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Author: Fowler, Cary

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The Svalbard Seed Vault and Crop Security

CARY FOWLER

It could easily provide the backdrop for a James Bond movie. Deep inside a mountain near the North Pole, down a fortified tunnel, and behind air-locked doors in a vault frozen to –18 degrees Celsius, scientists are squirreling away millions of seed samples. The samples constitute the very foundation of agriculture, the biological diversity needed so the world's major food crops can adapt to the next pest or disease, or to climate change.

It's little wonder that the Svalbard Global Seed Vault has captured the public's imagination more than almost any agricultural topic in recent years. Popular press reports about the "Doomsday Vault," however, typically mask the complexity of the endeavor and, if anything, underestimate its practical utility.

What is really going on? Despite the gathering together of so many seeds in Svalbard, no legal basis existed for the sharing of crop diversity until as recently as 2001, when the International Treaty on Plant Genetic Resources for Food and Agriculture was adopted. International agricultural research centers, as well as some countries, have traditionally been willing to give samples from their collections to others. Yet over the past 20 years, many countries have closed their borders to outgoing samples for fear of "biopiracy," the idea that a recipient might acquire intellectual property rights through such a sample and reap undeserved benefits. Consequently, some of the world's most important gene banks, holding tens of thousands of unique varieties, have not provided a single sample to a foreigner in years, even though gene banks are highly dependent on crops and crop diversity that originate elsewhere.

The jealous guarding of such collections has rarely been matched by funding adequate for their conservation. National gene banks have languished, and the biological diversity in their care has deteriorated or even been lost. Collections became victim to anemic budgets and a reluctance to allow genetic resources out of their native country, even if only for safety duplication. Accidents, mismanagement, equipment failures, wars, and natural disasters have also taken a toll.

This depressing background explains why a "Plan B" was desperately needed, yet almost impossible to imagine. This is where Svalbard and the idea of a global insurance policy entered the picture.

Self-funded national projects typically serve national self-interest, and international support is hard to generate when countries act solely in self-interest. The idea of having a secure global backup system for hundreds of individual gene banks makes sense, but it is fundable only if the gene banks agree to cooperate and to address more than their immediate national concerns: that is, they must agree to a common standard of access and benefit sharing. The international treaty provided this standard, making it possible to think of constructing a communal safety net for all crop diversity held in gene banks. Even so, the scientific, organizational, legal, and political hurdles remained high.

The Svalbard initiative thus took on the challenge of attracting biological diversity and managing it properly and cost-efficiently, while sidestepping political and property-rights issues. The latter could be accomplished only if deposits of seeds in Svalbard did not involve the transfer of legal ownership. Organizers opted for a "black box" arrangement wherein a "deposit agreement" would be concluded between the depositing gene bank and the Norwegian government. The agreement would recognize that legal ownership remained vested in the depositor, in much the same way that a bank recognizes that a customer owns the contents of a safety deposit box held by the bank.

Resolution of the ownership question paved the way for development of a realistic management plan. The seed vault would store deposited materials, but it would not be responsible for monitoring their viability—opening boxes to do so would undermine depositors' confidence that their material was legally inviolate. Moreover, the vault would not be responsible for regenerating materials when germination rates dipped, a procedure best carried out by the depositor under conditions similar to those where the sample was originally collected. Rather, when gene banks regenerate their own stocks, they will simply resupply the vault with fresh seed at the same time. The ideal storage conditions in Svalbard mean that samples there will not need to be regenerated more often than they will be in the gene bank that supplies the samples.

Moreover, a sample can be retrieved only by the gene bank that deposited it, and only when it has been lost by that gene bank (and by any other gene bank that might be holding an additional copy). Svalbard will thus function as a seed supplier of last resort, unlike typical gene banks, which supply users directly. The Svalbard vault is not, however, a "time capsule," as sometimes portrayed in the press. Seeds will move in and out as the need arises.

This minimalist approach to management promises to keep the costs of

Cary Fowler (e-mail: cary.fowler@croptrust.org) is executive director of the Global Crop Diversity Trust in Rome. *© 2008 American Institute of Biological Sciences.*

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operations low enough to ensure the sustainability of funding even with only a modest endowment fund. The Global Crop Diversity Trust is assembling an endowment to underwrite a complete global system with Svalbard as its linchpin, and the maintenance costs of the Svalbard vault will be guaranteed by the Trust.

Although a management plan can never seize the imagination in the way the vault itself does, that plan is what makes the whole notion, and the remarkable physical structure, a durable institution. In an affirmation of the combination of structure and plan, the Commission on Genetic Resources of the Food and Agriculture Organization of the United Nations has welcomed the initiative, and virtually all major gene banks have indicated their intention to use the facility. Indeed, it will open with samples from all the main international gene banks, and with seeds originating from some 170 countries.

The physical facility is fit for a movie. Three vault rooms lie at the end of a 125-meter tunnel, deep within the permafrost that naturally keeps the temperature year-round between –3 and –5 degrees Celsius. At this temperature, even without the benefit of mechanical cooling (supplied by a local power plant fueled by locally mined coal), the seeds of most species would be safe for decades. With only permafrost cooling, the Nordic countries have successfully held a backup copy of their seed collection in an abandoned coal mine in Svalbard since 1984.

Global warming will certainly diminish the utility of the permafrost cooling at the new seed-vault site, though the seeds will be stored so deep in the mountain that permafrost should persist there for some 200 years even in a worst-case climate-change scenario. The site is also situated so high above sea level that even if all the glaciers and ice caps melted, the water would not rise to its doors.

Finally, the location itself—outside the Norwegian village of Longyearbyen in Svalbard at 78 degrees north—means that the facility is both remote and accessible, the two factors that must be balanced to achieve safety and functionality. No place in the world offers such a good combination, together with political stability, an excellent infrastructure, and a local energy source.

The Svalbard Global Seed Vault, conceived as protection against the loss of diversity that takes place routinely across the world, is an insurance policy for a global system that doesn't quite exist yet. If the past is any indication, dramatic events such as natural disasters, war, and civil strife will take their toll, triggering repatriation of samples from Svalbard. But the most serious problem facing gene bank collections is the steady, unseen attrition attributable to poor management and even poorer funding. Svalbard will provide the means to avoid that.

No single facility can promise a complete, fail-safe solution for all threats to crop diversity—such guarantees are unavailable in this world. However, the Svalbard Global Seed Vault is a key component of the global system. It is the best solution we can devise at this time. Moreover, it is a demonstration of what can be accomplished when countries work cooperatively toward a positive and concrete goal.

We have a common, but still unmet, responsibility to conserve and share crop diversity. Fulfilling that responsibility will not necessarily ensure that our agricultural systems will be able to provide food security for a growing world population or to cope with climate change, but without crop diversity, meeting either of those goals is inconceivable.

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