

The index seminum-process and evolution at the UBC Botanical Garden

An Internet search for the popular phrases “global warming” and “climate change” led me to more than 175,000,000 pages of information. Searches for “biodiversity” and “seed list” uncovered 27 and 23 million respectively, but “index seminum” produced a mere 122,000 citations. The University of British Columbia Botanical Garden has published an index seminum for almost seventy years and has gained a great deal by participating in this international activity.

Index seminum translates as ‘seed list’ and is also known as *delectus seminum*, or seed selection. It is often referred to simply as a seed exchange. Its Latin name provides a clue to its origins, probably from the days of the medieval cloister or monastery gardens tended by monks for contemplation, sustenance and sharing with others of meager means. Today many botanical gardens, in their role as repositories of floral diversity, mandate the publication of an index seminum. These indexes, which are produced by hundreds of botanical institutions, are a crucial tool for sharing and preserving the unique genetic properties of rare and endangered species that may be otherwise difficult to obtain. Their annual or biennial publication and international reach provide access to germplasm of high quality plant collections while fostering free exchange between institutions and individual researchers with similar goals. These may include conservation of rare taxa within or outside of seed banks, but also imply the management of plants for uses such as seed production and taxonomic, genomic, medicinal and other types of research. The objectives in many cases are the simple cultivation and display of familiar, new or unusual plants for the edification of the always curious garden visitor.

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Photo: Eric La Fontaine

Figure 1. UBCBG's first formal index seminum was published in 1939. Design has changed over time, but the mission is the same.

THE PROCESS

Early records are inconclusive, but UBCBG's formal index seminum began in 1939. (Figure 1) The founding Garden Director, John Davidson, certainly issued indexes and there are reliable reports of earlier publications by staff of the university's Physical Plant department, including one written by 'a man who used to live in the woods'. From the limited information available, it appears that the first index listed many seeds collected from wild BC plants and a few of the Botanical Garden's taxa of horticultural origin. It is not clear whether the listed native plant seeds were wild collected or already a part of the garden's established plantings. As the collections gradually matured, more of each publication was devoted to garden harvested seed. By the early 1970s collector names and corresponding numbers for wild source collections had been added, as well as an accompanying map of the Pacific Northwest region for reference. The 1979 index is still the largest, containing 379 wild collections of BC native plants. The collecting priorities for UBCBG's index have always been the responsibility of the individual who wrote and circulated the index. The taxa chosen for inclusion are currently based upon staff knowledge and experience with native and exotic plant material. For example, a part of the 2005 index was devoted to the genus *Sorbus*, including several species being grown in the David C. Lam Asian Garden. The 2007 Index Seminum (to be published in December 2007) will include material collected during a summer expedition through the US Intermountain region. Each index offered, and continues to offer, unique combinations of trees, shrubs, herbaceous perennials and annuals, limited material from rare ecological sites, and even isolated endemics. Other institutions' indexes sometimes include a variety of propagules such as bulbs, bulbils, corms, and even leaves, as in some succulents. However, UBCBG's index focuses exclusively on seed and pteridophyte spores. (Figure 2)

As each growing season progresses, plants in the garden are monitored and seeds are gathered from our collections and from natural sites. At UBCBG this involves staff and volunteers from the Friends of the Garden (FOGs). The FOGs assist garden management by collecting seed of accessioned plants throughout the garden and processing



Photo: Brent Hine

Figure 2. Spores are collected from *Pellaea quadrifida* for the index seminum.

seed from expeditions as well as from special collections. Several of the garden's horticulturists also assist the seed exchange coordinator in collecting and processing targeted seed from the garden or from field excursions. (Figure 3, Back Cover)

Major developments in information gathering have resulted in a new set of indispensable tools for field work including a digital camera, GPS unit and a laptop computer, which is typically preloaded with topographical maps of the collecting area. Photographic images of habitats, individual plants and high resolution close-ups of vegetative parts are particularly useful in clarifying uncertain field identifications. Backup in a storage database gives the botanical garden a permanent, comprehensive record of field collections. The GPS unit has become a standard navigating tool and provides instant access to geographical coordinates and altitude positioning. The portable laptop computer allows on-site location and documentation. All seed locations can be recorded and saved for straightforward future access and delivered to a central data repository. The recorded data increasingly provides enough useful information for others to cultivate the plant and to locate the original

population for comparison and potential future collections. Information on rare and endangered species is protected to ensure that only authorized users have access. The data set typically comprises collection date, location, habitat, plant associations, geographical coordinates and elevation as well as any site-specific observations and the collector's identity. Further information can be obtained directly from the collector.

After all collection documentation has been collated and field identifications have been confirmed, seed is dried at room temperature and cleaned. (Figure 4) Drying seeds at room temperature serves two useful purposes. First, evaporation of excess moisture within and around harvested seed reduces the spread of pathogens. Second, as humidity drops, chemical signals triggered within the seed initiate dormancy in many species. After drying for at least two weeks the seeds are cleaned of chaff and stored at 2-5°C (34-40°F) at approximately 30% humidity. Seeds with fleshy coats are first soaked in water until their flesh deteriorates to allow removal before drying. The occasional animal seed pest rarely survives initial scrutiny, cleaning and prolonged refrigeration.



Photo: Brent Hine

Figure 4. Friends of the Garden clean and prepare seeds.

While the methods employed at UBCBG do not involve complicated technology, they greatly improve seed viability prior to distribution. The seeds of many genera may be viable for several years (a few even multi-century), while others must be sown soon after collection. There are a few recalcitrant genera that have defied all attempts at long term refrigerated storage, including *Quercus* acorns and *Salix* and *Populus* seeds. These are examples of material that must be sown as soon as harvested ripe from the plant. For this reason they are seldom offered in seed exchanges. The UBCBG seed exchange closes in mid-Spring, allowing those receiving seed to sow for early germination in the following growing season.

Internet and email resources are increasingly the media of choice for seed exchange publication. The UBCBG document is posted on its web site (<http://www.ubcbotanicalgarden.org/community/002397.php>) and sent by email to those institutions on our recipient list. Requests are acknowledged promptly via email, greatly expediting the process, as well as contributing significant cost savings. This year's index is our first to eliminate publishing a printed version in favour of the electronic format. Requests for seeds are dealt with on a first-come first-served basis until supplies are exhausted.

ETHICS

When choosing seed for inclusion in an index, general guidelines show that 'what not to collect' is as important as what is purposefully offered. Control of the spread of noxious weeds is an important ethical concern for all collectors and for those who distribute seed. In many regions of the world there are species that have become weed pests as a result of exotic plant introductions that escaped from cultivation. They become established when they are spread, often inadvertently, by human activities, birds and other animals, or natural forces. The western coast of North America from southern coastal Alaska to northern California has enough climatic similarity to western Europe and parts of the Mediterranean Basin that species-transfer has led to emergence of several

noxious weeds. Plants with a potential for invasiveness are monitored more closely than others. *Cytisus scoparius* (Scotch broom), a shrub in the Fabaceae, has become a notorious invasive in many temperate regions of the world. Its pestiferous characteristics are drought tolerance, massive seed production and deep tap roots, all of which allow rapid spread and make eradication difficult. These types of plants, which may already be in cultivation or that are suspected or already listed as invasive elsewhere, are strictly prohibited from inclusion on the seed exchange lists.

Collections staff must obey local regulations when they collect on public lands and restricted lands designated for public trust, at home or in foreign countries. Relevant government agencies require notification before collecting permits will be issued. There are also specific guidelines for seed collection from wild populations. For example, no more than 50% of available seed may be harvested from a healthy population, and no more than 10% from a rare plant population. The definition of 'rare' in a population may vary with species and population, so collectors must understand as much about target species as possible, as well as undertaking a general site specific population survey before collection begins.

The Convention on Biological Diversity (CBD) provides clear ethical and conduct considerations for seed collection. UBCBG has adhered strictly to these principles since this multi-national declaration was ratified in 1992. Each signatory to the CBD is committed to conserve and protect the diversity of life on Earth. If and when plant material exchanges occur, they do so freely but with explicit respect and remuneration to the country of origin. As it is part of a signatory nation, UBCBG seeks to adhere to the spirit and letter of the Convention. Ethically sound seed collection practices are an obligation for all institutions. Before distributing seed, we require index participants to sign a form which declares they will abide by the spirit and letter of the CBD. The UBCBG web page states:

What is UBC Botanical Garden and Centre for Plant Research's Code of Conduct in Relation to the Convention on Biological Diversity?

UBC Botanical Garden and Centre for Plant Research intends to act within the letter and spirit of the Convention by:

- obtaining only material that has been legally collected, with transparent documentation
- maintaining transparent and accurate documentation of plants in the collections
- carefully maintaining living collections for conservation and education
- distributing material only to those institutions and individuals which agree (by signing a materials transfer agreement) to act within the spirit and letter of the CBD
- working in benefit-sharing partnerships with institutions in other countries to further common goals of the conservation of biological natural resources

The service of creating and offering an index seminum is typically provided as a free exchange between botanical institutions with allied goals. Some native plant seed societies offer wild origin seed on a cost recovery fee basis. This usually amounts to no more than postage. Other online services now provided by private commercial enterprises offer garden collected seeds (i.e. horticultural origin) for sale within an “index seminum” or “index rarium”. While these services appeal to a prospective buyer’s sense of what is new and unique, it borrows the term for use in making profit; yet the transaction is different from that between botanical institutions. The original botanical index was and remains an exclusive one, intended solely for gratis professional exchange. If a private individual wishes to obtain seed from UBCBG’s index but he or she is unknown to us, no transaction can take place, although there can be an exception if the inquirer is an amateur collector of known repute and is seeking to improve a private plant collection. In the not-for-profit, or botanical garden model of exchange, the institution publishing an index increases its standing and reputation among peers while gaining valuable germplasm with which to help meet the goals of its mission statement.

Each botanical garden has some unique goals. At UBCBG we are committed to excellence in research, education and community. In

the E.H. Lohbrunner Alpine Garden there is a collection of the genus *Hebe*. This genus contains about 90 species and is important to us in part because of our local climatic similarity to parts of New Zealand. The fact that the genus is almost entirely endemic to that country makes it an appealing subject for research and education. By collecting and offering seed (some of which originated from indexes), others may gain access to comparatively rare material.

Other material may be offered very occasionally. This year a single plant of *Saxifraga taylori* was received at UBCBG from a wild origin collection. The plant is endemic to extreme northwestern Vancouver Island and Haida Gwaii (Queen Charlotte Islands archipelago). If all goes well there may be an opportunity to offer one of BC's unique native plants in a future index.

Seed exchange work is unquestionably useful, rewarding and worthwhile when done in a cost-effective, efficient and responsible manner. Certainly UBCBG has gained tangible lasting benefits from its long-time participation in this international program.

