works whose copyrights they hold. Lessig (2004: 255) suggests that what industry really wants is

> "...that the public domain will never compete, that there will be no use of content that is not commercially controlled, and that there will be no use of content that doesn't require *their* permission first...Their aim is not simply to protect what is theirs. *Their aim is to assure that all there is is what is theirs.*

Lessig (2004: xiv) calls for resistance to this developing "permission culture" and a vigorous defense of the tradition of "free culture" in which "follow-on creators and innovators remain *as free as possible*" to share and build on and transform the music, ideas, writing, images, software – and, I suggest here, the *seeds and genetic resources* – of other creators and innovators.

Nowhere have the issues Lessig engages been played out more clearly than in the field of software development. Recent advances in hard and soft digital technologies have galvanized the rapid emergence of productive sectors of enormous power and value. Although creative capacity in software development is globally distributed among individuals, universities, and variously sized firms, a few companies have attained a dominant market position from which they have used copyright and patent arrangements to reinforce their own hegemony by restricting the use of their proprietary software, especially of operating system code. Frustrated by these expanding constraints on their ability to add to and to modify and to share as freely as seemed personally and socially desirable, software developers – hackers – have sought ways to create space in which they can develop content and code that can be liberally exchanged and built upon by others. The resultant emergence of a dynamic "free and open source software" (FOSS) movement has been widely documented and analyzed (Raymond 1999, Stallman 2002, Weber 2004).

The FOSS movement is quite diverse, encompassing a considerable range of organizations and methods (e.g., Creative Commons, FOSSBazaar, Free Software Foundation, Open Source Initiative). What unifies these initiatives is a commitment to allowing software users to access and modify code and – critically – to implementation of an enforceable legal framework that preserves access to the original source code and to any subsequent modifications and derivatives.

As the Free Software Foundation has famously observed, "Free software is a matter of liberty not price. To understand the concept, you should think of free as in free speech, not as in free beer" (Free Software Foundation 2008). The Foundation specifically refers to four kinds of freedom:

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and adapt it to your needs.
- The freedom to redistribute copies so you can help your neighbor.
- The freedom to improve the program, and released improvements to the public, so that the whole community benefits. (Free Software Foundation 2008)

A prominent exemplar of this approach is the General Public License (GPL) developed by Richard Stallman and promulgated by the Free Software Foundation. Software released under the GPL is copyrighted and made freely available through a license that permits modification and distribution as long as the modified software is distributed under the same GPL license through which the source code was originally obtained. That is, source code and any modifications must be freely accessible to others (hence "open source") as long as they in turn agree to the provisions of the GPL. Note that the "viral" effect of the GPL enforces continued sharing as the program is disseminated. Just as importantly, the GPL also prevents appropriation by companies that would make modifications for proprietary purposes since any software building on the licensed code is required to be openly accessible. Thus, software developed under the GPL is released not into an open access commons, but into a "protected commons" populated by those who agree to share.

The FOSS movement has enjoyed considerable success. Thousands of open source programs are now available, among them the e-mail program Firefox and the web browser Mozilla. The

best known open source program, however, is surely the operating system known as Linux. The originator of this program is Linus Torvalds, whose express objective was to develop a functional computer operating system as an alternative to those offered by Microsoft and Apple. Realizing that he could not undertake so large a task on his own, he released the "kernel" code of the program under an open source license and asked the global community of hackers to contribute their time and expertise to its elaboration, improvement, and modification. He subsequently involved thousands of colleagues in an ongoing, interactive process that has made Linux and its many iterations and "flavors" an operating system that competes with Microsoft and Apple. The practical utility of this collective enterprise is captured in what is known as Linus' Law: "Given enough eyeballs, all bugs are shallow" (Raymond 1999: 30) That is, the mobilization of large numbers of people working freely together in "decentralized/distributed peer review" generates what Eric Raymod (1999: 31) calls a "bazaar" – as opposed to a "cathedral-builder" – approach to innovation. Users are transformed from customers into co-developers and the capacity for creative, rapid, site-specific problem-solving is greatly multiplied. The social utility of such a collective enterprise is that, as a result of the open source licensing arrangements under which work proceeds, the results of social labor remain largely socialized and cannot be monopolized.

That they cannot be *monopolized* does not mean that they cannot be *commercialized*. Many of the hackers working on open source projects are motivated by peer recognition and the opportunity to contribute to the community (Raymond 1999: 53). But labor can (and should) also be materially rewarded (free as "speech," not as in "beer"). That is, open source software need not be made available at no cost, but it must be available free of restrictions on further *expression* via derivative works. Much open source software is indeed available free of price, but access to some does require payment of some kind of fee. What is distinctive about the pricing of software distributed under the GPL or other forms of "copyleft" licensing is that its level is moderated by the foreclosure of the monopoly pricing that conventional restrictive copyrighting is expressly used to enforce. "The moment any distributor develops a feature , all competitors are free to clone it" (Raymond 1999: 155). Interestingly, the business model for open source applications entails making money not off software sales, but off of the support services that can be provided to clients who receive the software itself free or for a nominal charge. A variety of firms (e.g., Red Hat, Debian, Caldera, Apache) have successfully pursued this approach to realizing the commercial potential of open source software.

The FOSS movement is by no means monolithic. Some elements are animated by an ideological commitment to sharing and to the development of alternative forms of property, others are more motivated by pragmatism and the technical efficiencies associated with the enhanced information flows of distributed peer review. Collectively, they constitute a significant challenge to the "culture of permission" that so concerns Lawrence Lessig. An interesting measure of the achievements of the FOSS movement is the response it has provoked from Microsoft. Having offered to bundle their software with its own but failing to persuade open source developers to modify their licenses to encompass its IPRs, the software giant has notified them that it believes they are in violation of 357 of Microsoft's patents (Parloff 2007). This direct assault may ultimately be less of a threat than the erosive effect that rapid growth and financial

success is having on the norms and practices of some open source firms. We cannot now say whether or not the FOSS movement is capable of catalyzing significant changes in capitalist property relations. The point is that space for change has been created by using existing property relations themselves. In a kind of institutional Aikido, FOSS is using the structure and the momentum of the IPR system itself to move that system in directions its corporate architects didn't intend and which undermine their hegemony.

Recently, academic and public sector biologists have found themselves in a position similar to that of the hackers (and to that of farmers and indigenous peoples!). The Gene Giants have both the resources and the will to explore the bioscape and to claim property rights over what had, until the Chakrabarty decision, been the shared public domain (Graf et al. 2003). But the proliferation of patents has had some problematic effects. Of particular concern is the apparent lowering of the thresholds for novelty, utility, non-obviousness which some argue has permitted far more patents to issue than is warranted. Increasingly, public scientists have found themselves pressed by thickets of biopatents that constrain their access to biological materials, limit their access to the tools they need, and force them to spend time establishing how much "freedom to operate" they can carve out for their work, and reduce their willingness to share their work with others (Campbell et al. 2002). The restrictive licenses and covenants and materials transfer agreements (MTAs) that now accompany both public and private research in molecular biology and genetics and plant breeding – as well as the sheer number of biopatents – is now feared to be leading to what has been termed a "tragedy of the anticommons" in which scientific progress is retarded by the legal and managerial difficulties of reconciling and coordinating different owners' property rights (Heller and Heisenberg 1998). Monsanto can be understood to be the Microsoft of the life sciences.

A number of analysts have begun to look to the FOSS movement as a model for development of "open source biology" practices – "Biolinuxes" (Srinivas 2002) – that might be the basis for resisting enclosure of the genescape and for reasserting modalities for freer exchange of biological materials and information (Deibel 2006, Rai and Boyle 2007, Hope 2008). Efforts have been made to apply open source and copyleft principles to a variety of bioscience enterprises including mapping of the haplotypes of the human genome (International HapMap Project), drug development for neglected diseases in the global South (the Tropical Diseases Initiative), the standardization of the components of synthetic biology (BioBricks Foundation), and a database for grass genomics (Gramene).

By far the most substantial of such initiatives has been that undertaken by Richard Jefferson and his colleagues at the non-profit CAMBIA. Jefferson is the inventor of the GUS reporter system which has been a key enabling tool in plant biotechnology work. Convinced of the utility of advanced genetics for improving agriculture in marginal and inadequately served communities, he had been frustrated by the narrow uses to which corporations have put genetic engineering and deeply critical of the constraints they place on the sharing of patented technology (Poynder 2006). With the explicit intent to "extend the metaphor and concepts of Open Source to biotechnology," Jefferson has fostered the construction of BiOS (Biological Open Source), an

"innovation ecosystem" designed to "ensure common access to the tools of innovation, to promote the development and improvement of those tools, and to make such developments and improvements freely accessible to both academic and commercial parties." BiOS involves integrating cutting edge biological research with open source licensing arrangements that "support both freedom to operate, and freedom to cooperate" in a "protected commons." By agreeing to the provisions of a BiOS license, scientists can gain access to CAMBIA's portfolio of vectors and technologies, most notably its TransBacter vector system which provides an alternative means of gene transfer to the widely used but IPR-restricted techniques involving *A. tumefaciens* or the Gene Gun (Broothaerts et al. 2005).

The technology CAMBIA offers is powerful and appealing but has attracted relatively few licensees. On the one hand, the copyleft provisions of the license deflect participation by companies and organizations seeking access to the technology in order to develop derivative products that would not be shared except on their terms. On the other hand, although public agencies and universities might be interested in the technology, they too have been reluctant to acquire a BiOS license because they cannot mix CAMBIA technology with the proprietary technology that already constitutes a large portion of the intellectual and technical milieu in which they operate (see PIPRA 2006). The BiOS license effectively serves its protective function but, at least in the context of the capital-intensive and highly privatized biotechnology sector, but also makes it difficult to recruit a sufficient number of actors into the protected commons to attain the scale threshold that makes distributed peer production possible. Copyleft and open source arrangements can indeed create a relatively autonomous, protected commons. But are there technologies that are sufficiently attractive and institutions that are both path-independent and sufficiently well endowed to populate that space in a productive and sustainable way?

A Biolinux for Seeds?

The seed sector appears to offer some interesting potentials for elaboration of a "Biolinux" approach to open source innovation. Millions of farmers the world over are engaged in the recombination of plant genetic material and are constantly selecting for improvements. Even more massively than their software hacker counterparts, they are effectively participating in the process of distributed peer production that Eric Raymond has characterized as the "bazaar." Like hackers, farmers have found their traditions of creativity and free exchange being challenged by the IPRs of the hegemonic "permission culture" and have begun looking for ways not just to protect themselves from piracy or enclosure, but also to reassert their own norms of reciprocity and innovation. Moreover, farmers have potential allies in this endeavor who themselves are capable of bringing useful knowledge and significant material resources to bear. Although its capacity is being rapidly eroded, public plant breeding yet offers an institutional platform for developing the technical kernels needed to galvanize recruitment to the protected commons. And in the practice of "participatory plant breeding" there is an extant organizational vehicle for articulating the complementary capacities of farmers and scientists in the North as well as the South (Almekinders and Joost 2002, Murphy et al. 2004, Salazar et al. 2007). Could copyleft

arrangements establish a space within which these elements might coalesce and unfold into something resembling seed sovereignty?

I am not the first to pursue this line of thought. Ravi Srinivas (2002), Boru Douthwaite (2002), Margaret Kipp (2005), Roberto Verzola (2005), Steve Hughes and Eric Deibel (2006/07), Keith Aoki (2008) and Janet Hope (2008) have also suggested applying open source principles to the seed sector. Srinivas (2002: 325) put it very simply:

> A biolinux model will also be based on the logic that farmers are both users and innovators of technology...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. There will be no restriction on using this to develop new varieties or to experiment with but it is essential that the variety derived from this should also be available without any monopolistic claims and restrictions on further development.

These analysts have established a point of departure, but have not pursued the practical exigencies of how an open source system for seeds could actually be developed. Here, I build on their work by initiating that process, with specific reference to the utility of open source methods for achieving Via Campesina's goal of seed sovereignty.

Interestingly – and appropriately – this recent appreciation of the utility of open source methods for the seed sector was preceded by a similar apprehension on the part of a member of the plant breeding community itself. At the 1999 Bean Improvement Conference, University of Guelph bean breeder Tom Michaels presented a paper titled "General Public License for Plant Germplasm" (Michaels 1999). In it, he noted that as a result of

> ...the opportunity to obtain more exclusive novel gene sequence and germplasm ownership and protection, the mindset of the public sector plant breeding community has become increasingly proprietary. This proprietary atmosphere is hostile to cooperation and free exchange of germplasm, and may hinder public sector crop improvement efforts in future by limiting information and germplasm flow. A new type of germplasm exchange mechanism is needed to promote the continued free exchange of ideas and germplasm. Such a mechanism would allow the public sector to continue its work to enhance the base genotype of economically important plant species without fear that these improvements, done in the spirit of the public good, will be appropriated as part of another's proprietary germplasm and excluded from unrestricted use in other breeding programs (Michaels 1999: 1).

The specific mechanism Michaels goes on to propose is a "General Public License for Plant Germplasm (GPLPG)" that is explicitly modeled on the GPL developed by the FOSS movement for software.

For Michaels, creating the GPLPG involves a straightforward adaptation of the GPL. Plant scientists would supply germplasm to other parties accompanied by a Materials Transfer

Agreement (MTA) specifying the conditions under which the material is being made available. Those conditions would include copyleft provisions permitting (indeed, encouraging) further development and recombination and improvement of the germplasm, but requiring that any lines or cultivars "derived in whole or in part from GPL plant germplasm must likewise be made available to others under GPLPG and without further restriction for use in subsequent breeding programs" (Michaels 1999).

This mechanism is simple, elegant, and effective. No new law is required; like the "shrink-wrap" license already common to software and commercial seed sales, the GPLPG is based on existing contract law. No patenting or PBR protection is necessary; again, the GPLPG is based on existing contract law, not on IPR statutes. The GPLPG is enforceable in existing law; just like the "shrink-wrap" license already common to software and commercial seed sales (Technology Use Agreements), there are statutory legal consequences for those who violate the license provisions. The vehicle for the GPLPG, the MTA, is familiar to the plant science community; the MTA is now the standard mechanism for germplasm exchanges in universities, government agencies, private companies, and the international system and scientists and administrators are accustomed to its use. The GPLPG can be used for patented or otherwise IPR-protected materials; if an owner chooses to release IPR-protected materials under the GPLPG, those IPR provisions are not enforced against GPLPG licensees. The GPLPG is compatible with a flow of benefits to the breeder; royalties may be charged for reproduction and distribution of lines, but not on subsequent uses or distributions by others. The GPLPG is compatible with commercial seed sales; seed of GPLPG lines maybe reproduced and sold, but the vendor has no claim on subsequent uses or distributions. GPLPG seed will not be attractive for appropriation and incorporation into proprietary breeding programs; the "viral" nature of the license requires that any derivative lines developed using GPLPG germplasm must also be distributed under the GPLPG, thus eliminating the possibility of capturing monopoly profits from downstream and derivative applications and uses.

In sum, the GPLPG is sufficiently simple to be used by many different actors (individual farmers, communities, indigenous peoples, plant scientists, universities, non-governmental organizations, government agencies, and private companies) in many places and diverse circumstances. Properly deployed, it could be an effective mechanism for creating a "protected commons" for those who are willing to freely share continuous access to a pool of plant germplasm for the purposes of "bazaar"-style, distributed peer production.

How might use of the GPLPG (or some variant) by farmers, indigenous peoples or public agencies and scientists contribute to the achievement of Vía Campesina's objectives in regard to seed sovereignty (see Table 2)? The GPLPG has useful application to *resistance* activities:

- ***Prevent or impede the patenting of plant genetic material.*** A GPLPG would not directly prohibit patenting (or any other form of IPR protection) of plant genetic material. However, the GPLPG does mandate sharing and free use of the subsequent generations and derivatives of the designated germplasm. In effect, this prevents patenting since there can be no income flow from the restricted access to subsequent generations and derivative lines that it is the

function of a patent to generate. While the GPLPG does not prohibit patenting, it renders it pointless. Further, the "viral" nature of the GPLPG means that as germplasm is made available under its provisions and used in recombination, there is a steadily enlarging the pool of material that is effectively insulated from patenting. Enforcing the GPLPG against possible violators would not be easy given the resources necessary. But even the mere revelation of violations would have the salutary effect of illuminating corporate malfeasance and eroding the legitimacy of industry and its practices. The threat of potential GPLPG-related legal challenges could also have the generalized effect of making companies more circumspect about what they do patent. Further, since it relies on existing juridical arrangements and has minimal cost, use of the GPLPG is more efficient and cheaper than other measures intended to prevent inappropriate patenting (e.g., "community registration," defensive patenting).

- ***Prevent or impede bioprospecting/biopiracy.*** The GPLPG could be similarly effective in deterring biopiracy. Faced with a request to collect germplasm, any individual, community or people could simply require use of a MTA incorporating the GPLPG provisions. Few commercially oriented bioprospectors will be willing to collect under those open source conditions. Again, enforcing the GPLPG against possible violators would not be easy, but instances in which "bioprospecting " can be revealed to unambiguously be "biopiracy" would contribute to public awareness and strengthen popular and policy opposition to unethical appropriation of genetic resources.
- ***Prevent or impede the use of farmer derived genetic resources in proprietary breeding programs.*** Because neither the germplasm received under a GPLPG nor any lines subsequently derived from it can be use-restricted, such materials are of little utility to breeding programs oriented to developing proprietary cultivars. Any mixing of GPLPG germplasm with these IPR-protected lines potentially compromises their proprietary integrity. Application of the GPLPG to landraces could therefore effectively prevent their use in proprietary breeding programs.
- ***Prevent or impede further development and deployment of GMOs.*** The development of transgenic cultivars almost universally involves multiple layers of patented and patent-licensed germplasm. Moreover, all of the critical enabling technologies employed in genetic engineering are patented and their use restricted by licenses. Given the large investments that have been made and accompanying expectations of high financial returns, GMOS will not be developed if they cannot be IPR-protected. Any mixing of GPLPG germplasm with these IPR-protected materials and tools potentially compromises their proprietary status. Use of the GPLPG cannot itself stop the further development of GMOs, but it can impede it by preventing additional genetic resources from being drawn into the web of proprietary and IPR-protected materials.

In addition to its capacity for reinforcing *resistance*, the GPLPG may have even more potential for *creativity*, for the creation of effective space for the elaboration of transformative alternatives.

- ***Develop a legal/institutional framework that recognizes farmers' collective sovereignty over seeds.*** A major advantage of the GPLPG is that it does not require the extensive

development of new legal statutes and institutions for its implementation. It relies on an elegantly simple vehicle (the MTA) that is already established and enforceable in conventional practice and existing law. It uses the extant property rights regime to establish rights over germplasm, but then uses those rights to assign sovereignty over seed to an open-ended collectivity whose membership is defined by the commitment to share the germplasm they now have and the germplasm they will develop. Those who do not agree to share are self-selected for exclusion from that protected commons. It is important to note that this approach really assigns sovereignty over seed to a collectivity of "seed users" rather than farmers *per se*, although that collectivity is effectively composed largely of farmers.

- ***Develop a legal/institutional framework that allows farmers to freely exchange, save, improve, and sell seeds.*** For farmers, the feature of the space created by implementation of the GPLPG that is of principal importance is the freedom to plant, save, replant, adapt, improve, exchange, distribute and sell seeds. To paraphrase the "four freedoms" specified by the Free Software Foundation, the GPLPG establishes a legal framework within which farmers can maintain:
    1. The freedom to grow the seed, for any purpose.
    2. The freedom to study how the seed works, and adapt it to their needs.
    3. The freedom to redistribute the seed so they can help their neighbors.
    4. The freedom to improve the seed, and release improvements to the public, so that the whole community benefits.

  The flip side of these freedoms is responsibility (and under the GPLPG, the obligation) to grant others within the collectivity the same freedoms; no one is entitled to impose purposes on others or to restrict the range of uses to which seed might be put. In the face of increasing restrictions on their degrees of freedom to access and use seed – patents, PBRs, TUAs, GURTs – application of the GPLPG offers a means for farmers to create a semi-autonomous, legally secured, "protected commons" in which they can once again work collectively to express the inventiveness that has historically so enriched the agronomic gene pool.
- ***Develop an institutional framework in which farmers cooperate with plant scientists in the development of new plant varieties that contribute to a sustainable food system.*** The "protected commons" that could be engendered by the GPLPG can, and must, also encompass scientific plant breeders whose skills are different from but complementary to those of farmers. Many new cultivars will be needed to meet the challenges of sustainably and justly feeding an expanding global population in a time of energy competition and environmental instability. The open source arrangements that have undergirded the successes of distributed peer production in software could have a similar effect in plant improvement. If in software it is true that "to enough eyes, all bugs are shallow," it may follow that "to enough eyes, all agronomic traits are shallow." Participatory plant breeding offers a modality through which the labor power of millions of farmers can be synergistically combined with the skills of a much smaller set of plant breeders. The GPLPG offers plant scientists in public institutions a means of recovering the freedoms that they – no less than farmers – have lost to corporate penetration of their workplaces. Public universities, government agencies, and the CGIAR system should be the institutional platform for knowledge generation based

on the principle of sharing rather than exclusion. Public plant breeders, too, can be beneficiaries of and advocates for the protected commons.

- ***Develop a framework for marketing of seed that is not patented or use-restricted.*** The GPLPG is antagonistic not to the market, but to the use of IPRs to extract excess profits and to constrain creativity through restrictions on derivative uses. Under the GPLPG, seed may be reproduced for sale and sold on commercial markets. By carving out a space from which companies focusing on proprietary lines are effectively excluded, the GPLPG creates a market niche that can be filled by a decentralized network of small scale, farmer-owned, and cooperative seed companies that do not require large margins and that serve the interests of seed users rather than investors.

Seed sovereignty as envisioned by Vía Campesina does not involve farmers alone, nor can it be achieved solely by farmers. Seed sovereignty will be manifested as a system encompassing farmers, indigenous peoples, plant scientists, public scientific institutions, and seed marketers. GPLPG/Biolinux/open source/copyleft arrangements could plausibly constitute a legal/regulatory framework that could open an enabling space within which these different social actors could be effectively affiliated.

Enacting a Biolinux Model: Fundamental Issues and Differential Positionings

But can these different social actors be effectively affiliated? Will a Zimbabwean subsistence farmer and a Canadian wheat farmer see "seed sovereignty" in similar enough terms to feel part of a common endeavor? Will the Dutch participatory plant breeder feel there is common ground with the bean breeder at CIAT or the soybean gene jockey at the University of Minnesota? Especially, with scientists and farmers and indigenous communities and states commonly taking defensive stances in regard to what they increasingly see as "their" genetic resources and looking for ways to exclude others from access to those materials, what will be attitudes to an open source initiative that asks them to *share* more *widely*?

I suggest that what is so powerful and potentially transformative about open source principles is precisely the manner in which they encourage us to look beyond the constraints of the taken-for-granted, dominant system and ask us to embrace the potentialities of freely given and shared social labor. One of hallmarks of opposition to the current economic and social formation is the emergence of a sense of the plausibility of coalescing local struggles into a global mass movement (Kingsnorth 2004, Bello 2007). Hardt and Negri (2004: xiii, xv) call this coalescence the "multitude, the living alternative that grows within Empire" and suggest that the challenge facing the multitude is not to homogenize, but to discover "*the common* that allows them to communicate and act together." I believe that Vía Campesina shares this orientation (Desmarais 2007: 36, 38; McMichael 2006). Hardt and Negri (2004: xv) observe that "the common we share, in fact, is not so much discovered as it is produced." Application of open source principles to plant genetic resources offers a concrete and critically important context in which to materially enact that production.

But, enactment of open source principles requires a fundamental commitment to an approach to sharing that may be more expansive than farmers and indigenous peoples have yet envisioned. Participating in a GPLPG/Biolinux framework for the exchange of genetic resources does, of course, mean foregoing the opportunity to direct a flow of benefits from sale of the right to access and use materials to a particular geographic or social entity. Additionally, open source provisions not only mandate sharing, they also eschew restrictions on subsequent use. That means the loss of the ability to control the uses to which materials are ultimately put by those who are willing to reciprocally share. Are farm communities with uniquely useful germplasm, or indigenous peoples who regard certain plants as sacred, going to be willing to share such materials without payment or restrictions on end uses? Versions of open source software licenses have been developed that incorporate various restrictions on the use or development of a program or its derivatives (e.g., "some rights restricted," etc, see Raymond 1999). Stronger or weaker versions of the GPLPG can be written to account for special situations, but such iterations would be steps back toward the exclusivist arrangements that seed sovereignty is intended to undermine.

Moreover, genetic resources with special utility (and therefore potential market value) are precisely the materials that it would be most desirable to retain within the protected commons. The fertility and dynamism of bazaar-style distributed peer production is a function of the number of "eyes" available to work on bugs (software) or traits (plants). In turn, recruitment to the bazaar is in large measure a function of interest in the materials being made available for digital or biological "hacking." This point is especially important in regard to recruitment of plant scientists to the protected commons. Such personnel are already deeply invested in conventional practices and patterns and something more than germplasm may be required to draw them into the open source network. Here, it may be useful for farmers and indigenous peoples to rethink rejectionist positions toward the techniques and products of biotechnology and consider their potential for contributing to a just and sustainable agroecology (see CAMBIA, Broothaerts et al. 2005). What attracts farmers and/or scientific innovators to the bazaar will be materials that are exciting and useful, and they could be transgenic constructs as well as landraces.

Use of the GPLPG by farmers, indigenous peoples and progressive plant scientists could initiate the establishment and elaboration of an alternative network of varietal development and seed production and exchange. Given the power of agribusiness, the coopted and compromised character of public agricultural science, and the constraints of many national agricultural policies, that is now no easy task. If a protected commons based on open source principles can be birthed, its midwives must be the constellation of diverse social movements now working around the globe for a more just and sustainable agriculture.

What are the prospects for implementing a GPLPG/Biolinux program in different geopolitical circumstances?

Biolinux and the South. It is in the geopolitical South that farmers would be most receptive to a Biolinux approach and that open source arrangements could be most rapidly

implemented and disseminated. Farmers from Mali to India to Indonesia to Colombia are keenly aware of the way in which the transformation of plant breeding and the seed/life industries sector has damaged their interests and is threatening their livelihoods. Many have organized themselves to resist corporate efforts to spread GMOs and IPRs and to pursue seed saving, to work for farmers rights, to create community gene banks, and to continue the traditions of landrace exchange and development (e.g., India's Gene Campaign and "seed satyagraha"). Proliferating linkages between these organizations, facilitated by NGO allies (e.g., ETC Group, Genetic Resources Action International-GRAIN, Asociación ANDES, Vía Campesina) and digital communications, provide a network through which understanding and implementation of a global Biolinux/GPLPG initiative can be widely and effectively promulgated. If large numbers of farmers could be persuaded to refuse to supply seeds to any representative of *any* organization (farmer group, NGO, government agency, university, private company) except with an accompanying GPLPG-MTA, a protected commons could be rapidly and virally enlarged. Most peasant farmers freely exchange seeds now and will likely be glad to continue that practice with any individual or any organization that is willing to reciprocate. The difficulties of associating particular crop genetic traits with a particular person or community makes monetary "benefit-sharing" impracticable, and most farmers should be willing to eschew such improbable opportunities in favor of the real benefits of the continued free availability of germplasm. Protection from appropriation for varieties produced by farmer-breeders would be effectively established, agricultural biopiracy would be eliminated, and a barrier to the rampant spread of corporate cultivars would be erected.

Such defensive measures could be complemented by cultivation of an institutional and technical platform for development of open source crop varieties. There already exist a variety of reasonably robust participatory breeding programs that have produced productive collaborations between farmers and plant scientists (Almekinders and Hardon 2006, Salazar et al. 2007). The mutual generation of different diversity is superior to reliance on a single modality. Intensive efforts can be made to persuade public agencies to also adopt the GPLPG protocol so as to strengthen varietal development within the protected commons. At the national level, this will mean confronting state assertion of "national sovereignty" over genetic resources and the role of national agricultural research services (NARS). At the international level, this will mean pushing the CGIAR centers and the Mulitlateral System of the ITPGFRA in open source directions. This will be difficult but not necessarily unworkable. The CG system and national agricultural research services (NARS) are deeply invested in top-down/hi-tech approaches to plant improvement and deeply compromised by their existing connections to private industry. However, their funding, technical capacity and relevance are declining rapidly (Guimares et al. 2006, Morris et al. 2006). Life industry firms and neoliberal foundations are forming partnerships (e.g., Danforth Foundation, African Agricultural Technology Foundation) to bypass the CGIAR/NARS institutions and intend to supplant them as the principal architects of technical innovation for agricultural development in the South. The CGIAR system in particular yet retains a commitment to public purpose and its broad germplasm holdings and experience with participatory breeding would be

invaluable resources for building the protected commons. Moreover, the MTA now officially adopted by the CGIAR centers contains an open source element which, even in diluted form, has already led private firms to balk at its use (Saenz 2008). Given its declining status in the global constellation of agricultural research institutons, the CGIAR system might be made amenable to some significant restructuring if appropriate pressures could be brought to bear by social movements.

Biolinux and Indigenous Peoples.

If many peasant farmers are likely to be receptive to an open source approach to crop genetic resources, indigenous peoples in both the South and the North can be expected to take a considerably more cautious attitude. Although most crop genetic resources are relatively widely distributed, some are in fact closely and even exclusively associated with a particular native people. One of the most egregious examples of agricultural biopiracy has been appropriation of wild rice from Anishinaabeg communities of Minnesota and Wisconsin (LaDuke 2007). Further, many of the most visible and contentious instances of biopiracy have involved collection of medicinal plants and associated cultural knowledge from indigenous communities (Hayden 2003, Greene 2004). Indigenous peoples have deep historical experience with many types of colonialism and multiple forms of appropriation. They are rightfully suspicious of proposals made by those outsiders who purport to make proposals on their behalf or in what are alleged to be their best interests. Should they be anything but extremely skeptical of a Biolinux imaginary that would ask them to share more widely, when what sharing they have previously undertaken – voluntary or imposed – has almost always resulted in asymmetric extraction? As Lorenzo Muelas Hurtado (1999:15) of the Movimiento Autoridades Indígenas de Colombia puts it, sharing for indigenous peoples has meant that "what is theirs is theirs, but what is ours is everybody's."

And, in truth, implementation of open source principles among indigenous peoples does indeed ask that what is "theirs" should become the "ours" of a larger social enterprise. The critical distinction is that it is not the "ours" of Hurtado's "everybody" (i.e., an open access commons") but the "ours" of a "protected commons" populated by those who agree to reciprocally share both the resources for and the fruit of their collective labor. For indigenous peoples this should at least be conceivable, since in some ways it is but the projection of their own internal practices and commitments to a larger social context. But that projection is fraught with hazards. There may be materials so imbued with spiritual or cultural meaning that they cannot be shared. There may be materials so imbued with spiritual or cultural meaning that, even if they can be shared, it may be unacceptable to relinquish control over subsequent uses to distributed peer production. However, these may not be insurmountable barriers to participation in a Biolinux. Just as open source software licenses have been developed that are not entirely "free," it may be possible to write GPLPG licenses that specify "some rights reserved" to encompass the concerns or needs of indigenous peoples.

Advocates of a Biolinux system need not shrink from raising these issues with indigenous peoples who, after all, are already being approached by bioprospectors who encourage them

to accept various market and market-like arrangements. Indigenous communities are rarely homogeneous entities, and there is considerable internal debate as to the desirability or appropriateness of concluding such deals. There are many indigenous organizations with which conversations regarding open source approaches may be initiated (e.g., Indigenous Peoples Council on Biocolonialism, Native Earth Bio Culture Council). At least one such organization, Tebtebba (Indigenous Peoples' International Centre for Policy Research and Education) has already begin its own discussions with open source software proponents n the Philippines to explore common ground.

Biolinux and the North. In 1999, Tom Michaels proposed the use of the GPLPG both to his fellow bean breeders and to a Canadian expert committee on cereal breeding. He reports to me that "no-one voiced opposition or even criticism, but neither did they get excited enough to volunteer to help with the cause" (Michaels, 2007, personal communication). This response isn't really surprising. Public breeders have long been aware of the way in which their freedom to operate has been progressively circumscribed (see especially Coffman 1998, Sears 1998) but have never generated much resistance to long-term corporatization trends that they have apparently regarded as inevitable or irresistible. Most North American farmers, for their part, have been preoccupied with just staying in business and have not yet mounted broad opposition to growing restrictions on their ability to save or sell seeds. This may now be changing. Suddenly, even the deans of agricultural universities find their faculties without access to the privately patented "enabling technologies" of plant improvement (Atkinson et al. 2003). Farmers in Canada and the U.S. find themselves the objects of a blitzkrieg of lawsuits from Monsanto which is determined to make sure that seed serfdom, not seed sovereignty is their unquestioned future (Barlett and Steele 2008). The introduction of crop varieties with "stacked" GMO traits, the continuing acquisition of independent seed companies by the Gene Giants, and the withering of public varietal release mean that soon it may be that, as Lawrence Lessig fears for society as a whole, "all there is is what is theirs." And what is theirs comes at a high price: a 40% rise in the price of seed over the last two years, according to the USDA (2008).

In response, the components of what could become a vigorous resistance are now appearing in both the public science and farm communities, and this oppositional tendency is being facilitated and nourished by a variety of advocacy organizations. In September, 2003, some twenty-five U.S. public plant scientists met with representatives of selected NGOs and farmers' organizations at a "Summit on Seeds and Breeds for the 21st Century." Recognizing that public breeders now operate in an environment "where control of elite germplasm has increasingly become proprietary," the goal of the Summit was to "Develop a blueprint or road map for re-invigorating public domain land and animal breeding to meet the needs of a more sustainable agriculture" (Sligh and Lauffer 2004). Notably, the Summit participants also made an explicit commitment to research approaches that incorporate "tie in with farmers (particpatory programs)" and "cooperative problem solving." This group has continued to meet and developed a variety of recommendations, some of which were included in the 2008 Farm Bill. More recently, the Organization for Competitive Markets (OCM - see

http://www.competitivemarkets.com/) has inaugurated a Seed Concentration Project" and is planning a conference to bring together public breeders, farmers, and advocacy organizations to address the effects of corporate consolidation in the seed sector. A similar undertaking – the "Seed Policy Project" – has been inaugurated in Canada by the Forum on Privatization and the Public Domain (see Martin 2008 and http://forumonpublicdomain.ca/node/257). A key feature of these initiatives is the opportunity for public sector plant science to withdraw from its accustomed role as a supplicant to private industry and to embrace an alliance with farmers civil society organizations willing to directly confront the Gene Giants and demand that resources be provided for alternative paths.

Farmers in the North are increasingly restive under seed price hikes and the decreasing availability of anything but GMO varieties (Roberts 2008). Both the Saskatchewan Canola Development Commission and the Canadian Seed Growers Association have plans to develop farmer-owned seed companies. The Canadian Wheat Board has floated a plan for farmers to fund the breeding of varieties to which they would retain ownership. In Europe, José Bové has called for the complementary addition of a free seed exchange movement ("semeurs volontaires") to the work of the anti-GMO reapers ("fauchers d'OGM"), and a "Liberate Diversity" network is opposing restrictive seed directives promulgated by the European Commission. Critical to the success of such efforts to build an alternative to corporate seed will be the revitalization of public breeding. In contrast to farmers in the South, few producers in the North systematically select or breed cultivars. However, there is in both North America and Europe a vibrant community of public plant scientists who are committed to various forms of participatory breeding (Almekinders and Jongerden 2002, Murphy et al. 2004, Public Seed Initiative). Such scientists generally demonstrate a commitment to organic/agroecological approaches to plant improvement and are also often actively resistant to extensions of corporate power (see especially Jones 2004).

Would a Biolinux approach be attractive to farmers and public plant scientists in the North? On the one hand, these Northern actors have a considerable volume of political and institutional capital to deploy in working toward seed sovereignty. The consequences of continued inaction cannot be much clearer than they are now, and a Biolinux approach at least offers a refreshingly aggressive orientation. On the other hand, both farmers and public scientists are deeply embedded in existing norms and practices and this profound path dependency makes radical change appear implausible. They are actually less likely than their counterparts in the South to recognize, understand, and act on the structural conditions that entangle them. Trapped as they are in a narrowing seed market, farmers would likely warm to a protected commons of public varieties if it offered them the cultivars they need and want. But in its debilitated condition, public plant breeding is not now producing those cultivars. Application of the GPLPG is no simple, and certainly not a quick, solution. Few public plant scientists will see it as a practical possibility. The protected commons might seem attractive in some abstract future, but there is a severe threshold constraint to be overcome. A functional protected commons capable of innovative and fecund production requires a significant population of participants and a stock of quality material on which to work. What

scientists will be willing to move their personal and genetic resources into that space, especially since the "protection" gained by the GPLPG also means isolation from the huge stocks of proprietary materials and methods with which they necessarily now work?

A tactic that might at least partially resolve this threshold constraint would be to focus efforts on a sub-sector of plant improvement. An obvious candidate for this approach would be the development of cultivars for organic and agroecological production systems, an area in which public and independent institutions now have a comparative advantage and which has not yet attracted substantial interest from the dominant firms of the private sector. In addition, a variety of independent research organizations (e.g., The Land Institute, Michael Fields Agricultural Institute, Organic Seed Alliance) and a number of small and cooperative seed companies (e.g., Johnny's Selected Seeds, Fedco Seeds) offer an established research and marketing platform and can be expected to be willing to seriously consider the potentials of an open source approach.

Finally, public scientists are not free actors. Most have assigned rights over the products of their labor to their institutions as a condition of employment. It is not the individual scientist, then, but the public institution that must be the real object of transformation. Public scientists can – indeed, must – be part of that process. But ultimately, if space is going to be opened for introduction of Biolinux mechanisms in public institutions, it will be pressures from outside the institution that motivate or enable that outcome. This points to the critical importance of pursuing the development of alliances between the social actors who stand to gain if alternative paths to cultivar development can be pursued: farmers, public scientists, independent seed companies, advocacy organizations, and an informed and activated citizenry.

Conclusion: Vía Campesina and Seed Sovereignty

> *We should sit down with the legal people who drew up the Creative Commons licenses and see whether farmers could use a similar approach with seeds.*
>
> *José Bové (2005: 11)*

If seed sovereignty is to be pursued as part of a larger conception of food sovereignty, what is to be done? José Bové is clear about what path should be taken. If germplasm had been made available by farmers and indigenous peoples under the GPLPG since 1950, I believe that world agriculture would look very different today. At a minimum, the public agricultural research system would be far more robust than it is now, most seeds in most genebanks would be freely available to any breeders willing to share the results of their work, and it would be Monsanto – not farmers – that would be finding the international plant genetic resources regime to be unduly restrictive. With such potency, might a Biolinux approach be useful today? Might Vía Campesina take a lead role in advocating and enacting open source measures?

A wide variety of analysts have grappled with what to do abut the asymmetric and unjust character of plant germplasm use and exchange. Their counsel can be separated into three types. The first is to do nothing. Some are so overwhelmed by practical complexities and moral ambiguities that they simply don't know what to do and fail to provide any effective guidance at all (e.g., Brown 2003, Gepts 2004, Eyzaguirre and Dennis 2006). Others bemoan the problematics of existing arrangements, but accept their inevitability (e.g., Wright 1998). Brush (2007: 1511), dusting off an old seed industry apologia, concludes that existing mechanisms of development assistance and technology transfer represent sufficient means of ensuring "reciprocity" and "benefit sharing." Fowler (2003:3, 11) flatly declares that "for better or worse, the debate concerning whether the international community will sanction the existence and use of IPRs in relation to germplasm...is over" and that "Anyone who is not happy will remain unhappy." Well, as Vía Campesina knows well, many farmers are still not happy and they are not willing to simply accept unhappiness as their allotted portion.

The second and much larger group agrees that *something* needs to be done about the injustices, but that the realities of corporate power and a dominant capitalism require a "situational pragmatism" (Brown 1998: 205) that involves cutting the best deal you can. So Mgbeoji (2006: 170) recommends that indigenous peoples consider a "more astute and pragmatic response" to patenting of sacred plants. Salazar et al. (2007) advise trying out the new and trendy "declaration of origin" as a means of preventing appropriation. This is the well worn terrain of all the bioprospecting contracts and the discoverer's rights and the geographic indications and the biopartnerships and the recognition funds and the royalty agreements and the exploration fees and the all the other arrangements that have been proposed and tried. I have no objection to trying them out and am in no position to tell any peasant communities or indigenous peoples what they should or should not do. I *will* point out that none of these arrangements have yet worked. Darryl Posey observed that, as far as he was concerned, these deals were holding actions that would not enfranchise anyone but that would "at least buy some time" (cited in Hayden 2003: 38). But, buy time for what? Hurtado (1999:7-8) warns of the dangers in the pressures to be pragmatic and to accept what he calls the "intermediate" solutions where

> ...we must not go to extremes, but rather negotiate and arrive at a mid-point. And in this the INTERMEDIATES are the special or *sui generis* regimes, which seek to sit indigenous people at the negotiating tables, in order to talk us into submission. Because it is there where the banana skins are placed, it is there where we start to skid.

The third option is to take Hurtado's advice, to avoid the banana skins, to refuse to accept the unhappiness or the deals and to go for broke, to go for it all, to go for real transformation, to go for Biolinux. The aggressions of the neoliberal project must, of course, be resisted whenever possible. However, resistance is a necessary but not sufficient condition for the realization of seed sovereignty (or, for that matter, of food sovereignty). Resistance must be complemented by creative actions that are not just reactions to corporate/neoliberal conditions but which are offensive, affirmative, positive, proactive undertakings designed to establish and maintain alternative, (relatively) autonomous spaces.

Achieving seed sovereignty will not be easy. What is required is simultaneous and linked development of concepts and applications among farmers, plant scientists, seed vendors, public institutions and civil society advocacy groups in the face of corporate and state opposition. Open source biology is no panacea. But, as I have hope to show, it is a plausible vehicle for enacting all eight of the elements of resistance and creativity that comprise what I believe Vía Campesina regards as seed sovereignty.

Given that its network spans North and South, given its commitment to a comprehensive restructuring of the food system, and given its goals for seed sovereignty, Vía Campesina would appear to be well situated to take leadership in exploring the potential of open source biology. Would the movement consider taking on that task?

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