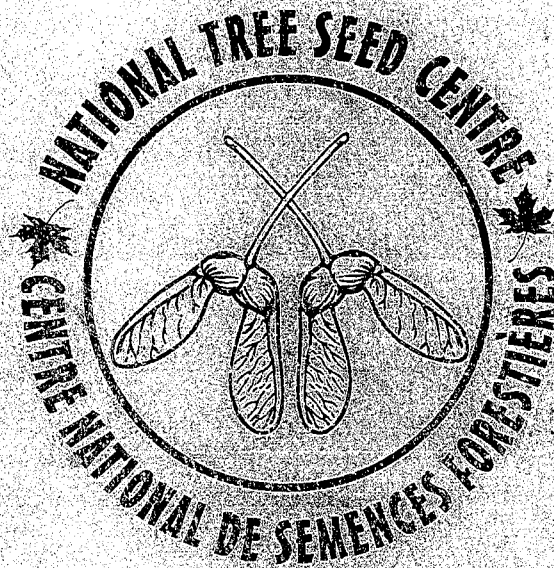


National Tree Seed Centre

Annual Report

1998



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## Introduction

The National Tree Seed Centre (NTSC) was established in 1967 at the Petawawa National Forestry Institute in Ontario. It was transferred to the Atlantic Forestry Centre in Fredericton, New Brunswick in 1996. The mandate of the NTSC is to obtain, store, and provide seed of known origin for forest research and gene conservation.

The NTSC currently has seed stored in four different categories: Seed Bank, Reserved, Tree Breeding, and Provenance Tests (Table 1).

Table 1. Seed stored at the National Tree Seed Centre (as of Aug 3, 1999).

Category	Number Species	Number Seedlots
Seed Bank	212	3079
Reserved	36	1709
Tree Breeding	34	4452
Provenance Tests	3	1362

The Seed Bank seedlots are defined as being those that are available for distribution. One of the objectives of the NTSC is to obtain seed samples of Canadian tree and shrub species from across their natural ranges. As of August 3, 1999 the NTSC Seed Bank had 121 different Canadian species (2635 seedlots) in storage. An additional 112 exotic species (444 seedlots) is also stored. Some overlap exists as certain species have been collected in Canada as well as in other countries. With the mandate of the Centre now concentrating on Canadian trees and shrubs, the percentage of exotics may decrease although some opportunistic acquisitions will still be made. The bulk of Canadian collections is from Ontario (Table 2). This is primarily due to approximately 700 seedlots from single-tree collections of Ottawa Valley white spruce. Since moving to Fredericton, staff at the NTSC have concentrated their efforts in acquiring collections from New Brunswick, Nova Scotia, and Prince Edward Island. In future years, an effort will be required to collect or acquire seed from more distant locations. There is an ongoing effort to acquire seed from other provinces and Seed Centres whenever the opportunity presents itself.

The Reserved category contains seedlots that have been reserved by researchers. Many of these seedlots were collected by the researchers for special projects. The main users of this service are researchers at CFS Atlantic. (1262 of the 1709 seedlots). Other notable users are Mr. Ben Wang (130 seedlots) and Dr. Kristyna Klimaszweska (41 seedlots). There are 205 seedlots that are reserved with no indication of who they are reserved for. The remaining reserved seedlots are as follows: Burgess (42), Hurley (16), Mittal (7), OMNR (1), Rutledge (1), and Wetzal (2). Some clean-up of this category is necessary but is a low priority at this time.

Table 2. Number of species and number of seedlots by province contained in the Seed Bank.

Province	# Species	# Seedlots	%
Alberta	13	54	2.2
British Columbia	27	287	10.9
Manitoba	1	4	0.2
New Brunswick	50	387	14.7
Newfoundland	11	80	3.0
Nova Scotia	24	175	6.6
Ontario	66	1370	52.0
Prince Edward Island	25	63	2.4
Quebec	12	141	5.4
Saskatchewan	9	27	1.0
Yukon Territory	2	43	1.6

The Tree Breeding category contains the largest number of seedlots. These originated from geneticists at PNFI and were transferred to the Seed Centre for storage. Many of these have been stored in sub-optimal conditions for many years. This seed is of questionable quality and must be tested before being stored at  $-20^{\circ}\text{C}$  as tree breeding material or moved to the Seed Bank. Most of the material tested (62%) was discarded following testing due to low germination results. Also discarded were seedlots containing very small quantities. Table 3 shows the tree breeding material that was tested in 1998.

The Provenance Test category is composed mainly of white spruce seedlots from the range-wide white spruce provenance tests established in cooperation with PNFI in the early 1980s. Most of these are 5 or 10 gram quantities contained in sealed plastic packets that have been placed in larger jars. Most of these seedlots are also found in the Seed Bank category. A sample of these seedlots was tested and the seed found to be of extremely good quality when compared to their counterparts in the Seed Bank. These seedlots should be kept as is and perhaps transferred to the gene conservation category when this is developed.

Another priority of the Centre is to periodically test the material in storage. This is an ongoing process. One of the limiting factors is germinator availability. The NTSC has access to three germinators. These are kept full most of the time. Freshly collected material is not tested for germination immediately. It is cleaned, dried to acceptable moisture content, and the 1000 seed-weights determined. It is then stored for several months before germination testing is done. This practice has provided better results in some cases than testing of fresh seed. It also subjects the seedlot to frozen conditions and any loss of seed vigour that may occur because of this is therefore accounted for.

Table 3. Tree Breeding seedlots tested in 1998.

Species	# Seedlots Tested	# Discarded	Good Seedlots Stored at -20°C
<i>Larix decidua</i>	45	15	30
<i>Larix decidua</i> var. <i>sudetica</i>	6	3	3
<i>Larix eurolepis</i>	9	6	3
<i>Larix laricina</i>	3	0	3
<i>Larix kempferi</i>	7	6	1
<i>Larix siberica</i>	47	0	47
<i>Picea abies</i>	113	59	54
<i>Picea glauca</i>	206	183	23
TOTAL	436	272	164

## Collections in 1998

The hot, dry summer of 1997 resulted in an abundance of seed from most species in 1998. Staff at the NTSC were kept busy from June through October with seed collections. In all, 284 collections were made from 47 species. Most of the collections were from New Brunswick (232) with 24 collections coming from Nova Scotia and 27 from Prince Edward Island. Table 4 provides a summary of the collections made during 1998. Many of these collections were bulk collections which involved collecting from 30 to 40 trees. One collection was made in Ontario. Methods used to collect seed ranged from picking seed directly from the tree or shrub, using the bucket truck, climbing, pole pruners, and collecting from the ground. Several new collections were added in 1998. These included *Cephalanthus occidentalis*, *Betula cerulea*, *Salix discolor*, *Salix bebbiana*, *Acer spicatum*, and *Corylus cornuta*.

Table 4. Collections made by Seed Centre staff in 1998.

Species	N.B.	N.S.	P.E.I.	ON	Total
<i>Abies balsamea</i>	15	2	2	0	19
<i>Acer pensylvanicum</i>	6	0	2	0	8
<i>Acer rubrum</i>	9	3	1	0	13
<i>Acer saccharum</i>	5	1	0	0	6
<i>Acer spicatum</i>	2	0	0	0	2
<i>Alnus rugosa</i>	1	0	0	0	1
<i>Alnus crispa</i>	4	0	0	0	4
<i>Amelanchier</i>	1	0	0	0	1
<i>Betula alleghaniensis</i>	11	1	1	0	13
<i>Betula papyrifera</i>	13	2	2	0	17
<i>Betula populifolia</i>	6	2	2	0	10
<i>Betula x caerulea</i>	1	0	0	0	1
<i>Cephalanthus occidentalis</i>	1	0	0	0	1
<i>Corylus cornuta</i>	1	0	0	0	1
<i>Fagus grandifolia</i>	8	0	1	0	9
<i>Fraxinus americana</i>	16	1	1	0	18
<i>Fraxinus pennsylvanica</i> var. <i>austini</i>	1	0	0	0	1
<i>Hamamelis virginiana</i>	2	0	0	0	2
<i>Ilex verticillata</i>	2	0	1	0	3
<i>Juglans cinerea</i>	1	0	0	0	1
<i>Juniperus virginiana</i>	0	0	0	1	1
<i>Larix laricina</i>	4	0	0	0	4
<i>Nemopanthus mucronatus</i>	1	0	1	0	2
<i>Ostrya virginiana</i>	6	1	0	0	7
<i>Picea glauca</i>	7	2	2	0	11
<i>Picea mariana</i>	2	2	1	0	5
<i>Picea rubens</i>	10	2	6	0	18
<i>Pinus banksiana</i>	3	0	0	0	3
<i>Pinus resinosa</i>	1	0	0	0	1
<i>Pinus strobus</i>	4	0	0	0	4
<i>Populus balsamefera</i>	1	0	0	0	1
<i>Populus grandidentata</i>	1	0	0	0	1
<i>Populus tremuloides</i>	1	0	0	0	1
<i>Prunus pensylvanica</i>	3	1	0	0	4
<i>Prunus serotina</i>	1	0	0	0	1
<i>Prunus virginiana</i>	3	1	1	0	5
<i>Quercus rubra</i>	5	0	0	0	5
<i>Salix bebbiana</i>	1	0	0	0	1
<i>Salix discolor</i>	1	0	0	0	1
<i>Sambucus canadensis</i>	1	0	1	0	2
<i>Sambucus pubens</i>	4	1	0	0	5
<i>Sorbus americana</i>	4	0	0	0	4
<i>Sorbus decora</i>	2	1	1	0	4
<i>Thuja occidentalis</i>	5	0	1	0	6
<i>Tilia americana</i>	3	0	0	0	3
<i>Tsuga canadensis</i>	38	1	0	0	39
<i>Ulmus americana</i>	4	0	0	0	4
Total	222	24	27	1	284

In addition to collections made by NTSC staff, seedlots were also acquired through donations or purchase. Table 5 shows the seedlots acquired during 1998 that were not collected by staff.

Table 5. Seedlots acquired through donation or purchase by the Seed Centre in 1998.

Species	Origin	# Seedlots
<i>Abies balsamea</i>	Prince Edward Island	1
<i>Acer saccharum</i>	Ontario	1
<i>Acer saccharum</i>	Prince Edward Island	1
<i>Carya ovata</i>	Ontario	1
<i>Cornus florida</i>	Ontario	1
<i>Hamamelis virginiana</i>	Ontario	1
<i>Larix laricina</i>	Nova Scotia	1
<i>Picea glauca</i>	Quebec	14
<i>Picea koyamae</i>	Japan	1
<i>Pinus cembroides</i>	Mexico	12
<i>Pinus cembroides</i> var. <i>lagunai</i>	Mexico	1
<i>Pinus culminicola</i>	Mexico	3
<i>Pinus discolor</i>	Mexico	1
<i>Pinus johannis</i>	Mexico	2
<i>Pinus maximartinezii</i>	Mexico	3
<i>Pinus nelsoni</i>	Mexico	2
<i>Pinus pinceana</i>	Mexico	3
<i>Pinus strobus</i>	Newfoundland	1
<i>Pinus strobus</i>	Ontario	1
<i>Prunus serotina</i>	Ontario	1
<i>Prunus nigra</i>	Ontario	1
<i>Quercus alba</i>	Ontario	1
<i>Quercus macrocarpa</i>	Ontario	1
<i>Thuja occidentalis</i>	Prince Edward Island	1
<b>TOTAL</b>		<b>56</b>



## Seed Requests

Although the National Tree Seed Centre was established in 1967, records of seed requests are not available from 1967 to 1982. However, since 1983, the number of requests for seed has ranged from a low of 17 in 1996 to a high of 156 in 1986 and 1987 (average 95 per year) (see Table 6). The number of seedlots supplied has ranged from 99 in 1996 to 1603 in 1986 (average 794 per year). The relocation of the National Tree Seed Centre from Petawawa to Fredericton had an affect on the number of requests for seed. However, there now appears to be an increase in the number of requests being received. This increase should continue as we continue to promote the NTSC to clients throughout the world. It is the policy of the Seed Centre to provide seed at no cost providing of course that the seed be used for scientific research. Seed is also provided on occasion for educational purposes and to arboretums.

Table 6. Number of requests and number of seedlots supplied by the Seed Centre since 1983.

Year	# Seed Requests	# Seedlots
1983	85	772
1984	86	807
1985	123	1603
1986	156	1329
1987	156	865
1988	123	761
1989	98	615
1990	119	807
1991	102	893
1992	93	765
1993	91	810
1994	102	778
1995	53	440
1996	17	99
1997	52	742
1998	64	617
Average	95	794

The number of seedlots provided is a better measure seedlot requests than the number of requests. In the past, requests were not always completely filled at the time they were received and several "requests" would therefore appear under the same seed order. The numbers of seedlots provided in 1985 and 1986 is higher than in most other years. This increase can be attributed to large numbers of seedlots being supplied to one individual. In 1985, 470 seedlots of various alder species were supplied to a researcher and in 1986, 277 seedlots of black spruce were sent to another individual. Such requests, although not common, tend to skew the numbers.

During 1998, a total of 64 seed requests representing 617 seedlots were processed. Most of the requests were from Canada but seed was also sent to the United States, France, India, Slovakia, and Australia. Table 7 shows the number of requests and seedlots that were sent to the various countries.

Table 7. Number of requests and number of seedlots sent by country in 1998.

Country	# Requests	# Seedlots
Australia	1	2
Canada	54	522
France	1	1
India	1	4
Slovakia	2	38
United States	5	50
Total	64	617

## Seed Testing

Germination tests are performed on all freshly collected seedlots as well as seedlots in storage that have not been tested for several years. In most cases, due to small seedlot size, four replicates of 50 seed are placed in germination trays on moistened Kimpak. When larger seed is being tested, the number of seed is reduced. Two replicates of 100 seeds are sometimes used especially when dealing with small seed. Nine hundred and sixty four germination tests were carried out in 1998.

Table 8 shows the number of tests carried out by the National Tree Seed Centre since 1983. Some testing was carried out prior to 1983 (1970-82), however, the number of tests conducted was low and does not represent the operations of a fully operational lab. The reduction in the number of tests between 1994 and 1996 coincides with the transferring of the Seed Centre from Petawawa to Fredericton. These figures were not used for the calculation of averages.

Once a seedlot has been cleaned, the percentage of moisture is determined by oven-drying a weighed sample of seed at 103-105 °C for 16 hours. The target moisture content for orthodox seed is between 6 and 8 percent. Seed that are above this range are further dried before being stored. Three hundred and nineteen moisture content determinations were carried out by NTSC staff in 1998.

Once moisture content is within acceptable limits, the 1000-seed weight is determined. This is carried out by counting and weighing eight replicates of one hundred seeds. When dealing with extremely small seed (birches, poplars, willows) fewer replicates are performed. When the collected sample is small (less than 800 seed), the total number of seed is counted and the total weight of the sample is determined and the 1000-seed weight is then calculated. A total of 710 1000-seed weights were done in 1998.

Table 8. Number of germination tests, moisture content (MC) tests, and 1000-seed weight tests (TSW), carried out between 1983 and 1998.

Year	# Germ. Tests	# MC Tests	# TSW Tests
1983	961	1400	992
1984	1079	132	686
1985	2101	744	1758
1986	1349	266	1259
1987	691	73	91
1988	658	275	377
1989	517	627	543
1990	431	713	303
1991	323	176	139
1992	413	126	336
1993	793	218	708
1994*	0	0	0
1995*	13	14	13
1996*	0	13	16
1997	702	143	425
1998	964	319	710
Average	846	401	641

\* The figures for these years are not included in the calculation of averages.

## Willow Storage Experiment

Collections of *S. discolor* and *S. bebbiana* were made in May and June to test the possibility of storage of these species for long periods of time. Willow was selected since there are several species thought to be at risk and very little is known about long term storage of the species.

Collection of *S. discolor* and *S. bebbiana* were made at the UNB woodlot in Fredericton on May 20th and June 2nd respectively. The catkins were brought into the lab and left to air dry until they were fully opened. The "cotton" containing the seed was then rubbed on a screen to dislodge the seed. Moisture content, 1000-seed weight, and germination tests were performed on the seed prior to storage. Seed were stored at ambient, 4°C, and -20°C. Germination tests were performed at intervals to determine the seed quality (Tables 9a and 9b).

Table 9a. Germination results (%) from *Salix discolor* stored at 20°C, 4°C, and -20°C.

Week #	20°C	4°C	-20°C
1	96.0	96.0	96.0
3	79.0	83.5	88.5
4	55.0	72.0	87.0
6	31.0	72.0	85.5
26	0.0	6.5	76.5

Table 9b. Germination results (%) from *Salix bebbiana* stored at 20°C, 4°C, and -20°C.

Week #	20°C	4°C	-20°C
1	99.0	99.0	99.0
2	77.0	90.5	94.0
4	39.0	79.0	85.0
26	0.0	39.0	86.5

The seed stored at ambient temperature (20°C) lost viability very quickly and all viability was lost within 7 weeks for *S. bebbiana* and 9 weeks for *S. discolor*. Seed stored at 4°C performed better but also decreased in viability. Seed stored at -20°C performed best and germination percentages of 76.5 and 86.5 were observed 6 months after storage.

The *S. discolor* was infested with aphids. These were impossible to completely remove from the sample. The stored sample contained many aphid parts. The effect this had on the seed is not known. The moisture content of the samples were 8.9 and 9.1 %. This moisture content is higher than what is considered optimal for most seed.

Based on the encouraging results of this preliminary test, a follow-up experiment will be undertaken in 1999. It will be similar to the 1998 test but greater care will be taken to test various parameters. Collections will only be made from individuals with little or no aphids present. Moisture content of the samples will be monitored closely and attempts will be made to store samples at different moisture contents.

## **Special Collections**

The National Tree Seed Centre sometimes receives special requests for seed that are not stored at the Centre. These are usually directly associated with proposed or ongoing research. Four such requests were received in 1998. Staff at the Centre were able to collect seed to fill three of these requests while the fourth was filled through purchase of seed from Ontario. Following is additional detail on each of these special collections.

### White Pine Collections

Dr. Alex Mosseler of CFS Atlantic requested some single tree collections of white pine cones from New Brunswick populations. Some collections were made in 1997 from sites in New Brunswick, Nova Scotia, and Prince Edward Island. Seed was also acquired by Dr. Mosseler from Newfoundland. The request was for 5 lots of 4 cones from 6 trees in each stand. Collections were made from stands in Upper Blackville, Pineville, and West Branch.

### Eastern Hemlock Collection

A request was received from Dr. Gary Hawley of the University of Vermont in Burlington to make single-tree collections of eastern hemlock seed from a contiguous population. A site was selected in Hamtown Corner, just North of Fredericton and 38 collections were made. In addition to NTSC staff, several other individuals from the Biodiversity Network at CFS Atlantic assisted with the collections. Some of the cones from this collection were reserved for Dr. Alex Mosseler for work to be performed later.

### Red Oak Collection

Dr. Franz Quednau from CFS Laurentian in Quebec requested some red oak seed. Two collections totaling 75 kg were made from a stand at Forks Stream, New Brunswick. A third request for seed from the same area was denied due to other commitments by staff. It would have been possible to supply more seed if the request had been received earlier or if the total amount desired had been indicated in the original request.

### White Oak and Shagbark Hickory Collections

Mr. Peter Salenius from CFS Atlantic contacted us about some white oak and shagbark hickory seed from Southern Ontario. Mr. Salenius is doing research on global warming and is interested in testing more southern species in the Maritimes. Seed was purchased from Ted Cormier in Oxford Mills, Ontario. In addition to the two requested species, six other species were also acquired.

## Visitors to the Seed Centre

Each year, numerous people tour the Seed Centre. Most are researchers and forestry workers from Canadian provincial and federal governments, academia and industry. Several foreign visitors also tour our facility. Following are the names of some of the visitors in 1998.

In August the Seed Centre was visited on two separate occasions by Señor Eduardo Castro Cisneros of Argentina. Sr. Castro is President of the "Fundacion Penninsula Rauli". The foundation is an environmental non-governmental organization that has ties with the Argentinian National Parks Administration. During his initial visit, Sr. Castro was toured by Dr. Joanne MacDonald since none of the Seed Centre staff were available. During his second visit, he met with Mr. Bernard Daigle to discuss seed testing and storage. There is a possibility of collaboration with Sr. Castro's organization in the future.

In September Dr. Eduardo Cassas Diaz and Professor Maria Angeles Velasquez of Mexico visited the Seed Centre. The Mexicans were on a visit sponsored by the National Office of the Institute of Forestry.

Also in September, the Scientific editors from various CFS labs across Canada toured the Centre. They were attending a Scientific Editor's Meeting which was being hosted by CFS-Atlantic.

Mr. Tashio Katsuki from Tama Forest Science Garden Dendrology lab in Tokyo, Japan visited the Seed Centre in October. In addition to touring the Seed Lab, Mr. Katsuki accompanied us on a seed collection trip where basswood (*Tilia americana*) was collected using the bucket truck. He took many photos and was extremely appreciative of his visit.

## **Equipment Changes / Modifications**

Nineteen ninety eight was the third year since the NTSC moved to Fredericton. The space available for frozen storage (-20 degrees Celsius) was found to be insufficient. It was therefore decided to convert one of the coolers from 4 degrees to -20 degrees Celsius. The old shelving was also removed and replaced with sliding track shelving. This increased our shelf storage space by over 2.5 times. There is also the opportunity to further increase this by adding additional shelving or by decreasing the space between shelves. This provided sufficient space to separate the seed bank, tree breeding and reserved seedlots collections. Another improvement to the storage area was the labeling of all of the storage bins with laminated labels. This makes finding and replacing seedlots much easier and faster.



## **National Tree Seed Centre Staff**

The staff at the NTSC in 1998 consisted of one full time seed technologist (Bernard Daigle), a fourth-year forestry student (Lori Burry) which was hired for the summer months, and two youth interns from the YMCA Youth Intern Program (Peter Doherty and Tim MacDonald). The staff is under the supervision of the National Forest Genetics Resources Centre manager, Mr. Dale Simpson.

Lori Burry had worked for the NTSC in 1997 and was hired again in 1998. Her experience was very valuable since she was able to work with minimal supervision. She also helped in the supervision of the youth intern from the YMCA program. In addition to her work in the lab, Lori also did her undergraduate thesis on storage of red oak acorns.

Because 1998 was going to be an extremely good seed year, we decided to apply to the Career Edge Program. This program would supply an individual who would be hired for a one-year term to work in an environment where he/she would gain valuable work experience. There were several categories ranging from individuals who had failed to complete their high school to university graduates. In order to increase our chances of success, it was decided to apply for candidates who had not yet completed high school we needed manpower in the field to assist with the collections and it was felt that the lab work could be performed by such an individual.

We were successful in our application and in early June Mr. Peter Doherty started work. Although he was eager at first, Peter did not work out and was dismissed in July. We were offered the opportunity to accept another candidate to replace Peter and in early September Mr. Tim MacDonald started work. Tim was an excellent worker, but due to health problems, was dismissed in early January.