Seeds, Law and Identity: Conserving Biodiversity

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Abstract

This paper examines seeds' role in sustaining civilizations and asserts that the basis for food security is seed saving. It follows the history of wheat and peoples, focusing on personal experience growing landrace "Turkey" Hard Red Winter Wheat. The Turkey Red story of 140 years ago has been called a myth. It is part of a developing business model for future seed savers that encourages diverse and locally saved seed supplies. That model is being threatened by patenting seeds today, which limits the availability of seed and the role of seed savers. The paper documents attempts for the development of a biological open source license. The license would work toward preservation of seeds and an indigenous knowledge base for future generations.

SEEDS

Turkey Red hard red winter wheat growing history

Wheat fields have looked like waves in a small sea in Kansas each spring for nearly 150 years. A hard red winter wheat commonly called Turkey Red formed that picture. It grew on 9.2 million acres in the Kansas in 1919, more than the other 33 states in which it was grown. The wheat grew well in the range of the country's cold regions as well as the hot and dry regions, being winter hardy and drought tolerant. (Ball, Clark and Martin, 1922.) Turkey Red wheat could be the story of any seed with a diverse genetic code; it is worth saving.

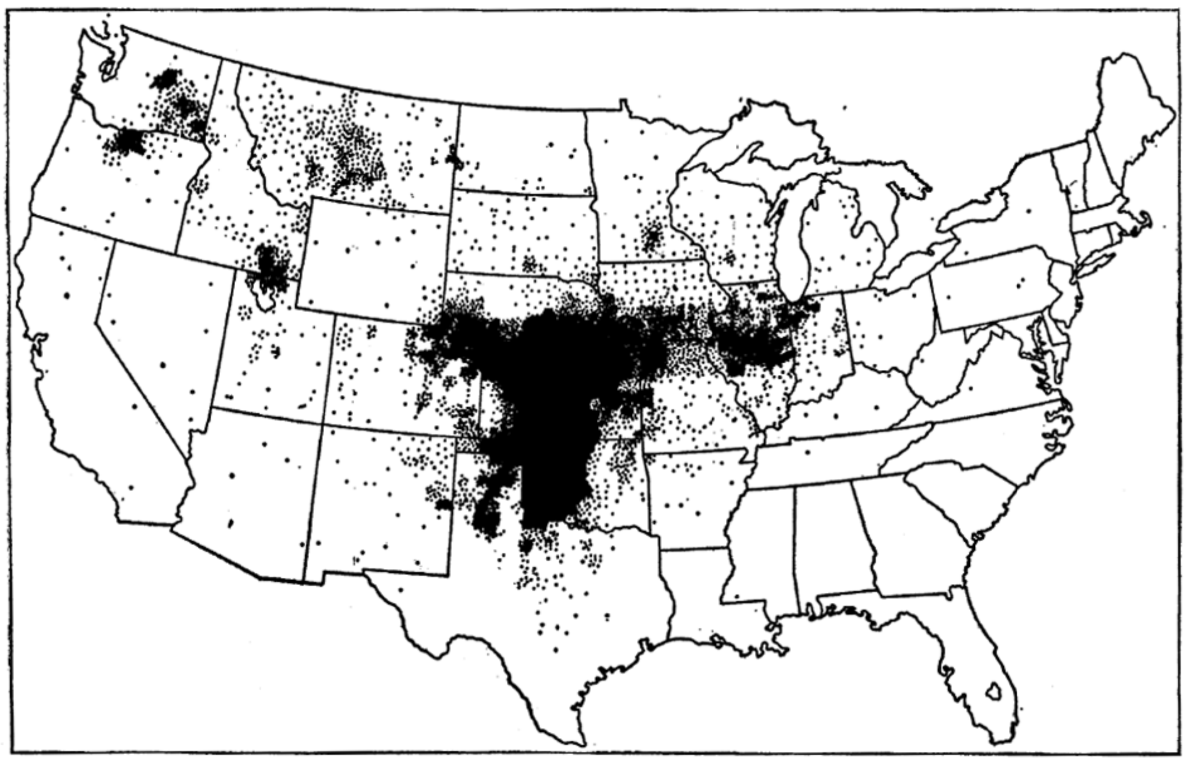

Fig. 57.—Outline map of the United States, showing the distribution of Turkey wheat in 1919. Estimated area, 21,588,300 acres.

Figure 1.*(*Ball, et al., 1922, 145.)

Much has been written about Turkey Red wheat since it was first planted in the United States in 1873. Its origin story has been called a myth (Saul, 1989.) Some of its lost history could have been because Turkey Red wheat is a landrace. Landraceseed can adapt to needs of bioregions when people grow and save it. It can be renamed. Turkey Red wheat gained 28 synonyms in the United States by 1919. The word Red was omitted starting in the early 1900s.

Synonyms

"Alberta Red, Argentine, Bulgarian, Crimean, Defiance, Egyptian, Hard Winter, Hundred-and-One, Hungarian, Improved Turkey, Kharkof, Lost Freight, Malcome, Malakof, Minnesota Red Cross, Minnesota Reliable, Pioneer Turkey, Red Russian, Red Winter, Romanella, Russian, Tauranian, Theiss, Turkey Red, Turkish Red, Ulta, Wisconsin No. 18, Worlds Champion" (Ball et. al., 1922, 146.)

Turkey wheat is part of the patterned story of plants' relationship with people. Domestication of plants and animals occurred worldwide after the melting of the last glacial period, during the Holocene, in the agricultural revolution. Wheat, among other grains, were known to be domesticated in Southwest Asia in the Neolithic age. Common wheat (TriticumAestivum)came from two direct parent plants, Einkorn and Emmer, and an unknown third parent.

Growers built wheat's adaptable genes by saving it yearly. They called Turkey wheat simply winter wheat where it grew in the semi-arid regions of the steppes of Russia, a climate similar to the U.S. Great Plains. Wheat built empires, including in the United States when Russian Mennonites brought Turkey wheat to Kansas in the 1870s (Ball et. al., 1922.) Millers discounted Turkey wheat prior to the 1900s because they weren't well equipped to process it; using stone burr mills at the time. The millers had to change their equipment to roller mills. They persisted with reports that Turkey wheat was higher yielding (Quisenberry and Reitz, 1974.)

The narrative shifted when varieties derived from Turkey wheat were crossed for even better "winter hardiness, disease and insect resistance, earliness, stiffness of straw, yield, and

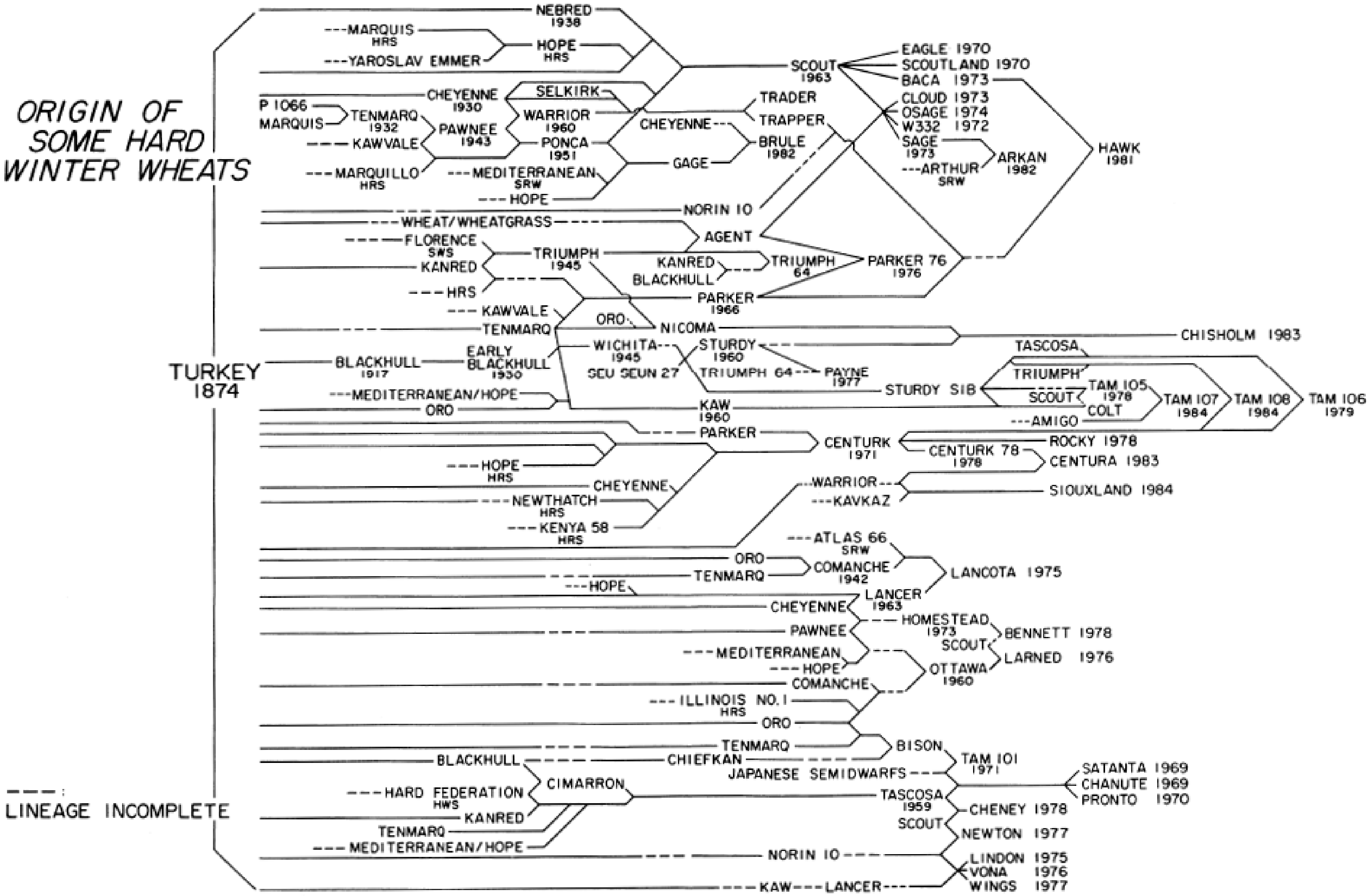

Figure 2. (Cox, T. S., &Shroyer, J. P., 1984, 2.)

quality," as Quisenberry said. The number of Turkey acres grown decreased in just three decades from 99 percent of all hard red winter wheat in the United States to 7 percent (or 3 million acres) by 1949 (Bayles and Clark, 1951.) The Kansas wheat waves got shorter, more uniform after World War II when breeders used semi-dwarf Norin 10 wheat from Japan -- itself a Turkey wheat derivative.Quisenberry concluded, "the legacy of Turkey, a great wheat, continues and will continue for years to come, even though it may no longer be grown on farms in the United States" (Quisenberry and Reitz, 1974, 110.)

The wheat's story continues in two prominent forms. First, it is blamed for a bottleneck of U.S. wheat's genetic diversity resulting in trait problems that Turkey wheat was once said to have improved (United States Department of Agriculture Agricultural Research Service, 1996.) Second, it is praised for qualities people can now appreciate; it's a public domain wheat with a particular nutty flavor, some people with gluten sensitivity have said they can eat it and it has a heritage (Glanville, 2012.)

People need to eat more than wheat to survive. Wheat should be nutrient dense when people do eat it. Modern wheat perhaps has lower levels of micronutrients (Garvin, 2006.) The number of wheat acres, along with other staple crops such as rice and corn, increased worldwide over the past 50 years, while the diversity of those crops' varieties decreased. Loss of diversity leads to entropy, food insecurity (Khoury, Bjorkman, Dempewolf, Ramirez-Villegas, Guarino, Jarvis, Rieseberg and Struik, 2014.)

Some say smallholder growers can specifically focus more on nutrient dense foods, social stability and mitigating climate change (Nierenberg, Ahern and Andrews, 2014.) The United Nations declared 2014 the International Year of Family Farming, highlighting extensive contributions smallholder, family farms make toward food security. These include smallholders and medium scale growers, to peasants, indigenous peoples, traditional communities, fisherfolk, pastoralists and many other groups in any region and biome of the world (Food and Agriculture Organization of the United Nations, 2014.) U.S. family growers often operate hundreds of acres, far outside the common definition that a smallholder is about 5 acres or less (FAO, 2000.)

Some large and small U.S. seed growers see loss of seed diversity in past 100 years as the result of seed companies merging and being acquired and as seeds are increasingly restrictedthrough patenting (Dillon, n.d.) My family's farm in Kansas continues to plant Turkey wheat on about 200 acresa year, or what could have been the "largest planting in decades" in the United States (Buchanan, 2012, 19.) Patenting a trait found in Turkey wheat would limit its availability, proliferation and threatens the conservation effort of seed-saving farms like my family's.

Diverse paths to achieve goals of sustainability

In all of the centuries that domesticated plants and people have coexisted, the most radical changes to that relationship happened during the mid-1900s. The Green Revolution produced hybrids, semi-dwarf wheat, bred for synthetic chemical applications and resultant high yields. The chemical inputs substituted for plant and animal residues that regenerate the soil. Along with fast-tracked genetic changes, the right to own those changes shifted quickly to private hands with the Supreme Court decision of Diamond v. Chakrabarty in 1980.

A second green revolution is planned for 2050 -- about 100 years after the first -- when the United Nations projects the world's population will reach 9 billion. The chant is to feed the world on less land and with fewer resources. The chanters continue that this can be achieved with bioscience; specifically agricultural biotechnology that they say can increase yields faster than traditional breeding and landrace adaptation.

Nearly half of the genetically engineered crops approved for field-testing are patented for herbicide tolerance and insect resistance. Herbicide tolerant crops let farmers spray chemicals and kill weeds, not the crops, while insect resistant crops kill insects after they feed on the crops. Most of the remaining traits are for product quality (such as increased micronutrients,) agronomic properties (like drought tolerance), other resistances (to fungus, for example) and pharmaceutical crops (Fernandez-Cornejo, Wechsler, Livingston & Mitchell, 2013.)

Biodynamic and organic agricultural systems emerged alongside the plant-patenting paradigm. Rudolf Steiner described common farming practices that were being lost with synthetic chemical applications with a series of lectures in Germany in 1924. This became a U.S. environmental movement in the 1960s, expanding into social, economic and scientific research layers as growers struggled to keep in business during the 1980s. Growers developed as professionals by reviewing each other's operations to self-made organic standards that said growers know about their business best. The standards ensured distant customers that products were grown with the environment in mind and helped growers get prices closer to what their costs were (Lee, 2010.)

Those agricultural rules prohibit synthetic pesticides and genetic engineering. Grower discussions surrounding these issues have included concerns such as health, ecology and socio-economics. They cite the precautionary principle, saying there are too many unknowns surrounding genetic engineering to grow them (Heald and Smith, 2006; Antoniou Robinson and Fagan, 2012.)These concerns fit the U.S. legal definition for sustainable agriculture (Title 7 - Agriculture chapter 64 – Agricultural research, extension, and teaching, 2011.) Kansas State University professors showed sustainability's definition changes depending on perspectives as seen in Table 1. Growers in general saw the importance of all three components.

Biodynamic and organic agriculture recognize that biotechnology is incompatible with sustained biodiversity when life is restricted through patenting. The preface "bio" (meaning "life") conflicts with the agricultural biotechnology paradigm when seeds' genetic diversity is lost in monoculture -- growing the same crop and crop variety consecutively. U.S. rotations have varied by region. Major grain crops corn, wheat and soy all are commonly grown consecutively or in rotation, sometimes with a year of fallow, where the ground is left idle. The rotation method was useful to break the cycles of invasive plant species and pests. This has been the prevailing practice for decades, if not the last century.

Table 1: Interacting Components of Sustainability[a]

Levels Influencing Sustainability	**Components of Sustainability**		
	Ecological	**Economic**	**Social/Institutional**
International	Secondary	Secondary	Secondary
National	Secondary	Secondary	Primary
Community	Secondary	Primary	Primary
Farm	Primary	Primary	Primary
Field	Primary	Secondary	Secondary

a. The ‘primary’ cells represent where the component of sustainability is mainly expressed, and the ‘secondary’ cells represent other factors that can influence sustainability.

(*Source:* Freyenberger, Janke, Kok, Norman, &Schurle, n.d.)

Crop rotations are an integral practice in organic and Biodynamic rules. Organic agriculture was codified by the U.S. Congress in the Organic Farm Production Act of 1990 that sought to reduce confusion about what organic meant by making a uniform rule. U.S. farmers had to certify crops to the National Organic Program Final Rule to sell products in the United States as organic starting in 2002. Biodynamic remains a private, international standard. While organic and Biodynamic rules include biodiversity conservation, there is no requirement to use landrace seed stock, where genetic diversity is intact, possibly a result of the loss of crops’ varieties in the past 100 years.

Agricultural biotechnology encourages further loss of diversity through monoculture because of its traits that are marketed to growers under the overall message of increased crop yield. Many growers accepted the use of genetically engineered seed as it was advertised. About 169 million acres, or nearly half of the corn, soybeans and cotton planted in 2013 were genetically engineered (Fernandez-Cornejo et. al., 2014.) The large percent of genetically engineered crops being grown is a grower concern because of the lack of locally adapted seed.

The trend is also for tighter control of seed with a few companies patenting gene traits. Gene-flow control increases as crop diversity decreases. However, the chance for ecological catastrophe increases because of something like plant diseases.

LAW

Three legs of sustainability conflicting on the farm as paradigms converge

The prevailing argument for plant patenting is it keeps companies innovating. Seed companies would continue development of better traits through fresh patents as they bring in license fees for use of the old technology (Heald and Smith, 2006.) Patents limit seed saving with license fees for use and potential for infringement lawsuits if a grower sells a crop without paying.

Growers who sign license agreements are bound by contracts made with the patent-holding companies, but the liability is still a question when it comes to the unintended spread of the technology. An ongoing international example is canola grower Steve Marsh who sued his neighbor in Australia when his crop was “contaminated” by genetically engineered canola. While Marsh has gathered public support, Michael Baxter, his neighbor, appears to have support from Monsanto Company that held the genetically engineered canola seed patent (Bettles, 2014; Australian Associated Press 2014.)

In this case, and others of organic farmers, “the invention confers no benefit; in fact, it imposes a cost” (Heald and Smith, 2006, 29.) Growers lose freedom to sell to their desired market. The Organic Trade Association collected data that some grain buyers rejected loads of crops with more than 0.9 percent presence of genetically engineered crops at an estimated loss of $40 million annually (Food and Water Watch, 2012, 1.)

Presently, anyone can be a seed developer in the United States if they use public domain, unpatented seed. Those who choose not to grow patented seed don’t have a choice when patented seed mixes with their seed. Landrace seed contaminated by patented seed increases as growers save seed yearly. A concerned seed grower can take measures to reduce the risk of gene flow contamination by doing such things as taking land out of production in a buffer strip (isolation distances,) adjusting planting dates and cleaning equipment (Cederholm, 2014.) Neighbors can communicate planting plans, but plans become unmanageable where crops with potential to cross-pollinate are grown by multiple neighbors and with unpredictable weather events.

There is an admitted lack of data on seed gene flow in the United States, but it is a reality. Contaminated seed growers not only lose the irreplaceable seed and ability to sell to desired markets: they could also be sued for patent infringement. Growers, seed businesses and other agricultural organizations preemptively sued Monsanto Company in 2011. Plaintiffs sought a declaratory judgment asking for protection from patent infringement, seed patents invalidity and unenforceability (Organic Seed Growers and Trade Association et al v. Monsanto, 2011.)

The lawsuit went through three years of dismissals, appeals and a petition to the U.S. Supreme Court that denied them certiorari in 2014. The courts weren’t ready to affirm these seed patents were invalid. An ancillary outcome was an estoppel on Monsanto Company, preventing the company from suing a grower in the United States for patent infringement with up to one percent of seed contaminated (Murphy, 2014.)

Any crop can be contaminated, wheat included. Though no wheat is commercially available, an unapproved genetically engineered wheat crop developed by Monsanto Company was found in a by standing field in the United States in May 2013 (Pollack.) Several companies and universities are developing genetically engineered wheat. Bayer CropScience is looking at landrace wheat to broaden the crop's gene pool while they genetically engineer it for desirable traits (Bayer CropScience, n.d.) Those traits could include herbicide resistance, drought tolerance, disease resistance and increased nutrients. Researchers have found that all commercial pasta and bread wheat varieties analyzed so far have a nonfunctional copy of a wheat protein gene that suggests the gene was lost during the domestication of the crop (Uauy, C., Distelfeld, A., Fahima, T., Blechl, A., &Dubcovsky, J., 2006.)

With exceptions such as Bayer CropScience, wheat breeders are engineering with modern "elite" wheat, as Harold Trick, Kansas State University plant pathologist, put it during a lecture in Colby, Kansas, on March 20. He said his university is ready to start field trials. Hesitation is due to a lack of public acceptance. Tolerance levels for contamination from genetically engineered crops would be pursued as genetically engineered varieties such as wheat become commercially available (National Association of Wheat Growers, U.S. Wheat Associates, North American Millers' Association, Independent Bakers Association and Wheat Foods Council, 2009.)

An argument for genetically engineered wheat is that yield increases for crop aren't rising fast enough to be a desirable crop for growers so the wheat sectors would suffer. Kansas still leads with the most wheat acres planted in the United States, but the growers in the state are planting fewer acres overall -- 9,500,000 acres of wheat, which is comparable to 100 years ago. "Kansas, known as the 'Wheat State,' now produces more corn than wheat." (National Association of Wheat Growers et. al., 2009, 2, 3.)

Short-term plan for coexistence

Grower issues with seed gene flow and marketability are an issue of coexistence, according to the USDA. The USDA has directed the dialogue for coexistence with the Advisory Committee on Biotechnology and 21st Century Agriculture. Its charter was examining, "the long-term impacts of biotechnology on the U.S. food and agriculture system and USDA, and providing guidance to USDA on pressing individual issues, identified by the Office of the Secretary, related to the application of biotechnology in agriculture." The AC21 committee wrote in 2005 on three scenarios for the next decade with biotech crops, "Rosy Future," "Continental Islands" and "Biotech Goes Niche." It cautioned that none might actually happen (AC21, 2005, 9-15.) Nearly 10 years later, society is still sorting through the scenarios.

The committee's final report tried to answer who pays for contamination, the polluter or the pollutee by proposing an option for growers to buy insurance for contamination (AC21, 2012.) That proposal has been vocally opposed among growers, as seen in the USDA public comment docket APHIS-2013-0047 that ended March 4. The growers say insurance contributes to long-term contamination. With 2050 as the next scenario, the question is: which paradigm encourages biodiversity?Rather than courts or committees, society will answer it.

Conserving genetics in an open source age: biological open source licenses

Some seed-grower groups are organizing models for future seed licensing. The latest example is the Open Source Seed Initiative. The group promotes sharing among plant breeders and growers, following the lead of open-source software with a biological open source license. It holds a principle to respect "the rights and sovereignty of indigenous communities over their seeds and genetic resources" (Kloppenburg, 2014, 15.)Jack Kloppenburg, co-founder of the initiative, draws on examples working with worldwide groups, such as Navdanya International in India. Navdanya published the Law of Seeds that is a model for community-oriented seed saving and improvement, stressing that growers participate in plant breeding (Buiatti, M., Ceccarelli, S., Dolder, F., Esquinas, J. T., Mammuccini M. G., Magarinos-Rey, B., … Shiva, V., 2013.)

Frank Morton, in the Northwest United States, is an example of a seed grower who has worked with plant breeders and actively seeks ways to keep his plants a common resource. He cites concerns about companies patenting the traits that are found in his and other lettuce, such as the color red. A post on his website said open source licensing for seed "turns out to be extremely complicated, completely untested in the courts, and fraught with real world differences between creative intellect, software code, and new seeds for food crops. To begin with, seeds are alive, and the rest is not" (Wild Garden Seed, 2014.)

Kloppenburg admits his initiative is a working model. It's split between two camps, those who want a completely "free" license with the only restriction being the license can't be restricting in future use, and those who want a "royalty-bearing" license may collect royalties on the commercial sale of the seed, but have no other restrictions. (Kloppenburg, 2014, 2, 16.)

There are many not-for-profit groups that encourage breeding, seed saving, and growing. Projects such as seed libraries are popping up in the United States where people can check out and add seed to collections. Some communities set up seed swaps on National Seed Swap Day, the last Saturday of January. And seed banks capture an image, a small amount of a seed's genes at a specific time in its life. Some attempt to rebuild the knowledge of indigenous plant stewardship with the people on the land now as well as those there before.

The Ta S'inaTokaheya Foundation is a Native American not-for-profit group established in 1989 on the Pine Ridge Indian Reservation. A "key component" of the group has been "the creation of a Native American seed bank to preserve ancient seed species." (Foote, 2012, 237.) A similar group in New Mexico, CuatroPuertas, houses the "largest collection of native and drought-tolerant seeds" in the state. IsauraAndaluz, a co-founder of the group, has been working to save Chile Nativo, the state's native chili, from genetically engineered chili contamination through a united legal effort called the "Save NM Seeds Coalition" (Andaluz, 2012, 228, 232.)

The models are as diverse as there are different seeds. One should understand a seed fully to protect and proliferate it. That understanding comes from growing seed.

IDENTITY

Model conversing Turkey Hard Red Winter Wheat

The following paragraphs expand on a "new business model, a way to develop a brand around genetic conservation," described by author David Buchanan on Turkey wheat. That model engages "producer and chefs with heritage varieties in the field and at the market" (Buchanan, 2012, 20.) It is a first-person account written by Demetria Stephens, who describes growing Turkey wheat to recover diversity as a project manager at Stephens Land and Cattle near Jennings, Kansas.

There's a gap between the needs of growers and consumers that is perpetuated by third parties between them, the international sectors involved in sale of U.S. wheat. Large-scale growers use the other sectors so they can focus on fieldwork. Everyone eats. When sectors have an active discussion of their needs, the consumer can be a blank spot at the end of the line.

Figure 3Sectors that might be involved in a wheat product, adapted from a Wheat Summit document on biotech wheat (National Association of Wheat Growers et. al., 2009.)

I designed the direct-marketing chart in Figure 4 to show how my family's farm has operated in the past two years. Examples below show that a community may have one or more components of a direct-marketing model. It is a work in progress and wouldn't fit every operation. Isolated farms like my family's farm can't easily market directly because of the cost of transportation. People in rural U.S. communities don't necessarily buy directly from farmers any longer. Many of those rural areas are food deserts where supermarkets are beyond 10 miles. Local food networks are slowly rebuilding with help from networking tools online. A local food network includes observing the effect a farm's practices have on the surrounding ecosystem and sharing that information with others.

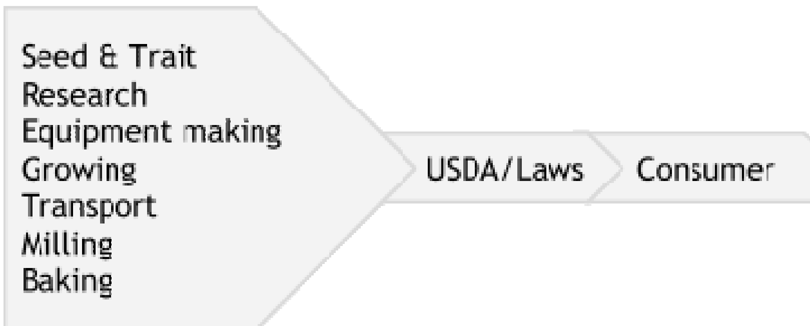

Figure 4. Direct-marketing chart.

Interest in Turkey wheat over 20 years

In the 20 years my family grew Turkey wheat, last year was the first year I can say interest in it was starting to increase. Views on an online listing for my farm, through the website LocalHarvest.org, increased from an average 56 views per month for 2012 to 104 views per month for 2013. A doubling of views in a year might seem small. It is not a paradigm shift. Consider that the views are for a farm in Western Kansas, where the population is now less people per square mile than during the frontier days of westward expansion of settlers.

Turkey wheat was the most popular type of hard red winter wheat in the United States, until 1944 when Tenmarq replaced it (Bayles and Clark, 1951.) Turkey wheat dropped off the map until the mid-1990s, probably 1994, when my father started certifying his fields as organic through the Organic Crop Improvement Association. He spoke with an organic milling business about the best wheat varieties to grow. They gave him a list of wheat good for milling and baking. He planted four for the miller and one more. My grandmother, still living on the farm at the time, wanted to grow Turkey wheat because it was what her father grew. My father spoke with someone in his local OCIA chapter who had a source for seed. Though we don't know the name of the person, we think it was a grower near Yoder, Kansas.

We followed rules for keeping all of the wheat separate, identity preserved during its growing season and harvest. When it was time to sell, the miller said to put all the wheat in the same load. It was $3 per bushel more price than non-organic markets, but the Turkey wheat was not in the market with its identity preserved. We stopped growing the other varieties, but kept growing Turkey wheat that reminded my father of the tall wheat fields he saw as a child and he just liked growing it. For the next 15 years, we continued keeping the wheat separate during its growth, but people in the nearby communities had other priorities for desired traits. We sold it to a nearby grain elevator where the wheat was mixed with every other farmer's crop.

1922 Morphological characteristics of Turkey wheat

"Plant winter habit, midseason, midtall; stem white, slender, weak; Spike awned, fusiform, middense, inclined; glumes glabrous, white, midlong, midwide; shoulders wanting to narrow, oblique; beaks 2 to 8 mm. long; awns 3 to 8 cm. long; kernels dark red, midlong. Hard, ovate to elliptical; germ small; crease narrow to midwide, middeep; cheeks rounded; brush small, midlong. This variety is winter hardy and drought resistant, which accounts for its wide cultivation. The first leaves of the stool are narrow and of a dark-green color. The kernels are usually distinguishable because of their dark-red color and small germ" (Ball et. al., 1922, 144.)

Paramount Seed Farms, a seed company in Kansas, found out we had a source for the seed and asked for some. The company sent a sample to the Kansas Crop Improvement Association in 1996 with a letter back saying it tested with a PAGE Electrophoresis analysis against the Kansas State University Foundation Seed Project sample. The test matched the university sample except two bands were missing, but it was close enough to be called a line of Turkey wheat.

The company pointed to the Turkey wheat as inferior to the modern varieties during a field day my father attended. Turkey wheat continues to be referenced and set aside by breeders. A University of Nebraska-Lincoln stored sample of Turkey wheat was planted in an organic wheat breeding trial in 2011 for one year before it was discontinued. The trial ran 120 winter wheat varieties. Richard Little, the wheat breeder presented an update on the trials in Ogallala, Nebraska, December 2013. He said one reason Turkey wheat was discontinued in this trial was the coleoptiles that aid with reaching moisture in the ground were short compared to other varieties. He said he was breeding to help growers' transition to organic, assuming they get a "yield drag" because they can't use high-nitrogen fertilizers.

Little did say bakers like the Turkey wheat for its flavor, possibly referring to the well-known bread baker Thom Leonard who suggested Turkey wheat should be used in the trial. Much of the renewed interest in Turkey wheat came from Leonard. He got Turkey wheat listed in 2009 in the Slow Food USA Ark of Taste, for seed to save. He worked with my farm, other potential growers, an organic miller and an organic marketer to get Turkey wheat ready to bake at WheatFields, a brick oven bakery he built in Lawrence, Kansas.

Leonard wanted to develop a Turkey wheat seed that would follow "certified seed." Such rules are for seed purity and high germination primarily, but can be linked with presence of seed-borne disease, vigor of the seed and seed size. Kansas, Nebraska and Iowa have been particularly suited for growing winter wheat seed (Dondlinger, 1908.) The certified Turkey wheat never developed, possibly because certified seed requires Distinctiveness, Uniformity and Stability. Landrace seed is always changing. Turkey wheat would cease to be a landrace if you select seed for something like uniformity. We lost contact with Leonard, though some of other growers continued to grow and sell a strain of Turkey wheat for milling from a different source than what is grown on my family's farm.

Figure 5.Turkey wheat harvested in Western Kansas in 2012. Photo taken in 2014.

Direct-marketing qualities

Interest started to pick up in a more direct form starting in 2012. More than 30 from individuals in 14 states contacted me about getting Turkey wheat since then. They were growers, millers, bakers and eaters who found likeable qualities of the wheat mentioned in the first part of this paper; its flavor, itsheritage, it is in the public domain and it could be eaten by people who have mild gluten sensitivities.

Some of those who inquired about the wheat didn't care about the price or distance. I shipped wheat as far as Oregon and people drove as far as from Wisconsin and Texas to pick it up. They were all talking about this wheat and trying to figure out how to get it to the people who wanted to eat it. One baker in Texas said it had a nutty flavor. One in Kansas said it had a rich aroma while she milled at home and she liked that it made a dense loaf. Another in Wisconsin found its consistency worked well for sourdough bread. Some bakers had difficulty finding someone to grow it in their area.

People with gluten sensitivities, digestive reactions, encouraged the bakers to source the seed. Gluten is a prime part of wheat kernels. Some of the people interested in Turkey wheat who were concerned about gluten cited the book "Wheat Belly" whose author Davis said modern dwarf wheat was the cause of many ailments, especially gluten sensitivities (2011.) This claim has been widely disputed (Cox 2014.) Some who work with Sonora wheat said, rather than gluten, the milling process causes a reaction, where wheat is refined and the bran is sifted out (Spiller, 2014.) Rather than stop eating wheat entirely, the people who contacted me decided to source older kinds of wheat. Older wheat could be Sonora, Red Fife, Emmer, Einkorn and others. Davis said older wheat could be an alternative for those with gluten sensitivity (2011.)

Nutritional qualities are one of many potential research projects on older wheat. Wheat breeder Richard Little said in his 2013 presentation that Turkey wheat and older varieties had vomitoxin (or Deoxynivalenol, a plant pathogen) levels at zero parts per million. The other, modern wheat had at least point six parts-per-million vomitoxin.

With the exception of nutrition, the direct-marketing qualities fit the factors driving Turkey wheat's recovery as described in a 2013 Slow Food USA document. The factors were:

- A link to recovery of local identity, culture and community
- Recovering from climate catastrophes, adapting to change
- Providing taste/options to GMOs or industrial processed foods
- Focus on artisanal processing, jobs in local economies

(Nabhan, ed., 2013, 17.)

Heritage as factor of seed recovery

Some wanted the wheat to connect to their roots as Mennonite immigrants. One man in Oklahoma said his family brought some Turkey wheat from Russia in a trunk. His family now plants thousands of acres of modern wheat and he wanted to plant a few Turkey wheat acres in his yard for his sons. Having a cultural connection is part of the bigger picture of genetic conservation, not just of seed, but also of heritage.

Ethnic settlements in the interior grasslands of North America have exhibited various cultural practices for agricultural livelihoods carried in their migrations. One group migrating from overseas assessed the land and environment in their considerations of location to farm and raise families, build communities. These people known in the Hays, Kansas, resettled from Germany for a few generations from along the Volga River, in the Russian steppe region.

The Volga Germans sent representatives to bring back soil from their destination in advance of their decision to move (Kloberdanz, 1980.) This concern and assessment, although not precisely defined as indigenous, does express a knowledge-based system of how they survived and thrived in relation to land and seed. Indigenous means of, or belonging to the land.The migrant populations who brought the Turkey wheat into the region were not ethnic Volga Germans, but tied with Mennonite ancestry in Germany. Wheat was not a native seed to Kansas, but it was similar region to the area in Crimea where wheat was grown; both were breadbaskets.

My own heritage is not Volga German or Mennonite, but follows the pattern of German farm settlements in Kansas. My paternal family came from the Alsace-Lorraine area of Germany and France. I look to Rudolf Steiner's Biodynamic practices as part of the new model for seed saving because it is a system built from the knowledge of growers in my family's area of origin. While Steiner was Austrian, German growers continue to lead with the most certified Biodynamic operations, 1,431 in 2013. There are still few farms certified in the United States, 111 (Demeter International Statistics, 2014.)

Public domain status aiding seed proliferation

Public domain seed, let alone Biodynamic seed is scarce. Turkey wheat was slow to become a leading U.S. wheat type in the last century partly because of the lack of seed available (Quisenberry and Reitz, 1974.) This is true today, too. Demand is outpacing supply for us. For a full year in 2012, my farm fell into the highest category of drought, "exceptional." The drought damaged the wheat crop and persists in the extreme category three years later.

Some people contacted me for the wheat because it was in the public domain, meaning you can save it, replant it, adapt it to your area and sell it without penalty of paying royalties on sales. The only external influence is public domain and other agricultural seeds have government regulations over a growers' operation. In the case of my farm, U.S. law requires labeling information when seed is sold off farm.

There is no organized effort to conserve large quantities of landrace grain seed, but there is a great need. Seed banks sent some people Turkey wheat. They grow that seed and sell it in more small quantities, for a lot of money. Some people told me they were concerned that making seed available -- free or at low prices and large quantities, encouraging people to grow it, save it themselves for their communities -- could put my family's farm out of business. The model would be a success then, because the seed would live on. One farm shouldn't grow the only supply of Turkey wheat because the chance of consecutive years of crop failures making the seed extinct.

Landrace Turkey Hard Red Winter Wheat is one of many seeds that should be conserved. Just as peoples' diets require more than just the staple crops, a grower's life can't depend on growing only wheat (Khoury et. al., 2014.) Einkorn, barley, oats, grain and forage sorghum are among many seeds with potential in the Great Plains. Sharing seed and seeds' stories increases its physical and intellectual diversity, its ability to survive and encourages communities to thrive.

Figure 6.Map of Turkey wheat seed sent to states in 2012 to 2014. Numbers are individuals who received more than 10 pounds of seed.

"Conserving seed is conserving biodiversity, conserving knowledge of the seed and its utilization, conserving culture, conserving sustainability" (Lockhart, C. Shiva, V., &Shroff, R, 2012, 9.)

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