

Open Sources, Open Minds: Open Source Biology and the Struggle for Organic Seed Sovereignty

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SPEAKERS BIO

Jack Kloppenburg teaches in the Department of Community and Environmental Sociology at the University of Wisconsin-Madison. He has long been interested in the organization of plant breeding and the global regime of access to genetic resources. His most recent work is marked by excitement over the emergence of local/regional “foodsheds,” the growing international movement for “food sovereignty,” and the possibilities of applying “open source” principles in the biosciences.

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PAPER

“Right now, an urgent need in organic agriculture is for greater volumes of organically produced seed. But a weightier concern – at an organic systems level – is the essential need to encourage seed (and animal) breeding programs that are both designed in concert with organic systems, and in the public domain.” Micaela Colley and Matthew Dillon (2004)

“Being a protest movement against developments in industrialized, conventional agriculture, the organic movement has been value-based from the very beginning. However the objectives of values are not only to resist unwanted developments, but also to support development and extension of organic agriculture into new areas; and to plan pro-active research.” Edith Lammerts van Bueren (2008)

Introduction

Even in the face of the current economic downturn, growth in the demand for organic foods has only been slowed, not reversed. As Micaela Colley and Matthew Dillon (2004) observe, there is and will continue to be an urgent need for more organically produced seed. They go on to make the critically important point that what is really needed is not simply a larger quantity of organically produced seed, but a larger quantity of organically bred seed. Further, they suggest that

such varieties bred within organic production systems ought to be maintained in the “public domain” where their genetic potential can be kept accessible to a broad range of breeders.

As Edith Lammerts van Beuren reminds us, developing organically bred varieties and keeping them in the public domain must be understood as a social *struggle*. The global movement for sustainable and organic food systems, of which organic breeding is a part, involves struggle against the corporate project of restructuring the social and natural worlds around the narrow logic of the market. The seed is 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 – who achieves “seed sovereignty” – gains a substantial measure of control over the shape of the entire food system.

Over the last century, seed sovereignty has been gradually transferred from farmers and their communities, and from public plant breeders and their trial plots, to the boardrooms and laboratories of the five transnational firms known as the “Gene Giants.” A principal mechanism by which this shift has been engineered is the promulgation and elaboration of a set of intellectual property rights (IPRs) that has facilitated the enclosure of the genetic public domain. The failure of debilitated public breeding programs to provide alternatives 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.

In this increasingly bleak agricultural genescape, the organic sector has bloomed with the promise that “another world is possible.” According to Lammerts van Bueren (2008), organic breeders who want to help create that world face two strategic tasks: they must “resist unwanted developments” and undertake “pro-active research.” On the one hand, they must resist the concentration of corporate power in the life sciences industry, the extension of IPRs, the privatization of public science, the spread of genetically modified crops, the development of “Terminator” technologies, and the proliferation of bioprospecting/biopiracy. On the other, they must proactively create space for the elaboration of participatory plant breeding, a revitalized public science, a robust agroecology, and decentralized and community-based seed distribution and marketing.

That is a challenging set of tasks. I suggest that “open source biology” offers a mechanism for simultaneously pursuing *both* effective resistance *and* the pro-active creation of a protected space into which plant breeding practices and institutions with truly transformative capacity can be introduced and elaborated. Whereas conventional IPRs are used to enact and enforce the principle of *exclusion*, open source mechanisms use existing law to mandate *sharing*. Open source biology is no panacea. However, it could plausibly be a mechanism for farmers and publicly-minded plant scientists to begin the recovery of seed sovereignty. For a variety of reasons, the organic sector is an ideal place to initiate this work. What is needed just now is a willingness on the part of organic breeders to open their minds to a serious consideration of the possibilities and potentialities of open source arrangements.

Open Sourcing: From Software to Seeds

Issues of commodification, ownership and exclusion of use are not unique to plant breeding. Nowhere have these problematics been more clearly engaged than in the field of software development. 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 IPRs to reinforce their own hegemony by restricting the use of their proprietary software, especially of operating system code. Frustrated by 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 – sought ways to create space in which they could 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, Weber 2004).

Software released under open source arrangements 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 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 open source license. Note that the “viral” effect of such “copyleft” arrangements enforces continued sharing as the program is disseminated. Just as importantly, this form of licensing 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 open source arrangements 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, the best known among the being the operating system 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, derivative iterations 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 Raymond (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. As the Free Software Foundation (2008) 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”. 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.

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, Hope 2008). Efforts have been made to apply open

source and copyleft principles to a variety of bioscience enterprises. By far the most substantial of such initiatives has been that undertaken by Richard Jefferson (2006) and his colleagues at the non-profit CAMBIA who are integrating cutting edge biological research with open source licensing arrangements that "support both freedom to operate, and freedom to cooperate" in a "protected commons."

Plant breeding appears to offer some interesting potentials for elaboration of a "Biolinux" approach to open source innovation (Douthwaite 2002, Srinivas 2002, Aoki 2008). 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 extension of IPRs 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 are themselves capable of bringing useful knowledge and significant material resources to bear. Although its capacity is being rapidly eroded, public plant breeding still 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 (Murphy et al. 2004, Salazar et al. 2007). 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. Could copyleft arrangements create space for the sorts of pro-active research that Lammerts van Beuren has called for? And, further, could copyleft arrangements be used to keep that research and its associated germplasm in the public domain, as Colley and Dillon demand?

The recent appreciation of the potential 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, bean breeder Tom Michaels presented a paper titled "General Public License for Plant Germplasm." 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).

The specific mechanism Michaels goes on to propose is a "General Public License for Plant Germplasm (GPLPG)" that is explicitly modeled on a type of license common to open source arrangements in software. The GPLPG is simple, elegant, and effective. It could 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.

Enacting Open Source: A Role for Organics?

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, 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, 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. 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 (Kimbrell and Mendelson 2005). 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.

Would an open source approach be attractive to farmers and public plant scientists in the global North? On the one hand, these 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 an open source initiative would at least offer 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 may actually be less likely than their peasant 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? 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.

A tactic that might at least partially resolve these threshold and institutional constraints would be to focus efforts on a sub-sector of plant improvement. An obvious candidate for this

approach is the development of cultivars for organic production systems. The organic sector is appealing for several reasons. Because of its small size relative to the overall seed market, organics has not yet attracted substantial interest or investment from the dominant firms of the private sector. This means that the breeders and small companies and independent research institutions working in the area now have a comparative advantage in germplasm improvement and varietal development over conventional industry. It also means that they have been able to maintain a relatively autonomous scientific, commercial, and genetic space which is not immediately subject to appropriation or control by dominant firms. Further, as Edith Lammerts van Bueren notes, the values that motivate and guide participants in the organic sector – farmers, independent breeders, public breeders, seed companies, farmer cooperatives – are not reducible to the financial bottom line and incorporate clear commitments to the public interest, to public service, and to both social and environmental sustainability. A corollary to such attitudes is often active resistance to extensions of corporate power (Jones 2004). A notable feature of the organic breeding sector is also its appreciation of the enormous potential of “bazaar”-style, “distributed peer production” – that is, participatory breeding. With a full complement of farmers, farmer-breeders, plant scientists, private research institutions (e.g., The Land Institute, Michael Fields Agricultural Institute, Organic Seed Alliance), public research institutions, small independent and cooperative seed companies (e.g., Johnny’s Selected Seeds, Fedco Seeds), and information networks (e.g., IFOAM, Organic Seed Alliance), the organic sector offers a complete and established ideological, intellectual, institutional, production and commercial framework within which an effective open source initiative could be plausibly constructed.

Conclusion

Open source offers to organic breeders the same thing that it offered to software hackers: a *protected commons* in which those who are willing to share can share, and from which those who will not share are excluded. Until recently, the organic sector has been of little concern to the Gene Giants. This is going to change. As the market for organic food continues to grow, the market for organic seed – and soon for organically *bred* varieties – is going to grow. The Gene Giants and their many seed subsidiaries will covet the germplasm that has been developed in the fields of organic farmers and the test plots of organic breeders. Unless that germplasm is protected, they will freely appropriate it and turn it to their own purposes and profits. Organic farmers and plant breeders can submit to the IPR regime, or they can join the resistance and go open source.

There is already urgency to protect the organic sector from the predatory activities that plague the conventional sector. In the face of increasing restrictions on their degrees of freedom to access and use seed, application of an open source mechanism such as the GPLPG offers a means for farmers and plant breeders 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. Open source 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. Open source 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. By carving out a space from which companies focusing on proprietary lines are effectively excluded, open source arrangements can create 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.

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