

TREES AND SHRUBS ON RESIDENTIAL LOTS
IN EDMONTON, 1973

BY

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ABSTRACT

In 1973 a tree and shrub survey was carried out in Edmonton as part of a background study on urban forestry. It was apparent, based on annual expenditures both in time and money, that homeowners place a high utilitarian value on their woody plants. A conservative estimate puts the replacement value of trees and shrubs on residential lots in Edmonton at about \$63 000 000.

Homeowners perceived a need for more research and information particularly as related to insect and disease problems, tree improvement, and cultural practices. As a contribution towards satisfying these needs the Northern Forest Research Centre is undertaking insect and disease research and a pesticide evaluation program. In addition a series of publications on pest problems has been initiated.

Additional information will have to be collected before the Northern Forest Research Centre can fully assess its role in solving urban forestry problems.

RESUME

En 1973, les auteurs effectuèrent un inventaire des arbres et des arbustes à Edmonton pour les fins de foresterie urbaine. Se fondant sur les dépenses annuelles de temps et d'argent faites par les résidents, il est évident que ceux-ci considèrent leurs plantes ligneuses comme très utiles. Selon une estimation faible, la valeur de remplacement des arbres et arbustes dans les lots résidentiels de cette ville s'élève à \$63 000 000.

Les propriétaires de lots déclarèrent que l'on doit intensifier les recherches et donner plus d'informations en ce qui concerne surtout les insectes nuisibles et les maladies, l'amélioration des arbres et les méthodes de culture. En vue de contribuer à satisfaire ces besoins, le Centre de recherches forestières du Nord est à mettre au point un programme de recherches sur les insectes et les maladies et d'évaluation des pesticides. En outre, il commence à publier sur les problèmes concernant les ennemis des arbres et des arbustes.

Le Centre de recherches forestières du Nord aura besoin d'informations supplémentaires avant qu'il puisse estimer entièrement le rôle qu'il doit jouer pour résoudre les problèmes de foresterie urbaine.

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INTRODUCTION

A survey of trees and shrubs growing on residential lots in the greater Edmonton area was carried out in September 1973 as part of a background study on urban forestry (Jorgensen 1970). The principal objective of the background study was to determine what role, if any, the Northern Forest Research Centre might play in resolving, through research, urban forestry problems in the three prairie provinces. The purposes of the tree and shrub survey were:

1. To determine species and numbers
2. To determine source, groupings, and location within lots
3. To assess cultural problems being encountered by homeowners and recommend corrective treatment
4. To determine the amount of time and money being spent annually by homeowners on the establishment, maintenance, and protection of trees and shrubs
5. To assess the economic (including replacement cost) and social value of trees and shrubs to homeowners.

METHODS

The city of Edmonton, the town of St. Albert, and the hamlet of Sherwood Park were subdivided into 23 "neighborhoods" (Figure 1) on the basis of a zone map prepared by the Edmonton Real Estate Board (1974). Within each neighborhood the number of residential lots was determined using large-scale planning maps on which lots were easily identifiable. There were 83 512 residential lots in Edmonton, 3254 in St. Albert and 6004 in Sherwood Park (Table 1).

A total of 287 residential lots (0.3% sample) was randomly selected on a proportional basis from the 23 neighborhoods. The sample

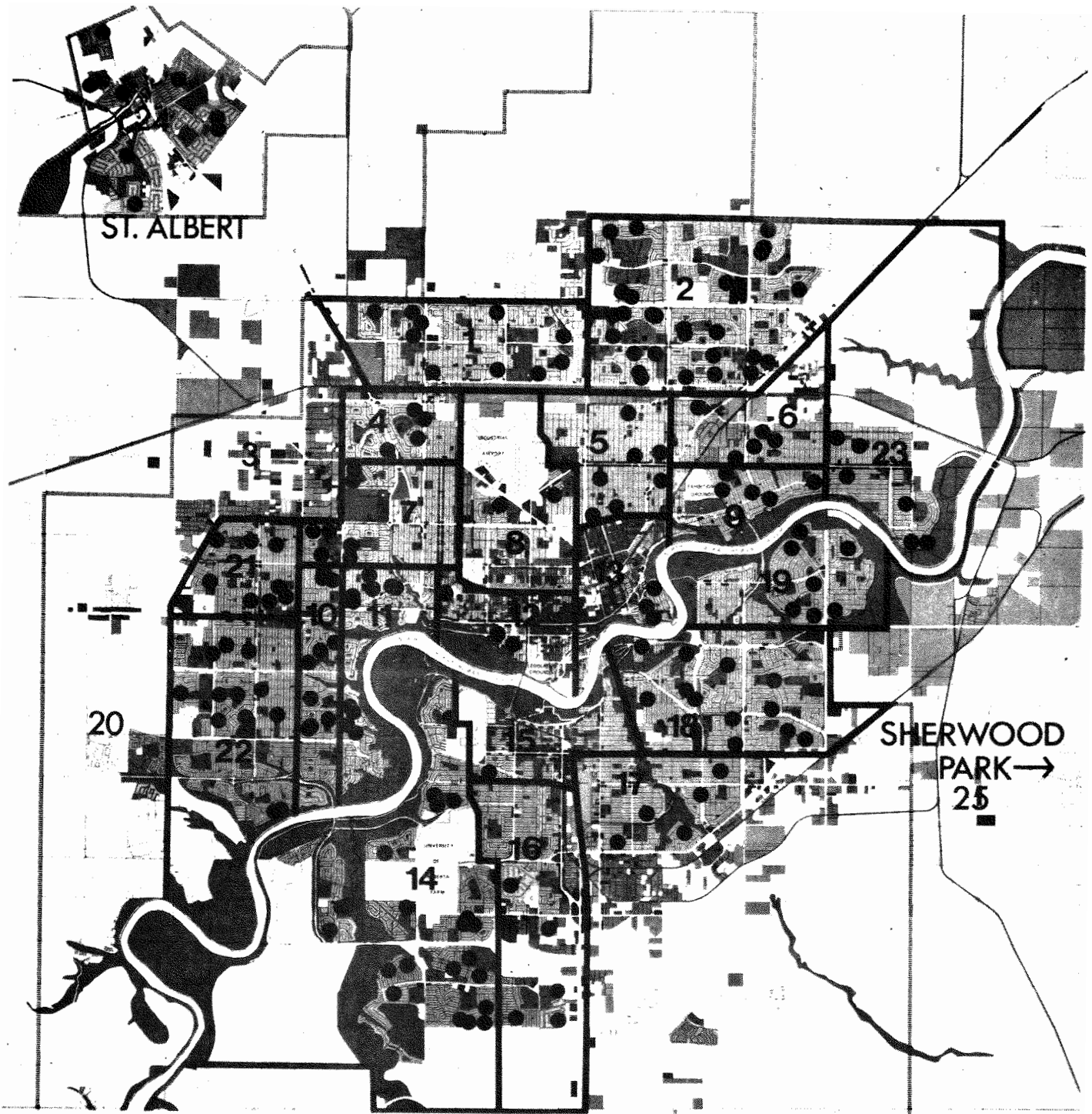


Figure 1. Neighborhoods and sample residential lots in Edmonton and St. Albert.

TABLE 1
Residential lot survey

Neighborhoods ¹	Number of residential lots	Number of lots selected	Number of responses to the questionnaire	Number of lots examined
Edmonton				
1	5377	15	5	10
2	9386	31	19	29
4	2211	6	2	4
5	5454	12	5	8
6	3239	7	3	5
7	3544	10	6	7
8	1844	5	0	2
9	2852	7	1	5
10	3099	11	6	10
11	2659	10	6	10
12	632	3	0	3
13	928	3	1	3
14	5407	22	17	22
15	2835	5	1	1
16	4625	11	6	5
17	5456	15	4	5
18	7382	22	10	12
19	4211	11	6	7
21	2952	12	6	8
22	6330	20	14	12
23	3089	9	6	6
St. Albert (24)	3254	12	7	8
Sherwood Park (25)	6004	28	10	26
TOTALS	92 770	287	141	208
%		0.3	49.1	72.5

¹ Neighborhoods 3 and 20 are presently used for industrial or agricultural purposes and thus were omitted from the survey.

size was limited to what a crew of four persons: experienced in tree and shrub identification and familiar with cultural and protection problems could survey in a 6-week period.

Ownership of the selected residential lots was determined using legal lot descriptions and municipal government tax rolls. Initial contact was made by means of an introductory letter from the Director, Northern Forest Research Centre. Included with the letter was a questionnaire requesting information on the number of hours and dollars spent on various aspects of tree and shrub establishment, maintenance and protection including the use of landscape architects. Residents were also asked to indicate their source of horticultural information, to evaluate the contribution of trees and shrubs to their lot, and indicate priority needs, as they saw them, for research or additional information.

The second step was a visit to the selected residential lots to gather information relating to species, numbers, grouping, source, age, height, tree diameter at breast height (dbh), vigor, condition class, location, problems or damage to the trees and shrubs; and to recommend cultural treatments. When possible the owner's assistance in carrying out the appraisal was used.¹

All data were subsequently transferred to computer cards and tabulated. Because of the small number of samples in many neighborhoods, results are provided on a city-wide basis rather than for the 23 neighborhoods as originally intended.

¹ Copies of the introductory letter, homeowner questionnaire and lot tally sheet are available upon request from the authors.

Species lists, their scientific and common names, and assignment to tree or shrub categories are based on the 1973 edition of the Alberta Horticultural Guide (Appendix I). A species replacement value was calculated for the tree and shrub species based on 1974 nursery stock prices listed in catalogues obtained from tree nurseries in the Edmonton area. A tree replacement value (based on species, dbh, and condition) was also calculated for trees 6.6 cm (2.6 in.) dbh and larger and is based on a formula developed by the International Shade Tree Conference, Inc. (1970). A base value of \$10 per 6.5 cm² (1 in.²) in cross section at 1.4 m (4.5 ft) above ground level was assigned. Modifying factors included tree species (ranging from 110% for Koster's blue spruce to 60% for hybrid poplars--Table 2) and condition class (ranging from perfect specimen at 100% to very poor specimen at 20%). A more refined technique has since been suggested by the Ontario Shade Tree Council (1974) which includes climatic suitability and land value as factors.

RESULTS

SPECIES

The survey indicated a total of 3 708 900 trees and shrubs on Edmonton, St. Albert, and Sherwood Park residential lots, 34% of which were trees and 66% shrubs:

	Trees		Shrubs		Both	
	Number	%	Number	%	Number	%
Coniferous	518 600	41	182 600	7	701 200	19
Deciduous	734 400	59	2 273 300	93	3 007 700	81
	1 253 000	100	2 455 900	100	3 708 900	100

Seventy five tree and 92 shrub species were identified (Tables 2 and 3). The ten most common genera² were:

Trees		Shrubs	
Spruces	- 388 400	Cotoneasters	- 870 600
Maples	- 114 660	Lilacs	- 349 600
Birches	- 113 700	Caraganas	- 328 200
Apples, crabapples	- 94 200	Roses	- 235 900
Willows	- 77 100	Junipers	- 120 600
Mountain ashes	- 72 700	Cherries	- 120 300
Poplars	- 72 200	Spireas	- 85 100
Cherries	- 70 900	Honeysuckles	- 51 700
Pines	- 64 600	Pines	- 43 800
Elms	- 56 300	Elders	- 39 300

² Genera - a classification of trees or shrubs with common distinguishing characteristics, i.e. spruce = white spruce + blue spruce + Engelmann spruce + etc.

TABLE 2

List of trees and 1974 nursery replacement values on residential lots in Edmonton, Sherwood Park, and St. Albert, 1973.

Species	Code ¹	Species	Number ² Genera	Nursery replacement value - 1974 ³ \$ per plant	Tree class ⁴
CONIFEROUS					
Cedars (sp) ⁵	80	7 600		5	2
white	81	400		5	2
columnar white	82	28 100		10	2
Ware's siberian	83	16 100	52 200	18	2
Douglas-fir	70	900	900	19	2
Fir, balsam	11	3 600	3 600	3	2
Juniper (sp)	20	400		20	2
Rocky mtn.	21	8 500	8 900	20	2
Pines (sp)	50	1 800		25	2
jack	51	4 900		25	3
lodgepole	53	33 000		25	3
mugo (tree form)	56	17 800		18	2
Austrian	57	900		9	2
red	59	400		10	2
eastern white	60	1 300		10	2
Scots	61	4 500	64 600	8	2
Spruces (sp)	30	5 400		20	2
Norway	31	2 200		40	2
Engelmann	33	400		40	2
white	34	235 000		20	2
western white	35	2 200		20	2
Colorado	37	45 500		25	2
Colorado blue	38	41 900		40	2
Koster's blue	39	10 700		40	1
blue	40	32 600		40	2
black	41	12 500	388 400	20	3
Total coniferous			518 600		

¹See Appendix 1 for scientific name.

²Nearest 100 plants.

³Nursery costs only.

⁴Used in the calculation of the International Shade Tree Conference tree replacement value (1 - 110%, 2 - 100%, 3 - 80% and 4 - 60%).

⁵Sp = species; species not identified.

TABLE 2 (cont.)

DECIDUOUS

Apples, crabapples (sp)	250 254	88 800		5	3
siberian crabapple	251	1 800		8	3
rosybloom crabapples	253	3 600	94 200	8	2
Ash, green	223	48 600	48 600	6	3
Basswood, small-leaved	352	400	400	8	2
Birch (sp)	170	8 000		9	3
paper	171	77 600		9	3
european white	172	9 800		9	3
cut-leaved weeping	173	18 300	113 700	8	2
Cherries, plums (sp)	290	9 400		5	3
amur	291	900		8	3
may day	292	24 100		5	2
pincherry	293	25 900		5	3
chokecherry	294	7 100		5	3
western chokecherry	295	1 300		5	3
Schubert chokecherry	296	2 200	70 900	5	3
Crabapples - see apples					
Elm (sp)	360	3 600		4	3
american	361	31 700		4	2
manchurian	362	21 000	56 300	4	3
Hawthorn (sp)	200	400	400	6	3
Larch (sp)	240	2 700		7	3
tamarack	242	3 100		7	3
siberian	244	900	6 700	7	3
Maple (sp)	150	4 000		4	4
Manitoba	151	105 300		4	4
silver	152	2 200		5	2
sugar	153	2 200		8	2
Norway	155	900	114 600	7	2
Mountain ash (sp)	330	19 600		5	3
american	331	19 200		5	3
european	332	5 400		5	3
russian	333	400		6	3
showy	334	27 200		6	3
Green's	335	900	72 700	5	3

TABLE 2 (cont.)

Oak (sp)	310	400		5	2
bur	312	1 300	1 700	5	2
Plums - see cherries					
Poplars (sp)	270	7 100		3	4
balsam	275	28 100		5	4
trembling	276	24 100		5	4
Griffin	278	8 900		3	4
northwest	279	4 000	72 200	3	4
Russian olive	210	1 800	1 800	7	3
Siberian pea tree (Sutherland)	190	400	400	1	2
Tree lilac (Japanese)	340	2 700	2 700	4	2
Willow (sp)	320	26 800		5	4
siberian white	323	400		5	4
golden	324	4 900		5	4
laurel-leaved	325	45 000	77 100	5	4
Total deciduous			734 400		
Total trees			1,253 000		

TABLE 3

List of shrubs and 1974 nursery replacement values on residential lots in Edmonton, Sherwood Park, and St. Albert, 1973.

Species	Code ¹	Number ²		Nursery replacement value - 1974 ³ \$ per plant
		Species	Genera	
CONIFEROUS				
Cedar (sp) ⁴	140	8 900		4
globe	141	6 700	15 600	4
Fir, (balsam (dwarf))	90	900	900	5
Ground hemlock	830	1 300	1 300	4
Juniper (sp)	100	48 200		12
compact	102	8 500		14
golden pfitzer	103	10 700		12
mountain	104	4 000		9
creeping	105	7 600		17
Dunvegan blue	108	5 400		10
savin	110	30 800		10
arcadia	111	1 800		17
tamarix-leaved	113	3 600	120 600	14
Pine (dwarf sp)	130	36 600		8
compact mtn.	131	4 500		8
dwarf mtn.	132	2 700	43 800	8
Spruce (dwarf sp)	120	400	400	7
Total coniferous			182,600	
DECIDUOUS				
Alder (sp)	820	400	400	2
Almonds - see plums				
Barberry (sp)	800	8 900	8 900	1
Birch, swamp	841	5 400		3
water	840	900	6 300	3

¹ See Appendix 1 for scientific name.

² Nearest 100 plants.

³ Nursery costs only.

⁴ Sp = species; species not identified.

TABLE 3 (cont.)

Buffaloberry (sp)	690	900		4
silver	691	2 700	3 600	4
Burning bush (sp)	500	400		3
dwarf-winged	503	400	800	3
Caragana (sp)	410	278 300		1
common	411	20 100		1
weeping	413	400		15
pygmy	416	29 400	328 200	1
Cherries - see plums				
Cherry prinsepia	590	900	900	4
Cinquefoil (sp)	580	26 300		3
scrubby	581	2 200	28 500	3
Cotoneaster (sp)	460	870 600	870 600	1
Currant, gooseberry (sp)	640	16 900		2
alpine	641	3 100		2
american black	642	2 700		2
buffalo	645	400	23 100	2
Dogwood (sp)	430	8 000		3
silver leaved	432	15 200		3
siberian	435	1 300		3
gold leaved	436	2 700		3
red osier	438	10 700		3
golden twig	439	1 300	39 200	3
Elder (sp)	680	15 600		2
american	681	900		2
golden european	682	11 200		3
red	683	4 000		3
golden plume	684	7 600	39 300	5
Gooseberry - see currant				
Hawthorn (sp)	470	1 800		6
chinese	473	400	2 200	8
Hazelnut	450	1 800	1 800	1
Honeysuckle (sp)	540	49 500		4
dwarf european	550	1 800		4
scarlet trumpet	551	400	51 700	4

TABLE 3 (cont.)

Hydrangia (sp)	530	2 200		2
snow hill	531	400	2 600	2
Lilac (sp)	740	290 300		4
common	751	59 300	349 600	2
Maple (sp)	380	2 200		4
amur	381	4 500	6 700	4
Mock orange (sp)	560	17 800	17 800	2
Ninebark (sp)	570	2 700		4
common	571	400		4
golden	572	3 600		4
dwarf	573	400	7 100	4
Oleaster, russian olive	491	1 800		2
wolf willow	492	1 300	3 100	2
Plums, cherries, almonds (sp)	600	76 700		3
western sand cherry	602	900		3
purple leaved sand cherry	603	400		3
Canada plum	606	1 800		8
Nanking cherry	607	28 500		3
russian almond	608	2 200		3
flowering plum	609	1 300		3
double flowering plum	610	5 400		4
prairie almond	611	2 200		3
chinese bush cherry	612	900	120 300	3
Roses (sp)	650	235 000		3
Kamtchatica	660	900	235 900	3
Saskatoon	390	4 000	4 000	2
Sea buckthorn	520	3 100	3 100	4
Siberian pea tree - see caragana				
Snowberry	810	900	900	1
Spirea (sp)	720	84 300		3
oriental	726	400		4
bridal wreath	733	400	85 100	3
Viburnums (sp)	770	5 400		3
nannyberry	773	900		4
dwarf european	775	1 300		4
snowball	776	400		4
highbush cranberry	779	19 200	27 200	3

TABLE 3 (cont.)

Willows (sp)	670	4 000		3
coyote	672	400	4 400	3
<hr/>				
Total deciduous			2 273 300	
<hr/>				
Total shrubs			2 455 900	
<hr/>				

SOURCE

Seventy two percent of the trees and shrubs were purchased from commercial nurseries, 23% were obtained from friends or as wildings from the forest, and 5% were native or natural reproduction from seed or suckers (Table 4). Most coniferous and deciduous shrubs were from tree nurseries while one-half of the trees (principally white spruce, lodgepole pine, white birch, and pincherry) were commonly obtained as wildings from the forest.

TABLE 4

Source of trees and shrubs in Edmonton, 1973

Source	Frequency - %				All
	Coniferous Trees	Shrubs	Deciduous Trees	Shrubs	
Nursery stock	51	94	52	81	72
Friends, relatives	20 ^a	4	16 ^c	15 ^f	15
Wildings from the forest	28 ^b	2	14 ^d	1	8
Native	1	-	9 ^e	1	2
Seed	-	-	7	1	2
Suckering	-	-	2	1	1
Totals	100	100	100	100	100

a, b - principally white spruce, lodgepole pine

c - Manitoba maple, white birch

d - white birch, pincherry

e - trembling aspen

f - cotoneaster, lilacs, roses, and cherries

GROUPINGS

The arrangement of trees and shrubs was classified into five distinct categories:

Specimen--single tree or shrub separated by grass from other plants

Clump-- single species with more than 1 stem (i.e. birch)
separated from other plants by grass

Grouping-- two or more trees or shrubs planted as a group

Hedge-- composed of a row of at least ten individual plants;
plants are usually trimmed and do not attain their
normal height

Windbreak-- similar to a hedge but plants are not trimmed

Fifty-eight percent of the trees and 28% of the shrubs were set out in the yard as specimens (Table 5). Approximately 19% of both trees and shrubs were set out as part of a group. Fifty-one percent of the shrubs but only 10% of the trees were set out as hedges.

TABLE 5

Arrangement of trees and shrubs on residential lots in Edmonton, 1973.

Grouping	% of trees	% of shrubs	% trees and shrubs
Specimen	58 ^a	28 ^b	38
Clump	5	1	3
Group	18	19	19
Hedge	10	51	37
Windbreak	9	1	3
Totals	100	100	100

a - principally spruces, birches, maples, and apples

b - roses, cotoneasters, lilacs, cherries

There are 347 miles of hedges in Edmonton and they are composed principally of cotoneaster (45%), lilac (24%), and caragana (20%).

Species	Miles	Number of plants (nearest 'ooo)
White spruce	16	86 000
Willow, manchurian elm	16	84 000
Cotoneaster, lilac, caragana	315	1 664 000
Totals	347	1 834 000

LOCATION WITHIN LOTS

The location of trees and shrubs on residential lots was described in terms of their relationship to the house-- front, back, and side yards and boulevard--and within the first three macrolocations in terms of their microlocation with respect to lot or fence lines (border), buildings (foundation), and grassed areas.

Macrolocation

More than one-third (35%) of the trees and shrubs were located in the front yard and almost half (49%) in the back (Table 6). Side yards, which tended to be narrow except on corner lots, accounted for 15%, while boulevards contained 1% of the trees and shrubs. There was no strong species identification with these macrolocations. However, cedars, pines, junipers, cotoneaster, and caraganas appeared to be more common in front yards while lilacs, roses, cherries, and honeysuckles were more common in back yards. Side yards were dominated by cotoneaster, caragana,

and lilacs. Boulevard trees were largely white elm and green ash and had been planted by the city.

TABLE 6

Location of trees and shrubs on residential lots in Edmonton, 1973

Macrolocation	% trees	% shrubs	% trees and shrubs
Front yard	31	37	35
Back yard	57	45	49
Side yard	8	18	15
Boulevard	4	<1	1
Totals	100	100	100

Microlocation

Fifty-nine percent of the trees and shrubs were located beside fences or along lot lines. Fourteen percent were planted adjacent to foundations of houses or garages, 26% were in the grassed areas, and 1% were on boulevards (Table 7).

In the grassed area (microlocation) in the front yard (macrolocation) spruce species predominated (29%), followed by birches (16%), mountain ashes (7%), pines (7%), apples (4%), and poplars (4%).

One of the purposes of collecting this information was to determine if homeowners were planting their trees and shrubs in microlocations recommended by experts. Results (see Table 9-"relocate plants") suggest that poor location of plants is not a serious problem.

TABLE 7

Location of trees and shrubs on residential lots in Edmonton, 1973

Microlocation	% trees	% shrubs	% trees and shrubs
Borders	48 ^a	65 ^b	59
Foundation	7	17 ^c	14
Grassed area	41 ^d	18 ^e	26
Boulevard	4	<1	1
Totals	100	100	100

^a principally spruces, willows, maples, birches

^b lilacs, caraganas, roses, cotoneasters

^c roses, junipers, spireas, cherries

^d spruces

^e cedars

DAMAGE OR PROBLEMS ENCOUNTERED

At the time of the survey almost half (46%) of the trees and shrubs were found to be in excellent condition (Table 8). Insects, principally the birch leaf miner and pear slug, were the most common (37%) problem encountered. Birches, Manitoba maple, mountain ashes, may day trees, cotoneasters, lilacs, roses, and caraganas were the species affected. Other significant problems encountered were dead branch tips ("flagging") on junipers, columnar white, and Ware's siberian cedars due primarily to inadequate watering; suppression or overcrowding of blue and white spruce as reflected by reduced growth, broken tops and sparse foliage; and chemical damage (herbicide) to Manitoba maple.

If the survey had been carried out earlier in the year dieback (dead branches) which occurred following an unusually warm winter in 1972-73 would have been prevalent on a number of shrub species including the dogwoods, elders, ninebarks, and burning bush. Winter browning of conifers and lilac leaf miner were also very common problems in 1973.

TABLE 8

Damage or other problems of trees and shrubs in Edmonton, 1973

Types of damage or problems encountered	Frequency - %				All	Basis: number of observations
	Coniferous Trees	Shrubs	Deciduous Trees	Shrubs		
Insect	10 ^a	<1	30 ^e	49 ^g	37	3115
Disease	1	-	3	<1	1	85
Climatic ¹	3	4	5	2	3	248
Flagging ²	5 ^c	19 ^d	<1	-	-	138
Chemical ³	-	1	7 ^f	<1	2	134
Suppression, overcrowding	8 ^b	1	2	2	3	215
Suckering	<1	-	4	4	3	282
Mechanical	3	2	2	<1	1	81
Other	4	5	-	3	4	173
Nil	66	68	47	40	46	3847
Totals	100	100	100	100	100	8318

¹ Principally winter browning and frost damage.

² Dead branch tips resulting from inadequate watering.

³ Principally herbicides, some insecticides.

a - White spruce

b - Blue and white spruce

c - Columnar white and Ware's siberian cedar

d - Junipers

e - Birches, Manitoba maple, mountain ashes, may day tree

f - Manitoba maple

g - Cotoneaster, lilac, rose and caragana

Because damage to trees and shrubs varies within seasons and between years the results of this survey cannot be considered a complete overview of problems which might be encountered from time to time.

CULTURAL RECOMMENDATIONS

At the time of examination notes were made on cultural treatments which should be carried out to control damage or to improve the aesthetic quality of the trees or shrubs (Table 9).

TABLE 9

Cultural recommendations to correct damage or other problems of trees and shrubs in Edmonton, 1973

Cultural recommendations	Frequency - %				All	Basis: number of observations
	Coniferous Trees	Shrubs	Deciduous Trees	Shrubs		
Insect control	10 ^a	<1	23 ^e	41 ^g	31	2565
Disease control	1	-	2	<1	<1	58
Prune or trim	14 ^b	21 ^d	15 ^f	14 ^h	14	1176
Weed	7	3	5	7	6	512
Edging ¹	3 ^c	3	2	3	3	235
Remove suckers	<1	-	3	3	2	197
Fill in hedge	-	-	1	3	2	163
Relocate plant	3	1	1	1	1	95
Other	6	3	3	-	4	235
Nil	56	69	45	28	37	3082
Totals	100	100	100	100	100	8318

¹ Removing lawn from around perimeter of plant to reduce competition for nutrients and moisture.

a - White spruce

b - Spruces, cedars

c - Spruces

d - Junipers

e - Birches, mountain ashes, may day, elms

f - Birches, apples, basswood

g & h - Cotoneasters, lilacs, caraganas, rose

Insect control was the most common (31%) recommendation and pruning or trimming the second (14%). Pruning of spruces, cedars, and junipers was recommended in order to remove branches affected by flagging. Adequate watering should prevent future occurrence of this particular problem. Birches, apples, and basswoods appeared in special need of pruning, while hedges made up of cotoneaster, lilacs, and caraganas were in need of trimming. Weeding (6%), edging adjacent lawn (3%), and removal of suckers (2%) in order to reduce competition for moisture were also recommended.

HOOR AND DOLLAR INPUTS

Based on the survey it is estimated that individual residential lot owners in Edmonton, St. Albert, and Sherwood Park spent 1 591 900 hours on their trees and shrubs in 1973, an average of 17.2 hours per household (Table 10). The largest amounts of time were for watering, pruning, insect control, and planting. Maintenance of existing trees and shrubs accounted for 81% of the time, protection for 10%, and establishment for 8%. Assuming the 1973 minimum provincial pay rate of \$2 per hour the dollar value of this input is equivalent to \$3 183 800.

Purchases of equipment and materials by residential lot owners totalled \$1 479 100, an average of \$16 per household (Table 11). The largest expenditures were made for nursery stock, pruning and trimming equipment, fertilizers, and insecticides. Establishment of new trees and shrubs accounted for 42% of the money spent, protection of established trees and shrubs for 28%, and maintenance for 26%.

Total input into trees and shrubs in Edmonton in 1973 amounted to \$4 662 900, an average of \$50 per household (Table 12). Maintenance

TABLE 10

Hour inputs into trees and shrubs in Edmonton, 1973

Activity	Group	Number of Hours Activity	of Hours Group	% Group
Planting	Establishment	128 200	128 200	8
Pruning, trimming	Maintenance	420 500		
Fertilizing		73 700		
Thinning		93 600		
Removal		65 000		
Watering		633 600	1 286 400	81
Insect control	Protection	131 800		
Disease control		31 600	163 400	10
Other	Other	13 900	13 900	1
Totals		1 591 900	1 591 900	100

TABLE 11

Dollar inputs into trees and shrubs in Edmonton, 1973

Purchases	Group	Dollars (\$) Purchases	Group	% Group
Nursery stock	Establishment	441 200		
Planting equipment		60 500		
Soil mulches		108 500		
Equipment rental (1/2)		15 000	625 200	42
Equipment rental (1/2)	Maintenance	15 000		
Pruning equipment		204 200		
Fertilizers		168 800	388 000	26
Spraying equipment	Protection	118 400		
Insecticides		156 800		
Fungicides		14 000		
Fencing		118 500	407 700	28
Bird Feeders	Other	58 200	58 200	4
Totals		1 479 100	1 479 100	100

accounted for 63% of the total input, establishment for 19%, and protection for 16%.

TABLE 12

Total inputs (hours and \$) into trees and shrubs in Edmonton, 1973

Grouping	\$ (hours)	\$ (purchases)	Total \$	\$
Establishment	256 400	625 200	881 600	19
Maintenance	2 572 800	388 000	2 960 800	63
Protection	326 800	407 700	734 500	16
Other	27 800	58 200	86 000	2
Total	3 183 800	1 479 100	4 662 900	100

As expected, the dollar input values varied by neighborhoods. In Sherwood Park and St. Albert, newer residential areas in Edmonton, most of the time and money was spent on establishment of trees and shrubs, while in older areas maintenance was of greater importance.

Between 1968 and 1973, three of the lot owners who responded to the questionnaire contracted tree and shrub maintenance and six purchased their nursery stock through contract with either a professional landscaper or local tree nursery. The value of this contracted work in the city is estimated at \$40 000 annually. This figure, which appears to be somewhat low, is in addition to the \$4.7 million shown in Table 12.

REPLACEMENT VALUES

The species replacement value of all trees and shrubs was determined using 1974 nursery stock costs obtained from local suppliers and amounted to \$26 452 700. This amount takes into account

species only and no allowance is made for size, condition, or cost of replanting.

Using the International Shade Tree Conference formula developed for evaluating tree replacement value based on species, size (6.6 cm (2.6 in.) dbh and larger), and condition the value arrived at was \$44 391 800. To this amount can be added the current value of nursery stock for trees 6.5 cm (2.5 in.) dbh and less and all shrub species for a total replacement value of \$63 231 700.

SOURCE OF HORTICULTURAL INFORMATION

The survey revealed that the most common sources of horticultural information for urban dwellers are friends (22%), books (15%), and newspaper columns (12%) (Table 13).

SOCIAL VALUE OF TREES AND SHRUBS

Residential homeowners were asked to indicate the contribution or value of trees and shrubs to their lot by ranking the following criteria: increased property value, improved visual amenity, improved physical amenity, provision of habitat for birds and wild animals, and other. The highest rating possible was 1 and the lowest 5.

Results indicate that most people plant trees and shrubs to improve the visual appearance of their lot (Table 14). Improved physical amenities ranked second, increased property value third, and habitat for birds and animals fourth.

TABLE 13

Sources of horticultural information in Edmonton, 1973

Source	% Response
1. Friends	21.5
2. Gardening books	15.3
3. Newspaper columns	11.9
4. Labels on products	9.3
5. Tree nurseries	8.2
6. Retail stores	6.8
7. T.V., radio	6.2
8. Alberta Dept. Agriculture	3.7
9. Handouts	3.7
10. Edmonton Parks Dept.	2.8
11. University of Alberta	2.5
12. Landscape companies	2.5
13. Alberta Forest Service	1.4
14. Canadian Forestry Service	0.8
15. Horticultural societies	0.8
16. Canada Dept. Agriculture	0.6
17. Other	2.0
Total	100.0

TABLE 14

Social value of trees and shrubs in Edmonton, 1973

	Number of responses by rating					Average rating	Basis: number of responses
	1 (highest)	2	3	4	5 (lowest)		
Improved visual amenity ¹	82	24	13	8	1	1.6	128
Improved physical amenity ²	22	54	35	12	4	2.4	127
Increased property value	22	33	32	35	8	2.8	130
Habitat (birds, animals)	8	12	35	53	10	3.4	118
Other	3	5	5	5	15	3.7	33

¹ Color, flowers and fruit, visual privacy, softening or hiding of stucco, cement, rigid building lines, and utility poles.

² Shade, reduced traffic noise, wind and snowbreaks, modified air temperatures, purified air.

NEED FOR INFORMATION AND RESEARCH

The residential owners who responded to the questionnaire perceived a need for additional research on trees and shrubs:

Need for Research	% Response
Yes	57
No	16
Undecided	23
Question not answered	4
Total	100

Results indicated a need for more research on insect and disease controls (21%), more publications and handouts (22%), and additional research on tree improvement (17%) and cultural practices (16%) (Table 15).

TABLE 15

Research and information needs in Edmonton, 1973

Subject	% Response
1. Insect and disease research	21
2. More publications, handouts on cultural techniques	22
3. Tree improvement research	17
4. Research on cultural practices	16
5. Research on wildlife habitat	7
6. Research on effects of trees and shrubs on the visual and physical environment	7
7. Research on effects of trees and shrubs on real estate value	6
8. Other	4
Total	100

DISCUSSION

The Edmonton tree and shrub survey has provided useful background information on urban forestry problems. However, additional information will be required before the Northern Forest Research Centre can determine its role, if any, in solving problems or capitalizing on research opportunities in urban environments.

The survey indicates quite clearly that the average homeowner places a high value on trees and shrubs. Each year he spends a considerable amount of time (17.2 hours) and money (\$16) in establishing, maintaining, and protecting his woody plants. Quite similar results were obtained from a less intensive survey carried out in Winnipeg in 1969 in which it was determined that residential lot owners spent an average

of 15 hours and \$20 annually². Interestingly enough these inputs covered approximately the same number of trees and shrubs on individual lots:

	Edmonton	Winnipeg
No. of trees	14	10
No. of shrubs	5	9
No. of feet of hedge (1 foot apart)	21	22
Total no. of plants per lot	40	41

The importance of trees and shrubs on residential lots was further reflected in the Edmonton survey by the calculation of replacement values. Total replacement value for all trees and shrubs on residential lots in Edmonton is estimated at \$63 000 000.

However, the survey revealed no problems which would require a significant research input by the Northern Forest Research Centre. Interestingly, the homeowners themselves perceived research needs but the data indicated that the only significant problems encountered were pest control and cultural treatment such as pruning and trimming. In the first instance control techniques for most pests have already been developed. For those insects and diseases for which control techniques are nonexistent or unsatisfactory the Canadian Forestry Service, other federal and provincial agencies, and the chemical industry itself have ongoing testing and evaluating programs. In the second instance there appears to be sufficient information available to resolve most cultural problems (e.g. Knowles 1967 and 1973, Oliver 1957a, b).

² Karaim, B.W. and A.G. Teskey. 1970. Estimated dollar inputs into agricultural zone forestry, Manitoba and Saskatchewan 1968-69. Can. Dep. Fish. For., Can. For. Serv. Intern. Rep. MS-112. 17 pp.

Research problems can easily be perceived by those who might have a vested interest in them. For example, the opinion has been expressed that new and more hardy trees and shrubs should be developed because of the present lack of suitable species. In fact, over 300 species of woody shrubs are currently recommended by the Alberta Department of Agriculture for out planting in Edmonton.

It is doubtful whether the results of any research relating to wildlife habitat or the effects of trees and shrubs on real estate values would have much ongoing impact. The survey suggested that well landscaped lots and high-priced homes go hand-in-hand and vice-versa. Payne (1973) has reported that trees contribute 7-15% of suburban property values. It is doubtful that any further elaboration on this topic would be meaningful at this time.

Additional background on the effect of trees and shrubs on the visual and physical environment will be required before any research program is undertaken. Highway noise in residential areas is presently a problem in the city of Edmonton.

It appears to the authors that the real need of most homeowners at the present time is information. The survey revealed that garden books (i.e. comprehensive publication on horticulture) and newspaper columns are the prime media for getting new and old information to the homeowner. It was equally clear that most of the agencies whom the public might associate with the establishment and care of trees and shrubs are rarely approached by homeowners (12%) with problems.

As one of its contributions towards satisfying this information need the Northern Forest Research Centre has initiated a series of leaflets on the control of tree and shrub pests. This is a continuing series that will be expanded as specific needs are identified. In addition it is proposed that two "garden-type books" entitled *Selection, establishment and care of urban trees and shrubs* and *Insects and diseases of urban trees and shrubs* be prepared and sold to the general public.

It is recommended that, pending a full evaluation of urban forestry problems, the Northern Forest Research Centre restrict its contribution to research on insect and disease control methods and the preparation and distribution of suitable publications, and that staff continue to work closely with those individuals and agencies that have day-to-day contact with the public sector.

Particular emphasis must be placed on the need for making our research findings and publications readily available to newspaper, TV and radio horticulturalists in the three prairie provinces.

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APPENDIX I

SCIENTIFIC AND COMMON NAMES OF TREES AND SHRUBS¹

Code	Scientific Name	Common name
Trees - coniferous		
11	<i>Abies balsamea</i>	- Balsam fir
20	<i>Juniperus</i> sp.	- Juniper species
21	<i>Juniperus scopulorum</i>	- Rocky mtn. juniper
30	<i>Picea</i> sp.	- Spruce species
31	<i>Picea abies</i>	- Norway spruce
33	<i>Picea engelmannii</i>	- Engelmann spruce
34	<i>Picea glauca</i>	- White spruce
35	<i>Picea glauca albertiana</i>	- Western white spruce
37	<i>Picea pungens</i>	- Colorado spruce
38	<i>Picea pungens glauca</i>	- Colorado blue spruce
39	<i>Picea pungens kosteriana</i>	- Koster's blue spruce
40	<i>Picea</i> (species unknown)	- Blue spruce
41	<i>Picea mariana</i>	- Black spruce
50	<i>Pinus</i> sp.	- Pine species
51	<i>Pinus banksiana</i>	- Jack pine
53	<i>Pinus contorta latifolia</i>	- Lodgepole pine
56	<i>Pinus mugo rostrata</i> (tree form)	- Mugo pine
57	<i>Pinus nigra</i>	- Austrian pine
59	<i>Pinus resinosa</i>	- Red pine

¹ Alberta Department of Agriculture. 1973. Alberta horticultural guide. pp. 40-46. Species 40, 41, 155, 800, 810, 820, 830, 840 and 841 are additions to the list of recommended trees and shrubs.

60	<i>Pinus strobus</i>	- Eastern white pine
61	<i>Pinus sylvestris</i>	- Scots pine
70	<i>Pseudotsuga menziesii</i>	- Douglas-fir
80	<i>Thuja</i> sp.	- Cedar species
81	<i>Thuja occidentalis</i>	- White cedar
82	<i>Thuja occidentalis pyramidalis</i>	- Columnar white cedar
83	<i>Thuja occidentalis wareana</i>	- Ware's siberian white cedar
Shrubs - coniferous		
90	<i>Abies balsamea nana</i>	- Dwarf balsam fir
100	<i>Juniperus</i> sp.	- Juniper species (dwarf)
102	<i>Juniperus chinensis pfitzeriana compacta</i>	- Compact pfitzer juniper
103	<i>Juniperus chinensis pfitzeriana</i> (gold form)	- Golden pfitzer juniper
104	<i>Juniperus communis saxatilis</i>	- Mountain juniper
105	<i>Juniperus horizontalis</i>	- Creeping juniper
108	<i>Juniperus horizontalis</i> 'Dunvegan Blue'	- Dunvegan blue juniper
110	<i>Juniperus sabina</i>	- Savin juniper
111	<i>Juniperus sabina arcadia</i>	- Arcadia juniper
113	<i>Juniperus sabina tamariscifolia</i>	- Tamarix-leaved juniper
120	<i>Picea</i> sp.	- Spruce species (dwarf)
130	<i>Pinus</i> sp.	- Pine species (dwarf)
131	<i>Pinus mugo compacta</i>	- Compact mountain pine
132	<i>Pinus mugo pumilio</i>	- Dwarf mountain pine

140	<i>Thuja</i> sp.	- White cedar species (dwarf)
141	<i>Thuja occidentalis globosa</i>	- Globe white cedar
Trees - deciduous		
150	<i>Acer</i> sp.	- Maple species
151	<i>Acer negundo</i>	- Manitoba maple
152	<i>Acer saccharinum</i>	- Silver maple
153	<i>Acer saccharum</i>	- Sugar maple
155	<i>Acer platanoides</i>	- Norway maple
170	<i>Betula</i> sp.	- Birch species
171	<i>Betula papyrifera</i>	- Paper birch
172	<i>Betula pendula</i>	- European white birch
173	<i>Betula pendula gracilis</i>	- Cut-leaved weeping birch
190	<i>Caragana arborescens</i> 'Sutherland'	- Sutherland siberian pea tree
200	<i>Crataegus</i> sp.	- Hawthorn species
210	<i>Elaeagnus angustifolia</i>	- Russian olive
223	<i>Fraxinus pennsylvanica</i> subintegerrima	- Green ash
240	<i>Larix</i> sp.	- Larch species
242	<i>Larix laricina</i>	- Tamarack
244	<i>Larix sibirica</i>	- Siberian larch
250	<i>Malus</i> sp.	- Flowering crab apples species
251	<i>Malus baccata</i>	- Siberian flowering crab
253	Rosybloom F.C. Hybrids	- Almey, Royalty etc.
254	<i>Malus</i> sp.	- Apple species

270	<i>Populus</i> sp.	- Poplar species
275	<i>Populus balsamifera</i>	- Balsam poplar
276	<i>Populus tremuloides</i>	- Quaking aspen
278	<i>Populus</i> 'Griffin'	- Griffin poplar
279	<i>Populus</i> 'Northwest'	- Northwest poplar
290	<i>Prunus</i> sp.	- Plum, cherry species
291	<i>Prunus maackii</i>	- Amur chokecherry
292	<i>Prunus padus commutata</i>	- May day tree
293	<i>Prunus pensylvanica</i>	- Pincherry
294	<i>Prunus virginiana</i>	- Chokecherry
295	<i>Prunus virginiana melanocarpa</i>	- Western chokecherry
296	<i>Prunus virginiana</i> 'Schubert'	- Schubert chokecherry
310	<i>Quercus</i> sp.	- Oak species
312	<i>Quercus macrocarpa</i>	- Bur oak
320	<i>Salix</i> sp.	- Willow species
323	<i>Salix alba sericea</i>	- Siberian white willow
324	<i>Salix alba vitellina</i>	- Golden willow
325	<i>Salix pentandra</i>	- Laurel leaved willow
330	<i>Sorbus</i> sp.	- Mountain ash species
331	<i>Sorbus americana</i>	- American mtn. ash
332	<i>Sorbus aucuparia</i>	- European mtn. ash
333	<i>Sorbus aucuparia rossica</i>	- Russian mtn. ash
334	<i>Sorbus decora</i>	- Showy mtn. ash
335	<i>Sorbus scopulina</i>	- Green's mtn. ash

340	<i>Syringa amurensis japonica</i>	- Japanese tree lilac
352	<i>Tilia cordata</i>	- Small leaved basswood
360	<i>Ulmus</i> sp.	- Elm species
361	<i>Ulmus americana</i>	- American elm
362	<i>Ulmus pumila</i>	- Manchurian elm
Shrubs - deciduous		
380	<i>Acer</i> sp.	- Maple species
381	<i>Acer ginnala</i>	- Amur maple
390	<i>Amelanchier alnifolia</i>	- Saskatoon
410	<i>Caragana</i> sp.	- Siberian pea tree species
411	<i>Caragana arborescens</i>	- Common s.p.t.
413	<i>Caragana arborescens pendula</i>	- Weeping s.p.t.
416	<i>Caragana pygmaea</i>	- Pygmy s.p.t.
430	<i>Cornus</i> sp.	- Dogwood species
432	<i>Cornus alba argenteo-marginata</i>	- Silver leaved dogwood
435	<i>Cornus alba sibirica</i>	- Siberian coral dogwood
436	<i>Cornus alba spaethii</i>	- Gold leaved dogwood
438	<i>Cornus stolonifera</i>	- Red osier dogwood
439	<i>Cornus stolonifera flaviramea</i>	- Golden twig dogwood
450	<i>Corylus</i> sp.	- Hazelnut species
460	<i>Cotoneaster</i> sp.	- Cotoneaster species
470	<i>Crataegus</i> sp.	- Hawthorn species
473	<i>Crataegus pinnatifida</i>	- Chinese hawthorn
491	<i>Eleagnus angustifolia</i>	- Russian olive

492	<i>Eleagnus commutata</i>	- Wolf willow
500	<i>Euonymus</i> sp.	- Burning bush
503	<i>Euonymus alata compacta</i>	- Dwarf winged burning bush
520	<i>Hippophae rhamnoides</i>	- Sea buckthorn
530	<i>Hydrangea</i> sp.	- Hydrangea species
531	<i>Hydrangea arborescens grandiflora</i>	- Snow hill hydrangea
540	<i>Lonicera</i> sp.	- Honeysuckle species
550	<i>Lonicera xylosteum nanum</i>	- Dwarf european fly honeysuckle
551	<i>Lonicera</i> 'Scarlet Trumpet'	- Scarlet trumpet honeysuckle
560	<i>Philadelphus</i> sp.	- Mock orange species
570	<i>Physocarpus</i> sp.	- Nine bark species
571	<i>Physocarpus opulifolius</i>	- Common ninebark
572	<i>Physocarpus opulifolius luteus</i>	- Golden ninebark
573	<i>Physocarpus opulifolius nanus</i>	- Dwarf ninebark
580	<i>Potentilla</i> sp.	- Cinquefoil species
581	<i>Potentilla fruticosa</i>	- Shrubby cinquefoil
590	<i>Prinsepia sinensis</i>	- Cherry prinsepia
600	<i>Prunus</i> sp.	- Plum, cherry and almond species
602	<i>Prunus besseyi</i> (low form)	- Western sand cherry
603	<i>Prunus cistena</i>	- Purple leaved sand cherry
606	<i>Prunus nigra</i>	- Canada plum
607	<i>Prunus tomentosa</i>	- Nanking cherry
608	<i>Prunus tenella</i>	- Russian almond

609	<i>Prunus triloba simplex</i>	- Flowering plum
610	<i>Prunus triloba multiplex</i>	- Double flowering plum
611	<i>Prunus</i> 'Prairie almond'	- Prairie almond
612	<i>Prunus japonica</i>	- Chinese bush cherry
640	<i>Ribes</i> sp.	- Currant, gooseberry species
641	<i>Ribes alpinum</i>	- Alpine currant
642	<i>Ribes americanum</i>	- American black currant
645	<i>Ribes odoratum</i>	- Buffalo currant
650	<i>Rosa</i> sp.	- Rose species
660	<i>Rosa rugosa kamtchatica</i>	- Kamtchatica rose
670	<i>Salix</i> sp.	- Willow species
672	<i>Salix exigua</i>	- Coyote willow
680	<i>Sambucus</i> sp.	- Elder species
681	<i>Sambucus canadensis</i>	- American elder
682	<i>Sambucus nigra aurea</i>	- Golden european elder
683	<i>Sambucus racemosa</i>	- Red elder
684	<i>Sambucus racemosa plumosa aurea</i>	- Golden plume elder
690	<i>Shepherdia</i> sp.	- Buffaloberry species
691	<i>Shepherdia orgentea</i>	- Silver buffaloberry
720	<i>Spirea</i> sp.	- Spirea species
726	<i>Spirea media sericea</i>	- Oriental spirea
733	<i>Spirea vanhouttei</i>	- Bridal wreath spirea
740	<i>Syringa</i> sp.	- Lilac species
751	<i>Syringa vulgaris</i>	- Common lilac

770	Viburnum sp.	- Viburnum species
773	Viburnum lentago	- Nannyberry
775	Viburnum opulus nanum	- Dwarf european highbush cranberry
776	Viburnum opulus roseum	- Snowball highbush cranberry
779	Viburnum trilobum	- Highbush cranberry
Additional shrub species		
800	Berberis sp.	- Barberry
810	Symphoricarpos albus	- Snowberry
820	Alnus sp.	- Alder
830	Taxus canadensis	- Ground hemlock
840	Betula occidentalis	- Water birch
841	Betula glandulifera	- Swamp birch