



The average length of freeze-free season as an index to woody ornamental plant hardiness
by James Lee Murphy

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Horticulture
Montana State University
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Abstract:

This study was undertaken to determine the identity of woody ornamental plants currently grown in Montana. Recommendations for plant adaptability and hardiness zones were based upon this information. Communities selected for this survey included the long freeze-free cities of Billings, Columbus, Miles City, Glendive, Sidney, Glasgow, Great Falls, and Kalispell. Short freeze-free season towns observed were Red Lodge, Lambert, Lindsay, Richey, Scobey, Opheim, Lewistown, Augusta, and Whitefish. Comparisons of the two types of communities revealed that the use of a length of freeze-free season map as a plant hardiness region map was not feasible.

Local floras were established from surveys of all woody plants growing in various blocks of residential areas previously selected in an unbiased fashion from city maps. Resultant data leading to local hardiness designations was used as a basis upon which to suggest changes in the USDA Plant Hardiness Zone Map.

Distribution of species was useful in challenging specific hardiness numbers for several species encountered,

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Date

March 1, 1971

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ABSTRACT

This study was undertaken to determine the identity of woody ornamental plants currently grown in Montana. Recommendations for plant adaptability and hardiness zones were based upon this information.

Communities selected for this survey included the long freeze-free cities of Billings, Columbus, Miles City, Glendive, Sidney, Glasgow, Great Falls, and Kalispell. Short freeze-free season towns observed were Red Lodge, Lambert, Lindsay, Richey, Scobey, Opheim, Lewistown, Augusta, and Whitefish. Comparisons of the two types of communities revealed that the use of a length of freeze-free season map as a plant hardiness region map was not feasible.

Local floras were established from surveys of all woody plants growing in various blocks of residential areas previously selected in an unbiased fashion from city maps. Resultant data leading to local hardiness designations was used as a basis upon which to suggest changes in the USDA Plant Hardiness Zone Map.

Distribution of species was useful in challenging specific hardiness numbers for several species encountered.

INTRODUCTION AND LITERATURE REVIEW

Winter injury and death of woody ornamental plants has plagued and puzzled home owners, nurserymen and researchers for a long time. Among the proposed explanations of freezing injury to plants is the intracellular ice crystal theory as stated by Levitt (21), Wieser (31), Kenefick (17), Howell and Weiser (16), and Chandler (7). Intercellular ice formation is apparently non-lethal to plants. As ice forms water is drawn from the protoplasts. When a point is reached at which no additional water is available from the cells, ice crystals form within the cells causing their death. Howell and Weiser (16) stated that membrane puncture by ice crystals may be a means of cellular destruction by ice.

Weiser (32) proposed an alternate theory for winter plant mortality through excessive loss of intracellular water. The withdrawal of protoplasmic water by intercellular ice may cause death through several avenues as outlined by Howell and Weiser (16), proteins may be denatured by increased concentration of cytological chemicals as water loss increases, water removal may bring proteins closer together thus allowing for linkage and resultant denatured protein, and some proteins may require a water shell for activity.

Levitt (21), Free (13), Corman (9), and Chandler (7) suggested that the rate of temperature drop is of critical importance in killing of hardy tissues. Gradual temperature decline promotes acclimation; rapid decline results in injury or death. Corman (9) believed that rapid

temperature decline causes sun-scald in woody plants. During the day, the sun warms bark on the southwest side of plant stems to a temperature considerably above air temperature. After sunset the temperature drop of heated tissue is rapid enough to cause injury. Weiser (37) noted that at extremely rapid (experimental) rates of temperature drop the intracellular water does not crystallize but solidifies without crystals through a process called vitrification. Even non-hardy cells can survive vitrification. Weiser (32) concurred with Chandler (7) regarding the inverse relationship between the normal rate of temperature drop and acquired hardiness. Levitt (21) was of the opinion that rapid thawing might also cause injury to plants.

A number of factors affect the ability of cells to develop hardiness. Accumulation of sugars and a decrease in starch tend to increase acclimation according to Levitt (21) and Lapin (20). Weiser (32) expressed the possibility that cellular structures may be disassembled or translocated factors promoting hardiness may form. Levitt (21), Lapin (20) and Kenefick (18) pointed out that membranes may become more permeable and protoplasm more resistant to desiccation, thus allowing free movement of water out of the cells to form intercellular ice and avoid ice crystal formation within cells. Rehder (30) suggested that in general, plants in dry condition can withstand cold because of cellular resistance to desiccation damage. Levitt (21) and Lapin (20) indicated that older plants tend to fare better during winter than

younger ones due to reduced water content. Flint, Boyce, and Beattie (12) were of the opinion that herbaceous species are killed by a single freezing temperature while woody species with more tissues frost kill over a range of temperatures specific for the various tissues. Young woody plants may be affected by cold much as herbaceous species are.

Differentials in growth rhythms related to time of hardening exist between species and among populations of a species. Exotics that could withstand the minimal temperatures of an area are too slow in hardening or too fast in dehardening to survive in that area according to Weiser (32), Flint (11), Lapin (20), and Clark (8). Weiser (32) believed that the initial stimulus to hardening is short days followed by a secondary stage of chilling and a tertiary stage of prolonged cold temperatures. Hardening can be partially inhibited by application of artificial light or periods of warm temperatures.

Many external environmental factors may affect the ability of plants to harden. Wyman (35) cited soil chemistry and physical condition, rainfall, and temperature, especially minimum, as the most influential factors affecting plant hardiness in North America. Soils are often modified by addition of mulch and fertilizer, by leaching, and by removal or burial of topsoil during construction. Rainfall is adequate in most areas of the United States for most ornamentals and is supplemented by irrigation. It has been upon climate, and more specifically temperature, that judgements as to probable hardiness of plant species for given areas have been based.

Montanans have little information available to them regarding the woody plants of potential hardiness in specific areas of the state. Tests currently underway at the Montana Agricultural Experiment Station and its branches may yield useful information in this regard. However, these tests will require years of evaluation, and the number of species potentially desirable for testing may be limited. . .

At present, inquiries regarding plant hardiness must be answered using adaptability information obtained in tests at Bozeman, or based upon staff members' knowledge of plant species found in the locality in question or in analogous sites.

Several hardiness maps have proven useful to Montanans in estimating plant adaptability for given areas. In the Atlas of American Agriculture 1936, the U. S. was divided into 28 growth regions based on homogeneous native species. A revision extended the zonation to 32 regions.

Rehder (30) of the Arnold Arboretum used mean minimum winter temperatures in producing a zone map of most of the United States and southern Canada (Fig. 1d). Species were rated according to the coldest zone in which they were expected to survive with Zone I the coldest and Zone VII the mildest. Ratings were based on trials at the Arnold Arboretum of Harvard University which is located in Zone V. Recommendations for species not tested were deduced from performances under similar European conditions. A later revision by Rehder was followed by a revision to 10 zones by Wyman (34). A 1967 Hardiness Zones of the

United States and Canada by the Arnold Arboretum was revised from Rehder's older work using more recent weather data (Fig. 1c).

The United States Department of Agriculture released a hardiness zone map in 1960 (27) (Fig. 1b). It is more detailed than the Arnold Arboretum Map (14) but unfortunately its zone numbers were not equated with those of the Arnold Arboretum. Thus species assigned zone numbers in the Manual of Cultivated Trees and Shrubs by Rehder (30) are not delineated by zones of the same number on the Plant Hardiness Zone Map. A comparison of zones from the two sources as adapted from Horticulture Magazine (23) is shown in the table below.

Table 1. Comparison of Plant Hardiness Zones. Temperatures indicated are mean minimums in which plants of that zone can survive.

°F	USDA Zone	Rehder Zone	°F
-50°	1	I	-50°
	2a		
-40°	b	II	
	3a		-35°
-30°	b		
	4a	III	
-20°	b		-20°
	5a		
-10°	b	IV	-10°
	6a	V	- 5°
0°	b		
	7a	VI	5°
10°	b	VII	10°
	8a		
20°	b	VIII	20°
	9a		
30°	b	IX	30°
	10a		
40°	b	X	40°

Although the USDA Map (27) is more complex than those based on Rehder's work, by its own admission it must be considered general in nature and not specific enough for local conditions. It states that "in determining if a certain plant will survive in a given zone, it is necessary to consider factors other than the minimum temperature range of each zone. For example, temperatures of adjacent zones tend to become increasingly similar near their boundaries. Moreover there are innumerable island climates that may be considered milder or colder than the zone average. These islands are especially frequent in hilly or mountainous areas. Mountainous areas on this map are not shown to be as cold as might be expected. The reason for this is that most weather stations from which records were obtained are located in valleys where temperatures tend to be milder and where plants are most likely to be cultivated. Other plant growth factors must also be considered. Frost occurrence, seasonal rainfall distribution, humidity, soil characteristics and duration and intensity of sunlight may bear little relationship to mean winter temperature. The combined effects of all factors determine the plant adaptability. They would be difficult to depict geographically. Frost dates, length of growing season, and minimum winter temperatures are among the least readily controlled of the major factors that govern the geographic adaptability of plants" (27).

A 1967 California study attempted to establish plant climate zones by observed reactions of many native, field crop, and ornamental plants

to the total environment. Kimball and Gilbert (19) considered plants as indicators of climate and their distribution, native and exotic, a response to climate. The three or more regional plant climates within major plant climates were composed of zones and subzones based mostly on temperature.

Canada commissioned an ambitious hardiness study based on low winter temperature, frost free period, summer and winter rainfall, summer high temperatures, snow depth, and wind velocity, Oullet (24), Oullet and Sherk (25, 26). One hundred seventy-four species and cultivars were planted at 108 stations for hardiness observation. Estimates of suitability indices for 640 stations were made. Ten probability of survival zones were then drawn.

The scope of the above investigation seemed impossibly large for a single researcher to attempt in a thesis study for Montana. For the purpose of the present study many environmental influences were considered for examination.

Soils characteristics differ so greatly from one home to the next that a study based on soil chemistry and condition would not be practical. Irrigation negates the effect of seasonal rainfall deficiencies. Subsurface drainage may not be variable enough between Montana cities to base a hardiness study on. Buildings greatly affect air drainage. The effects of sunlight vary within an individual lawn since all exposures are utilized. Inherent vigor of individual plants, and the effects of

animal and spray damage are too variable to be of much consequence. Information on humidity in various Montana communities is of limited availability. Hoag (15) considered soil temperatures due to variable snow cover a factor limiting hardiness. Again, conditions vary greatly from one lawn to another because of utilization of all exposures, variability of snow covers due to changes in air drainage, and wind blockage by buildings. Urban snow cover is less a factor than on rural sites due to the use of mulches on urban plantings. The probability of chinook winds which can cause winter damage was considered according to the Relative Frequency of Distinct Chinooks in Montana 1923 to 1932 inclusive Map (31) (Fig. 1e). The inseparable and not readily controlled factors of frost dates and length of freeze-free season were chosen as a basis for the present study. Fortunately, a detailed average length of freeze-free season map for the State of Montana, based on 32° F freezes, has been prepared by Caprio (6) (Fig. 1a).

The purposes for conducting the research leading to this dissertation were fourfold.

1. To ascertain the identity of currently cultivated woody ornamental plants as a guide to adapted species and varieties in a selected series of Montana cities and towns, and as an aid in selecting plant materials for further testing.

2. To challenge the accuracy of the Montana section of the USDA Plant Hardiness Zone Map (27).
3. To question the accuracy of zone number designations for species currently grown in Montana.
4. To test the Freeze-Free Season Map (6) as a more accurate guide for local conditions. The Freeze-Free Season Map (6) might then be used as an alternate for or a complement to the USDA Plant Hardiness Zone Map (27).

Figure 1 Montana Climatological Information

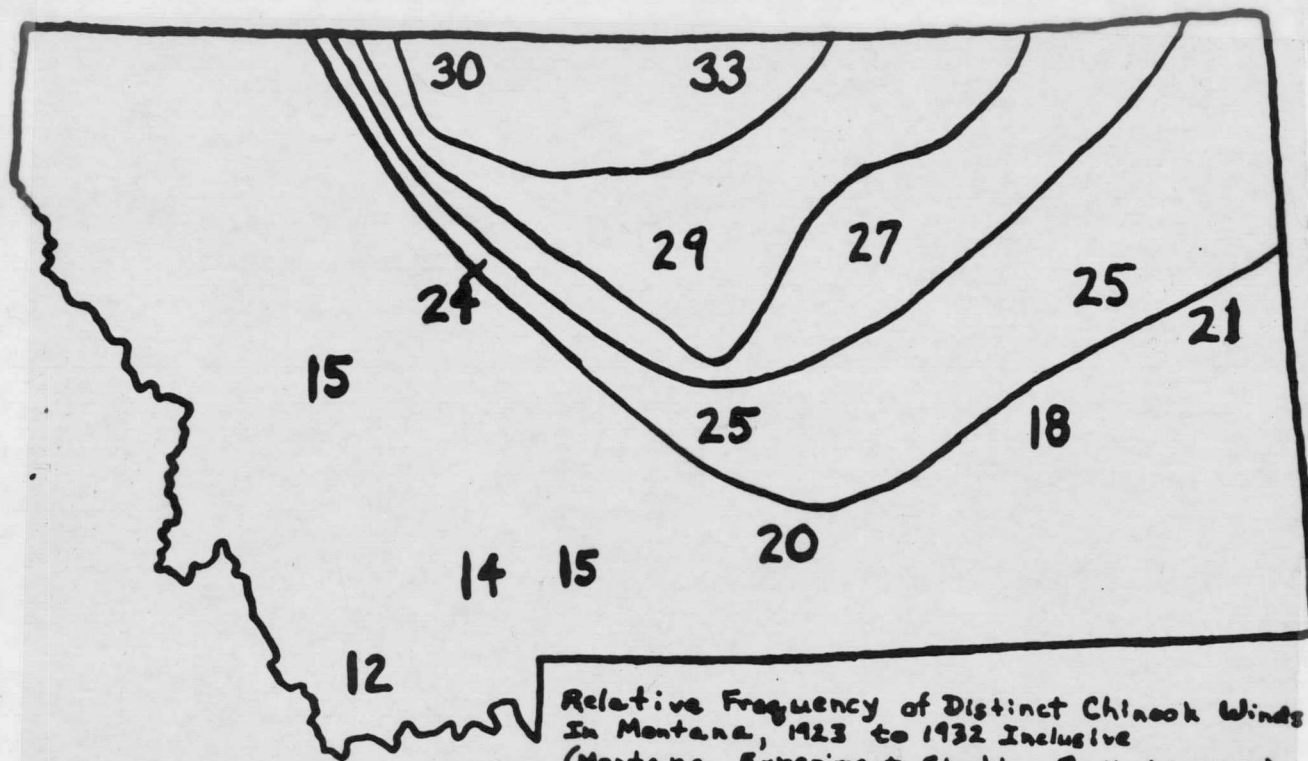
Figure 1a (Colored Photo) Montana Average Length of Freeze-Free Season.

Figure 1b (Transparency) USDA Plant Hardiness Zone Map.

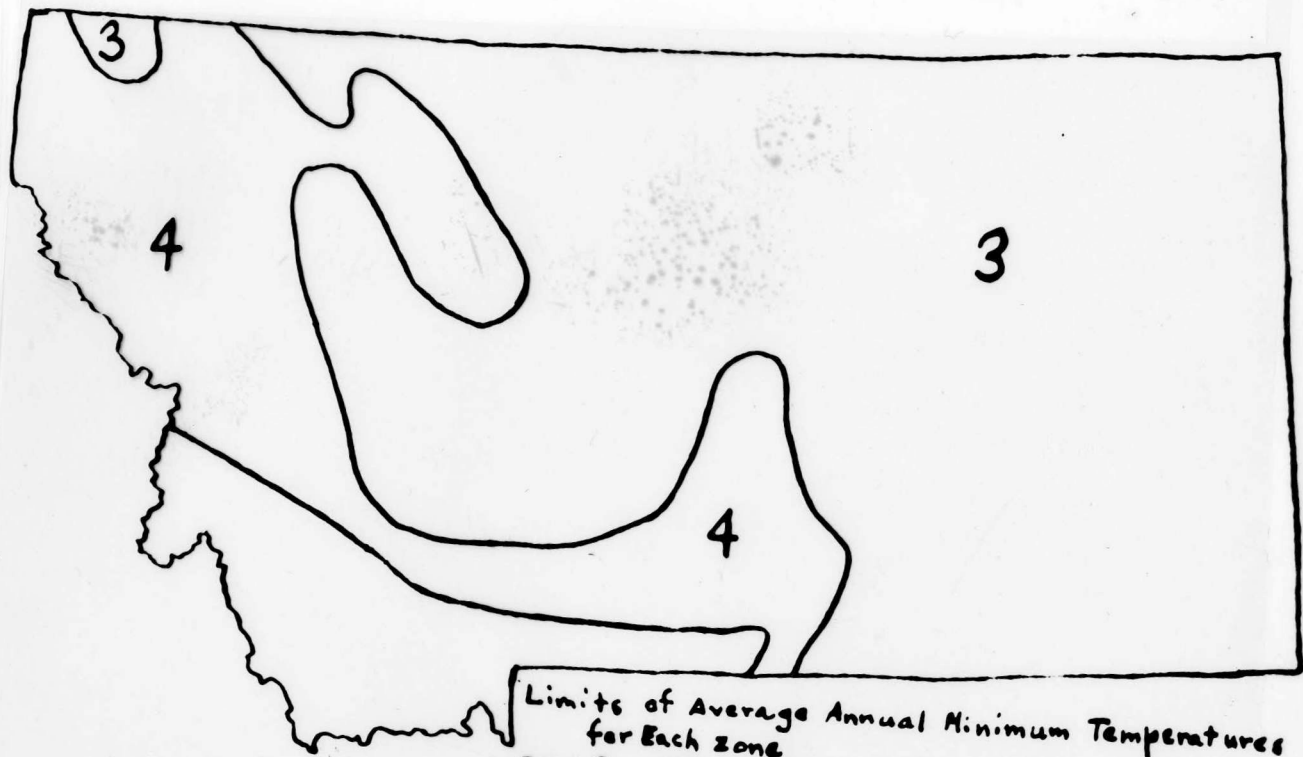
Figure 1c (Transparency) Hardiness Zones of the United States and Canada (Arnold Arboretum).

Figure 1d (Transparency) Map of Climatic Zones (Rehder).

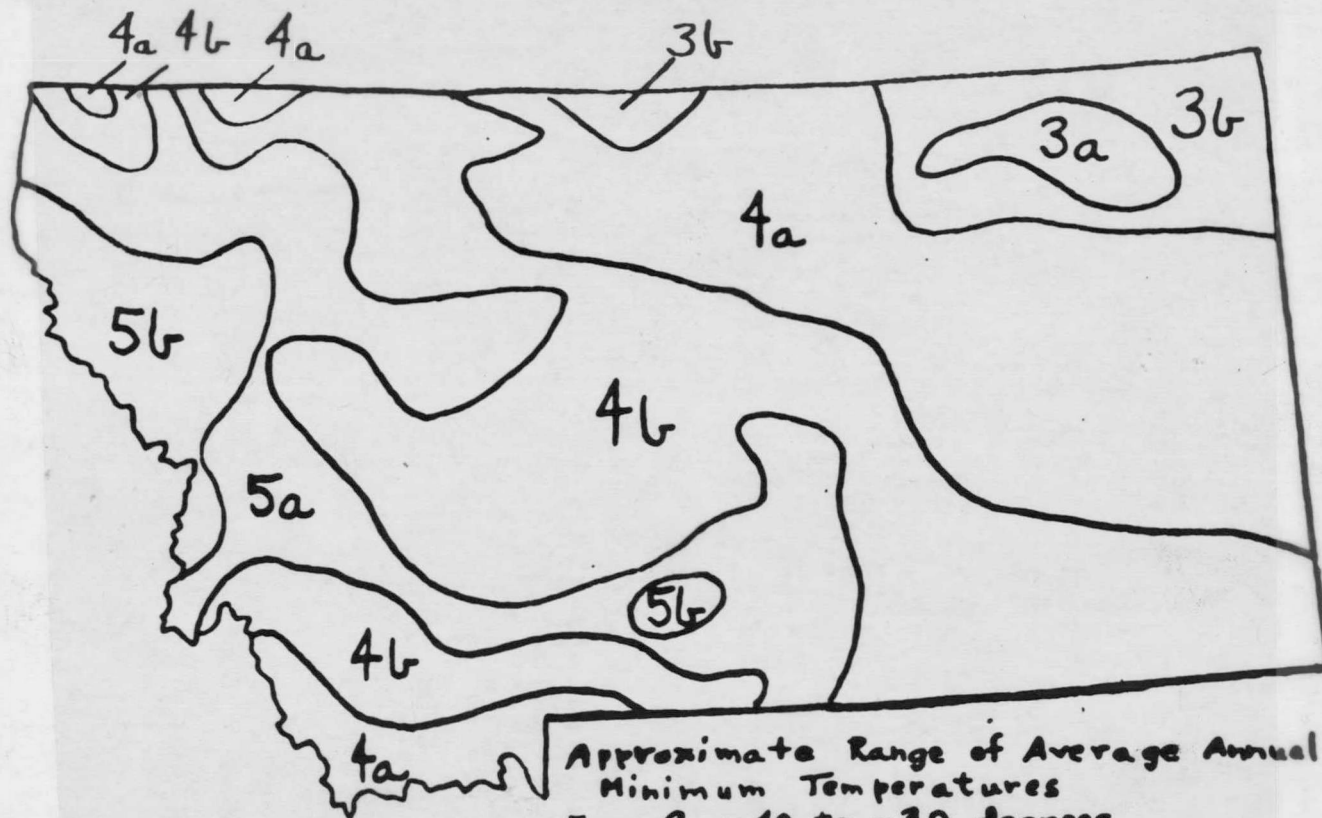
Figure 1e (Transparency) Relative Frequency of Distinct Chinooks in Montana 1923 to 1932 Inclusive. (Reitz).



Relative Frequency of Distinct Chinook Winds
In Montana, 1923 to 1932 Inclusive
(Montana Experiment Station Bulletin 340)



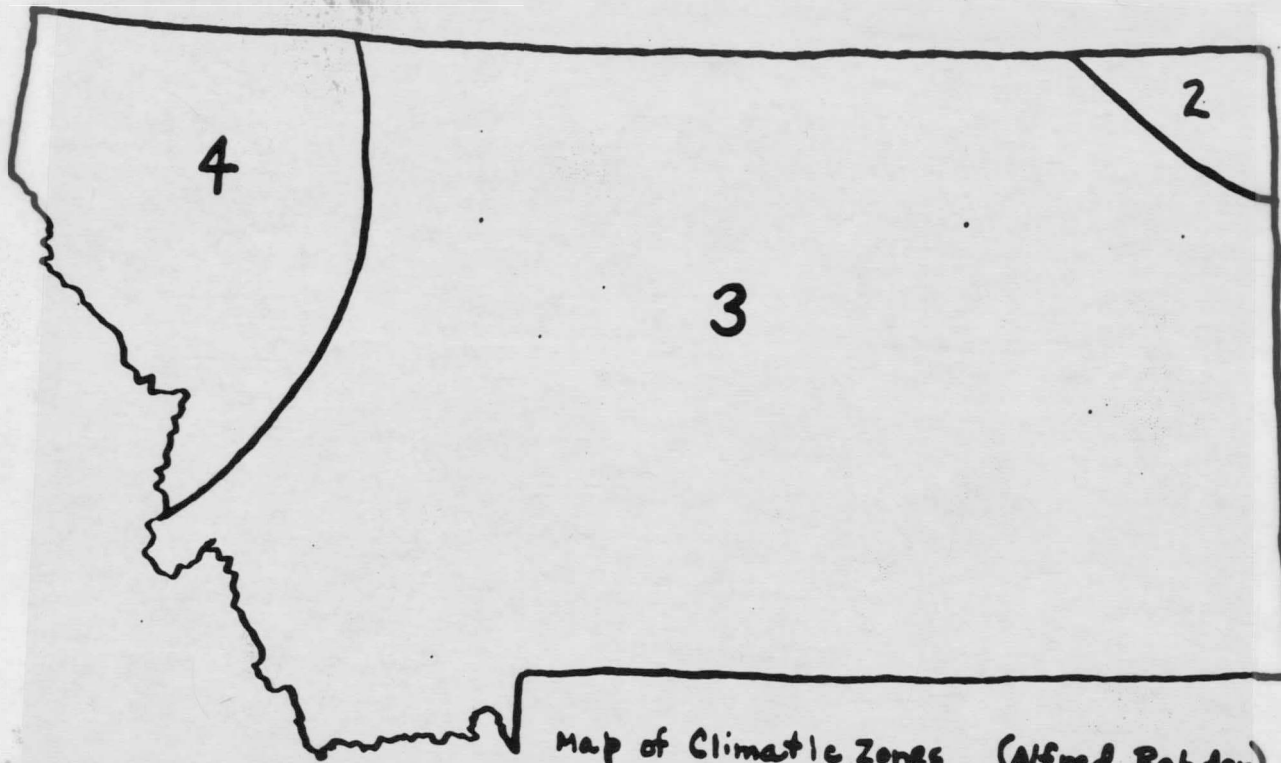
Limits of Average Annual Minimum Temperatures
for Each zone
Zone 3 -35 to -20 degrees
Zone 4 -20 to -10 degrees (Arnold Arboretum 1967)



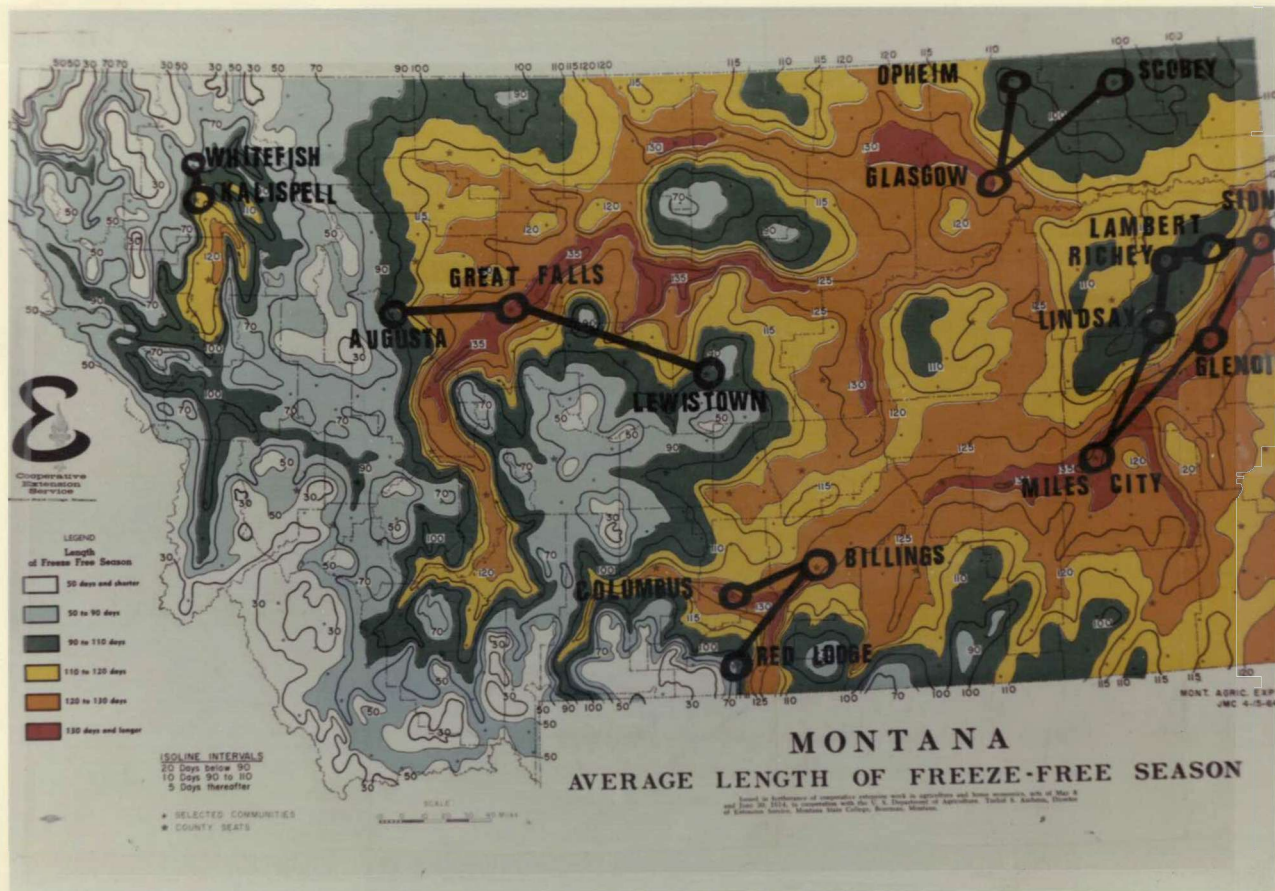
Approximate Range of Average Annual
Minimum Temperatures

Zone 3	-40 to -30 degrees
Zone 4	-30 to -20 degrees
Zone 5	-20 to -10 degrees

(U.S.D.A.)



Map of Climatic Zones (Alfred Rehder)



EXPERIMENTAL PROCEDURES

The Montana Average Length of Freeze-Free Season Map (6) is divided into six colored zones. Freeze-free seasons of 50 days and shorter are depicted as white areas, 50 to 90 days blue, 90 to 110 days green, 110 to 120 days yellow, 120 to 130 days orange, and 130 days and longer red (Fig. 1a).

Five areas distinguished by length of freeze-free season were selected as study sites. One or more communities in each long season area were researched and nearby relatively short season communities were surveyed for comparison.

Area 1 was concerned primarily with Billings (120-130 frost-free days). Nearby Columbus (130 days +) was also observed. Red Lodge (50-90 days) was the nearest short season community and was chosen for comparison.

Area 2 included the long season cities of Miles City, Glendive and Sidney (all 130 days +). The small 90-110 day communities of Lambert, Lindsay and Richey were surveyed as short season comparisons.

Glasgow (130 days +) and Scobey and Opheim (90-110 days) were selected as Area 3.

The central Montana cities of Great Falls (130 days +) and Lewistown and Augusta (90-110 days) were selected as Area 4.

Although, relatively brief in freeze-free season, Kalispell (110-120 days) was chosen to represent western Montana and was designated

Area 5. With the exception of Polson, all other sizable communities west of the continental divide having growing seasons shorter than 110 days. Whitefish, with 50 to 90 consecutive freeze-free days, was selected as the short season city to compare to Kalispell.

City maps were procured from the major communities under study, although none were available from the small communities of Opheim, Lambert, Lindsay, Richey and Augusta. With help from city officials, the commercial and industrial sections were identified on the maps. Beginning in the residential areas every third block in either direction was marked on the map. In the larger cities of Billings and Great Falls every sixth residential block was marked. These blocks were chosen in an unbiased fashion before visiting the site. In Lambert and Lindsay all buildings were visited. In Richey and Augusta the residential area containing the most houses was surveyed until a typical flora was established by visiting about three blocks in each community.

Once the blocks to be studied were established, the author, during the summer of 1968, recorded all woody plants present in them. Volunteer specimens of such species as Populus alba and Fraxinus pennsylvanica were not considered as being planted purposely and so were not recorded. The multitude of roses, hardy everywhere in Montana, were also not considered. Counting the number of plants in hedges proved impractical so an estimate of the hedge footage was recorded. For the purposes of this paper the term 'hedge' was used to indicate a row of

closely planted trees or shrubs, a wall or fence of vines, an expanse of ground cover plants, and all situations where difficulty was encountered in distinguishing individual plants.

To aid in species identification, 311 pressed specimens were collected and filed in the Montana State University Herbarium. Primary sources consulted for specimen identification were Rehder (29, 30), Wyman (33, 34, 35, 36), Booth (4), Booth and Wright (5), Hoag (15), Bailey (2, 3), and Anderson and Weir (1). A Checklist of Woody Ornamental Plants of California by Mathias and McClintock (22) was chosen as the standard upon which to base scientific names.

An attempt was made to record the mean age of plants grown in a sample block because it was believed that newly planted specimens could not be considered as having demonstrated hardiness. Such age values were approximations. Some new homes had been built and landscaped in old residential areas while in other cases new plants were added to older lawns. This age approximation was made by observation of plant size and apparent age of buildings. Although probably not necessary here, for future publication the age could be determined by checking dates when building permits were issued.

The data was arranged for each city by the block surveyed; alphabetically listing the Zone I species, then Zone II species, etc. Species were further categorized as broadleaf trees, coniferous trees, broadleaf shrubs, coniferous shrubs, and vines and ground covers. Totals for individual specimens of each species observed were then determined.

Hedge footage was converted to individual plants to simplify the statistical treatment. To convert footage to individuals the recommendations of Wyman (34) were used. The suggested spacing of 18 inches for most species, 3 feet for evergreens, 5 feet for large trees, and 5 feet for vines, produced the number of individual plants per hedge from the footage estimated. Tabulated results were recorded as individual plant counts for each species; hedge footage for each species was listed as a separate count. Hedge conversion values were recorded and the individual counts and conversion individuals were added and recorded as Individuals plus Hedge Conversion. The figures of the Individuals plus Hedge Conversion were used in the final summation of plants for each zone number in each category.

Percent of the total plant population per species, percent of the total plant population in each zone and a mean zone number for the total plant population for each community was also determined.

RESULTS AND DISCUSSION

While conducting this survey a number of difficulties in plant identification were encountered. Varieties and forms are difficult to identify so varietal names were given only on positive identifications. Habit or color adjectives were often added to species names, for example, tall blue forms of Rocky Mountain juniper might be listed as Juniperus scopulorum upright blue. Hybrids can be confused with species. For example, Ulmus x rubra often looks much like Ulmus americana. Some species easily hybridize and offspring show gradations of form between species. The Betulae are quite interfertile. Betula pendula 'Gracilis' is unique, but other birches were all called Betula papyrifera in this thesis with the realization that others may be present in the population. The Salix also cross freely and many specimens were referred to as Salix sp. The various Prunus sp. and Ribes sp. are difficult to identify. Rapid field differentiation between Cornus stolonifera and Cornus alba 'Sibirica' and between the many Philadelphus sp. is impossible. The author encountered difficulty in differentiating between Pinus cembra and Pinus nigra austriaca. Counts on these two species may be inaccurate. Finally, immature and clipped specimens of some conifers were difficult to identify. Since all spruces grown in Montana are Zone II species, unidentified specimens were included in statistical data. Junipers vary in zonation, so unidentified specimens were listed but not included in the data.

One must not assume that a species not growing in a certain locale

could not do so. What is planted in a community is often a reflection of what is available from local nurseries or mail order catalogs servicing that community. What survives is a reflection of the community's climate.

Affluence of an area also affects the type of plant materials grown. Low income neighborhoods are often underplanted or planted with either native species or those exotics that tend to multiply easily. The author felt that community size was an indication as to the ability of the local homeowners to care for exotic species. Very small communities tend to be agriculturally oriented. Citizens must spend long hours working during the growing season, and have less time for lawn work than individuals in larger cities. An abundance of plant materials requiring little care was noted in smaller cities. The maturity of many plantings in low population centers was also noted. Small communities reflect the exodus to the cities in that most homes and plantings are over 30 years old and few new residences are being constructed. Many buildings have been abandoned. Only Billings and Great Falls show a regular gradation in age of residential areas from the older center of the city to new suburbs.

Data from the appendix survey tables (pages 81 to 184) was condensed into short summaries appended to discussions regarding the communities studied.

In comparing survey results in the communities involved, the

author attempted to first characterize the climate of each city. Next, hardiness zones of the old Rehder map (30), the later Arnold Arboretum map (14), and the USDA Plant Hardiness Zone Map (27) were compared. A weighted mean for all plants recorded in each local survey was used to compare cities. The author then chose what he felt was a possible hardiness zone designation for each community based on previous work and that of this paper. Finally, unusual species noted in each community were discussed.

AREA 1 - BILLINGS, COLUMBUS AND RED LODGE:

The larger community of Billings is horticulturally complex. A mild climate allows for great variety among woody ornamental plants.

The mean minimum January temperature in Billings was recorded as 12° F. Relative humidity varies from a yearly average of 48% at 5 P.M., M.S.T. to 69% at 5 A.M., M.S.T. (10) Chinook winds have been rare - 20 or less (31) and Billings has enjoyed an average of 120-130 freeze-free days yearly. Rehder considered Billings to be in a Zone III area (USDA 3b, 4a, 4b). The Arnold Arboretum and the USDA designated Billings Zones IV and 5a respectively. The author found all plants recorded averaged a zone number of 3.164, second only to Miles City's 3.198.

Comparing percent total plant population for plants in various zone numbers, the author would concur with the USDA and raise the zone number to 5a for Billings. While only 6% of all plants were ZONE V species, the author felt the tempering effects of the sizeable city's

shelter allowed for a high zone rating. Suburban areas would not enjoy as hardy a plant climate. Certainly the Arnold Arboretum designation of Zone IV (USDA 5b) would be a minimal zone recommendation. In general the plant population of Billings was found to be thrifty with little evidence of winter damage. In suburban areas the hot dry summer climate was found to be more detrimental than the winter climate.

Billings appeared to be a horticulturally aware city, with evidence of professional landscaping. As noted, much variety of materials exists in Billings. The amount of affluence dictated the amount of variety. In the comparatively wealthy Rimrock section of the city unusual and expensive species and varieties abound. The same was not true of the less affluent south side.

Among the more unusual specimens sighted were Platanus occidentalis, Rhamnus davurica, Fraxinus mandshurica, Rhamnus frangula, Quercus borealis, Pyracantha coccinea, Buxus microphylla japonica, Robinia hispida, Liriodendron tulipifera and Phellodendron amurense.

Campsis radicans did well in Billings as a blooming vine. Ginkgo biloba was sighted only in Billings, and the much unexpected Buddleia alternifolia was observed while in blossom.

Tabular results include total plants recorded in each of Rehder's zone classes. The % total of the entire plant population (T.P.P.) for each city was determined. The product of zone number and the % total plant population (Zone # X % T.P.P.) was recorded.

Table 2. Plant population summary and mean zone designation for Billings, Montana.

Plant Zone		Totals	% Total Plant population	Zone # X % T.P.P.
Total Zone I	Plants	18	.095	.001
Total Zone II	Plants	4553	24.077	.482
Total Zone II.5	Plants	528	2.792	.070
Total Zone III	Plants	7192	38.033	1.141
Total Zone III.5	Plants	26	.137	.005
Total Zone IV	Plants	5319	28.128	1.125
Total Zone IV.5	Plants	6	.032	.001
Total Zone V	Plants	1152	6.092	.305
Total Zone V.5	Plants	94	.497	.027
Total Zone VI	Plants	14	.074	.004
Total Zone VII	Plants	8	.042	.003
Total all plants		18,910		
Average zone number for total of all plants identified				3.164

Columbus has a mean minimum January temperature of 8° F and a mean maximum July temperature of 90° F, the highest recorded by Dightman (10). The chinook belt did not extend to Columbus where an average of 15 chinooks were recorded per year (31). An average of 130 or more consecutive freeze-free days can be expected yearly.

Rehder considered the area surrounding Columbus to be of Zone III (equal to USDA 3b, 4a, 4b) in climate. The Arnold Arboretum indicated

Zone IV , while the USDA classified Columbus as a Zone 5a. The author found that an average zone number for all plants recorded in Columbus was a relatively high 3.067. Only Miles City and neighbor city Billings were found to rate higher. Fifty percent of all plants recorded were of Zone III (3b, 4ab) designation. Twenty percent were Zone IV plants (5ab).

Because of the high average zone number and a sizable Zone IV (5ab) plant population the author would choose middle ground and agree with the former consideration by the Arnold Arboretum and the USDA of Zone IV (5a).

Table 3. Plant population summary and mean zone designation for Columbus, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	199	13.365	.267
Total Zone II.5	Plants	199	13.365	.334
Total Zone III	Plants	747	50.168	1.505
Total Zone IV	Plants	294	19.745	.790
Total Zone IV.5	Plants	2	.134	.006
Total Zone V	Plants	37	2.485	.124
Total Zone V.5	Plants	11	.739	.041
Total all plants		1489		
Average zone number for total of all plants identified				3.067

Red Lodge, Montana was characterized climatically as an alpine community. The mean minimum January temperature was calculated to be 12° F (10). The frequency of chinook winds was found to be low, as the chinook belt did not extend this far south. Average length of freeze-free season was found to be 50 to 90 days. The 1967 Arnold Arboretum map and Rehder's map included Red Lodge in a Zone III area. Rehder's III includes USDA's (3b, 4ab). The USDA map indicated a Zone 4b designation. Plants recorded in Red Lodge revealed an average zone number of only 2.631, which was found to be eleventh or twelfth of the 15 communities researched. Fifty-seven percent of the plants recorded were Zone II species. Nineteen percent were Zone III and 17 percent Zone IV. All former work pointed toward a ZONE III designation. This study found no justification for a change from III (4b).

The author noted that the climate of Red Lodge was harsh on ornamental plants. Fraxinus pennsylvanica was found to be of marginal hardiness because of winter injury. Red Lodge as a whole appeared underplanted with a limited number of species. Sorbus aucuparia, Syringa vulgaris and Lonicera tatarica were overplanted.. Much native material was grown probably as much for necessity as for preference.

Two unusual plants were noted. A mature weeping form of Sorbus aucuparia seemed worthy of propagation. Also a hardy Rhododendron sp. was seen during two consecutive summers. The azalea was not thrifty.

Table 4. Plant population summary and mean zone designation for Red Lodge, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone I	Plants	8	.389	.004
Total Zone II	Plants	1180	57.393	1.148
Total Zone II.5	Plants	65	3.161	.079
Total Zone III	Plants	397	19.309	.579
Total Zone IV	Plants	342	16.634	.665
Total Zone IV.5	Plants	3	.146	.007
Total Zone V	Plants	60	2.918	.146
Total Zone VII	Plants	1	.049	.003
Total all plants		2056		
Average zone number for total of all plants identified				2.631

AREA 2 - MILES CITY, GLENDIVE, SIDNEY, LAMBERT, LINDSAY AND RICHEY:

Miles City had the highest average zone number for all plants recorded in this survey. A fairly low 6° F mean minimum January temperature was recorded. The chinook belt does not include Miles City where 18 or less chinooks were observed yearly (10). Miles City has an average of 130 or more consecutive freeze-free days each year.

Rehder and the Arnold Arboretum have classified Miles City as a Zone III city. Rehder's Zone III includes the USDA 3b, 4a and 4b. The USDA designated Miles City as a Zone 4a. With 28% of all plants grown in this city belonging to the Zone IV (5a) category, that zone would be

a minimal zone designation. Nearly 7% of the plants were Zone V species, indicating that Miles City might be considered marginally Zone V (6a).

Much of the Miles City residential area was older. Thus, those plants that grew there could be considered hardy, but a lack of newer introduction was noted. Ulmus pumila was much overplanted.

Morus alba, Cotinus coggygia and Fraxinus nigra were unusual members of the local flora. A fairly large Prunus armeniaca was also noted.

Table 5. Plant population summary and mean zone designation for Miles City, Montana.

Plant Zone	Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants 1208	21.618	.432
Total Zone II.5	Plants 69	1.235	.031
Total Zone III	Plants 2374	42.484	1.275
Total Zone IV	Plants 1542	27.595	1.104
Total Zone IV.5	Plants 2	.036	.002
Total Zone V	Plants 375	6.711	.336
Total Zone V.5	Plants 18	.322	.018
Total all plants	5588		
Average zone number for the total of all plants identified			3.198

Mean minimum January temperature in Glendive was found to be 40° F. The Montana chinook belt stopped north of Glendive where an average 21 chinook winds were recorded each year (31). The average annual length

of freeze-free season was noted as the maximal 130 days or longer, Rehder and the 1967 Arnold Arboretum works suggest that Glendive lies in a number III hardiness zone. The USDA map rated Glendive as Zone 4a. In observing the horticultural flora of Glendive, the author found that all plants recorded growing in the community averaged a mean zone classification of 3.067. Only Miles City and Billings averaged higher. The USDA designation might have been the more accurate. Thirty-two percent of the species found in Glendive were Zone IV with more than 3% Zone V species as a marginal group. Having used Rehder extensively as the reference for species hardiness numbers, the author noted that the large Zone IV group of plants would be equivalent to a zone 5a, b rating by the USDA. The author felt that a hardiness rating of 5a on the USDA Scale (IV) is a safe minimal designation with the likelihood that a number of Zone V species should also be hardy.

Several unusual plants found in Glendive were worthy of note. The heart leaf Dioscorea batatas vine was seen once, a particularly coarse leaf Ulmus americana might be worthy of propagation, and the only specimens of Viburnum lentago found in this work were seen in Glendive.

For a small community, Glendive possessed a good variety of materials and ornameals rarely seen.

Table 6. Plant population summary and mean zone designation for Glendive, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	1747	31.874	.637
Total Zone II.5	Plants	130	2.372	.059
Total Zone III	Plants	1640	29.922	.898
Total Zone IV	Plants	1754	32.001	1.280
Total Zone IV.5	Plants	5	.091	.005
Total Zone V	Plants	190	3.467	.173
Total Zone V.5	Plants	14	.255	.014
Total Zone VII	Plants	1	.018	.001
Total all plants		5481		
Average zone number for total of all plants identified				3.067

Climatological data for Sidney is rather sparse. Mean minimum January temperature has been found to be 0° F. Sidney can expect an average 25 chinook winds yearly and the maximal 130 consecutive freeze-free days or more.

Rehder and the Arnold Arboretum designated Sidney Zone III for plant hardiness. The USDA said Zone 4a which is equivalent to the Rehder III. The author found that Sidney rated a Zone 3.062 as a weighted mean for all plants noted in that city. Former work may have underestimated the mild climate of the Sidney area. Although 39% of all species noted in Sidney were Zone III species, 19% and 9% were found to be Zone IV and V

plants, respectively. Nineteen percent of all plants noted represents a sizeable part of the population. Nine percent of all plants must not be overlooked either. Judging from the numbers of high zone number species and apparent thriftiness of the specimens being grown, the author felt that Sidney might easily be considered Zone IV (5a) and marginally Zone V.

Unusual plants included in the varied plant population of Sidney were Acer tatarica, Viburnum lantana, Lonicera xylosteum and Prunus padus.

Table 7. Plant population summary and mean zone designation for Sidney, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	915	31.530	.631
Total Zone II.5	Plants	38	1.309	.033
Total Zone III	Plants	1121	38.629	1.159
Total Zone IV	Plants	549	18.918	.757
Total Zone IV.5	Plants	3	.103	.005
Total Zone V	Plants	268	9.235	.462
Total Zone V.5	Plants	8	.276	.015
Total all plants		2902		
Average zone number for the total of all plants identified				3.062

The small communities of Lambert, Lindsay and Richey were chosen as short season comparisons to long season Miles City, Glendive and Sidney. Due to the limited data available from these small towns, they will be considered collectively as one area. Little has been recorded for the climate of these towns. The mean minimum January temperature was recorded as 0° F. Chinook winds occur on the average of 25 times a year. Ninety to 110 freeze-free days are expected each growing season. A low mean annual precipitation of 14 inches per year was recorded and Richey residents indicated that irrigation is financially prohibitive.

Early authors (30, 14, 27) agreed on placing these communities in a Zone III area. The USDA Zone 4a is included in the Rehder and Arnold Arboretum III. The mean zone number for the recorded plant population was found to be a low 2.682, tenth ranked among all 15 communities researched. Forty-five percent of the species seen were Zone II plants and 42% were Zone III. Nearly 12% of all plants noted were Zone IV species. But almost 10 of this 12% was Ulmus pumila, which the author felt was hardier than its designated Zone IV. Zone III for that species might be more realistic.

The author would concur with Rehder, the Arnold Arboretum, and the USDA on a Zone III designation (4a). Overall, the climate appeared harsh to ornamental plants and the desiccation by hot dry winds was evident. One specimen of the rarely seen Phellodendron amurense was observed in Lambert.

Table 8. Plant population summary and mean zone designation for Lambert, Lindsay, and Richey, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	927	44.718	.894
Total Zone II.5	Plants	19	.917	.023
Total Zone III	Plants	865	41.727	1.252
Total Zone IV	Plants	240	11.577	.463
Total Zone IV.5	Plants	1	.048	.002
Total Zone V	Plants	18	.868	.043
Total Zone V.5	Plants	2	.096	.005
Total all plants		2072		
Average zone number for the total of all plants identified				2.682

AREA 3 - GLASGOW, SCOBEEY, AND OPHEIM:

Glasgow's mean minimum January temperature was found to be -4° F. Frequent chinook winds average 27 times a year in Glasgow where a long growing season of 130 days or more can be expected.

All early work agreed on III as the proper zone for Glasgow's area; 3b in the case of the USDA. The plant population of Glasgow had a mean zone number of 3.003. Thirty-one percent of those plants were Zone III species and 25% were Zone IV. Fifteen of the 25% was found to be Ulmus pumila. The Zone IV designation for some of the species noted in Glasgow might be a bit high. The author felt such was the case with Ulmus pumila.

All hardiness figures indicated that Glasgow should be considered Zone III (3b). The author would agree after noting that zone changes might be necessary for some species growing in Glasgow.

Among the more unusual plants seen in Glasgow were Juniperus virginiana 'Henwick', Juniperus squamata meyeri, Cornus alba 'Sibirica' argenteo marginata, Salix purpurea, Symphoricarpos chenaultii and Weigela florida.

Table 9. Plant population summary and mean zone designation for Glasgow, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone I	Plants	1	.033	.000
Total Zone II	Plants	1018	33.742	.675
Total Zone II.5	Plants	143	4.740	.119
Total Zone III	Plants	928	30.759	.923
Total Zone III.5	Plants	5	.166	.006
Total Zone IV	Plants	757	25.091	1.004
Total Zone IV.5	Plants	1	.033	.001
Total Zone V	Plants	147	4.872	.244
Total Zone V.5	Plants	14	.464	.026
Total Zone VI	Plants	1	.033	.002
Total Zone VII	Plants	2	.066	.005
Total all plants		3017		
Average zone number for total of all plants identified				3.005

The mean minimum January temperature for Scobey was recorded at -4° F. The chinook belt extends through Scobey which experiences an average of 27 chinook winds yearly. Scobey's short growing seasons average 90 to 110 freeze-free days.

Rehder expected mostly Zone I and II plants to survive in Scobey and designated the area III. The Arnold Arboretum indicated Zone III and the USDA placed it in a 3b, which is included in a Rehder's III. The author found Scobey's plant population to average a Zone 2.391, which except for nearby Opheim was the lowest recorded.

The majority of all plants grown in Scobey were Zone II species representing 66% of the total. A sizeable 28% of the population were Zone III. In choosing a hardiness number for Scobey the author would follow former work and suggest a Zone III (3b). The Arnold Arboretum, the USDA, and Scobey's plant population give creditability to that designation.

Fraxinus mandshurica, Sambucus canadensis 'Aurea', Caragana frutex, Euonymus nana were among the rarer specimens seen in Scobey.

Table 10. Plant population summary and mean zone designation for Scobey, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	3219	65.909	1.318
Total Zone II.5	Plants	86	1.761	.044
Total Zone III	Plants	1379	28.235	.847
Total Zone IV	Plants	111	2.273	.091
Total Zone IV.5	Plants	2	.041	.002
Total Zone V	Plants	87	1.781	.089
Total all plants		4884		
Average zone number for total of all plants identified				2.391

The mean minimum January temperature for Opheim was recorded at a cold -4° F. An average of 27 chinook winds a year can be expected. The freeze-free season in Opheim lasts 90 to 110 days. Zone III was apparently the concensus of Rehder, the Arnold Arboretum and the USDA (3b) for the Opheim area. The author found that the plant population of Opheim averaged a Zone 2.25, the lowest of all areas surveyed. Seventy-eight percent of the plant population was Zone II species. Fifteen percent was found to be Zone III. Much data pointed to a III (3b) for Opheim, which the author considered representative of that community's area.

The rare Clematis tangutica was the most surprising specimen noted in Opheim.

Table 11. Plant population summary and mean zone designation for Opheim, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	1905	78.170	1.563
Total Zone II.5	Plants	67	2.749	.069
Total Zone III	Plants	376	15.429	.463
Total Zone IV	Plants	70	2.872	.115
Total Zone V	Plants	18	.739	.037
Total Zone VII	Plants	1	.041	.003
Total all plants		2437		
Average zone number for total of all plants identified				2.250

AREA 4 - GREAT FALLS, LEWISTOWN, AND AUGUSTA:

The mean minimum January temperature in Great Falls was recorded as 12° F. The average annual humidity varied from 67% at 5 A.M. to 47% at 5 P.M. Great Falls lies within the Montana chinook belt and can expect an average of 25 chinook winds yearly. Residents in Great Falls enjoy the maximal 130 or more freeze-free days yearly.

According to Rehder, Great Falls should be considered a Zone III area. The Arnold Arboretum extended the Zone IV of western and southern Montana to Great Falls. The USDA map recorded a similar zonal extension of Zone 5a to Great Falls, which is equal to a Rehder Zone IV. Data from this survey resulted in a mean zone designation of 2.814 for all plants recorded which ranks eighth among all 15 communities researched.

The majority of all plants noted in Great Falls were Zone II species. That group represented 45% of the total. Twenty-five percent of all plants were Zone III species and 17% were of Zone IV designation. Only 4.5% were rated Zone V.

It would seem to the author that a certain amount of plant material in the Zone IV group found in Great Falls was not deserving of such a tender zonal designation. Based on that observation and an overall comparison of Great Falls to Zone IV cities, a III (4b) designation might be justified for Great Falls.

Dioscorea batatas was among the more unusual species noted in Great Falls. The author would suggest this species for trial as a possible recommended plant for Montana's short list of hardy vine species. Other unusual plants seen included Corylus americana, Fraxinus nigra, Kolkwitzia amabilis, Quercus borealis, Cotoneaster racemiflora soongorica, Euonymus europaea, Viburnum opulus 'Nanum', Acer platanoides 'Harlequin', the Daphne species cneorum and mezereum, and Cercis canadensis.

Table 12. Plant population summary and mean zone designation for Great Falls, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone I	Plants	10	.116	.001
Total Zone II	Plants	3845	44.590	.892
Total Zone II.5	Plants	574	6.657	.166
Total Zone III	Plants	2193	25.432	.763
Total Zone III.5	Plants	9	.104	.004
Total Zone IV	Plants	1508	17.488	.700
Total Zone IV.5	Plants	7	.081	.004
Total Zone V	Plants	390	4.523	.226
Total Zone V.5	Plants	72	.835	.046
Total Zone VII	Plants	15	.174	.012
Total all plants		8623		
Average zone number for total of all plants identified				2.814

Eight degrees F was found to be the average minimum January temperature for Lewistown, where the effects of chinook winds are commonly observed. A mean 29 chinooks are recorded annually. The growing season of Lewistown averaged 90 to 110 days a year.

Rehder and the Arnold Arboretum declared the area surrounding Lewistown to be Zone III. The USDA designated the area 4b which is included in Rehder's III. This study revealed that all plants grown in Lewistown averaged a zone number of 2.646 which is 13th of the 15 areas surveyed.

Forty-eight percent of Lewistown's woody flora were Zone II species, 37%, 7%, and 3% were Zones III, IV and V, respectively. Some of the species noted as Zones IV and V designation may not be that tender.

All former works indicated a Zone III. This research found no evidence to rate Lewistown as milder than that (4b). Therefore, no zonal change was deemed necessary.

Acer rubra, Fraxinus nigra, Chaenomeles japonica, Cornus racemosa, and Lonicera claveryi 'nana' were the more unusual members of Lewistown's plant population.

Table 13. Plant population summary and mean zone designation for Lewistown, Montana.

Plant Zone	Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants 2547	47.590	.952
Total Zone II.5	Plants 264	4.933	.123
Total Zone III	Plants 1960	36.622	1.099
Total Zone IV	Plants 394	7.362	.294
Total Zone IV.5	Plants 2	.037	.002
Total Zone V	Plants 158	2.952	.148
Total Zone V.5	Plants 27	.504	.028
Total all plants	5352		
Average zone number for total of all plants identified			2.646

Augusta, Montana's mean minimum January temperature was found to be 8° F.. Chinook winds are not as frequent, 15 yearly, as in nearby Great Falls. An average 90 to 110 freeze-free days are expected annually in Augusta.

Zonal designations for Augusta were Rehder III, the Arnold Arboretum III and the USDA 5a (included in Rehder IV). All plants grown in Augusta averaged Zone 2.631 which was twelfth of the 15 areas surveyed.

Half of Augusta's ornamental plants were Zone II species. Thirty-nine percent were of Zone III. Nearly 8% of all plants were found to be Zone IV species. The author felt that a number of those species rated Zone IV could thrive in harsher areas and, therefore, could be considered in lower hardiness zones.

The USDA Zone 5a seemed too high judging from the mean zone number for all plants recorded. The author would concur with Rehder and the Arnold Arboretum zonation of III (4b).

Sorbus hybrida (intermedia x aucuparia) was the most unusual plant noted in an otherwise common flora.

Table 14. Plant population summary and mean zone designation for Augusta, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone II	Plants	272	49.908	.998
Total Zone II.5	Plants	6	1.101	.028
Total Zone III	Plants	210	38.532	1.156
Total Zone IV	Plants	43	7.890	.316
Total Zone V	Plants	12	2.202	.110
Total Zone V.5	Plants	1	.183	.010
Total Zone VII	Plants	1	.183	.013
Total all plants		545		
Average zone number for total of all plants identified				2.631

AREA 5 - KALISPELL AND WHITEFISH:

The mean minimum January temperature of Kalispell, situated in the apparently mild Flathead Valley, was recorded as 16° F (10). A rather high average annual relative humidity of 58% may have contributed to a tempering of the climate toward woody ornamental plants. Damaging chinook winds have been rare. The average length of freeze-free season in Kalispell was found to be 110-120 days. Rehder (30) and Arnold Arboretum (14) maps assigned a Zone IV to Kalispell and the surrounding northwest tip of Montana (the mildest zone designation assigned to the state). The USDA Plant Hardiness Zone Map (27) characterized Kalispell as Zone 5a. The designation is equal to a Rehder Zone IV. An average

zone number for all the plants recorded in the Kalispell survey was calculated to be 3.008; sixth in comparison to all communities researched (Table 15). Such a low average zone number would place Kalispell far below what the author felt was a true indication of the hardiness zone for that city. Kalispell did, however, have a higher average zone number than nearby, short season Whitefish with an average of 2.719.

Judging from the percent of total plant population representing plants in various zone numbers, the author would concur with the USDA map rating of Zone 5a (equal to Rehder IV). Because over 20% of the plants recorded were identified as Zone IV species by Rehder (USDA 5), a safe minimum recommendation would be Zone IV (5b) for Kalispell. Nearly 9% of all plants observed were Zone V species (USDA 6a). This might suggest Kalispell to be considered marginally a Zone 6a area.

Aside from statistical evidence for a mild hardiness rating, the author noted certain species were much more robust in the Flathead area than in other Montana communities. Leaflets on a collected specimen of Aesculus hippocastanum measured 33 x 16 cm - fully twice as large as observed elsewhere. Kolkwitzia amabilis grew to approximately 6 dm. in height. In other localities it rarely reached 4 dm. The only healthy blooming Hydrangea paniculata 'Grandiflora' observed was noted in Kalispell.

A number of unusual plants were recorded only in Kalispell: Acer pseudo-platanus, Chamaecyparis lawsoniana, Clematis crispa, and Clematis

texensis. The rare Acer platanoides 'Harlequin', Acer rubrum, Acer saccharum, Corylus americana, and Hypericum calycinum were also noted.

Table 15. Plant population summary and mean zone designation for Kalispell, Montana.

Plant Zone	Total	% Total Plant population	Zone # X % T.P.P.*
Total Zone II	Plants 1191	38.259	.765
Total Zone II.5	Plants 58	1.863	.047
Total Zone III	Plants 924	29.682	.890
Total Zone IV	Plants 643	20.655	.826
Total Zone IV.5	Plants 2	.064	.003
Total Zone V	Plants 279	8.962	.448
Total Zone V.5	Plants 15	.498	.027
Total Zone VII	Plants 1	.032	.002
Total all plants	3113		
Average zone number for total of all plants identified			3.008

* % T.P.P. equals the % of the total plant population.

Meteorological data for the mountain community of Whitefish has not been recorded as completely as for most Montana cities. Chinook winds do not frequent Whitefish. Short summers average 50 to 90 freeze-free days annually.

Along with Kalispell, Rehder and the Arnold Arboretum map considered the plant climate of Whitefish to be a Zone IV. The USDA classi-

fied the area as Zone 5a. The Rehder Zone IV is comparable to the USDA Zone 5ab. In totaling all plants recorded in Whitefish, the author found a weighted mean zone of 2.719.

Fifty percent of all plants were Zone II species, 27% Zone III, 9% Zone IV and nearly 5% Zone V. With such a wide range of zones for species being grown, the author found it difficult to choose an appropriate zone number for the community. Whitefish did not appear as mild as nearby long-season Kalispell. A possible compromise zone might be IV (5a) with a note that Zone III species are common and Zone IV species are more than marginal.

The only specimen of hardy Fuchsia was observed in Whitefish. It was thought to be Fuchsia magellanica. The native Acer glabrum might prove worthy of selection as many Whitefish specimens were showing brilliant red leaves and colorful twigs.

Table 16. Plant population summary and mean zone designation for Whitefish, Montana.

Plant Zone		Total	% Total Plant population	Zone # X % T.P.P.
Total Zone I	Plants	11	.863	.009
Total Zone II	Plants	643	50.471	1.009
Total Zone II.5	Plants	72	5.651	.141
Total Zone III	Plants	340	26.688	.801
Total Zone IV	Plants	117	9.184	.367
Total Zone V	Plants	58	4.553	.228
Total Zone V.5	Plants	14	1.099	.060
Total Zone VII	Plants	19	1.491	.104
Total all plants		1274		
Average zone number for total of all plants identified				2.719

The listing of all cities researched in descending order of the average hardiness zone for each city based on the surveys yielded interesting comparisons.

Table 17. Comparisons of hardiness zone designations for all communities surveyed.

	AZN*		USDA*	Re*	A*	R*	P*	Re2*
1.	3.198	Miles City	4a	III	III	III	5a	IV
2.	3.164	Billings	5a	IV	IV	III	5b	IV
3.	3.067	Columbus	5a	IV	IV	III	5a	IV
4.	3.067	Glendive	4a	III	III	III	5a	IV
5.	3.062	Sidney	4a	III	III	III	5a	IV
6.	3.008	Kalispell	5a	IV	IV	IV	5b	IV
7.	3.005	Glasgow	3b	III	III	III	3b	III
8.	2.814	Great Falls	5a	IV	IV	III	4b	III
9.	2.719	Whitefish	5a	IV	IV	IV	5a	IV
10.	2.682	Lambert, Lindsay and Richey	4a	III	III	III	4a	III
11.	2.631	Red Lodge	4b	III	III	III	4b	III
12.	2.631	Augusta	5a	IV	III	III	4b	III
13.	2.646	Lewistown	4b	III	III	III	4b	III
14.	2.391	Scobey	3b	III	III	III	3b	III
15.	2.250	Opheim	3b	III	III	III	3b	III

AZN*-Average zone number based on all plants identified in each community;
 USDA*-Present United States Department of Agriculture zones; Re*-Rehder's
 equivalent of that USDA zone number; A*-Arnold Arboretum's zones;
 R*-Rehder's zones; P*-Proposed zones based on the work for this paper;
 Re2*-Rehder's equivalent to proposed zones.

This thesis was based on the premise that length of freeze-free season is a significant factor in the hardiness of woody ornamental plants and that the length of freeze-free season might be used as an index to hardiness. One will note (Table 17) that all long season cities had a higher hardiness number for plants growing in those areas than did all short season cities. The first 8 cities represented long season areas; the last seven represented short season areas. This data indicated to the author that the length of freeze-free season is a significant hardiness factor.

In comparing hardiness designations from earlier work one finds close agreement for most of the communities researched. Rehder (30) tended to use lower recommendations for several cities than did later workers (14, 27).

For the most part, the author would agree with former efforts in mapping plant climate hardiness of Montana. The Rehder and the Arnold Arboretum maps tended to be too general for many hardiness recommendations. They did point out that western Montana and the south-central areas tend to be milder while the northeastern tip of the state is harsh. The USDA map was quite similar but attempted to be more specific in zonation.

Recommendations for hardiness based on the findings of this research tended to deviate only slightly from former works. The major changes suggested were for the Yellowstone Valley, the Upper Flathead Valley,

and the Great Falls area. The author felt that northwestern Montana had not been given the mild hardiness recommendation it deserved. The Great Falls-Augusta climate may not be as mild as had been suggested. From Billings to the eastern edge of Montana the author noted greater numbers of species and more robust growth than throughout much of the state. Indicator species were difficult to detect, but several observations are worth noting. Evergreen material in eastern Montana was rather scarce and served as poor comparative species. Vines and ground covers hardy in the state tended to be dispersed throughout the entire state. One deciduous tree Catalpa speciosa, was useful in comparing areas of Montana. This species was recorded in Kalispell (8 specimens), Billings (8), Miles City (6), and Glendive (3). These 4 cities fall within those areas the author recommended as perhaps milder than formerly thought. Two broadleaf shrubs were also noted to exist in predominantly the Flathead and Yellowstone Valleys. Kolkwitzia amabilis was recorded 7 times in Kalispell, 11 times in Billings, twice in Glendive, and once in Sidney. Weigela florida was found in Kalispell twice, Whitefish 4 times, Billings 10 times and Sidney 3 times. Three small specimens were noted in Great Falls and one in Glasgow. In general, with the exceptions of the latter two, all these communities were within the boundaries of the areas suggested for increased hardiness ratings. Comparison of the following two maps (Figures 2 and 3) shows how proposed changes would affect the USDA zonation. The first map is the USDA

map as presently stated for Montana, the second includes suggested revisions.

In challenging the accuracy of previous work on Montana hardiness zones the author was faced with a major problem. When changes appeared appropriate, the question arose as to which was in error, the zone numbers for species recorded in the community in question, or the hardiness rating of that community? As previously stated, city zonation was not changed significantly by this paper. In a few cases where significant numbers of a species appeared to exist in an environment thought to be too harsh for them, it was suggested that species numbers be lowered to conform to the areas in which they survived. In general, species zone numbers were changed to be in agreement with the proposed alteration of the USDA map (Figs. 2 and 3). Table 18 includes all species and varieties observed in this research and the communities in which they were seen. The Rehder zone designation and USDA zones in which these species are expected to survive follow the specific epithets. Finally, any recommended zone change for various species was listed. To aid readers not familiar with all the Latin names, a common name based primarily on Standardized Plant Names (17) and somewhat on Recommended Plant Names (28) and the Manual of Cultivated Trees and Shrubs (30) was added.

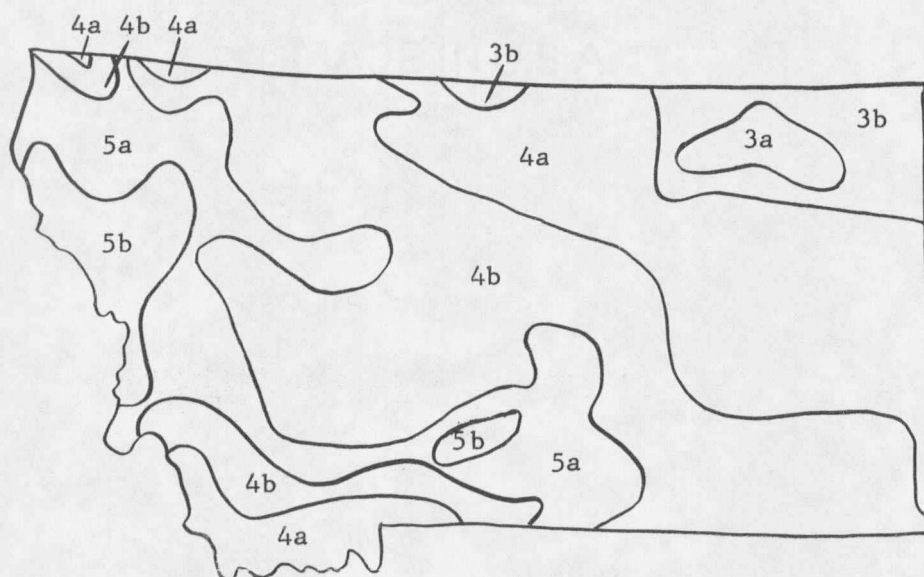


Figure 2. USDA Plant Hardiness Zone Map as it originally appeared.

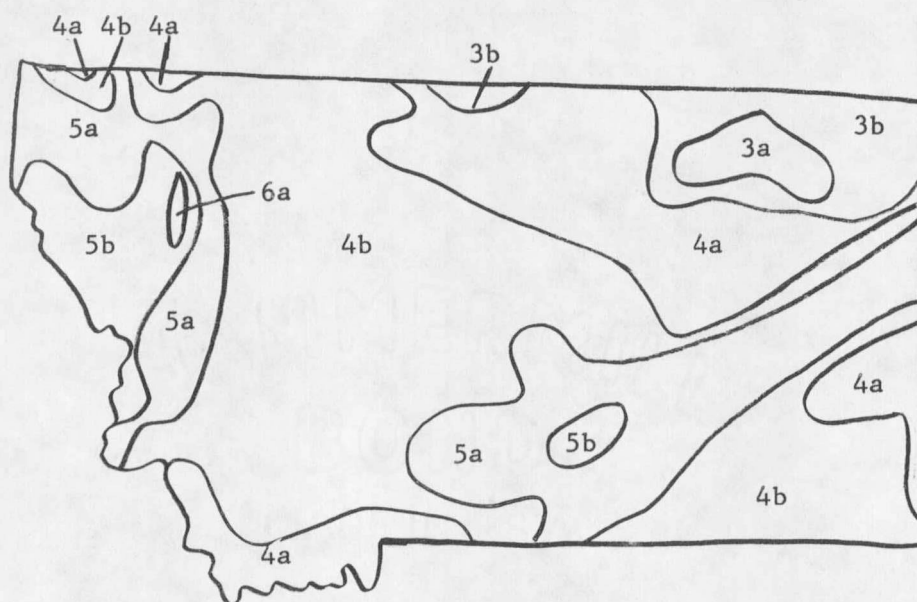


Figure 3. Proposed alteration of the USDA Plant Hardiness Zone Map.

SUMMARY AND CONCLUSIONS

The purposes for conducting this research have been fulfilled. The primary value of this work will be as a future reference to what was found growing in the areas sampled. Hardiness recommendations for many species can be based on this paper. The volume of material to be tested at Agricultural branch stations might be reduced due to proven existence of many species in areas near the branch stations. New materials worthy of testing can be found within the tables of this survey.

The length of freeze-free season as a factor in the hardiness of an area has been shown. However, the author felt that length of freeze-free season was not a significant enough factor upon which to base hardiness regions. In comparing cities with the same length of freeze-free season, the author noted great differences in effect of climate on plants. Great Falls and Glasgow's climate appeared much harsher than that of Billings even though all 3 cities have 130 or more consecutive freeze-free days a year. Kalispell seemed much milder than did most Montana cities even though its growing season is shorter than that of many communities. The author suspects that many areas of western Montana, especially near Hamilton, might be milder than longer season sections of the state. Mean minimum temperature apparently remains the strongest determinant of plant hardiness. The USDA map is a worthwhile reference to general areas of relative hardiness. The suggested existence of mild, island climates was encountered in several cities. Rural areas surrounding those islands may have been zoned properly.

Changes based on several cities with hardiness not in accord to the map have been suggested. Zone designations for a number of species that do not coincide with the areas they exist in have been changed according to suggestions in Table 18.

Considerable difficulty was encountered in switching from Rehder-Arnold Arboretum Zones to those of the USDA. It was believed that many laymen may not be aware that Rehder's and USDA zones do not coincide. Much work must be done to verify zone designations for the many species and varieties of ornamentals grown in America. It is hoped that the Manual of Cultivated Trees and Shrubs (30) might be revised to include new species zone designations as interpreted through the USDA zone system. Local research such as that upon which this thesis was based will add greatly to the knowledge of plant hardiness and to maps delineating hardiness zones.

It is hoped that this will be an initial, not terminal, study. Eastern Montana was surveyed quite thoroughly. Hardiness of much of the mountainous western part of the state remains unknown. The cities of Butte, Helena, Missoula and Bozeman should be surveyed. Preliminary observation of the smaller communities of Polson, Hamilton, Havre, Malta and Plentywood suggested particularly interesting floras.

The author would hope that this dissertation might allow for a better understanding of Montana horticulture and climate, thus adding to the body of knowledge of our ornamental flora for an improved aesthetic quality of the communities of Montana.

Table 18. Listing of All Plants Encountered in this Research with Zone Change Recommendations for Some Species. R* - Recommended species zone number changes.

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Abies concolor</i> (White Fir)	IV 5ab					X											
<i>A. lasiocarpa</i> (Alpine Fir)	II 2ab3a			X					X	X			X				
<i>Acer ginnala</i> (Amur Maple)	II 2ab3a	III 4b	X		X		XX		X								
<i>A. glabrum</i> (Rocky Mountain Maple)	V 6a												X				
<i>A. negundo</i> (Boxelder)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>A. platanoides</i> (Norway Maple)	III 3b4ab		X	X	X		X		X	X	X		X				
<i>A.p. Crimson King</i> (Crimson King Maple)		IV 5a	X	X					X	X	X		X				
<i>A.p. 'Harlequin'</i> (Harlequin Maple)				X						X							
<i>A.p. 'Schwedleri'</i> (Schwedler Maple)			X	X	X				X								X
<i>Acer pseudo-platanus</i> (Planetree Maple)	V 6a			X													
<i>A. rubrum</i> (Red Maple)	III 3b4ab			X									X				

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equivale- nts	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Acer saccharinum</i> (Silver Maple)	IV 3b4ab	III 4b	X	X		X	X	X	X	X	X	X	X		X	X	
<i>A. saccharum</i> (Sugar Maple)	III 3b4ab			X													
<i>A. tataricum</i> (Tatarian Maple)	IV 5ab							X									
<i>Aesculus glabra</i> (Ohio buckeye)	III 3b4ab				X			X		X	X						
<i>A. hippocastanum</i> (Common Horsechestnut)	III 3b4ab	III 4b	X	X	X		X	X	X	X	X		X				
<i>Amelanchier alnifolia</i> (Saskatoon serviceberry)	V 6a								X		X						
<i>Arctostaphylos uva-ursi</i> (Bearberry)	II 2ab3a								X								
<i>Aristolochia durior</i> (Common Dutchmanspipe)	IV 5ab	III 4b	X		X		X		X				X				
<i>Artemisia arborescens</i> (Oldman wormwood)	V 6a	III 3b	X	X				X		X	X	X	X		X	X	X
<i>A. ludoviciana</i> (Louisiana Sagebrush)			X														
<i>Berberis thunbergii</i> (Japanese Barberry)	V 6a	III 4b	X	X	X	X	X			X	X		X			X	
<i>B.t. 'Atropurpurea'</i> (Redleaf Japanese Barberry)			X	X			X	X	X	X							

Table 18. (Continued)

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Betula occidentalis</i> (Water birch)	IV 5ab	III 4b		X						X	X	X	X				
<i>B. papyrifera</i> (Paper birch)	II 2ab3a	III 3b	X	X	X	X	X	X	X	X	X		X		X	X	
<i>B. pendula gracilis</i> (Cutleaf European White Birch)	II 2ab3a	III 4b	X	X	X	X	X	X	X	X	X	X	X		X		
<i>B.p.g. 'Scarlet Glory'</i> (Scarlet Glory Cutleaf Weeping Birch)							X										
<i>Buddleia alternifolia</i> (Fountain Butterflybush)	V 6a		X														
<i>Buddleia</i> sp.				X													
<i>Buxus microphylla</i> japonica	VI																
(Japanese Littleleaf Box)	6b7a		X														
<i>Campsis radicans</i> (Common Trumpet creeper)	IV 5ab		X	X	X	X	X								X		
<i>Caragana arborescens</i> (Siberian Peashrub)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Caragana frutex</i> (Russian Peashrub)	II 2ab3a															X	
<i>C. pygmaea</i> (Pygmy Peashrub)	III 3b4ab		X				X	X							X		
<i>Caryopteris incana</i> (Common Bluebeard)	VII 7b			X						X							
<i>Catalpa speciosa</i> (Northern catalpa)	IV 5ab		X	X	X		X										
<i>Celastrus orbiculata</i> (Oriental Bittersweet)	IV 5ab				X												
<i>C. scandens</i> (American Bittersweet)	II 2ab3a		X	X	X					X							
<i>Celtis occidentalis</i> (Common Hackberry)	II 2ab3a	III 4b	X	X	X	X		X		X					X		
<i>Ceris canadensis</i> (Eastern Redbud)	IV 5ab		X							X							
<i>Chaenomeles japonica</i> (Japanese Flowering- quince)	IV 5ab		X	X	X		X		X				X				
<i>Chamaecyparis lawsoniana</i> (Lawson Falsecypress)	V 6a			X													
<i>Clematis crispa</i> (Curly Clematis)	V 6a			X													

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Clematis jackmani</i> (Jackman Clematis)	V.5 6ab	III 3b	X	X	X	X	X	X	X	X		X	X	X	X		
<i>C. ligusticifolia</i> (Western Virginsborder)	V 6a	III 3b	X	X	X	X	X	X		X		X	X		X		
<i>C. 'Mrs. Robert Brydon'</i>										X							
<i>C. tagutica</i> (Golden Clematis)	V 6a										X						X
<i>C. texensis</i> (Scarlet Clematis)	IV 5ab																
<i>Cornus alba 'Sibirica'</i> <i>argenteo marginata</i> (Creamedge Dogwood)			X	X						X					X		
<i>C. amomum</i> (Silky Dogwood)	V 6a		X														
<i>C. paucinervis</i> (Littleleaf Dogwood)	V 6a		X														
<i>C. racemosa</i> (Gray Dogwood)	IV 5ab			X				X		X			X				
<i>C. stolonifera</i> (Redosier Dogwood)	II 2ab3a	III 3b	X	X	X	X	X	X		X	X	X	X	X	X		
<i>C.s. flaviramea</i> (Yellowtwig Redosier Dogwood)			X			X				X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Corylus americana</i> (American Filbert)	IV 5ab			X						X							
<i>Cotinus coggygria</i> (Common Smoketree)	V 6a				X					X							
C.c. 'Purpureus' (Purple Smoketree)			X														
<i>Cotoneaster acutifolia</i> (Peking Cotoneaster)	III 3b4ab	III 3b	X	X	X	X	X	X	X	X	X	X	X	X		X	X
<i>C. integerrima</i> (European Cotoneaster)	V 6a		X							X							
<i>C. racemiflora</i> soon- gorica (Sungari Rockspray Cotoneaster)	III 3b4ab		X							X							
<i>Crataegus douglasii</i> (Douglas Hawthorn)	IV 5ab			X		X			X		X						
<i>C. oxycantha pauli</i> (Paul's Scarlet Hawthorn)	IV 5ab	IV 5a	X	X		X			X	X							
<i>Daphne cneorum</i> (Rose Daphne)	IV 5ab									X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Daphne mezereum</i> (February Daphne)	IV 5ab			X						X							
<i>Deutzia scabra</i> (Fuzzy Deutzia)	V 6a			X					X	X							
<i>Dioscorea batatas</i> (Cinnamon Vine)							X			X							
<i>Echinocystis lobata</i> (Wild Mockcucumber)		III 3b	X	X	X	X	X	X						X	X	X	X
<i>Elaeagnus angustifolia</i> (Russianolive)	II 2ab3a		X	X	X	X	X	X		X		X	X	X	X	X	X
<i>Euonymus alatus</i> (Winged Euonymus)	III 3b4ab	III 4b	X	X	X		X		X	X					X		
<i>E.a. Compacta</i> (Dwarf Winged Euonymus)			X														
<i>E. europaea</i> (European Euonymus)	III 3b4ab									X							
<i>E. fortunei</i> (Wintercreeper Euonymus)	V 6a		X							X							
<i>E. nana</i> (Dwarf Euonymus)	II 2ab3a		X													X	
<i>Forsythia ovata</i> (Early Forsythia)	IV 5ab	IV 5a	X	X			X	X	X	X			X		X		

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA EQUIVA- LENTS	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Fraxinus mandshurica</i> (Manchurian Ash)	III 3b4ab		X													X	
<i>F. nigra</i> (Black Ash)	II 2ab3a				X					X							
<i>F. pennsylvanica</i> (Red Ash)	II.5 3ab	II 3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>F. spaethiana</i> (Spaeth Ash)	V 6a		X														
<i>Fuchsia magellanica</i> (Magellan Fuchsia)									X								
<i>Ginkgo biloba</i> (Ginkgo)			X														
<i>Gleditsia triacanthos</i> (Common Honeylocust)	IV 5ab	III 4b	X		X	X		X		X	X		X		X		
<i>G.t. inermis</i> (Thornless Honeylocust)			X	X	X	X	X	X		X	X		X				
<i>G.t. 'Skyline'</i> (Skyline Honeylocust)			X														
<i>G.t. 'Sunburst'</i> (Sunburst Honeylocust)			X	X	X	X											
<i>Hedera helix</i> (English Ivy)	IV 5ab		X							X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
Hibiscus syriacus (Shrubalthea)	V 6a		X							X							
Humulus lupulus (Common Hop)		III 3b	X	X	X		X	X	X	X	X	X	X	X	X	X	
Hydrangea arborescens grandiflora	IV 5ab	III 4b	X	X	X	X	X	X	X	X			X				
H. paniculata 'Grandi- flora'	IV 5ab			X			X										
(Peegee Hydrangea)	5ab			X			X										
Hypericum calycinum (Aaronsbeard St. Johnswort)	V 6a								X								
Juglans nigra (Eastern Black Walnut)	IV 5ab	III 4b	X	X	X	X	X	X	X	X							
Juniperus chinensis (Pyramid chinese Juniper)	IV 5ab		X	X					X	X							
J.c. 'Armstrong'																	
(Armstrong Juniper)			X														
J.c. 'Pfitzeriana'		III															
(Pfitzer Juniper)		3b	X	X	X	X	X	X	X	X	X		X	X	X	X	

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Juniperus chinensis</i>																	
'Pfitzeriana Aurea'																	
(Golden Pfitzer Juniper)			X	X		X				X					X		
J.c. 'P. Compacta'																	
(Compact Pfitzer Juniper)			X	X	X		X			X	X						
J.c. 'P. Glauca'																	
(Blueleaf Compact Pfitzer Juniper)			X	X	X					X	X						
J.c. 'P.G. Compacta'																	
(Dwarf Blueleaf Pfitzer Juniper)			X														
<i>Juniperus communis</i>	II																
(Common Juniper)	2ab3a		X	X	X	X	X	X		X	X		X		X		
J.c. depressa																	
(Oldfield Common Juniper)										X							
J.c. fastigiata																	
(Upright Common Juniper)										X							
<i>Juniperus horizontales</i>	II																
(Creeping Juniper)	2ab3a		X	X			X			X	X		X		X		
J.h. glauca																	
(Blue Creeping Juniper)										X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA	Equiva- lents	R*	Billings	Kalispell	Miles City	Columbus	Glendive	Sidney	Whitefish	Great Falls	Red Lodge	Augusta	Lewistown	Lambert, Lindsay, Richey	Glasgow	Scobey	Opheim
				5b IV	5b IV	5a IV	5a IV	5a IV	5a IV	5a IV	4b III	4b III	4b III	4b III	4a III	3b III	3b III	3b III
<i>Juniperus horizontalis</i>																		
<i>plumosa</i>																		
(Andorra Creeping Juniper)														X				
<i>J. procumbens</i> Wiltoni	V																	
(Wilton Jag garden																		
Juniper)	6a			X														
<i>J. sabina</i>	IV	III																
(Savin Juniper)	5ab	3b		X	X	X	X	X	X		X	X		X		X		
<i>J.s. 'Tamariscifolia'</i>																		
(Tamarix Juniper)				X	X	X	X	X		X	X			X				
<i>J.s. 'Von Ehron'</i>																		
(Von Ehron Juniper)				X														
<i>Juniperus scopulorum</i>	V	III																
(Rocky Mountain Juniper)	6a	3b		X	X	X	X	X	X	X	X	X		X	X	X	X	X
<i>J.s. 'Blue Heaven'</i>																		
(Blue Heaven Juniper)				X														
<i>Juniperus squamata meyeri</i>	IV	III																
(Meyer Singleseed																		
Juniper)	5ab	3b		X	X					X	X					X		
<i>J. virginiana</i>	II	III																
(Eastern Redcedar)	2ab3a	4b		X		X	X	X	X		X				X			
<i>J.v. 'Glaucia'</i>																		
(Blue Eastern Redcedar)											X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Juniperus virginiana</i> 'Henwick' (Henwick Juniper)															X		
<i>Kolkwitzia amabilis</i> (Beautybush)	V 6a	IV 52	X	X			X	X		X							
<i>Larix occidentalis</i> (Western Larch)	V 6a			X				X	X				X				
<i>Ligustrum vulgare</i> (European Privet)	IV 5ab	III 3b	X	X		X	X	X		X	X		X		X	X	
<i>Liriodendron tulipifera</i> (Tulip Tree)	IV 5ab			X													
<i>Lonicera clavayi nana</i> (Clavey Dwarf Honeysuckle)				X						X			X		X		
<i>L. japonica</i> 'Halliana' (Halls Japanese Honey- suckle)	IV 5ab	III 4b								X	X		X		X		
<i>L. korolkowii</i> 'Zabelii' (Zabel Blueleaf Honey- suckle)	IV 5ab				X												
<i>L. sempervirens</i> (Trumpet Honeysuckle)	III 3b4ab	III 4b									X	X			X		X
<i>L. tatarica</i> (Tatarian Honeysuckle)	III 3b4ab	III 3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Lonicera xylosteum</i> (European Fly Honey- suckle)	IV 5ab							X									
<i>Lycium halimifolium</i> (Matrimonyvine)	IV 5ab	III 4b	X	X	X	X	X			X	X	X	X	X			
<i>Magnolia liliflora</i> 'Nigra'	V																
(Purple Lily Magnolia)	6a		X														
<i>M. souleangeana</i>	V																
(Saucer magnolia)	6a		X														
<i>Mahonia aquifolium</i>	V																
(Oregongrape)	6a		X														
<i>M. repens</i>	V																
(Creeping Mahonia)	6a		X														
<i>Malus baccata</i>	II																
(Siberian Crabapple)	2ab3a		X						X								
<i>M. coronaria</i>	IV																
(Wild Sweet Crabapple)	5ab						X										
<i>Malus</i> sp.	IV	III															
(Apple)	5ab	3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Malus</i> sp.	IV	III															
(Crabapple)	5ab	3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Morus alba</i> 'Tatarica' (Russian Mulberry)			X	X	X												
<i>Opuntia polyacantha</i> (Plains pricklypear)										X							
<i>Paeonia suffruticosa</i> (Tree Paeonia)	V 6a									X							
<i>Parthenocissus quinque- folia</i>	III	III															
(Virginia Creeper)	3b4ab	3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>P. tricuspidatum</i> (Japanese Creeper)	IV 5ab	III 3b	X	X				X		X						X	
<i>Phellodendron amurense</i> (Amur corktree)	III 3b4ab		X											X			
<i>Physocarpus opulifolius</i> (Common Ninebark)	II 2ab3a	III 4b	X	X			X	X	X		X						
<i>P.o. nana</i> (Dwarf Ninebark)			X			X				X							
<i>Picea abies</i> (Norway spruce)	II 2ab3a										X						X
<i>P.a. 'Nidiformis'</i> (Bird's Nest Spruce)			X				X			X							
<i>Picea engelmanni</i> (Engelmann Spruce)	II 2ab3a		X	X		X			X	X	X	X	X			X	

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Picea glauca</i> (White Spruce)	II 2ab3a		X	X	X	X	X	X		X	X		X	X		X	X
<i>P.g. 'Conica'</i> (Dwarf Spruce)			X				X										
<i>P.g. densata</i> (Black Hills Spruce)			X		X		X								X		
<i>Picea pungens</i> (Colorado Spruce)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Pinus cembra</i> (Swiss Stone Pine)	III.5 4a5b		X							X					X		
<i>P. contorta latifolia</i> (Lodgepole Pine)	VII 7b	III 3b	X	X			X		X	X	X	X			X		X
<i>P. mugo</i> (Swiss Mountain Pine)	II 2ab3a		X	X	X	X	X	X		X			X	X	X	X	
<i>P.m. mughus</i> (Mugho Swiss Mountain Pine)			X	X	X		X		X	X	X		X		X		
<i>P. nigra austriaca</i> (Austrian Pine)	IV 5ab		X	X						X							
<i>P. ponderosa</i> (Ponderosa Pine)	V 6a	III 4b	X	X	X	X	X	X		X	X		X		X		
<i>P. sylvestris</i> (Scotch Pine)	II 2ab3a		X														

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Platanus occidentalis</i> (American Planetree)	IV 5ab		X														
<i>Polygonum auberti</i> (Silvervine Fleece- flower)	IV 5ab									X							
<i>P. reynoutria</i>	IV 5ab			X													
<i>P. cuspidatum</i> (Japanese Fleece- flower)	IV 5ab	III										X			X		
<i>Populus acuminata</i> (Lanceleaf Poplar)	II 2ab3a																
<i>P. alba</i> (White Poplar)	III 3b4ab	III															
<i>P.a. 'Pyramidalis'</i> (Bolleana Poplar)																	
<i>P. angustifolia</i> (Narrowleaf Poplar)	II 2ab3a																
<i>P. x canadensis</i> (Carolina Poplar)	V 6a																
<i>P. deltoides</i> (Eastern Poplar)	II 2ab3a																

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Populus nigra</i> (Black Poplar)	II 2ab3a									X		X					
<i>P.n. 'Italica'</i> (Lombardy Poplar)	II 2ab3a		X	X	X	X	X	X	X	X				X	X	X	X
<i>P. sargentii</i> (Plains Poplar)	II 2ab3a		X								X				X	X	
<i>P. tacamahaca</i> (Tacamahac Poplar)	II 2ab3a					X				X			X				
<i>P. tremuloides</i> (Quaking Aspen)	I 1		X	X					X	X	X		X		X		
<i>P. tricocarpa</i> (California Poplar)	IV 5ab			X		X					X						X
<i>Potentilla fruticosa</i> (Bush Cinquefoil)	II 2ab3a		X		X	X		X	X	X	X		X		X		
<i>Prunus americana</i> (American Plum)	III 3b4ab	III 4b	X			X				X	X		X				
<i>P. armeniaca</i> (Apricot-kill to base)	V 6a		X	X	X			X		X		X					
<i>P. avium</i> (Mazzard cherry)	III 3b4ab		X	X					X	X							
<i>P. besseyi</i> (Bessey Cherry)	III 3b4ab	III 3b	X		X			X	X	X	X		X	X	X	X	X

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
X Prunus blireiana (Blireiana Plum)	V 6a	III 4b	X			X	X	X	X	X			X		X		
Prunus cerasus (Sour Cherry)	III 3b4ab	IV 5a	X	X	X	X			X	X	X				X		
P. cistena (Purpleleaf Sand- cherry)	II 2ab3a			X	X	X		X	X	X	X	X	X		X		
P. padus (European Birdcherry)	III 3b4ab							X									
P. persica (Peach)	IV 5ab	IV 5b	X	X			X			X			X				
X Prunus skinneri	II 2ab3a			X	X	X		X	X	X			X				
Prunus tenella (Russian Almond)	II 2ab3a			X		X	X				X					X	
P. tomentosa (Manchu Cherry)	II 2ab3a			X	X	X		X	X	X	X				X	X	
P. triloba multiplex (Flowering Plum)	IV.5 5b6a	III 3b	X	X	X	X	X	X		X	X		X	X	X	X	
P. virginiana (Common Chokecherry)	II 2ab3a			X	X	X	X	X	X	X	X	X	X	X	X	X	X
P.v. 'Schubert Chokecherry' (Schubert Chokecherry)							X									X	

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Pseudotsuga menziesii</i> (Common Douglasfir)	V 6a	III 3b	X	X		X		X	X	X	X		X				X
<i>Pyracantha coccinea</i> (Scarlet Firethorn)	VI 6b7a		X												X		
<i>Pyrus communis</i> (Common Pear)	IV 5ab		X	X	X												
<i>Quercus borealis</i> (Northern Red Oak)	IV 5ab		X							X							
<i>Q. macrocarpa</i> (Bur Oak)	II 2ab3a	III 4b	X	X						X	X		X				
<i>Rhamnus cathartica</i> (Common Buckthorn)	II 2ab3a		X		X		X	X	X	X	X		X		X		
<i>R. davurica</i> (Duhurian Buckthorn)	II 2ab3a		X														
<i>R. frangula</i> (Glossy Buckthorn)	II 2ab3a		X														
<i>Rhododendron canadense</i> (Rhodora)			X														
<i>R. catawbiense</i> (Catawaba Rhododendron)			X														
<i>R. sp.</i> (Azalea)											X						

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Rhus glabra</i> (Smooth Sumac)	II 2ab3a		X		X	X	X			X				X	X		
<i>R. trilobata</i> (Skunkbush Sumac)	V 6a	III 3b								X							X
<i>R. typhina</i> (Staghorn Sumac)	III 3b4ab	III 3b	X	X	X	X	X	X	X	X	X	X	X		X	X	
<i>R.t. dissectifolia</i> (Shredleaf Sumac)				X	X		X										
<i>Ribes alpinum</i> (Alpine Currant)	II 2ab3a		X	X	X		X	X		X		X			X		
<i>R. aureum</i> (Golden Currant)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Robinia hispida</i> (Roseacacia Locust)	V 6a		X		X												
<i>R. kelseyi</i> (Kelsey Locust)	V 6a								X	X							
<i>R. pseudoacacia</i> (Black Locust)	III 3b4ab	IV 5a	X	X	X	X			X	X			X				
<i>Rosa rubrifolia</i> (Redleaf Rose)	II 2ab3a		X				X			X					X		
<i>Salix alba</i> (White Willow)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>S.a. 'Seriecea'</i> (Silky White Willow)			X					X		X	X	X	X				

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
Salix alba 'Tristis' (Weepinggold Willow)			X	X	X	X	X	X	X	X						X	
S. amygdaloides (Peachleaf Willow)	IV 5ab		X														
S. caprea (Goat Willow)	IV 5ab		X							X			X				
S. incana (Elaeagnus Willow)	IV 5ab	III 4b	X	X	X			X	X	X	X	X	X		X		
S. purpurea (Purpleosier Willow)	IV 5ab		X												X		
Sambucus canadensis (American Elder)	III 3b4ab				X												
S.c. acutiloba (Cutleaf American Elder)		X															
S.c. aurea (Golden Elder)		III 4b	X	X			X			X	X				X		
Sambucus melanocarpa (Blackbead Elder)	V 6a		X								X		X				
S. racemosa (European Red Elder)	IV 5ab			X	X			X									
S.r. lacineata (Cutleaf European Red Elder)										X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
Shepherdia argentea (Silver Buffaloberry)	II 2ab3a											X					
Solanum dulcamara (Bitter Nightshade)	IV 5ab		X	X						X							
Sorbaria sorbifolia (Ural Falsespirea)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X		X	X	
Sorbus aucuparia (European Mountainash)	II 2ab3a		X	X	X	X	X	X	X	X	X		X	X	X	X	
S.a. fastigiata (Upright European Mountainash)									X								
S. hybrida (Oakleaf Mountainash)	IV 5ab											X					
S. scopulina (Greenes Mountainash)	V 6a								X		X						
Spiraea billiardi (Billiard Spirea)	IV 5ab	III 4b		X	X	X	X		X	X	X						
S. bumalda (Bumalda Spirea)	V 6a	III 3b	X	X	X	X	X	X	X	X	X		X		X		X
S. thunbergi (Thunberg Spirea)	IV 5ab	III 3b	X	X	X	X	X	X			X		X		X	X	
S.t. 'Snowgarland' (Snowgarland Spirea)								X		X							

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Spiraea van houttei</i> (Vanhoutte Spirea)	IV 5ab	III 3b	X	X	X	X	X	X		X	X	X	X	X	X	X	X
<i>Symphoricarpos albus</i> (Common Snowberry)	III 3b4ab	III 4b		X					X	X	X					X	
<i>S. chenaultii</i> (Chenault Coralberry)	V 6a																
<i>S. occidentalis</i> (Western Snowberry)	II 2ab3a		X		X		X							X			
<i>Syringa amurensis</i> <i>japonica</i> (Japanese Tree Lilac)	IV 4ab			X			X										
<i>S. persica</i> (Persian Lilac)	V 6a	III 3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>S. villosa</i> (Late Lilac)	II 2ab3a		X			X	X	X		X	X	X	X	X	X		X
<i>S. vulgaris</i> (Common Lilac)	III 3b4ab	III 3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Tamarix pentandra</i> (Fivestamen Tamarisk)	II 2ab3a		X	X	X	X		X		X			X	X	X		
<i>Taxus canadensis</i> (Canada Yew)	II 2ab3a	III 4b	X				X	X					X	X			
<i>Thuja occidentalis</i> (Eastern arborvitae)	II 2ab3a		X	X	X	X	X	X	X	X			X	X	X		

Table 18. (Continued)

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Thuja occidentalis</i> 'Globosa' (Globe Arborvitae)			X	X			X	X	X	X							
<i>T.o. pyramidalis</i> (Pyramidal Eastern Arborvitae)			X	X	X	X	X	X	X	X			X			X	
<i>T.o. robusta</i> 'Warreana' (Ware Eastern Arborvitae)			X		X						X					X	
<i>Thuja orientalis</i> (Oriental Arborvitae)	V 6a	IV 5a	X	X	X	X	X			X							X
<i>Tilia americana</i> (American Linden)	II 2ab3a		X	X	X			X	X	X	X		X	X			
<i>T. cordata</i> (Littleleaf Linden)	III 3b4ab	III 4b	X	X	X	X	X	X		X			X				X
<i>Ulmus americana</i> (American Elm)	II 2ab3a		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>U. pumila</i> (Siberian Elm)	IV 5ab	III 3b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Ulmus X rubra - pumila</i> (Hybrid Elm)		III 4b	X	X	X	X	X	X		X				X			
<i>Viburnum lantana</i> (Wayfaringtree Viburnum)	III 3b4ab		X	X				X							X		

Table 18. (Continued).

Specific Epithets (Common Names)	Rehder Zone Numbers, USDA Equiva- lents	R*	Billings 5b IV	Kalispell 5b IV	Miles City 5a IV	Columbus 5a IV	Glendive 5a IV	Sidney 5a IV	Whitefish 5a IV	Great Falls 4b III	Red Lodge 4b III	Augusta 4b III	Lewistown 4b III	Lambert, Lindsay, Richey 4a III	Glasgow 3b III	Scobey 3b III	Opheim 3b III
<i>Viburnum lentago</i> (Nannyberry Viburnum)	II 2ab3a						X										
<i>V. opulus</i> (European Cranberry- bush Viburnum)	III 3b4ab	III															
<i>V.o. 'rosea'</i> (Snowball European Viburnum)			4b	X	X	X	X	X	X	X	X	X			X		
<i>V.o. nanum</i> (Dwarf European Viburnum)										X							X
<i>V. trilobum</i> (American Cranberry- bush Viburnum)	II 2ab3a			X	X	X	X		X	X			X		X		
<i>Vinca minor</i> (Common Periwinkle)	V 6a	III		X	X			X		X	X		X				
<i>Vitis riparia</i> (Riverbank Grape)	II 2ab3a	III		X	X	X	X	X		X	X						
<i>Weigela florida</i> (Oldfashioned Weigela)	V 6a	IV		X	X			X	X	X					X		
<i>Wisteria floribunda</i> (Japanese Wisteria)	IV 5ab			X													
<i>Yucca glauca</i> (Small Soapweed)	IV 5ab				X												

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APPENDIX

Appendix Figure 1. Map of Billings, Montana. Blocks surveyed indicated by shading.

Appendix Table 1. Billings Survey Data.

[illegible]

BILLINGS, MONTANA

Blocks Surveyed

	Blocks Surveyed																																					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	Old Plantings								20-30 Years Old Plantings					10-20 Year Old Plantings										New Plantings 1-10 Years Old																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37						
ZONE II CONIFEROUS TREES																																											
Picea engelmanni		2					1								1	1					1						2	1							1	2		11	11	2.576	.058		
P. glauca		4		3		1															1																9	9	2.108	.048			
P.g. densata			3									1																									4	4	.937	.021			
P. pungens	49	7	9	8	2		1			3	7	27	2		4	3	22	6	8	3	7	7	5	3	1	3	9	5	2	3	3	10	5	2	1	3	3	4	237	237	55.504	1.253	
P. spp.											2	4	5	4		2	1	3	3	4	12	1	2	1			7	4		5	3	2	1				69	69	16.159	.365			
Pinus sylvestris			3												1											1	2		1								6	6	1.405	.032			
																																					336	336	78.689	1.777			
ZONE III.5 CONIFEROUS TREES																																											
Pinus cembra		2	4									3				1						1						12	3									26	26	6.089	.137		
																																						26	26	6.089	.137		
ZONE IV CONIFEROUS TREES																																											
Pinus nigra austriaca																							1		2			3						2				8	8	1.874	.042		
																																						8	8	1.874	.042		
ZONE V CONIFEROUS TREES																																											
Pinus ponderosa	10										12					2				2							10	1	1			1				5	2		46	46	10.773	.243	
Pseudotsuga menzeisii												2											1															3	3	.702	.016		
																																						49	49	11.475	.259		
ZONE VII CONIFEROUS TREES																																											
Pinus contorta latifolia																				1		1					5	1										8	8	1.874	.042		
																																						8	8	1.874	.042		

Blocks Surveyed

[illegible]

ZONE V BROADLEAF SHRUBS

[illegible]

Blocks Surveyed

	Blocks Surveyed																																					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion	
	Old Plantings								20-30 Year Old Plantings				10-20 Year Old Plantings												New Plantings 1-10 Years Old																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37							
ZONE II CONIFEROUS SHRUBS																																												
Juniperus communis fastigiate forms	3		1							2	1	5		2												4	5				2								25	25	1.114	.132		
Juniperus horizontalis blue		4	5			1						1		1				8		9		2	2				3	12	7		1	3	2				3		6	6	.267	.032		
Juniperus virginiana blue																										4	3											7	7	.312	.037			
Picea abies 'Nidiformis'										2							2									1												2	2	.178	.021			
Picea glauca 'Conica'												1														1												3	3	.134	.016			
Pinus mugo			1							11	4							3	3	3	1	3				1												2	2	.089	.010			
P.m. mughus			1	5	2					5	2					3		1	1	2		1	1			4	10	1	2	4	3							3	3	.089	.010			
Taxus canadensis																				3																		51	51	1.381	.164			
Thuja occidentalis																																							8	8	2.273	.270		
T.O. 'Globosa'		5	1		1					4	1			1	3	2	7	2	5	2	3							3				6						3	3	.357	.042			
T.O. pyramidalis	8	39	2	7		4				12	1	2			1	3	4	1	1	6	3		3			4					2	1		6	3				44	44	1.961	.233		
T.O. robusta 'Wareana'	1	2								3	17	12	5	2	2	3	5	8	11	3	3	1	3		13	2	2	2	8	3	6	3	2	3	3	1			57	57	2.540	.301		
																																							186	186	8.289	.984		
																																							12	12	.535	.063		
																																								551	551	24.554	2.914	
ZONE IV CONIFEROUS SHRUBS																																												
Juniperus chinensis																	3																							3	3	.134	.016	
J.c. 'Armstrong'																																							2	2	.089	.010		
J.c. 'Pfitzeriana'	14	13	38	6		2	2			18	77	8	2	10	29	46	3	11	21	24	15	31	12	5	53	44	48	1	17	18	18	9		11	6	4	9		714	714	31.818	3.776		
J.c. 'P. Aurea'	7									2	1			2		1			1	2			1		1	1	3	1	6									32	32	1.426	.169			
J.c. 'P. Compacta'							1					2													1	1	3	3										11	11	.490	.058			
J.c. 'P. Glauca'	2	1														1	2		1	1	1					1		4			3				5		3	25	25	1.114	.132			
J.c. 'P. Glauca Compacta'						1																																1	1	.045	.005			
Juniperus sabina	12	3	12	3			1			3	9	2		11	3	5	10	6	8	10	12	10	6			2	42	3	9	7	7	17		1			215	215	9.581	1.137				
J.s. 'Tamariscifolia'		17	11	1		2				1	29	8			12	12		8			5	20	9		66	39	28	22	21	1	7		2			321	321	14.305	1.698					
J.s. 'Von Ehron'																										1											1	1	.045	.005				
Juniperus squamata meyeri										1							1															1	1				4	4	.178	.021				
																																								1329	1329	59.225	7.028	
ZONE V CONIFEROUS SHRUBS																																												
Juniperus procumbens wiltoni																					49																		49	49	2.184	.259		
J. scopulorum	2	6	4	10		2	1		3	4	11	24		14	3	12		6	4	7	2	10	2		6	13	16	8	4	11	13	2	2			6	3	6		217	217	9.670	1.148	
'Blue Heaven'																									12													13	13	.579	.069			
blue			4	6	2					4	6			2				1	5	7		7	2		3		1	4			2	7	1	3	1			69	69	3.075	.365			
fastigiate					1																																	2	2	.089	.010			
																																								350	350	15.597	1.851	
ZONE V.5 CONIFEROUS SHRUBS																																												
Thuja orientalis		3	2					1		3								3					1																	14	14	.624	.074	
																																											.624	.074
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																																												
Juniperus spp.			5	10						5	9					5		6	4			12	4			4	2	32		2		1								105	105	105		

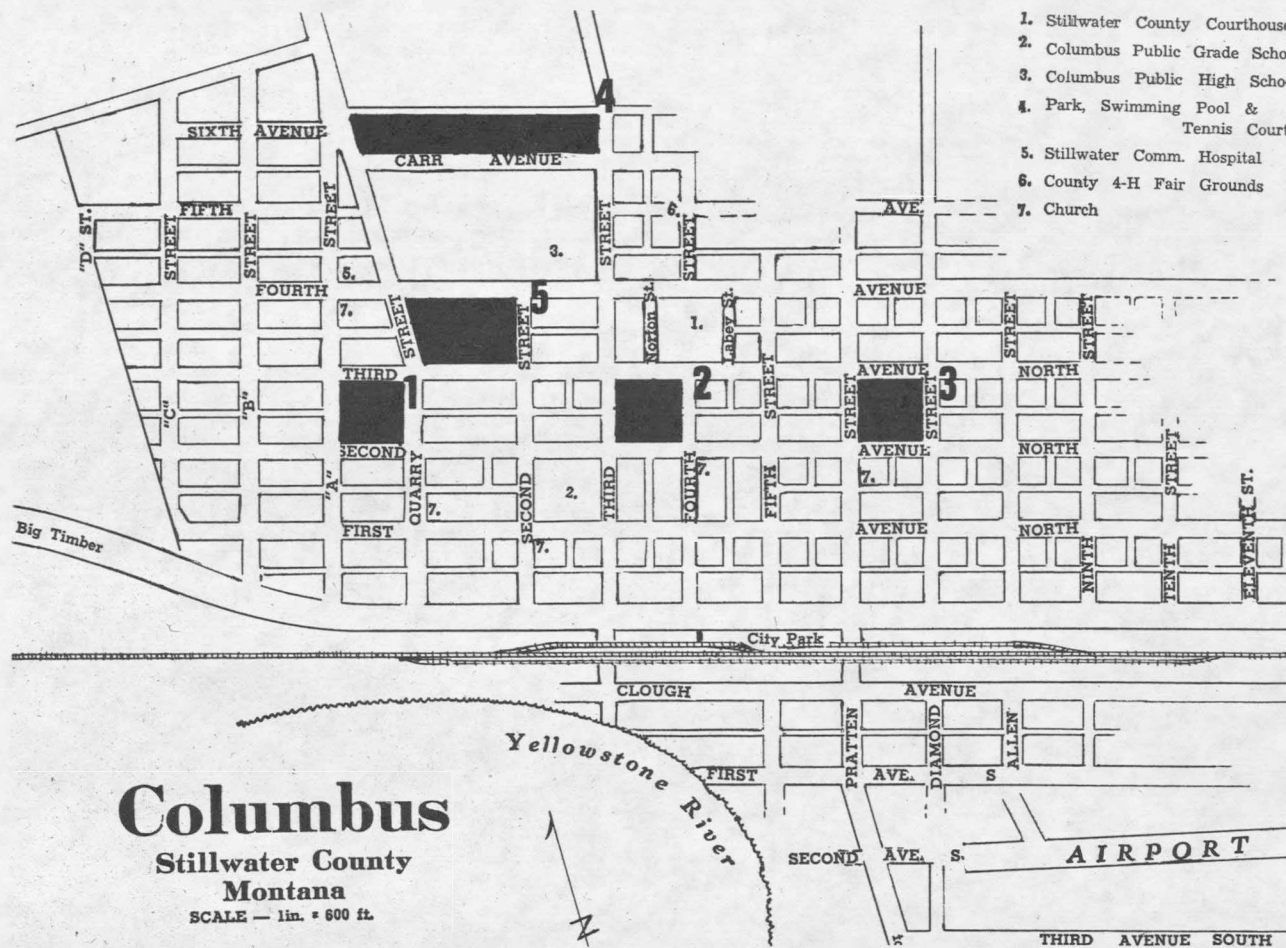
[illegible]

Species and varieties observed in Billings but not recorded in the survey.

**Buddleia alternifolia* ZONE IV WOODY VINE
Ginkgo biloba ZONE IV BROADLEAF CONIFER
Phellodendron amurense ZONE III BROADLEAF TREE
Rhamnus frangula ZONE II BROADLEAF SHRUB
Sorbus aucuparia - fastigiate form ZONE II BROADLEAF TREE

Appendix Figure 2. Map of Columbus, Montana. Blocks surveyed indicated by shading.

Appendix Table 2. Columbus Survey Data.



C O L U M B U S, M O N T A N A
Blocks Surveyed

	Older Plantings			1-10 Year Old Plantings		Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	1	2	3	4	5 ^{1/}						
ZONE II BROADLEAF TREES											
Acer negundo	1	2	3					6	6	1.489	.403
Petula pendula gracilis		1	1	2	1			5	5	1.241	.336
Elaeagnus angustifolia	5							5	5	1.241	.336
Populus deltoides			1	1				2	2	.496	.134
P. nigra 'Italica'				8				8	8	1.985	.537
Salix alba	2	2	2	1				7	7	1.737	.470
S.a. 'Tristis'		1	2		1			4	4	.993	.269
Sorbus aucuparia	1			2				3	3	.745	.201
Ulmus americana	11	4		4	7			26	26	6.452	1.746
									46	11.414	3.089
ZONE II.5 BROADLEAF TREES											
Fraxinus pennsylvanica	17	78	29	31	43			198	198	49.132	13.298
pendulous form	1							1	1	.248	.067
									199	49.380	13.365
ZONE III BROADLEAF TREES											
Populus alba	1	6		3				10	10	2.481	.672
Prunus cerasus	1							1	1	.248	.067
Robina pseudoacaria			11					11	11	2.730	.739
*Tilia cordata		1		1	1			3	3	.745	.201
									25	6.203	1.679
ZONE IV BROADLEAF TREES											
Gleditsia triacanthos					1			1	1	.248	.067
G.t. inermis			6	4				10	10	2.481	.672
G.t.i. 'Sunburst'				1				1	1	.248	.067
*Juglans nigra		1						1	1	.248	.067
Malus - apples			3	3	8			14	14	3.474	.340
Malus - flowering crabs	10		2	2	3			17	17	4.218	1.142
Populus tricocarpa	13	4						17	17	4.218	1.142
Ulmus pumila	2	8	31	24				65	65	6.129	4.365
									126	31.266	8.462
ZONE V BROADLEAF TREES											
Populus x canadensis		6			1			7	7	1.737	.470
									7	1.737	.470
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED											
Ulmus x rubra pumila		1		2				3	3		
									3		

^{1/} City Park

COLUMBUS, MONTANA

Blocks Surveyed

	Older Plantings			1-10 Year Old Plantings		Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	Total Conifer- ous Trees	Total Plant Popula- tion
	1	2	3	4	5						
ZONE II CONIFEROUS TREES											
Picea engelmanni	3		1	1	1			6	6	12.445	.403
P. glauca	1	1			1			3	3	6.122	.201
P. pungens	8	4		8	6			26	26	53.061	1.746
Picea sp.				10				10	10	20.408	.672
									45	91.837	3.022
ZONE V CONIFEROUS TREES											
Pinus ponderosa				2	2			4	4	8.163	.269
									4	8.163	.269

^{1/} City Park

COLUMBUS, MONTANA

COLUMBUS, MONTANA	Blocks Surveyed					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of	% of
	Older		1-10		Total Broad- leaf Shrubs					Total Plant Popula- tion	
	Plantings		Year Old Plantings								
	1	2	3	4							5
ZONE II BROADLEAF SHRUBS											
Caragana arborescens	13	9						22	22	2.306	1.478
Hedges	30'	10'				40'	27		27	2.830	1.813
Individuals + Hedge Conversion									49	5.136	3.291
Cornus stolonifera	3			2				5	5	.524	.336
C.s. flaviramea				1				1	1	.105	.067
*Physocarpus opulifolius 'Nana'	5							5	5	.524	.336
Potentilla fruticosa				2				2	2	.210	.134
X Prunus skinneri	2							2	2	.210	.134
Prunus tenella				1				1	1	.105	.067
P. virginiana	4		2	1				7	7	.734	.470
Rhus glabra			1					1	1	.105	.067
Ribes aureum	3			1				4	4	.419	.269
Sorbaria sorbifolia	4							4	4	.419	.269
Syringa villosa		20						20	20	2.096	1.343
Viburnum trilobum		1						1	1	.105	.067
									102	10.692	6.850
ZONE III BROADLEAF SHRUBS											
Lonicera tatarica	12	1	3	38	29			83	83	8.700	5.574
Prunus americana	6	2						8	8	.839	.537
Rhus typhina	12	8	5	5				30	30	3.249	2.015
Syringa vulgaris	22	33	28	54	5			142	142	14.885	9.537
Hedges	495'	135'	30'			660'	440		440	46.122	29.550
Individuals + Hedge Conversion									582	61.007	39.087
Viburnum opulus				1				1	1	.105	.067
									704	73.795	47.280
ZONE IV BROADLEAF SHRUBS											
Cotoneaster acutifolia	3			3				6	6	.629	.403
Crataegus douglasii	19	33		1				23	23	2.411	1.545
Hedges	20'			65'		85'	57		57	5.975	3.828
Individuals + Hedge Conversion									80	8.386	5.373
Ligustrum vulgare hedges		40'				40'	27		27	2.830	1.813
Spiraea thunbergi	6			1				7	7	.734	.470
S. vanhouttei	9	2	2	4				17	17	1.782	1.142
									137	14.361	9.201
ZONE V.5 BROADLEAF SHRUBS											
Prunus triloba multiplex	2							2	2	.210	.134
									2	.210	.134
ZONE V BROADLEAF SHRUBS											
X Prunus blirieana				2				2	2	.210	.134
Spiraea bumalda								7	7	.734	.470
									9	.943	.604
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED											
Philadelphus sp.	1			1				2	2		
single flowers		2						2	2		
Prunus sp. - plums			3					3	3		
Salix sp.			1	1				2	2		
									9		

COLUMBUS, MONTANA

Blocks Surveyed

COLUMBUS, MONTANA	Blocks Surveyed							Total		% of	% of
	Older			1-10		Total	Hedge	Total	Total	Total	Total
	Plantings			Year Old		Hedge	Conver-	Indivi-	Total	Conifer-	Plant
	1	2	3	4	5 ^{1/}	Footage	sion	dual	all	ous	Popula-
								Plants	Plants	Shrubs	tion
ZONE II CONIFEROUS SHRUBS											
Juniperus communis	2							2	2	4.545	.134
fastigiata				2				2	2	4.545	.134
Juniperus virginiana				1				1	1	2.273	.067
Thuja occidentalis pyramidalis	1							1	<u>1</u>	<u>2.273</u>	<u>.067</u>
									6	13.636	.403
ZONE IV CONIFEROUS SHRUBS											
Juniperus chinensis 'Pfitzeriana'					12			12	12	27.273	.806
J.c.'P. Aurea'			2					2	2	4.545	.134
Juniperus sabina				10				10	10	22.727	.672
J.s. 'Tamariscifolia'				2				2	<u>2</u>	<u>4.545</u>	<u>.134</u>
									26	59.091	1.746
ZONE V CONIFEROUS SHRUBS											
Juniperus scopulorum	1	1	5	5				12	<u>12</u>	<u>27.273</u>	<u>.806</u>
									12	27.273	.806

^{1/} City Park

COLUMBUS, MONTANA

COLUMBUS, MONTANA	Blocks Surveyed					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	Older		1-10		Total Hedge						
	Plantings		Year Old Plantings								
	1	2	3	4							
ZONE III VINES AND GROUND COVERS											
Campsis radicans			1					1	1	2.564	.067
Parthenocissus quinquefolia	2	6	4	5				17	<u>17</u> 18	<u>43.590</u> 46.154	<u>1.142</u> 1.209
ZONE IV VINES AND GROUND COVERS											
*Celastrus orbiculata	2							2	2	5.128	.134
Polygonum cuspidatum			1	1				2	2	5.128	.134
Hedges	8'					8'	1		<u>1</u> 5	<u>2.564</u> 12.821	<u>.067</u> .336
ZONE V VINES AND GROUND COVERS											
Clematis ligusticifolia			2	3				5	<u>5</u> 5	<u>12.821</u> 12.821	<u>.336</u> .336
ZONE V.5 VINES AND GROUND COVERS											
Clematis jackmani	9	2						11	<u>11</u> 11	<u>28.205</u> 28.205	<u>.739</u> .739
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED											
Echinocystis lobata			2					2	<u>2</u> 2		

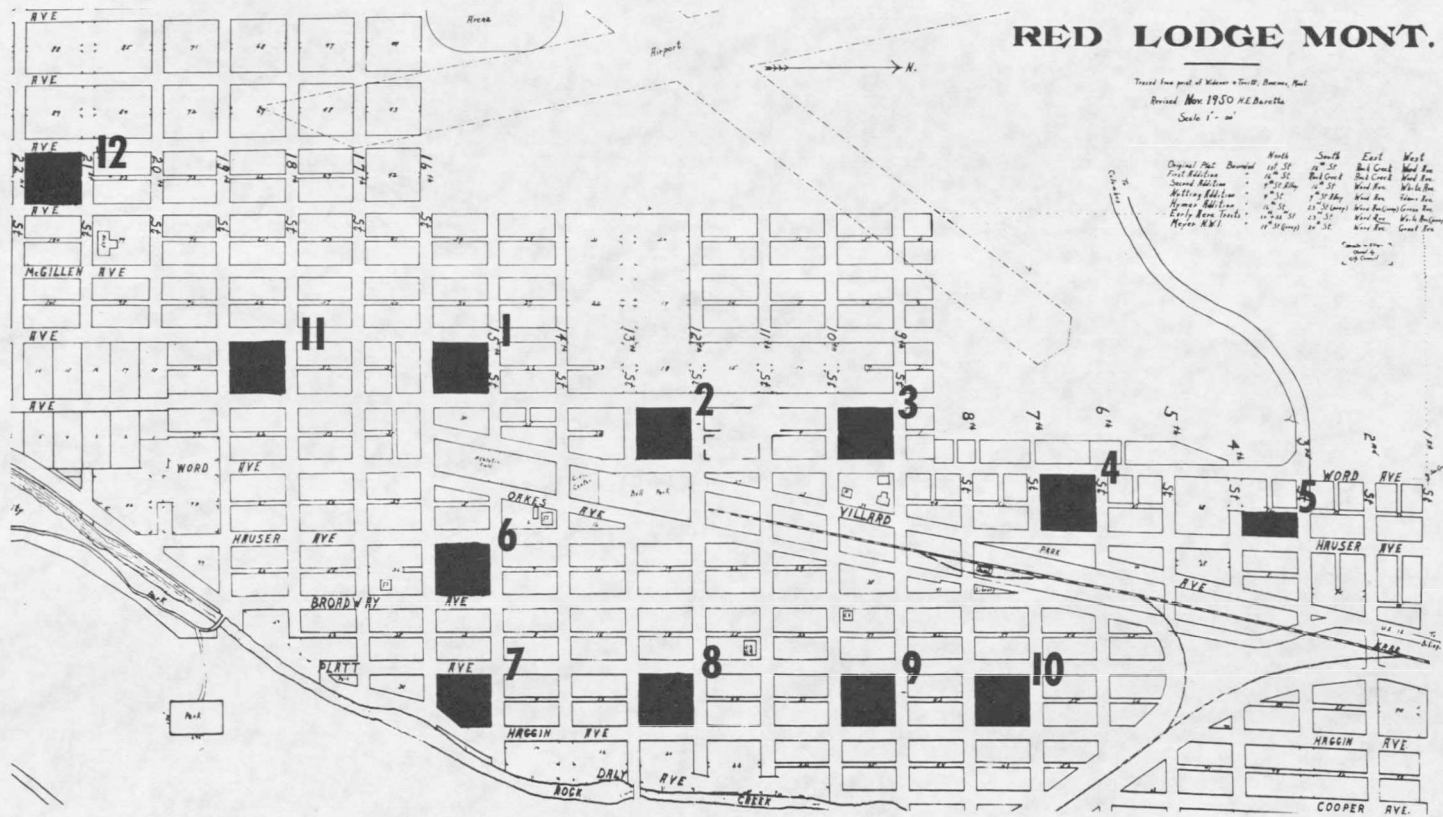
Species and varietes observed in Columbus but not recorded in the survey.

Abies concolor ZONE IV CONIFEROUS TREE
 Acer saccharinum ZONE III BROADLEAF TREE
 Berberis thunbergi ZONE V BROADLEAF SHRUB
 Betula papyrifera ZONE II BROADLEAF TREE
 Celtis occidentalis ZONE II BROADLEAF TREE
 Crataegus oxycantha pauli ZONE IV BROADLEAF TREE
 Hydrangea arborescens grandiflora ZONE IV BROADLEAF SHRUB
 Lycium halimifolium ZONE IV WOODY VINE
 Pinus mugo ZONE II CONIFEROUS SHRUB
 Prunus cistena ZONE II BROADLEAF SHRUB
 Populus tacamahaca ZONE II BROADLEAF TREE
 Pseudotsuga menzesii ZONE V CONIFEROUS TREE
 *Spiraea billiardi ZONE IV BROADLEAF SHRUB
 Syringa persica ZONE V BROADLEAF SHRUB
 Tamarix pentandra ZONE II BROADLEAF SHRUB
 Thuja occidentalis ZONE II CONIFEROUS SHRUB
 T. orientalis ZONE V.5 CONIFEROUS SHRUB

1/ City Park

Appendix Figure 3. Map of Red Lodge, Montana. Blocks surveyed indicated by shading.

Appendix Table 3. Red Lodge Survey Data.



RED LODGE, MONTANA
Blocks Surveyed

	RED LODGE, MONTANA										Mixed New & Old	12 ¹ / ₁₁	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad leaf Trees	% of Total Plant Popula- tion
	Blocks Surveyed																	
	Older Plantings																	
	1	2	3	4	5	6	7	8	9	10	11							
ZONE I BROADLEAF TREES																		
Populus tremuloides						5						3		8	<u>8</u> 8	<u>1.743</u> 1.743	<u>.389</u> .389	
ZONE II BROADLEAF TREES																		
Acer negundo	2	3	5	1		2		3		4	1	1		22	22	4.793	1.070	
Betula papyrifera					1							2		3	3	.654	.146	
Populus sargentii									1					1	1	.218	.049	
*Quercus macrocarpa									1					1	1	.218	.049	
Salix alba	1	1		3	35		1							41	41	8.932	1.994	
S.a. sericea				1				2						3	3	.654	.146	
Sorbus aucuparia	5	17	11	7	4	1	12	5	43	12	1			118	118	25.708	5.739	
*Pendent form					1									1	1	.218	.049	
Tilia americana		1												1	1	.218	.049	
Ulmus americana								1						1	<u>1</u> 192	<u>.218</u> 41.830	<u>.049</u> 9.339	
ZONE II.5 BROADLEAF TREES																		
Fraxinus pennsylvanica			11				1	2	8	1	24	17		64	<u>64</u> 64	<u>13.943</u> 13.943	<u>3.113</u> 3.113	
ZONE III BROADLEAF TREES																		
*Acer platanoides			1						1	2				4	4	.871	.195	
*A. saccharinum			1	1					2			1		5	5	1.089	.243	
Aesculus glabra					1									1	1	.218	.049	
Populus alba														2	<u>2</u> 12	<u>.436</u> 2.614	<u>.097</u> .584	
ZONE IV BROADLEAF TREES																		
Betula occidentalis					1									1	1	.218	.049	
Gleditsia triacanthos inermis												1		1	1	.218	.049	
Malus - apple	11	6	8	4	1	6	5	11	8	11	6			77	77	16.776	3.745	
Malus - flowering crab		4	2	3	3	2			4	2				20	20	4.357	.973	
Populus tricocarpa	2		5	7	49	4				1	8			76	76	16.558	3.696	
Ulmus pumila			5					1	1	1				8	<u>8</u> 183	<u>1.743</u> 39.869	<u>.389</u> 8.901	

^{1/} New Plantings - 1-10 Years Old.

RED LODGE, MONTANA

RED LODGE, MONTANA	Blocks Surveyed											Mixed New & Old	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	Older Plantings																	
	1	2	3	4	5	6	7	8	9									
	10	11	12															
ZONE II CONIFEROUS TREES																		
Picea alba				1		1									2	2	1.449	.097
P. engelmanni			4	5	10	2	7	7	1	7	2		2		47	47	34.058	2.286
P. glauca			3	6	1						1				11	11	7.971	.535
P. pungens	2			4	8	6	6	5	1	5	3	4	5		49	49	35.507	2.383
Picea spp.	2	1			4		3		2			7			19	19	13.768	.924
																128	92.754	6.226
ZONE V CONIFEROUS TREES																		
Pinus ponderosa								1							1	1	.725	.049
Pseudotsuga menziesii					1	1				2	4				8	8	5.797	.389
																9	6.522	.438
ZONE VII CONIFEROUS TREES																		
Pinus contorta latifolia	1														1	1	.725	.049
																1	.725	.049

^{1/} New Plantings - 1-10 Years Old.

RED LODGE, MONTANA

Blocks Surveyed

	Older Plantings									New & Old		12 1/2'	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	1	2	3	4	5	6	7	8	9	10	11							
ZONE II BROADLEAF SHRUBS																		
Caragana arborescens	2		5	3		4		1		4					19		1.390	.924
Hedges	265'		80'	20'				50'	95'	495'			1005'	670		670	49.012	32.588
Individuals + Hedge Conversion																689	50.402	33.512
Cornus stolonifera		1		1						1					2	2	.146	.097
Potentilla fruticosa										1					1	1	.073	.049
Prunus tenella										1					1	1	.073	.049
P. virginiana	1	6	5	2	6	4	2	6	7	5	3				47	47	3.938	2.286
*Rhamnus cathartica hedge						45'	60'						105'	70		70	5.121	3.405
Ribes aureum			1												1	1	.073	.049
Sorbaria sorbifolia	3		1	2		2	2	1	1	1					13	13	.951	.632
Hedges		15'		10'									25'	17		17	1.244	.827
Individuals + Hedge Conversion																30	2.195	1.459
Syringa villosa		2													2	2	.146	.097
																843	61.668	11.002
ZONE III BROADLEAF SHRUBS																		
Lonicera tatarica	4	16	18	10	3	7			3	7					68	68	4.974	3.307
Prunus americana	2	1	1								2				6	6	.439	.292
*P. besseyi									2						2	2	.146	.097
Rhus typhina			1	3		1						2			7	7	.512	.340
Syringa vulgaris	8	40	20	27	11	21	27	31	21	32	5	5			248	248	18.142	12.062
Hedges									45'				45'	30		30	2.195	1.459
Individuals + Hedge Conversion																278	20.337	13.521
Symphoricarpus alba							3								3	3	.220	.146
Viburnum opulus		2					1								3	3	.220	.146
																367	26.847	17.850
ZONE IV BROADLEAF SHRUBS																		
Cotoneaster acutifolia	14	2		4	4					1	2	20			47	47	3.438	2.286
Crataegus douglasii					1										1	1	.073	.049
Ligustrum vulgare						12									12	12	.878	.584
*Salix incana		1									1				2	2	.146	.097
Sambucus melanocarpa				1		1			5						7	7	.512	.340
Spiraea billiardi			5	1											6	6	.439	.292
S. thunbergii			2	1		1									4	4	.293	.195
S. vanhouttei		5	8	22	4	3			1	2		1			46	46	3.365	2.237
																125	9.144	6.080
ZONE IV.5 BROADLEAF SHRUBS																		
Prunus triloba multiplex							1	1	1						3	3	.220	.146
																3	.220	.146
ZONE V BROADLEAF SHRUBS																		
Amelanchier alnifolia										1					1	1	.073	.049
*Artemisia abrotanum										1					1	1	.073	.049
*Berberis thunbergii									3						3	3	.220	.146
Sorbus scopulina		1						2	2	1					6	6	.439	.292
Spiraea bumalda		1	3					4	3						11	11	.805	.535
Syringa persica			1	1	2		1		2						7	7	.512	.340
																29	2.121	1.411
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																		
Philadelphus sp.						2									2	2	.146	.097
Hedges		15'											15'	10		10	.732	.486
Individuals + Hedge Conversion																12	.878	.584
Single flowers			1			1				2					4	4	.293	.195
Prunus sp. - plums				3					1		2				6	6	.439	.292
*Rhododendron sp.										2					2	2	.146	.097
Ribes sp.		2	5				2	2	4	2	1				18	18	1.317	.875
Salix sp.									1						1	1	.073	.049
																43	3.146	2.091

1/ New Plantings - 1-10 Years Old.

RED LODGE, MONTANA

RED LODGE, MONTANA	Blocks Surveyed												Mixed New & Old	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
	Older Plantings																		
	1	2	3	4	5	6	7	8	9										

ZONE II CONIFEROUS SHRUBS																			
Juniperus communis				1				8							9	9	14.516	.438	
J. horizontalis			1												1	1	1.613	.049	
Pinus mugo Mughus						1			1	1					3	3	4.839	.146	
Thuja occidentalis robusta 'Wareana'										2					2	2	3.226	.097	
																15	24.194	.730	

ZONE IV CONIFEROUS SHRUBS																			
Juniperus chinensis Pfitzeriana						1	1		7		2	5			16	16	25.806	.778	
J.c.P. compacta	3														3	3	4.839	.146	
J.c.P. glauca			2												2	2	3.226	.097	
Juniperus sabina						1						3			4	4	6.452	.195	
																25	40.323	1.216	

ZONE V CONIFEROUS SHRUBS																			
Juniperus scopulorum	3		3				4	1	1	2	1	5			20	20	32.258	.973	
blue form															2	2	3.226	.097	
																22	35.484	1.070	

1/ New Plantings - 1-10 Years Old.

RED LODGE, MONTANA

Blocks Surveyed

	Older Plantings									Mixed New & Old	12 1/2	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	1	2	3	4	5	6	7	8	9								
ZONE II VINES AND GROUND COVERS																	
Vitis riparia			2											2	<u>2</u> 2	<u>5.000</u> 5.000	<u>.097</u> .097
ZONE II.5 VINES AND GROUND COVERS																	
Lonicera sempervirens				1										1	<u>1</u> 1	<u>2.500</u> 2.500	<u>.049</u> .049
ZONE III VINES AND GROUND COVERS																	
Parthenocissus quinquefolia		1	6	2		6				3				18	<u>18</u> 18	<u>45.000</u> 45.000	<u>.875</u> .875
ZONE IV VINES AND GROUND COVERS																	
Clematis tagutica				1										1	1	2.500	.049
Vinca minor				1					1					2	2	5.000	.097
Hedges			30'									30'	6		6	15.000	.292
Individuals + Hedge Conversion															<u>8</u> 9	<u>20.000</u> 22.500	<u>.389</u> .438
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																	
Humulus lupulus		1	1	3										5	5	12.500	.243
Hedges												25'	5		<u>5</u> 10	<u>12.500</u> 25.000	<u>.243</u> .486

Species and varieties observed in Red Lodge but not recorded in the survey

- Acer platanoides Crimson King ZONE III BROADLEAF TREES
 *Aesculus hippocastanum ZONE III BROADLEAF TREES
 *Lycium halimifolium ZONE IV VINE
 Physocarpus opulifolius ZONE II BROADLEAF SHRUBS
 *Prunus cerasus ZONE III BROADLEAF TREE
 P. cistena ZONE II BROADLEAF SHRUB
 *P. tomentosa ZONE II BROADLEAF SHRUB
 Sambucus canadensis aurea ZONE III BROADLEAF SHRUB.

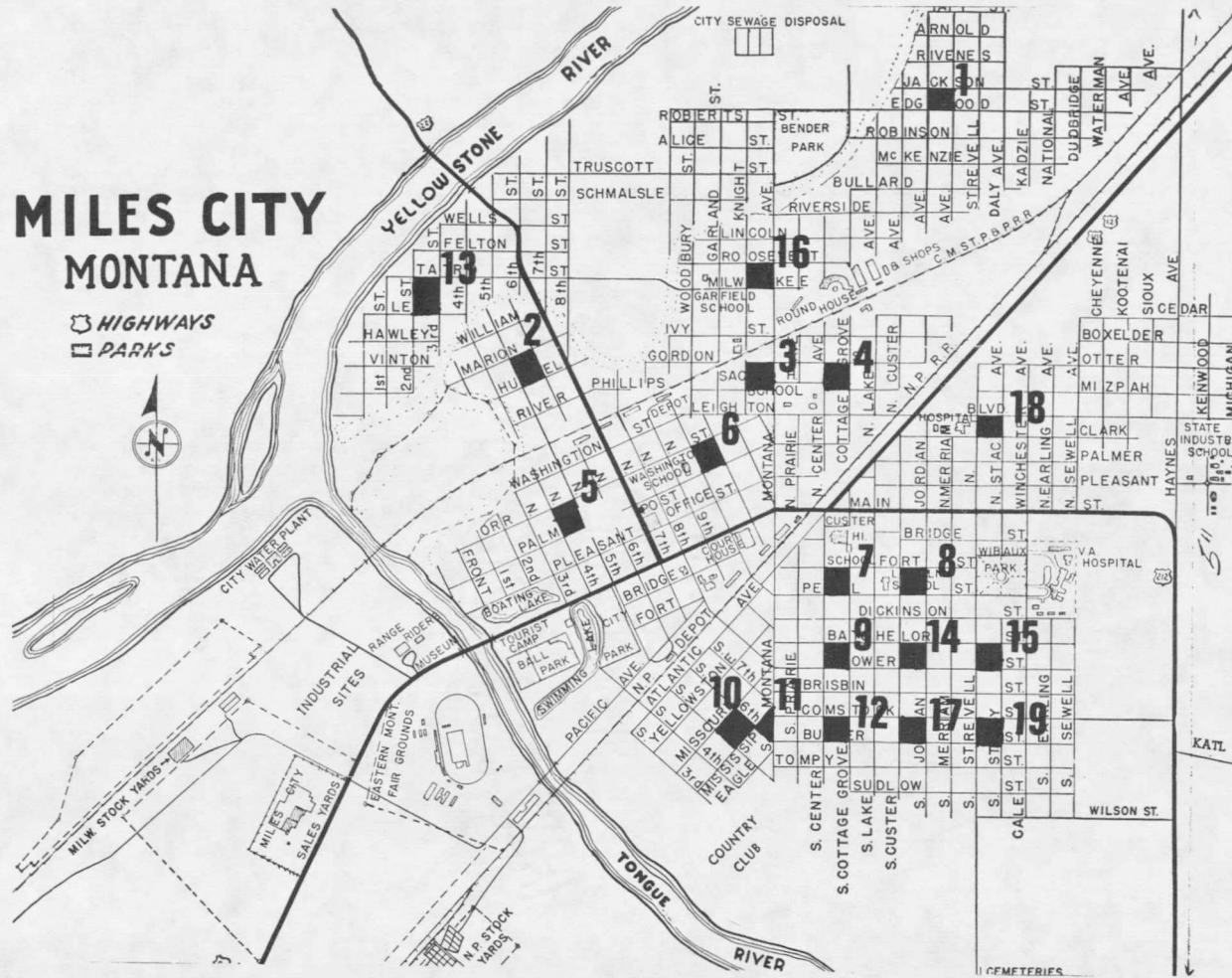
1/ New Plantings - 1-10 Years Old.

Appendix Figure 4. Map of Miles City, Montana. Blocks surveyed indicated by shading.

Appendix Table 4. Miles City Survey Data.

MILES CITY MONTANA

 **HIGHWAYS**
 **PARKS**



	M I L E S C I T Y Blocks Surveyed												20-30 Year Old Plantings		10-20 Yr. Plus Some Newer Plantings		Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion	
	Older Plantings												Mixed Old and New										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16							17
ZONE II BROADLEAF TREES																							
Acer negundo			1	2	1				1	1		2	1							9	9	.519	.161
Betula papyrifera				1									1	3						5	5	.288	.089
B. pendula gracilis					1					1	1	1	1	1						6	6	.346	.107
*Celtis occidentalis			3		5	8	11	4		1	1				3		6			42	42	2.421	.752
Elaeagnus angustifolia			1		1	2												1	5	10	10	.576	.179
*Fraxinus nigra																2				2	2	.115	.036
Populus deltoides	5	23	7	7		3	7	1	4	8	2	13	12	1	2	5	2	1	2	105	105	6.052	1.879
P. nigra 'Italica'									2		3		63	4	6			2		80	80	4.611	1.432
Salix alba							1										1			2	2	.115	.036
S.a. 'Tristis'	2																			2	2	.115	.036
Green Twigs	2							1		1	1				1	1				7	7	.402	.125
Sorbus aucuparia														2						2	2	.115	.036
Ulmus americana		3	5	3		5	3		2	1	1	5			3	9	4			43	43	2.378	.770
																				315	315	18.156	5.637
ZONE II.5 BROADLEAF TREES																							
Fraxinus pennsylvanica			5	1	5		4	1	14	4	1	5		4	10	6	8		1	69	69	3.977	1.235
																				69	69	3.977	1.235
ZONE III BROADLEAF TREES																							
Acer platanoides														1						1	1	.058	.018
A.p. 'Schwedieri'														1						1	1	.058	.018
Aesculus hippocastanum						3						1			1					5	5	.228	.089
Populus alba			1	7	1	16		4	11	3		3			13	7		6	2	74	74	4.265	1.324
P.a. 'Pyramidalis'																			5	5	.728	.089	
Robinia pseudoacacia	1									1		7		5	12	3	1		1	31	31	1.787	.555
Prunus cerasus					1															1	1	.058	.018
Tilia cordata														1	1					2	2	.115	.036
																				120	120	6.916	2.147
ZONE IV BROADLEAF TREES																							
*Catalpa speciosa			5		1															6	6	.346	.107
Gleditsia tricanthos			1																	1	1	.058	.018
G.t. inermis					1					1		1		1	6					10	10	.576	.179
G.t.i. 'Sunburst'					1									1						2	2	.115	.036
Malus - apple		12	5	3	4	3	3	2	1	3		6	15	1	2	4	6	3	1	64	64	3.689	1.145
M. - flowering crab		1			3		1	2			1	1	1	1	2		2	1	4	20	20	1.153	.358
Pyrus communis												1								1	1	.058	.018
Ulmus pumila	35	81	76	58	18	33	49	40	20	80	7	30	78	7	12	24	35	56	74	813	813	46.859	14.549
Hedges		195'	180'	310'	65'	20'	120'	30'	18'	105'	30'	80'				10'	160'	10'	225'	312	312	17.983	5.583
Individuals + Hedge Conversion																				1125	1125	63.842	20.132
																				1229	1229	70.836	21.994
ZONE IV.5 BROADLEAF TREES																							
*Morus alba 'Tatarica'															1					1	1	.058	.018
																				1	1	.058	.018
ZONE V BROADLEAF TREES																							
Prunus armeniaca																1				1	1	.058	.018
																				1	1	.058	.018
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																							
Ulmus rubra pumila													4				2	2		8	8		
																					8	8	

MILES CITY

MILES CITY	Blocks Surveyed																			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion		
	Older Plantings												Mixed Old and New		20-30 Year Old Plantings		10-20 Yr. Plus Some Newer Plantings										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19								
ZONE II CONIFEROUS TREES																											
Picea glauca												1											1	1	2.703	.018	
P.g. densata						1							2										3	3	8.108	.054	
Picea pungens		2				5						7		4									18	18	48.649	.322	
P. sp.		2				1						3	1						2				9	9	24.324	.161	
																							31	31	83.784	.555	
ZONE V BROADLEAF TREES																											
Pinus ponderosa												2				2		2					6	6	16.216	.107	
																								6	6	16.216	.107

MILES CITY	Blocks Surveyed															20-30 Year Old Plantings	10-20 Yr. Plus Some Newer Plantings	Total Hedge Footage	Hedge Con- version	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	Older Plantings												Mixed Old and New										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15								
ZONE II BROADLEAF SHRUBS																							
Acer ginnala													1	65'			65'	43	1	.032	.018		
Hedges																			43	1.370	.770		
Individuals + Hedge Conversion																			44	1.402	.788		
Caragana arborecens																			13	.414	.233		
Hedges																			477	15.196	8.536		
Individuals + Hedge Conversion																			490	15.610	8.769		
Cornus stolonifera													1		1				3	.096	.059		
Potentilla fruticosa													2		2				2	.064	.036		
Prunus virginiana													4	1		1			12	.382	.215		
P. tomentosa															1	1			8	.255	.143		
Rhamnus cathartica																			6	.191	.107		
Hedges																			210	6.690	3.758		
Individuals + Hedge Conversion																			216	6.881	3.865		
Rhus glabra																			1	.032	.018		
Ribes alpinum															1				1	.032	.018		
R. aureum															1				31	.988	.555		
Hedges																			10	.319	.179		
Individuals + Hedge Conversion																			41	1.307	.734		
Sorbaria sorbifolia																			1	.032	.018		
Symphoricarpos occidentalis																			1	.032	.018		
Tamarix pentandra																			5	.159	.089		
																			825	26.282	14.785		
ZONE III BROADLEAF SHRUBS																							
Lonicera tatarica																			66	2.103	1.181		
Hedges																			47	1.497	.841		
Individuals + Hedge Conversion																			113	3.600	2.022		
Euonymus alatus																			1	.032	.018		
Prunus besseyi													1						2	.064	.036		
Rhus typhina													2		2				22	.701	.394		
R.t. dissectifolia																			1	.032	.018		
Syringa vulgaris																			207	6.594	3.704		
Hedges																			1710	54.476	30.601		
Individuals + Hedge Conversion																			1917	61.070	34.305		
Viburnum opulus																			2	.064	.036		
																			2058	65.562	36.829		
ZONE IV BROADLEAF SHRUBS																							
Chaenomes japonica																			17	.542	.304		
Cotoneaster acutifolia																			70	2.230	1.253		
Hedge																			87	2.772	1.557		
Individuals + Hedge Conversion																			3	.096	.054		
Salix incana																			1	.032	.018		
Sambucus racemosa																			1	.032	.018		
Spiraea billiardii																			2	.064	.036		
S. thunbergii																			50	1.593	.895		
S. vanhouttei																			67	2.134	1.199		
Hedges																			117	3.727	2.094		
Individuals + Hedge Conversion																			1	.032	.018		
Yucca glauca																			212	6.754	3.794		
ZONE IV.5 BROADLEAF SHRUBS																							
Prunus triloba multiplex																			1	.032	.018		
																			1	.032	.018		
ZONE V BROADLEAF SHRUBS																							
Berberis thunbergii																			2	.064	.036		
*Cotinus coggygia																			1	.032	.018		
*Robinia hispida																			3	.096	.054		
Spiraea bumalda																			2	.064	.036		
Syringa persica																			15	.478	.268		
Hedges																			20	.637	.358		
Individuals + Hedge Conversion																			35	1.115	.626		
																			43	1.370	.770		
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																							
Philadelphus sp.																			3				
double flowers																			4				
single flowers																			2				
Prunus sp. - plums																			41				
Hedges																			13				
Individuals + Hedge Conversion																			1				
Prunus 'Jaunita'																			2				
P. 'Superior'																			2				
Ribes sp.																			2				
																			70				

Miles City	Blocks Surveyed																			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion						
	Older Plantings												Mixed Old and New		20-30 Year Old Plantings		10-20 Yr. Plus Some Newer Plantings														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19												
ZONE II CONIFEROUS SHRUBS																															
Juniperus communis				1													1										1	1	.276	.018	
J. virginiana							1						1					1									3	3	.829	.054	
Pinus mugho															1												1	1	.276	.018	
P.m. mughus															5			2		1							8	8	2.210	.143	
Thuja occidentalis				2			2			1			2	2			1										10	10	2.762	.179	
T.o. 'Pyramidalis'																2											2	2	.552	.036	
T.o. robusta 'Wareana'																				2							2	2	.552	.036	
																												27	7.459	.483	
ZONE IV CONIFEROUS SHRUBS																															
Juniperus chinensis 'Pfitzeriana'				1			2		3	4			2			13		8		3							36	36	9.945	.644	
J.c. 'P. Compacta'						3											2		5								10	10	2.762	.179	
J.c. 'P. Glauca'										4			2			3				2							11	11	3.039	.197	
Juniperus sabina										2						7	12										21	21	5.801	.376	
J.s. 'Tamariscifolia'											4							1									5	5	1.381	.089	
																												83	22.928	1.485	
ZONE V CONIFEROUS SHRUBS																															
Juniperus scopulorum		1	23			6	1	7	1		10		8			15	10	2		2	1						87	87	24.033	1.557	
Hedges																		225'										150	41.436	2.684	
Individuals + Hedge Conversion																												237	65.469	4.241	
Juniperus scopulorum blue varieties					2															1							3	3	.829	.054	
J.s. fastigate varieties																	2										2	2	.552	.036	
J.s. blue fastigate varieties																9											9	9	2.486	.161	
																												251	69.337	4.492	
ZONE V.5 CONIFEROUS SHRUBS																															
Thuja orientalis										1																		1	1	.276	.018
																													1	.276	.018
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																															
Juniperus sp.					5											2			1								8	8			

Miles City	Blocks Surveyed												20-30 Year Old Plantings	10-20 Yr. Plus Some Newer Plantings	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Cover	% of Total Plant Popula- tion												
	Older Plantings																															
	1	2	3	4	5	6	7	8	9	10	11	12									13	14	15									
ZONE II VINES AND GROUND COVERS																																
Celastrus scandens						2			1											3	3	.952	.054									
Vitis riparia					5							1					1			7	7	2.222	.125									
																					10	3.175	.179									
ZONE III VINES AND GROUND COVERS																																
Campsis radicans																	1	1		2	2	.635	.036									
Parthenocissus quinquefolia	1	3		7	8	3	3	3	3	1		2		3	9		1	3	4	54	54	17.143	.966									
Hedges				30'					60'							60'		60'			140	140	44.444	2.505								
Individuals + Hedge Conversion																					194	194	61.587	3.471								
																					196	196	62.222	3.508								
ZONE IV VINES AND GROUND COVERS																																
Aristolochia durior				1																1	1	.317	.018									
Lonicera japonica 'Halliana'																1				1	1	.317	.018									
*Lycium halimifolium				2		1				1										4	4	1.270	.072									
Hedges				15'																	10	10	3.175	.179								
Individuals + Hedge Conversion																					14	14	5.445	.251								
Polygonum cuspidatum												2								2	2	.635	.036									
																					18	18	5.714	.322								
ZONE V VINES AND GROUND COVERS																																
Clematis ligusticifolia						2	5			2				2				3		14	14	4.444	.251									
Hedges				75'			15'														60	60	19.048	1.074								
Individuals + Hedge Conversion																					74	74	23.492	1.324								
																					74	74	23.492	1.324								
ZONE V.5 VINES AND GROUND COVERS																																
Clematis jackmani		2			1		1	1		3		1		2	1	2	2		1	17	17	5.397	.304									
																					17	17	5.397	.304								
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																																
Echinocystis lobata									1	2							2			5	5											
Hedges									25'												17	17										
Individuals + Hedge Conversion																					22	22										
Humulus lupulus						1		2					1							4	4											
																					26	26										

Species and varieties observed in Miles City but not recorded in the survey

*Aesculus glabra ZONE III BROADLEAF TREE

Hydrangea arborescens grandiflora ZONE IV BROADLEAF SHRUB

Juglans nigra ZONE IV BROADLEAF TREE

Prunus cistena ZONE II BROADLEAF SHRUB

Prunus X skinneri ZONE II BROADLEAF SHRUB

Sambucus canadensis aurea ZONE III BROADLEAF SHRUB

Tilia americana ZONE II BROADLEAF TREE

Appendix Figure 5. Map of Glendive, Montana. Blocks surveyed indicated by shading.

Appendix Table 5. Glendive Survey Data.



G L E N D I V E Blocks Surveyed															Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion			
Older Plantings						Mixed		Plantings About 10-20 Years Old															
1	2	3	4	5	6	7	8	9	10	11	12	13											
ZONE II BROADLEAF TREES																							
Acer negundo	4		5	1	3		2		7				2			24	24	1.300	.438				
Betula papyrifera												1				1	1	.054	.018				
Betula pendula gracilis									3	1	1	2				7	7	.379	.128				
B.p.g. 'Scarlet Glory'								1								1	1	.054	.018				
Elaeagnus angustifolia						5						2	3			10	10	.542	.182				
Hedges					15'				230'					245'	49		49	2.654	.894				
Individuals + Hedge Conversion																59	59	3.196	1.076				
Populus deltoides	1	2		1	1	1	2	3	4				2			17	17	.921	.310				
Populus nigra 'Italica'			1					4	8	13	14					40	40	2.167	.730				
Salix alba			1				2									3	3	.163	.055				
S.a. 'Tristis'					1			1	1	1						4	4	.217	.073				
Sorbus aucuparia											1		1			2	2	.108	.037				
*Ulmus americana	8	9	33	17	9		2	19	26	31	14	8	11			183	183	9.913	3.339				
																341	341	18.472	6.221				
ZONE II.5 BROADLEAF TREES																							
Fraxinus pennsylvanica	10	34	17	7	8	4	7	4	17	5	1	8	8			130	130	7.042	2.372				
																	130	7.042	2.372				
ZONE III BROADLEAF TREES																							
Acer platanoides								3		1	1					5	5	.271	.091				
A. saccharinum	1		6		2	1		2	12	5	1	1				31	31	1.679	.566				
Aesculus hippocastanum							1									1	1	.054	.018				
Populus alba		18	6	9		3	2	4		4						46	46	2.492	.839				
P.a. 'Pyramidalis'									2	9	17		9			37	37	2.004	.675				
Tilia cordata							1		2							3	3	.163	.055				
																123	123	6.663	2.244				
ZONE IV BROADLEAF TREES																							
Catalpa speciosa		2														2	2	.108	.037				
Gleditsia triacanthos inermis			1				1						1			3	3	.163	.055				
Juglans nigra								3								3	3	.163	.055				
*Malus coronaria											1					1	1	.054	.018				
Malus - apples	4	3	7	8	5	2	6	8	6	11	5	7	8			80	80	4.334	1.460				
Malus - 'Anoka'				1												1	1	.054	.018				
Malus - flowering crabs	2	1		1			1	2	3	2	4	4	10			30	30	1.625	.547				
Malus - 'Hopa' crab												1				1	1	.054	.018				
Ulmus pumila	67	50	23	56	75	46	54	45	36	77	33	72	100			734	734	39.762	13.392				
Hedges	175'		60'	60'	90'	130'	30'	320'	310'	435'	235'		135'	1980'	396		396	21.452	7.225				
Individuals + Hedge Conversion																1130	1130	61.214	20.617				
																1251	1251	67.768	22.824				
ZONE V BROADLEAF TREES																							
Prunus persica												1				1	1	.054	.018				
																	1	.054	.018				
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																							
Fraxinus sp.								2								2	2						
Ulmus X rubra pumila		1														1	1						
																	3						

Glendive

Blocks Surveyed

Glendive	Blocks Surveyed													Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	Older Plantings						Mixed	Plantings About 10-20 Years Old											
	1	2	3	4	5	6	7	8	9	10	11	12	13						
ZONE II CONIFEROUS TREES																			
Picea glauca		2	2	2				4	1	1	4	2	2			20	20	23.529	.365
P.g. densata											1					1	1	1.176	.018
Picea pungens	1		1			2	3	2	16	6	4	1	8			45	45	52.941	.821
P. sp.				2	1				3		5	1	1			13	<u>13</u>	<u>15.294</u>	<u>.237</u>
																	79	92.941	1.441
ZONE V CONIFEROUS TREES																			
Pinus ponderosa									2		3					5	<u>5</u>	<u>5.882</u>	<u>.091</u>
																	5	5.882	.091
ZONE VII CONIFEROUS TREES																			
Pinus contorta latifolia													1			1	<u>1</u>	<u>1.176</u>	<u>.018</u>
																	1	1.176	.018

	Older Plantings						Mixed		Plantings About 10-20 Years Old					Total Hedge Footage	Hedge Conversion	Total Individual Plants	Total all Plants	Total Broad-leaf Shrubs	Total Plant Population
	1	2	3	4	5	6	7	8	9	10	11	12	13						
ZONE II BROADLEAF SHRUBS																			
Acer ginnala				1												1	1	.032	.018
Caragana arborea	2						2	45'	100'	255'	100'	105'	1	1130'	753	6	6	.188	.190
Hedges	100'		140'	210'	65'	20'											753	24,401	13,738
Individuals + Hedge Conversion									2	1	4	3	1				759	24,589	13,928
Cornus stolonifera	1		1														13	.421	.237
Physocarpus opulifolius											5						7	.227	.128
Prunus cistena																	2	.065	.037
Prunus X skinneri			1	1								1	1				3	.094	.055
Prunus tenella																	2	.065	.037
p. tomentosa hedge													25'	25'	17		17	.351	.310
P. virginiana	4	2	1	3	2		3	4		1			2			22	22	.713	.401
Hedges				10'										10'	7		7	.227	.128
Individuals + Hedge Conversion																	29	.940	.529
Prunus virginiana 'Schubert chokecherry'													1				1	.032	.018
Rhamnus cathartica											1	1					5	.162	.091
Hedges				40'						120'		150'	25'	335'	223		223	7,226	4,069
Individuals + Hedge Conversion																	228	7,388	4,160
Rhus glabra				1				1					1				3	.094	.055
Hedges				40'										40'	27		27	.875	.493
Individuals + Hedge Conversion																	30	.969	.548
Ribes alpinum																	1	.032	.018
R. aureum	7	3	1	2	1		1		2			1	3	20'	13	21	21	.680	.383
Hedges				20'													13	.421	.237
Individuals + Hedge Conversion																	34	1,101	.620
Rosa rubrifolia																	1	.032	.018
Sorbaria sorbifolia				2								15'		15'	10		3	.094	.055
Hedges																	10	.324	.182
Individuals + Hedge Conversion																	13	.418	.237
Symphoricarpos occidentalis												6					6	.188	.109
Syringa villosa											1						1	.032	.018
*Viburnum lentago				2													2	.065	.037
V. trilobum								1		1							2	.065	.037
																	1135	36,779	20,708
ZONE III BROADLEAF SHRUBS																			
Caragana pygmaea									4							4	4	.130	.073
Hedges													110'	110'	73		73	2,366	1,332
Individuals + Hedge Conversion										1	1						77	2,496	1,405
Euonymus alatus							2	6	6	4	1	1	4			2	2	.065	.037
Loniceria tatarica	1	3	5		1		2	200'	40'	35'				275'	183	34	34	1,102	.620
Hedges																	183	5,930	3,339
Individuals + Hedge Conversion																	217	7,032	3,959
Rhus typhina		4	4	3		1				7				40'	27	19	19	.616	.347
Hedges										40'							27	.875	.493
Individuals + Hedge Conversion																	46	1,491	860
Rhus typhina dissectifolia													2			2	2	.065	.037
Sambucus canadensis aurea																1	1	.032	.018
Syringa vulgaris	7	27	21	18	13	7	9	16	19	20	15	36	17			225	225	7,290	4,105
Hedges																	910	29,488	16,603
Individuals + Hedge Conversion																	1135	26,778	20,708
Viburnum opulus								1								5	5	.162	.091
																	1485	48,121	27,094
ZONE IV BROADLEAF SHRUBS																			
Chaenomeles japonica							1									1	1	.032	.018
Cotoneaster acutifolia	6			1						4	2	3	1			21	21	.680	.383
Hedges	75'							35'	20'				30'	160'	107		107	3,467	1,952
Individuals + Hedge Conversion																	128	4,147	2,335
Forsythia ovata				1													1	.032	.018
Hydrangea arborescens grandiflora											1	3					4	.130	.073
H. paniculata 'Grandiflora'			1														1	.032	.018
Ligustrum vulgare hedge														50'	50'	33	33	1,069	.602
Spiraea thunbergi								2	7	7	2	2				20	20	.648	.365
S. vanhouttei	3	14	12	5	2	1	11	8	4	10	7	7				84	84	2,722	1,533
Hedges								30'			40'		90'	160'	107		107	3,467	1,952
Individuals + Hedge Conversion																	191	6,189	3,485
Spiraea billiardi		1															1	.032	.018
*Syringa amurensis japonica			1														1	.032	.018
																	381	16,490	6,951
ZONE IV.5 BROADLEAF SHRUBS																			
Prunus triloba multiplex				1					2		1	1				5	5	.162	.091
																	5	.162	.091
ZONE V BROADLEAF SHRUBS																			
Berberis thunbergi										8			1			9	9	.292	.164
B.T. 'Atropurpurea'													1			1	1	.032	.018
Kolkwitzia amabilis											1					1	1	.032	.018
*Prunus bliriana			1									1				2	2	.065	.037
Spiraea bumalda				1					3	3	1	3	3			14	14	.454	.255
Syringa persica		1	3	5		2		3	2			2				20	20	.648	.365
Hedges							40'					2	10'	50'	33		33	1,069	.602
																	80	2,592	1,460

Glendive

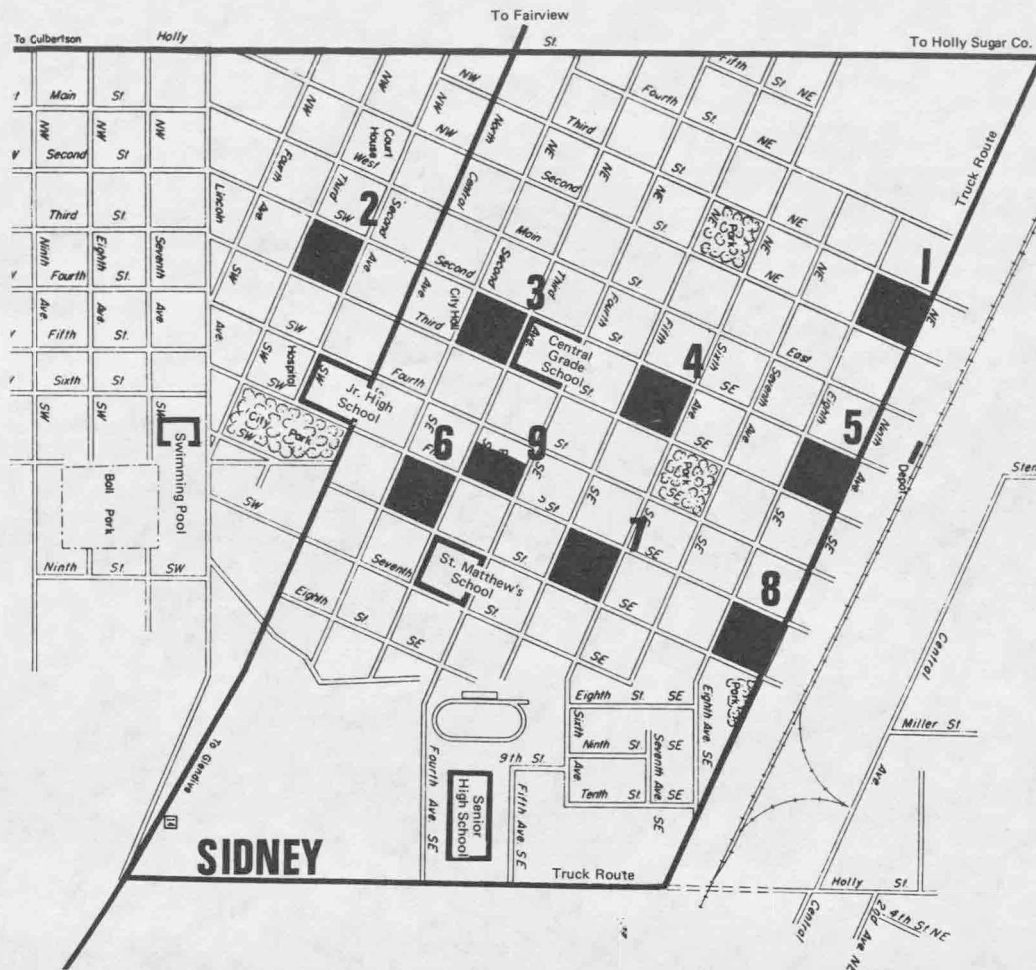
Blocks Surveyed

Glendive	Blocks Surveyed													Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	Older Plantings						Mixed		Plantings About 10-20 Years Old										
	1	2	3	4	5	6	7	8	9	10	11	12	13						
ZONE II CONIFEROUS SHRUBS																			
Juniperus communis								1	1	1						3	3	.752	.055
J. horizontalis										6						6	6	1.504	.109
J. virginiana							1	2		6	1					10	10	2.506	.182
blue								1		6						7	7	1.754	.128
columnar									2							2	2	.501	.037
Picea abies 'Nidiformis'								1								1	1	.251	.018
P. glauca 'Conica'					2								1			3	3	.752	.055
Pinus mugho			1				2	2		2						7	7	1.754	.128
P.m. mughus								5	2				2			9	9	2.256	.164
Taxus canadensis											6				2	8	8	2.005	.146
Thuja occidentalis	2		2					3	1	3	2			6		20	20	5.013	.365
Hedges										115'					115'	77	77	19.298	1.405
Individuals + Hedge Conversion																97	97	24.311	1.770
Thuja occidentalis globosa								2						3		5	5	1.253	.091
T.o. pyramidalis			2			2		4	4		1	3	11			27	27	6.767	.493
																	185	46.366	3.375
ZONE IV CONIFEROUS SHRUBS																			
Juniperus chinensis 'Pfitzeriana' 6			6				3	20	25	15	6	5	3			89	89	22.306	1.624
J.c. 'P. Compacta'										8						8	8	2.005	.146
Juniperus sabina			1						7	6	2		2			18	18	4.511	.328
J.s. 'Tamariscifolia'										1						1	1	.251	.018
																	116	29.073	2.116
ZONE V CONIFEROUS SHRUBS																			
Juniperus scopulorum	7	6		1	1	5	6	14	18	15		10	14			97	97	24.311	1.770
																	97	24.311	1.770
ZONE V.5 CONIFEROUS SHRUBS																			
Thuja orientalis													1			1	1	.251	.018
																	1	.251	.018
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																			
Juniperus sp.									3	13		2				18	18		
																	18		

Glendive	Blocks Surveyed													Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Cover	% of Total Plant Popula- tion
	Older Plantings						Mixed		Plantings About 10-20 Years Old										
	1	2	3	4	5	6	7	8	9	10	11	12	13						
ZONE II VINES AND GROUND COVERS																			
Vitis riparia				1				3	1						4	4	6.154	.073	
Hedges	15'													15'	3	3	4.615	.055	
																7	10.769	.128	
ZONE III VINES AND GROUND COVERS																			
*Campsis radicans													3		3	3	4.615	.055	
Parthenocissus quinquefolia	2	1	7	2		3	3		3	4	2	2			29	29	44.615	.529	
																32	49.231	.584	
ZONE IV VINES AND GROUND COVERS																			
Aristolochia durior				1											1	1	1.538	.018	
Lycium halimifolium				1											1	1	1.538	.018	
Polygonum cuspidatum hedge											20'			20'	4	4	6.154	.073	
																6	9.231	.109	
ZONE V VINES AND GROUND COVERS																			
Clematis ligusticifolia		6										1			7	7	10.769	.128	
																7	10.769	.128	
ZONE V.5 VINES AND GROUND COVERS																			
Clematis jackmani		1	1				1	2		2	1	1	4		13	13	20.000	.237	
																13	20.000	.237	
VINES AND GROUND COVERS NOT KNOWN OR SPECIES UNIDENTIFIED																			
*Dioscorea batatas													3		3	3			
Echinocystis lobata hedge											10'			10'	3		3		
Humulus lupulus	1	1													2	2			
																8			
Species and varieties observed in Glendive but not recorded in the survey																			
NONE																			

Appendix Figure 6. Map of Sidney, Montana. Blocks surveyed indicated by shading,

Appendix Table 6. Sidney Survey Data.



S I D N E Y Blocks Surveyed										Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
Older Plantings					Mixed Newer and Older Plantings			91/							
1	2	3	4	5	6	7	8								
ZONE II BROADLEAF TREES															
Acer negundo		6		8	2	1	2	4	1			24	24	3.414	.827
Betula papyrifera							1					1	1	.142	.034
B. pendula gracilis		2	2									4	4	.569	.138
Elaeagnus angustifolia	5	5			3							13	13	1.849	.448
*Celtis occidentalis		1							1			2	2	.284	.069
Populus deltoides	7			1	1	2	3					14	14	1.991	.482
P. nigra 'Italica'	4			1		5						10	10	1.422	.345
Salix alba									1			1	1	.142	.034
S.a. 'Sericea'									4			4	4	.569	.138
S.a. 'Tristis'	1	1			1		1	1	1			6	6	.853	.207
Sorbus aucuparia		1	1					1	8			11	11	1.565	.379
*Tilia americana							3		2			5	5	.711	.172
Ulmus americana		66	70	26	15	52	18	7	6			260	260	36.984	8.959
Hedges						195'				195'	39		39	5.548	1.344
Individuals + Hedge Conversion												299	299	42.532	10.303
												394	394	56.046	13.577
ZONE II.5 BROADLEAF TREES															
Fraxinus pennsylvanica		5		3	9	14	2	2	3			38	38	5.405	1.309
													38	5.405	1.309
ZONE III BROADLEAF TREES															
Acer saccharinum		1					1					2	2	.284	.069
*Aesculus glabra									1			1	1	.142	.034
*A. hippocastanum							1	1	1			3	3	.427	.103
Populus alba		1			6	3						10	10	1.422	.345
P.a. 'Pyramidalis'			1	3					2			6	6	.853	.207
*Tilia cordata									2			2	2	.284	.069
													24	3.698	.827
ZONE IV BROADLEAF TREES															
*Gleditsia triacanthos									1			1	1	.142	.034
G.t. inermis									1			1	1	.142	.034
*Juglans nigra							1		1			2	2	.284	.069
Malus - apple	2	4	1	6	4	5	9	11	1			43	43	6.117	1.482
Malus - flowering crab		3	1	4	1	1	2	4	1			17	17	2.418	.586
Ulmus pumila	54	5	2	2	43	5	8	19	2			140	140	19.915	4.824
Hedges	20'					75'	30'	85'		210'	42		42	5.974	1.447
Individuals + Hedge Conversion												182	182	25.889	6.271
												246	246	34.993	8.477
ZONE V BROADLEAF TREES															
Prunus armeniaca									1			1	1	.142	.034
													1	.142	.034
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED															
*Ulmus X rubra pumila						2						2	2	.284	.069

1/ City Park and 30 Years Old.

Sidney	Blocks Surveyed									91/ Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion	
	Older Plantings					Mixed Newer and Older Plantings										
	1	2	3	4	5	6	7	8								
ZONE II CONIFEROUS TREES																
*Larix occidentalis									2			2	2	3.030	.069	
Picea glauca				3	6			5				14	14	21.210	.482	
P. pungens	3			2	2	2	11	2	10	5		37	37	56.061	1.275	
P. sp.	1	2	2				2	2	1			10	<u>10</u>	<u>15.152</u>	<u>.345</u>	
													63	95.455	2.171	
ZONE V CONIFEROUS TREES																
Pinus ponderosa										2		2	2	3.030	.069	
Pseudotsuga menziesii							1					1	<u>1</u>	<u>1.515</u>	<u>.034</u>	
													3	4.545	.103	

1/ City Park and 30 Years Old.

Sidney	Blocks Surveyed										Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion	
	Older Plantings					Mixed Newer and Older Plantings											
	1	2	3	4	5	6	7	8	9	10							
ZONE II BROADLEAF SHRUBS																	
Acer glabrum									1	1			2	2	.100	.069	
Caragana arborescens				1									1	1	.050	.034	
Individuals + Hedge Conversion	220'	50'			25'						295'	197	197	9,840	6.788		
Cornus stolonifera						1			4				5	5	.250	.172	
Physocarpus opulifolius						1							1	1	.050	.034	
Potentilla fruticosa						1							1	1	.050	.034	
Prunus cistena									1	1			2	2	.100	.069	
*X Prunus skinneri		2		1									3	3	.150	.103	
Prunus virginiana	1	6	1	1	2	2	4						17	17	.849	.586	
Individuals + Hedge Conversion								10'			10'	7	7	.350	.241		
*Rhamnus cathartica		3	2					1	4				10	10	.500	.345	
Individuals + Hedge Conversion		20'						190'			210'	140	140	6,993	4.824		
Ribes alpinum													150	150	7.493	5.169	
R. aureum		2	6	3		1	2						6	6	.300	.207	
Sorbaria sorbifolia													8	8	.400	.276	
Syringa villosa				8		1							9	9	.450	.310	
Tamarix pentandra													1	1	.050	.034	
													1	1	.050	.034	
													411	20,529	13.784		
ZONE III BROADLEAF SHRUBS																	
Caragana pygmaea					1	2							3	3	.150	.103	
Lonicera tatarica													30	30	1.500	1.034	
Individuals + Hedge Conversion	150'				50'			50'			250'	17	17	.849	.586		
*Lonicera xylosteum hedge										50'	50'	33	33	1.648	1.137		
Prunus besseyi								2					2	2	.100	.069	
*P. padus													1	1	.050	.034	
*P. tomentosa										1			1	1	.050	.034	
Rhus typhina													3	3	.150	.103	
Syringa vulgaris	11	12	2	31	13	10	15	5	1				100	100	4.995	3.446	
Individuals + Hedge Conversion	120'	240'			80'	45'	310'	220'	305'		1320'	880	880	43.956	30.324		
*Viburnum lentana													980	48.951	33.770		
V. opulus													7	7	.350	.241	
													1	1	.050	.034	
													1078	53.846	37.147		
ZONE IV BROADLEAF SHRUBS																	
Acer tataricum													2	2	.100	.069	
*Cornus racemosa													1	1	.050	.034	
Cotoneaster acutifolia													2	2	.100	.069	
Individuals + Hedge Conversion	20'	140'									160'	107	107	5.345	3.687		
Foraythia ovata													109	5.445	3.756		
Hydrangea arborescens grandiflora													4	4	.200	.138	
Ligustrum vulgare													1	1	.050	.034	
Salix incana													8	8	.400	.276	
Sambucus racemosa													7	7	.350	.241	
Spiraea thunbergii													1	1	.050	.034	
S. vanhouttei													6	6	.300	.207	
Individuals + Hedge Conversion	2	6	7	8	4	4	14	2			150'	100	47	2.348	1.620		
	55'				60'			35'					100	4.995	3.446		
													167	7.361	5.066		
													282	14.086	9.717		
ZONE IV.5 BROADLEAF SHRUBS																	
Prunus triloba multiplex							1		1	1			3	3	.150	.103	
													3	3	.150	.103	
ZONE V BROADLEAF SHRUBS																	
Artemisia abrotanum													1	1	.050	.034	
Berberis thunbergii 'Atropurpurea'													2	2	.100	.069	
Kolkwitzia amabilis													1	1	.050	.034	
*Prunus blairiana													1	1	.050	.034	
Spiraea bumalda													1	1	.050	.034	
Syringa persica	1	2	1	5	1								19	19	.949	.655	
Individuals + Hedge Conversion											80'	1	8	300'	200	9.990	6.892
Weigela florida													3	3	.150	.103	
													228	11.389	7.857		
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																	
Philadelphus sp.													2	2			
* double flowers													6	6			
single flowers													3	3			
Prunus - plums													12	12			
Individuals + Hedge Conversion											20'	13	13	13			
Quercus sp.													2	2			
Ribes sp.													1	1			
Salix sp.													1	1			
													1	1			
													40	40			

1/ City Park and 30 Years Old.

Sidney	Blocks Surveyed									91/ Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	Older Plantings					Mixed Newer and Older Plantings									
	1	2	3	4	5	6	7	8							
ZONE II CONIFEROUS SHRUBS															
Juniperus virginiana		2					1				3	3	3.371	.103	
Pinus mugho		1				4	2				7	7	7.865	.241	
Taxus canadensis fastigiata							5				5	5	5.618	.172	
Thuja occidentalis		4	1				2		1		8	8	8.989	.276	
T.o. 'Globosa'			1						6		7	7	7.865	.241	
T.o. pyramidalis		3	4	1							8	8	8.989	.276	
												38	42.697	1.309	
ZONE IV CONIFEROUS SHRUBS															
Juniperus chinensis 'Pfitzeriana'		8					4				12	12	13.483	.414	
Juniperus sabina											7	7	7.865	.241	
												19	21.348	.655	
ZONE V CONIFEROUS SHRUBS															
Juniperus scopulorum	2	4	2	2	1	4	2	5	9		31	31	34.831	1.068	
fastigiata					1						1	1	1.124	.034	
												32	35.955	1.103	
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED															
Juniperus sp.					1			1			1	1			

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123

1/ City Park and 30 Years Old.

Sidney	Blocks Surveyed								91/ Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion	
	Older Plantings					Mixed Newer and Older Plantings									
	1	2	3	4	5	6	7	8							
ZONE II VINES AND GROUND COVERS															
Vitis riparia					1			2			3	3	7.143	.103	
Hedges		10'					20'			30'	6	6	14.286	.207	
Individuals + Hedge Conversion												9	21.429	.310	
ZONE III VINES AND GROUND COVERS															
Parthenocissus quinquefolia		10	1	2	2		2	1			19	19	45.238	.655	
												19	45.238	.655	
ZONE IV VINES AND GROUND COVERS															
Parthenocissus tricuspidatum			1								1	1	2.381	.034	
Polygonum cuspidatum							1				1	1	2.381	.034	
												2	4.762	.069	
ZONE V VINES AND GROUND COVERS															
Clematis lingusticifolia				1							1	1	2.381	.034	
Vinca minor			1								1	1	2.381	.034	
Hedges		10'								10'	2	2	4.762	.069	
Individuals + Hedge Conversion												3	7.153	.103	
												4	9.524	.138	
ZONE V.5 VINES AND GROUND COVERS															
Clematis jackmanii		3		2		1	1	1			8	8	19.048	.276	
												8	19.048	.276	
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED															
Echinocystis lobata								1			1	1			
Humulus lupulus		1									1	1			
												2			

Species and varieties observed in Sidney but not recorded in the survey.
NONE

1/ City Park and 30 Years Old.

Appendix Table 7. Lambert, Lindsay and Richey Survey Data.

LAMBERT, LINDSAY, RICHEY											% of	% of
	LAMBERT	Total all Plants	LINDSAY	Total all Plants	RICHEY	Total all Plants	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	Total Broad- leaf Trees	% of Total Plant Popula- tion
ZONE II BROADLEAF TREES												
Acer negundo	31		1		24				56	56	12.844	2.701
Elaeagnus angustifolia	38		12		4				54	54	12.385	2.605
Populus deltoides	6		7		14				27	27	6.193	1.302
P. nigra 'Italica'	12		2		2				16	16	3.670	.772
Salix alba	1								1	1	.229	.048
Sorbus aucuparia	2								2	2	.459	.096
Tilia americana			1						1	1	.229	.048
Ulmus americana	19		9		2				30	30	6.881	1.468
	109		32		46					187	42.890	9.021
ZONE II.5 BROADLEAF TREES												
Fraxinus pennsylvanicum	10		6		3				19	19	4.358	.917
										19	4.358	.917
ZONE III BROADLEAF TREES												
Phellodendron amurense	1								1	1	.229	.048
Populus alba 'Pyramidalis'	2								2	2	.459	.096
	3									3	.688	.145
ZONE IV BROADLEAF TREES												
Malus - apple	1		11		7	7			19	19	4.358	.917
Malus - flowering crab			2		2	2			4	4	.917	.193
Ulmus pumila	82		49		55	55			186	186	42.661	8.973
Hedges					90'	18	90'	18		18	4.128	.868
Individuals + Hedge Conversion										204	46.789	9.841
	83		62			82				227	52.064	10.950
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Ulmus X rubra pumila	2								2	2		
	2									2		

Lambert, Lindsay, Richey

	LAMBERT	Total all Plants	LINDSAY	Total all Plants	RICHEY	Total all Plants	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
ZONE II CONIFEROUS TREES												
Picea glauca			7						7	7	21.875	.338
P. pungens		8	2						10	10	31.250	.482
P. sp.		<u>4</u>	<u>11</u>						15	<u>15</u>	<u>46.875</u>	<u>.241</u>
		12	20							32	100.000	1.544

Lambert, Lindsay, Richey

	LAMBERT	Total all Plants	LINDSAY	Total all Plants	RICHEY	Total all Plants	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
ZONE II BROADLEAF SHRUBS												
Caragana arborescens	48	48	3	3	14	14			65	65	4.137	3.136
Hedges	360'	240	430'	287	105'	70	895'	597		597	38.001	28.799
Individuals + Hedge Conversion										662	42.138	31.935
Cornus stolonifera	2	2			1	1			3	3	.191	.145
Prunus virginiana	8	8	2	2	3	3			13	13	.827	.627
Rhus glabra	1	1	1	1					2	2	.127	.096
Ribes aureum	10	10	2	2	3	3			15	15	.955	.241
Symphoricarpos occidentalis	2	2							2	2	.127	.096
Syringa villosa	2	2	1	1					3	3	.191	.145
Tamarix pentandra					1	1			1	1	.064	.048
		313		296		92				701	44.621	33.816
ZONE III BROADLEAF SHRUBS												
Lonicera tatarica	10	10	3	3		9			22	22	1.400	1.061
Hedges			120'	80			120'	80		80	5.092	3.859
Individuals + Hedge Conversion										102	6.492	5.920
Prunus besseyi			3	3					3	3	.191	.145
Syringa vulgaris	46	46	23	23	53	53			122	122	7.766	5.885
Hedges	680'	453	230'	153	20'	13	930'	620		620	39.465	29.908
Individuals + Hedge Conversion										742	47.231	35.793
		509		262		75				847	53.915	40.859
ZONE IV BROADLEAF SHRUBS												
Cotoneaster acutifolia			1	1	2	2			3	3	.191	.145
Spiraea vanhouttei	2	2	4	4	1	1			7	7	.446	.338
		2		5		3				10	.637	.482
ZONE IV.5 BROADLEAF SHRUBS												
Prunus triloba multiplex	1	1/2							1	1	.064	.048
										1	.064	.048
ZONE V BROADLEAF SHRUBS												
Syringa persica	5	5/5	4	4/4	3	3/3			12	12	.764	.579
										12	.764	.579
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Philadelphus sp.	1	1							2	2		
Prunus - plums	3		5		9				17	17		
Salix sp.	1/4		5		9				1	1		
										18		

Lambert, Lindsay, Richey

	LAMBERT	Total all Plants	LINDSAY	Total all Plants	RICHEY	Total all Plants	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf- Shrubs	% of Total Plant Popula- tion
ZONE II CONIFEROUS SHRUBS												
Juniperus virginiana	1	1							1	1	6.667	.048
Pinus mugho			1	1					1	1	6.667	.048
Taxus canadensis			1	1					1	1	6.667	.048
Thuja occidentalis			4	4					4	4	26.667	.193
		<u>1</u>		<u>6</u>						<u>7</u>	<u>46.667</u>	<u>.338</u>
ZONE IV CONIFEROUS SHRUBS												
Juniperus chinensis pfitzeriana	2	<u>2</u>							2	<u>2</u>	<u>13.333</u>	<u>.096</u>
											13.333	.096
ZONE V CONIFEROUS SHRUBS												
Juniperus scopulorum	6	<u>6</u>							6	<u>6</u>	<u>40.000</u>	<u>.289</u>
											40.000	.289

Lambert, Lindsay, Richey

	LAMBERT	Total all Plants	LINDSAY	Total all Plants	RICHEY	Total all Plants	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
ZONE III VINES AND GROUND COVERS												
Parthenocissus quinquefolia	6	$\frac{6}{6}$	5	$\frac{5}{5}$	4	$\frac{4}{4}$			15	$\frac{15}{15}$	$\frac{83.333}{83.333}$	$\frac{.241}{.241}$
ZONE IV VINES AND GROUND COVERS												
Lycium halimifolium					1	$\frac{1}{1}$			1	$\frac{1}{1}$	$\frac{5.556}{5.556}$	$\frac{.048}{.048}$
ZONE V.5 VINES AND GROUND COVERS												
Clematis jackmanii	1	$\frac{1}{1}$	1	$\frac{1}{1}$					2	$\frac{2}{2}$	$\frac{1.111}{1.111}$	$\frac{.096}{.096}$
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Echinocystis lobata			1	$\frac{1}{1}$					1	$\frac{1}{1}$		
Humulus lupulus	2	$\frac{2}{2}$	1	$\frac{1}{2}$					3	$\frac{3}{4}$		

Species observed in Richey but not recorded in the survey

Juniperus scopulorum ZONE V (several)
Pinus mugho ZONE II (two)
Populus alba ZONE III (one)

NONE IN Lambert and Lindsay.

Appendix Figure 7. Map of Glasgow, Montana. Blocks surveyed indicated by shading.

Appendix Table 8. Glasgow Survey Data.

G L A S G O W, M O N T A N A																		% of	% of																						
Blocks Surveyed																		Total	Total	Total	Total																				
Old Plantings								Mixed	10-20 Year Old Plantings				New Plantings 1-10 Years Old			Total Hedge Footage	Hedge Conversion	Indivi- dual Plants	Total all Plants	Broad- leaf Trees	Plant Popula- tion																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15																											
ZONE I BROADLEAF TREES																																									
Populus tremuloides																								1												1	<u>1</u> 1	<u>.089</u> .089	<u>.033</u> .033		
ZONE II BROADLEAF TREES																																									
Acer negundo																					1	3	3		1		10	1				1					20	20	1.775	.663	
Betula papyrifera																															1						1	1	.089	.033	
B. pendula gracilis																											1		1								2	2	.177	.066	
Elaeagnus angustifolia																							6				17		1		10	2					36	36	3.194	1.193	
Hedges																															140'	195'			335'	67	67	5.945	2.221		
Individuals + Hedge Conversion																																					103	9.139	3.414		
*Celtis occidentalis																									1												1	1	.089	.033	
Populus sargentii																													2	4	7	3	19	17			59	59	5.235	1.956	
*P. deltoides																					23	12	6	13	4	14	11	7	3	28	10	14	18					163	163	14.463	5.403
P. nigra 'Italica'																											1				2						3	3	.266	.099	
Salix alba																							2		4		2	1			1						12	12	1.065	.398	
Sorbus aucuparia																											1		1								2	2	.177	.066	
Ulmus americana																							2	1	1	1	8	3	2	3		4	3		5	3	36	<u>36</u>	<u>3.194</u>	<u>1.193</u>	
																																						<u>402</u>	<u>35.670</u>	<u>13.324</u>	
ZONE II.5 BROADLEAF TREES																																									
Fraxinus pennsylvanica																					4	37	5	6	5	17	18	19		8	4	2	3	10	3			141	<u>141</u> 141	<u>12.511</u> 12.511	<u>4.674</u> 4.674
ZONE III BROADLEAF TREES																																									
Acer saccharinum																													1									1	1	.089	.033
*Populus alba																					1	1	2			12	13	1			1							31	31	2.751	1.028
P.a. pyramidalis																											10		9		3							22	22	1.952	.729
Prunus cerasus																											1											1	<u>1</u>	<u>.089</u>	<u>.033</u>
																																						55	4.880	1.823	
ZONE IV BROADLEAF TREES																																									
Gleditsia triacanthos																															1							1	1	.089	.033
Malus - apple																					2		2	8		3	13	7	1		1	3	3	4				47	47	4.170	1.558
Malus - flowering crab																					2			4			7	1	1			7		2				24	24	2.130	.795
Ulmus pumila																					44	48	20	41	5	29	66	23	12		9	8	32	19	9			365	365	32.387	12.098
Hedges																					20'						140'				90'			180'	25'	455'	91	91	8.075	3.016	
Individuals + Hedge Conversion																																						<u>456</u> 528	<u>40.462</u> 46.850	<u>15.114</u> 17.501	

GLASGOW, MONTANA

Blocks Surveyed

	Old Plantings							Mixed 8	10-20 Year Old Plantings				New Plantings 1-10 Years Old			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	1	2	3	4	5	6	7		9	10	11	12	13	14	15						
ZONE II CONIFEROUS TREES																					
Picea glauca densata												1						1	1	2.632	.033
P. pungens			2			4			1		1	5	1	5	1			20	20	52.632	.663
Picea sp.	1							1			1	4	1	1				9	9	23.684	.298
																			30	78.947	.994
ZONE III.5 CONIFEROUS TREES																					
Pinus cembra							1			1			2	1				5	5	13.158	.166
																			5	13.158	.166
ZONE V CONIFEROUS TREES																					
Pinus ponderosa												1						1	1	2.632	.033
																			1	2.632	.033
ZONE VII CONIFEROUS TREES																					
Pinus contorta latifolia								2										2	2	5.263	.066
																			2	5.263	.066

GLASGOW, MONTANA	Blocks Surveyed												New Plantings			Total Hedge Footage	Hedge Conversion	Total Individual Plants	Total all Plants	% of Total Broad-leaf Shrubs	% of Total Population		
	Old Plantings							Mixed	10-20 Year Old Plantings			1-10 Years Old											
	1	2	3	4	5	6	7		8	9	10	11	12	13	14							15	
ZONE II BROADLEAF SHRUBS																							
Caragana arborescens	1			3	1	5	1	1					5	1	15	9		42	42	2.689	1.392		
Hedges								50'								20'		70'	47	47	3.009	1.558	
Individuals + Hedge Conversion																				89	5.698	2.950	
*Cornus alba 'Sibirica argenteo-marginata															2					2	.128	.066	
Cornus stolonifera				1			1			1		12	2	3						20	20	1.280	.663
Potentilla fruticosa								2		8		9	1							20	20	1.280	.663
*Prunus cistena													5		1	1				7	7	.448	.232
Prunus virginiana			3		3	2	2	6	1					10	1	1				29	29	1.857	.961
Hedges			20'					20'										40'	27	27	1.729	.895	
Individuals + Hedge Conversion																				56	3.586	1.856	
*Prunus tomentosa	1																			1	1	.064	.033
*Rhamnus cathartica	3							2												5	5	.320	.166
Hedges								90'				240'						330'	220		220	14.085	7.292
Individuals + Hedge Conversion																				225	14.405	7.458	
Rhus glabra								2		1										3	3	.192	.099
Ribes alpinum				3						6		1								10	10	.640	.331
R. aureum	18	1	2	3	3	1	3	1						4		1				37	37	2.369	1.226
*Rosa rubrifolia													1	3						4	4	.256	.133
Hedges														75'				75'	50		50	3.201	1.657
Individuals + Hedge Conversion																				54	3.457	1.790	
Sorbaria sorbifolia							2			1			3	1						7	7	.448	.232
*Syringa villosa										1			6							7	7	.448	.232
*Tamarix pentandra										2				1						3	3	.192	.099
Viburnum trilobum										2				1						3	3	.192	.099
																				554		35.467	18.363
ZONE III BROADLEAF SHRUBS																							
Caragana pygmaea									6				5							11	11	.704	.365
Lonicera tatarica	4	7	4	5	4	1	13	2	1	2			8	5	1					57	57	3.649	1.889
Hedges								50'										50'	33	33	2.113	1.094	
Individuals + Hedge Conversion																				90	5.762	2.983	
Eunonymus alatus													1							1	1	.064	.033
*Prunus besseyi												1	1							1	1	.064	.033
Rhus typhina										1						6				7	7	.448	.232
Sambucus canadensis aurea										1		1	1							3	3	.192	.099
Syringa vulgaris	19	11	18	20	2	28	39	26	3	15	17	6	11	6	14	40'		700'	467	235	235	15.045	7.789
Hedge		20'				30'	465'	125'	10'											467	29.898	15.479	
Individuals + Hedge Conversion																				702	44.943	23.268	
Viburnum opulus										1		1								2	2	.128	.066
V. lantana															3					3	3	.192	.099
																				820		52.497	27.179
ZONE IV BROADLEAF SHRUBS																							
Cotoneaster acutifolia		1		1		1	1	3		6		2	6	1						22	22	1.408	.729
Hedges											50'	60'						110'	73	73	4.673	2.420	
Individuals + Hedge Conversion								1					1	1						95	6.081	3.149	
*Forsythia ovata																				3	3	.192	.099
Ligustrum vulgare hedges										30'								30'	20	20	1.280	.663	
Salix incana												1								1	1	.064	.033
*S. purpurea										1										1	1	.064	.033
Spiraea thunbergii							3			5					4					12	12	.768	.398
S. vanhouttei	1							6		2	1	6			4					19	19	1.216	.630
																				151		9.667	5.005
ZONE IV.5 BROADLEAF SHRUBS																							
*Prunus triloba multiplex													1							1	1	.064	.033
																				1	1	.064	.033
ZONE V BROADLEAF SHRUBS																							
*Artemisia abrotanum		1					1													2	2	.128	.066
*X Prunus blireiana										1										1	1	.064	.033
*Spiraea bumalda													5							5	5	.320	.166
*Symphoricarpos chenaultii													4							4	4	.256	.133
Syringa persica	1			2	3	2	2	5	1	1	1	3	1							22	22	1.408	.729
Weigela florida													1							1	1	.064	.033
																				35		2.241	1.159
ZONE VI BROADLEAF SHRUBS																							
Pyracantha coccinea									1											1	1	.064	.033
																				1	1	.064	.033
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																							
Philadelphus sp.										1				2						3	3		
double flowers					1															1	1		
single flowers							1						1							2	2		
Prunus - plums	2		3	4		7	9	4	5	3		1			1				39	39			
Ribes sp.	4			4										2	2	1				12	12		
																				57			

GLASGOW, MONTANA

Blocks Surveyed

GLASGOW, MONTANA	Blocks Surveyed												New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
	Old Plantings						Mixed	10-20 Year Old Plantings				1-10 Years Old									
	1	2	3	4	5	6		7	8	9	10	11	12	13	14						
ZONE II CONIFEROUS SHRUBS																					
Juniperus communis								2										2	2	.957	.066
J. horizontalis										3	1							4	4	1.914	.133
*J. virginiana 'Henwick'				5														5	5	2.392	.166
Pinus mugo								1	1	1	1	2						6	6	2.871	.199
P.m. mughus								2			2	5	1	3				13	13	6.220	.431
Thuja occidentalis																		2	2	.957	.066
																			32	15.311	1.061
ZONE IV CONIFEROUS SHRUBS																					
Juniperus chinensis 'Pfitzeriana'						4		9	2	9	1	14	3	5	1			48	48	22.967	1.591
J.c. 'P. Aurea'								1										1	1	.478	.033
Juniperus sabina							1		3	3	7	11						25	25	11.962	.829
J. squamata meyeri								1										1	1	.478	.033
																			75	35.885	2.486
ZONE V CONIFEROUS SHRUBS																					
Juniperus scopulorum	3	4	1	1		4	3	15	1	38	10	17	2	2	1			102	102	48.804	3.381
																			102	48.804	3.381
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																					
Juniperus sp.								1										1	1		

GLASGOW, MONTANA

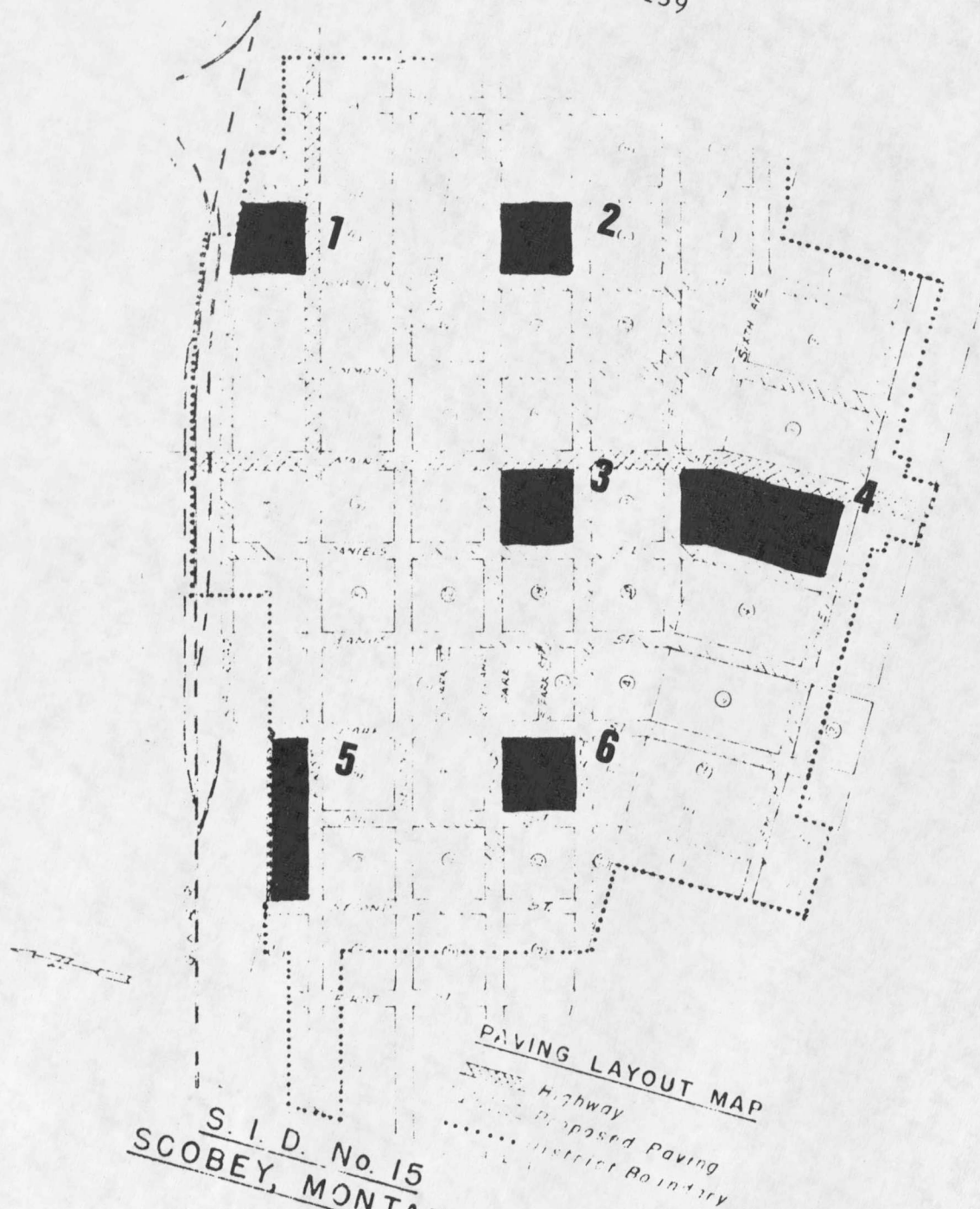
GLASGOW, MONTANA	Blocks Surveyed												New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	Old Plantings						Mixed	10-20 Year Old Plantings				1-10 Years Old									
	1	2	3	4	5	6		7	8	9	10	11	12	13	14						
ZONE II.5 VINES AND GROUND COVERS																					
Lonicera sempervirens								1				1						2	<u>2</u>	<u>2.469</u>	<u>.066</u>
ZONE III VINES AND GROUND COVERS																					
Parthenocissus quinquefolia	1		3	2	1	1	13	19	2	4	2		4					52	52	64.198	1.724
*Campsis radicans							1											1	<u>1</u>	<u>1.234</u>	<u>.033</u>
ZONE IV VINES AND GROUND COVERS																					
Polygonum cuspidatum							1											1	1	1.234	.033
Solanum dulcamara hedge								10'							10'	2			<u>2</u>	<u>2.469</u>	<u>.066</u>
ZONE V VINES AND GROUND COVERS																					
*Clematis ligusticifolia		1				1	6						1					9	<u>9</u>	<u>11.111</u>	<u>.298</u>
ZONE V.5 VINES AND GROUND COVERS																					
Clematis jackmani	1					2	3	4		1				3				14	<u>14</u>	<u>17.284</u>	<u>.464</u>
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																					
Humulus lupulus	1						1			1								3	3		
Echinocystis lobata	2						1											5	<u>5</u>		

Species and varieties observed in Glasgow but not recorded in the survey.

- *Crataegus oxycantha pauli ZONE IV BROADLEAF TREES
- *Euonymus fortunei ZONE V BROADLEAF EVERGREEN VINE
- *Lonicera clareyi nana ZONE ? BROADLEAF SHRUB
- *L. japonica 'Halliana' ZONE IV VINE
- *Populus X canadensis ZONE V BROADLEAF TREE

Appendix Figure 8. Map of Scobey, Montana. Blocks surveyed indicated by shading.

Appendix Table 9. Scobey Survey Data.



S. I. D. No. 15
SCOBEE, MONTANA

S C O B E Y, M O N T A N A
Blocks Surveyed

	1	2	3	4	5	6	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Broad- leaf Trees	% of Total Plant Popula- tion
ZONE II BROADLEAF TREES												
Acer negundo	2	3	34	14	19	24			96	96	13.079	1.906
Betula papyrifera			3						3	3	.409	.061
Elaeagnus angustifolia	48				5	3			56	56	7.629	1.467
Hedge					540'		540'	108		108	14.714	2.211
Individuals + Hedge Conversion										164	22.343	3.678
Populus sargentii	18	1				4			23	23	3.134	.471
P. deltoides	56	46	20	82	19	10			237	237	32.289	4.853
P. nigra 'Italica'	5								5	5	.681	.102
Salix alba						2			2	2	.272	.041
S.a. 'Tristis'	1	1							2	2	.272	.041
Sorbus aucuparia				3	2				5	5	.681	.102
Ulmus americana				6	1	4			11	11	1.499	.225
										548	74.659	11.220
ZONE II.5 BROADLEAF TREES												
Fraxinus pennsylvanica	4	2	5	43	17	15			86	86	11.717	1.761
										86	11.717	1.761
ZONE III BROADLEAF TREES												
Acer saccharinum					2				2	2	.272	.041
Populus alba				1					1	1	.139	.020
P.a. 'Pyramidalis'				6	3				9	9	1.226	.184
										12	1.635	.246
ZONE IV BROADLEAF TREES												
Malus - apples	4				5	1			10	10	1.362	.205
Malus - flowering crabs	5		2	5	6	1			19	19	2.589	.389
Ulmus pumila	12	8	20	1	5	13			59	59	8.038	1.208
										88	11.989	1.802

SCOBAY, MONTANA

SCOBEY, MONTANA	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	1	2	3	4	5	6						
ZONE II CONIFEROUS TREES												
Picea engelmanni			1						1	1	3.571	.020
P. glauca		1							1	1	3.571	.020
P. pungens	4	1	2	5	6	1			19	19	67.857	.389
Picea sp.	5		2						7	7	25.000	.143
										28	100	.573

Total
Hedge
Footage

Hedge Conver- sion

Total
Indivi-
dual
Plants

Total
all
Plants

% of
Total
Broad-
leaf
Shrubs

% of
Total
Plant
Popula-
tion

[illegible]

SCOBAY, MONTANA

Blocks Surveyed

	1	2	3	4	5	6	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
ZONE II CONIFEROUS SHRUBS												
Pinus mugo					2				2	2	7.407	.041
Thuja occidentalis pyramidalis	1								1	<u>1</u> 3	<u>3.704</u> 11.111	<u>.020</u> .061
ZONE IV CONIFEROUS SHRUBS												
Juniperus chinensis 'Pfitzeriana'	2								2	<u>2</u> 2	<u>7.407</u> 7.407	<u>.041</u> .041
ZONE V CONIFEROUS SHRUBS												
Juniperus scopulorum	2	8			4	1			15	15	55.556	.307
globose					5				5	5	18.519	.102
fastigiata					2				2	<u>2</u> 22	<u>7.407</u> 81.481	<u>.041</u> .450

SCOBEY, MONTANA	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of	% of
	1	2	3	4	5	6					Total Vines & Ground Covers	Total Plant Popula- tion
ZONE III VINES AND GROUND COVERS												
Parthenocissus quinquefolia	1	2	6	2	1	5			17	<u>17</u> 17	<u>85.000</u> 85.000	<u>.348</u> .348
ZONE IV VINES AND GROUND COVERS												
*Parthenocissus tricuspidata					3				3	<u>3</u> 3	<u>15.000</u> 15.000	<u>.061</u> .061
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Echinocystis lobata	1					2			3	3		
Humulus lupulus			2	2		1			5	5		
Hedge			100'				100'	20		20		
Individuals + Hedge Conversion										<u>25</u> 28		

Species observed in Scobey but not recorded in the survey

Caragana pygmaea ZONE III BROADLEAF SHRUB
 *Fraxinus mandsharica ZONE III BROADLEAF TREE
 *Prunus tomentosa ZONE II BROADLEAF SHRUB
 Sambucus canadensis aurea ZONE III BROADLEAF SHRUB
 Thuja occidentalis 'Wareana' ZONE II CONIFEROUS SHRUB

Appendix Table 10. Opheim Survey Data.

O P H E I M, M O N T A N A
Blocks Surveyed

	Age of Plants Varied			City Park	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	1	2	3	4						
ZONE II BROADLEAF TREES										
Acer negundo	29		24	22			95	95	37.549	3.898
Elaeagnus angustifolia		1	1				2	2	.791	.082
Malus baccata				1			1	1	.395	.041
Populus deltoides		10	1	11			22	22	8.696	.903
P. nigra 'Italica'				6			6	6	2.372	.246
P. trichocarpa				5			5	5	1.976	.205
Salix alba				1			1	1	.395	.041
Ulmus americana	33	9					42	<u>42</u>	<u>16.601</u>	<u>1.723</u>
								174	68.775	7.140
ZONE II.5 BROADLEAF TREES										
Fraxinus pennsylvanica	39	1	5	22			67	<u>67</u>	<u>26.482</u>	<u>2.749</u>
								67	26.482	2.749
ZONE III BROADLEAF TREES										
Acer platanoides 'Schwedleri'				1			1	1	.395	.041
Tilia cordata				1			1	<u>1</u>	<u>.395</u>	<u>.041</u>
								2	.791	.082
ZONE IV BROADLEAF TREES										
Malus sp. apples				5			5	5	1.976	.205
Malus flowering crabs				5			5	<u>5</u>	<u>1.976</u>	<u>.205</u>
								10	3.953	.410
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED										
*Ulmus X rubra pumila				1			1	<u>1</u>	<u>1</u>	

OPHEIM, MONTANA	Blocks Surveyed				Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plants Popula- tion
	Age of Plants Varied			City Park						
	1	2	3							
ZONE II CONIFEROUS TREES										
Picea alba			1				1	1	5.263	.041
P. glauca				4			4	4	21.053	.164
P. pungens			2	8			10	10	52.632	.410
Picea sp.		2		1			3	<u>3</u>	<u>15.789</u>	<u>.123</u>
								18	94.737	.739
ZONE VII CONIFEROUS TREES										
Pinus contorta latifolia		1					1	<u>1</u>	<u>5.263</u>	<u>.041</u>
								1	5.263	.041

OPHEIM, MONTANA

Blocks Surveyed

	Age of Plants Varied			City Park	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	1	2	3	4						
ZONE II BROADLEAF SHRUBS										
Caragana arborescens			6				6	6	.279	.246
Hedges	1080'	415'	435'	620'	2550'	1700		1700	78.923	69.758
Individuals + Hedge Conversion								1706	79.202	70.004
Prunus virginiana		2		1			3	3	.139	.123
Ribes aureum		2					2	2	.093	.082
*Syringa villosa				1			1	1	.046	.041
								1712	79.480	70.250
ZONE III BROADLEAF SHRUBS										
Lonicerus tatarica		4	1	1			6	6	.279	.246
Prunus besseyi				1			1	1	.046	.041
Syringa vulgaris		29	20	32			81	81	3.760	3.324
Hedges	175'	65'	180'		420'	280		280	12.999	11.490
Individuals + Hedge Conversion								361	16.759	14.814
Viburnum opulus 'Roseum'							1	1	.046	.041
								369	17.131	15.142
ZONE IV BROADLEAF SHRUBS										
Cotoneaster acutifolia				1			1	1	.046	.041
Hedges				75'	75'	50		50	2.321	2.052
Individuals + Hedge Conversion								51	2.367	2.093
Spiraea vanhouttei		4	1	4			9	9	.418	.361
								60	2.786	2.462
ZONE V BROADLEAF SHRUBS										
Artemisia abrotanum				1			1	1	.046	.041
Rhus trilobata			1				1	1	.046	.041
Spiraea bumalda				1			1	1	.046	.041
Syringa persica		2	4	4			10	10	.464	.410
								13	.604	.533

OPHEIM, MONTANA	Blocks Surveyed				City Park	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
	Age of Plants Varied										
	1	2	3	4							
ZONE II CONIFEROUS SHRUBS											
Thuja occidentalis				1				1	<u>1</u>	<u>.200</u>	<u>.041</u>
									1	.200	.041
ZONE V CONIFEROUS SHRUBS											
Juniperus scopulorum				4				4	<u>4</u>	<u>.800</u>	<u>.164</u>
										.900	.164

OPHEIM, MONTANA	Blocks Surveyed				Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	Age of Plants Varied	City Park								
	1	2	3	4						
ZONE III VINES AND GROUND COVERS										
Parthenocissus quinquefolia		2	1	2			5	<u>5</u> 5	<u>83.333</u> 83.333	<u>.205</u> .205
ZONE V VINES AND GROUND COVERS										
Clematis tangutica				1			1	<u>1</u> 1	<u>16.667</u> 16.667	<u>.041</u> .041

Species observed growing in Opheim but not recorded in the survey.

Echinocystis lobata ZONE ? VINE

Lonicera sempervirens ZONE II.5 VINE

Pseudotsuga menziesii ZONE V CONIFEROUS TREE

Appendix Figure 9. Map of Great Falls, Montana. Blocks surveyed indicated by shading.

Appendix Table 11. Great Falls Survey Data.



STREET MAP OF
GREAT FALLS, MONTANA

GREAT FALLS, MONTANA
Blocks Surveyed

	Old Plantings									20-30 Year Old Plantings						10-20 Year Old Plantings						New Plantings 1-10 Years Old					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	Total Broad- leaf Trees	Total Plant Popula- tion							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29										
ZONE I BROADLEAF TREES																																							
Populus tremuloides																					6		4										10	10	.481	.116			
ZONE II BROADLEAF TREES																																							
Acer negundo	2	2	7	1	1	21	1	6				1	10	4	29			8								1	2					98	98	4.714	1.136				
*Betula papyrifera	1																																18	18	.866	.209			
B. pendula gracilis	4		1	1		3	1		2		7	9	6	2	3	3	4		2		4	3	1	1								63	63	3.030	.731				
Elaeagnus angustifolia	16	4						1	1	1	1		2	7							4					1	1						34	34	1.635	.394			
Hedges	630'										40'																						670'	134	134	6.445	1.554		
Individuals + Hedge Conversion												4																					168	168	8.080	1.948			
Celtis occidentalis																																		5	5	.241	.058		
*Populus angustifolia				1															1	1													3	3	.144	.035			
P. deltoides	2						3		8	1						3	6			11	1	2	1	4	2	3			3	1			51	51	2.453	.591			
*P. nigra	8								2		5	2																					10	10	.481	.116			
P.n. 'Italica'																																		49	49	2.020	.489		
*Quercus macrocarpa				2												4																		2	2	.096	.023		
Salix alba	1								2	3		2	2			13	11			3			5	1									65	65	3.127	.754			
S.a. 'Sericea'	1			1										1						2													9	9	.433	.104			
S.a. 'Tristis'																																		6	6	.289	.070		
Sorbus aucuparia	2		1	2	2	4						5	2	3	3	4	3	1			2	4			2	2	2	1	1		1	2	47	47	2.261	.545			
Tilia americana			1								2	3														2	5	2						19	19	.914	.220		
Ulmus americana			63	39	50	31	15	38	24	1	2	10				26	16	12	1	2	4				3									329	329	15.825	3.815		
Hedges																																		29	29	1.395	.335		
Individuals + Hedge Conversion																																		358	358	17.120	4.151		
																																			964	964	46.368	11.179	
ZONE II.5 BROADLEAF TREES																																							
Fraxinus pennsylvanica	20	44	35	54	35	24	34	27	35	15	41	27	5	40	10	30	15	8		4	17	4	3	1	5			3	2	10			548	548	26.359	6.355			
Hedges																																		24	24	1.154	.278		
Individuals + Hedge Conversion																																			572	572	27.513	6.633	
ZONE III BROADLEAF TREES																																							
Acer platanoides												3							1			1											6	6	.289	.070			
A.p. 'Crimson King'																					1													3	3	.144	.035		
*A.p. 'Harlequin'																																		1	1	.048	.012		
A. saccharinum			2		2				3		1	1	1					1	3	4		5	2	5	5	2							44	44	2.116	.510			
*Aesculus glabra																																		3	3	.144	.035		
*A. hippocastanum																																		5	5	.241	.058		
Populus alba	21	8		9						3						16	1																	61	61	2.934	.709		
P.a. 'Pyramidalis'																																			8	8	.385	.093	
Prunus avium	1																																		1	1	.048	.012	
P. cerasus																																			4	4	.192	.046	
Robinia pseudoacacia																																			1	1	.048	.012	
Tilia cordata			4									2	1																						14	14	.673	.162	
																																			151	151	7.263	1.751	
ZONE IV BROADLEAF TREES																																							
*Betula occidentalis			1						7																									9	9	.433	.104		
*Crataegus oxyacantha pauli						1																												2	2	.096	.023		
Gleditsia tricanthos inermis																																			10	10	.487	.116	
*Juglans nigra																																			6	6	.289	.070	
Malus - apple	19		7	4	2	3	4	3		2	4	9	5	5	2	4	14	3	7	2	4	5	3	3	1	9							143	143	6.878	1.658			
M. - flowering crabapple	5	1		5		7					19	9				8	16	6		7	4	7	3	5	2	7	1	2	16					137	137	6.590	1.589		
'Dolgo' crab																																			1	1	.048	.012	
dwarf crab																																			1	1	.048	.012	
'Hope' crab																																			3	3	.144	.035	
red leaf crab																																			2	2	.096	.023	
Prunus armeniaca	1																																		1	1	.048	.012	
P. persica	1																																		1	1	.048	.012	
Salix caprea																																			2	2	.096	.023	
Ulmus pumila			1																																28	28	1.347	.325	
Hedges																																			28	28	1.347	.325	
Individuals + Hedge Conversion																																				374	374	17.989	4.337
ZONE V BROADLEAF TREES																																							
*Populus canadensis																																			8	8	.385	.093	

GREAT FALLS, MONTANA

Blocks Surveyed

	Old Plantings										20-25 Year Old Plantings					10-20 Year Old Plantings										New Plantings 1-10 Years Old					Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ZONE II CONIFEROUS TREES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

Blocks Surveyed

	Old Plantings								20-30 Year Old Plantings							40-50 Year Old Plantings									New Plantings 1-10 Years Old				Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	Total Broad- leaf Shrubs	Total Plant Popula- tion																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29																																				
ZONE II BROADLEAF SHRUBS																																																																	
*Acer ginnale									7																						7	7	.147	.081																															
Hedges	3	2	3	1								1	5																	15	15	.216	.174																																
Individuals + Hedge Conversion	555'	240'	120'	180'	20'	20'	140'	40'		30'	165'		110'	305'	205'		90'	30'		40'					40'	60'	60'			2450'	1633	34,350	18,938																																
Cornus alba 'Sibirica argenteo-marginata'																					1										1648	34,666	19,112																																
O. stolonifera	8	5			3	1						5	1		6	2	3	1	2		1	16			2	1		6	17		79	79	.042	.023																															
Hedges																															50	50	1.662	.916																															
Individuals + Hedge Conversion				1																											129	2,714	1,496																																
Cornus stolonifera flaviramea																						1									3	3	.063	.03																															
Physocarpus opulifolius "Nana"																															4	4	.084	.04																															
Potentilla fruticosa	2																														22	22	.423	.255																															
Prunus cistena												1		1																	18	18	.379	.209																															
*P. skimmeri																															8	8	.168	.093																															
P. tomentosa																																9	9	.189	.104																														
P. virginiana																																2	2	.042	.023																														
Hedges																																27	27	.568	.313																														
Individuals + Hedge Conversion																																10	10	.210	.116																														
Rhamnus cathartica	4	1																														80	80	1.683	.928																														
Hedges																																90	90	1.893	1.044																														
Individuals + Hedge Conversion																																4	4	.084	.04																														
*Rhus glabra																																2	2	.042	.023																														
Ribes alpinum																																10	10	.210	.116																														
Hedges																																12	12	.254	.139																														
Individuals + Hedge Conversion		1			1		1	1				1		2	1																9	9	.189	.104																															
Ribes aureum																																7	7	.147	.081																														
Rose rubrifolia																																14	14	.294	.162																														
Sorbaria sorbifolia		1	4	1	1			1																							3	3	.063	.03																															
Syringa villosa																																9	9	.189	.104																														
*Tamarix pentandra					1	1	1			1	3			1	1				1		3	2									10	10	.210	.116																															
*Viburnum trilobum				1						5				1																	2	2	.042	.023																															
																																2048	43,080	23,750																															
ZONE III BROADLEAF SHRUBS																																																																	
*Cotoneaster racemiflora soongorica																																																																	
Ruonymus alatus																																																																	
*R. europaea																																																																	
Lonicera tatarica	4	9			10	1	1	2		1		3	1		5	1			3	1		10		3	2	8		1	1	10		81	81	1.704	.939																														
Hedges																																																																	
Individuals + Hedge Conversion																																30'	20	20	.421																														
Prunus americana	15																															101	101	2.125	1.171																														
P. besseyi																																15	15	.316	.174																														
*Rhus typhina	11		3				1	5	4				3																		21	21	.442	.243																															
Cornus canadensis aurea																																69	69	1.451	.800																														
Syringa vulgaris	21	27	34	20	5	16	19	15	9	18	28	28	8		20	17															6	6	.078	.04																															
Hedges	130'	100'	95'	75'		140'	70'	40'		45'	60'		20'		435'																453	453	9,528	5,253																															
Individuals + Hedge Conversion																																1257	35,970	19,830																															
Symphoricarpos albus																																1710	1710	26,441	14,577																														
Viburnum opulus	2		1	1																												4	4	.084	.04																														
V.o. nanum																																58	58	1.220	.673																														
																																2	2	.042	.023																														
																																1992	41,932	23,101																															
ZONE IV BROADLEAF SHRUBS																																																																	
*Cercis canadensis																																																																	
*Cornus racemosa																																																																	
Hedges																																																																	
Individuals + Hedge Conversion																																																																	
Cotoneaster acutifolia	1	6	1	3		1				24		5	6		1	11	2	2																																															
Hedges	6'																																																																
Individuals + Hedge Conversion																																																																	
*Cotoneaster integerrima																																																																	
*Daphne cneorum																																																																	
*D. mezereum																																																																	
*Foraythia ovata																																																																	
Hydrangea arborescens grandiflora																																																																	
*Ligustrum vulgare																																																																	
Hedges																																																																	
Individuals + Hedge Conversion																																																																	
Salix incana																																																																	
*Sambucus racemosa laciniata																																																																	
Spiraea thunbergii																																																																	
'Snowgarden'																																																																	
Spiraea vanhouttei	2	15	12	11	1	18	5	1	4	1	3	4	2	6	3	6	6	11	1	1	5	3	3																																										
Hedges																																																																	
Individuals + Hedge Conversion															</																																																		

BROADLEAF SHRUBS (Continued)
GREAT FALLS, MONTANA

Blocks Surveyed

[illegible]

	Blocks Surveyed																													Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
	Old Plantings									20-25 Year Old Plantings					10-20 Year Old Plantings					New Plantings 1-10 Years Old															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29						
ZONE II CONIFEROUS SHRUBS																																			
Juniperus communis				1						5				1	1					1					5		1	2		17	17	1.683	.197		
J.c. fastigiata			1																						1					2	2	.198	.023		
J.c. depressa																											2			2	2	.198	.023		
J. horizontalis	5										1					4						2		2			5		2	21	21	2.079	.243		
J.h. glauca																													2	2	2	.198	.023		
J. virginiana														1															5	6	6	.594	.070		
J.v. 'Glaucal'																													1	1	1	.099	.012		
Picea abies 'Nidiformis'																													1	1	1	.099	.012		
Pinus mugho	1										5	1		2	1						3								1	14	14	1.386	.162		
P.m. mughus	1			3							2	2		1	1	14				9	2	3	3	3				8	1	8	61	61	6.040	.707	
Thuja occidentalis	5		2	2	2		2			2	7	2	1	2	3	3	9	1		2	3		3	3		4	4	1	3	66	66	6.535	.765		
T.o. 'Globosa'		4										3				2	2			3		7	4					1		28	28	2.772	.325		
T.o. pyramidalis					4		3			2		4		8	1	15	2					4				2			4	49	49	4.851	.568		
																														270		26.733	3.131		
ZONE IV CONIFEROUS SHRUBS																																			
Juniperus chinensis											1																			1	1	.099	.012		
J.c. 'Pfitzeriana'	5			4	1						12	9	8	6	7	30	2	5	7	12	21	4	9	7				3		43	197	197	19.505	2.285	
J.c. 'P. Aurea'																				1										2	2	.198	.023		
J.c. 'P. Compacta'											1													6						7	7	.693	.081		
J.c. 'P. glauca'																15		1	4							3		1	16	40	40	3.960	.464		
J. sabina			5	6	1	9	2				15	1		1	5	17	6	2	2	23	3	16	20	2	7		4	3	30	180	180	17.823	2.087		
J.s. 'Tamariscifolia'				2																															

Species and varieties observed in Great Falls but not recorded in the survey.

**Corylus americana* ZONE IV BROADLEAF SHRUB
**Fraxinus nigra* ZONE II BROADLEAF TREE
**Kolkwitzia amabilis* ZONE V BROADLEAF SHRUB
**Lonicera kolkowii* 'Zabelii' ZONE IV BROADLEAF SHRUB
**Populus tacamahaca* ZONE II BROADLEAF TREE
**Prunus domestica* - Prune ZONE IV BROADLEAF TREE
**Quercus borealis* ZONE IV BROADLEAF TREE
*Unidentified broadleaf shrub

Appendix Figure 10. Map of Lewistown, Montana. Blocks surveyed indicated by shading.

Appendix Table 12. Lewistown Survey Data.



- LEGEND**
- 1. ORIGINAL TOWN
 - 2. STAFFORD NUMBER ONE
 - 3. STAFFORD NUMBER TWO
 - 4. STAFFORD NUMBER THREE
 - 5. STAFFORD NUMBER FOUR
 - 6. STAFFORD NUMBER FIVE
 - 7. STAFFORD NUMBER SIX
 - 8. STAFFORD NUMBER SEVEN
 - 9. STAFFORD NUMBER EIGHT
 - 10. STAFFORD NUMBER NINE
 - 11. STAFFORD NUMBER TEN
 - 12. STAFFORD NUMBER ELEVEN
 - 13. STAFFORD NUMBER TWELVE
 - 14. STAFFORD NUMBER THIRTEEN
 - 15. STAFFORD NUMBER FOURTEEN
 - 16. STAFFORD NUMBER FIFTEEN
 - 17. STAFFORD NUMBER SIXTEEN
 - 18. STAFFORD NUMBER SEVENTEEN
 - 19. STAFFORD NUMBER EIGHTEEN
 - 20. STAFFORD NUMBER NINETEEN
 - 21. STAFFORD NUMBER TWENTY
 - 22. STAFFORD NUMBER TWENTY ONE
 - 23. STAFFORD NUMBER TWENTY TWO
 - 24. STAFFORD NUMBER TWENTY THREE
 - 25. STAFFORD NUMBER TWENTY FOUR
 - 26. STAFFORD NUMBER TWENTY FIVE
 - 27. STAFFORD NUMBER TWENTY SIX
 - 28. STAFFORD NUMBER TWENTY SEVEN
 - 29. STAFFORD NUMBER TWENTY EIGHT
 - 30. STAFFORD NUMBER TWENTY NINE
 - 31. STAFFORD NUMBER THIRTY
 - 32. STAFFORD NUMBER THIRTY ONE
 - 33. STAFFORD NUMBER THIRTY TWO
 - 34. STAFFORD NUMBER THIRTY THREE
 - 35. STAFFORD NUMBER THIRTY FOUR
 - 36. STAFFORD NUMBER THIRTY FIVE
 - 37. STAFFORD NUMBER THIRTY SIX
 - 38. STAFFORD NUMBER THIRTY SEVEN
 - 39. STAFFORD NUMBER THIRTY EIGHT
 - 40. STAFFORD NUMBER THIRTY NINE
 - 41. STAFFORD NUMBER FORTY
 - 42. STAFFORD NUMBER FORTY ONE
 - 43. STAFFORD NUMBER FORTY TWO
 - 44. STAFFORD NUMBER FORTY THREE
 - 45. STAFFORD NUMBER FORTY FOUR
 - 46. STAFFORD NUMBER FORTY FIVE
 - 47. STAFFORD NUMBER FORTY SIX
 - 48. STAFFORD NUMBER FORTY SEVEN
 - 49. STAFFORD NUMBER FORTY EIGHT
 - 50. STAFFORD NUMBER FORTY NINE
 - 51. STAFFORD NUMBER FIFTY
 - 52. STAFFORD NUMBER FIFTY ONE
 - 53. STAFFORD NUMBER FIFTY TWO
 - 54. STAFFORD NUMBER FIFTY THREE
 - 55. STAFFORD NUMBER FIFTY FOUR
 - 56. STAFFORD NUMBER FIFTY FIVE
 - 57. STAFFORD NUMBER FIFTY SIX
 - 58. STAFFORD NUMBER FIFTY SEVEN
 - 59. STAFFORD NUMBER FIFTY EIGHT
 - 60. STAFFORD NUMBER FIFTY NINE
 - 61. STAFFORD NUMBER SIXTY
 - 62. STAFFORD NUMBER SIXTY ONE
 - 63. STAFFORD NUMBER SIXTY TWO
 - 64. STAFFORD NUMBER SIXTY THREE
 - 65. STAFFORD NUMBER SIXTY FOUR
 - 66. STAFFORD NUMBER SIXTY FIVE
 - 67. STAFFORD NUMBER SIXTY SIX
 - 68. STAFFORD NUMBER SIXTY SEVEN
 - 69. STAFFORD NUMBER SIXTY EIGHT
 - 70. STAFFORD NUMBER SIXTY NINE
 - 71. STAFFORD NUMBER SEVENTY
 - 72. STAFFORD NUMBER SEVENTY ONE
 - 73. STAFFORD NUMBER SEVENTY TWO
 - 74. STAFFORD NUMBER SEVENTY THREE
 - 75. STAFFORD NUMBER SEVENTY FOUR
 - 76. STAFFORD NUMBER SEVENTY FIVE
 - 77. STAFFORD NUMBER SEVENTY SIX
 - 78. STAFFORD NUMBER SEVENTY SEVEN
 - 79. STAFFORD NUMBER SEVENTY EIGHT
 - 80. STAFFORD NUMBER SEVENTY NINE
 - 81. STAFFORD NUMBER EIGHTY
 - 82. STAFFORD NUMBER EIGHTY ONE
 - 83. STAFFORD NUMBER EIGHTY TWO
 - 84. STAFFORD NUMBER EIGHTY THREE
 - 85. STAFFORD NUMBER EIGHTY FOUR
 - 86. STAFFORD NUMBER EIGHTY FIVE
 - 87. STAFFORD NUMBER EIGHTY SIX
 - 88. STAFFORD NUMBER EIGHTY SEVEN
 - 89. STAFFORD NUMBER EIGHTY EIGHT
 - 90. STAFFORD NUMBER EIGHTY NINE
 - 91. STAFFORD NUMBER NINETY
 - 92. STAFFORD NUMBER NINETY ONE
 - 93. STAFFORD NUMBER NINETY TWO
 - 94. STAFFORD NUMBER NINETY THREE
 - 95. STAFFORD NUMBER NINETY FOUR
 - 96. STAFFORD NUMBER NINETY FIVE
 - 97. STAFFORD NUMBER NINETY SIX
 - 98. STAFFORD NUMBER NINETY SEVEN
 - 99. STAFFORD NUMBER NINETY EIGHT
 - 100. STAFFORD NUMBER NINETY NINE
 - 101. STAFFORD NUMBER HUNDRED
 - 102. STAFFORD NUMBER HUNDRED ONE
 - 103. STAFFORD NUMBER HUNDRED TWO
 - 104. STAFFORD NUMBER HUNDRED THREE
 - 105. STAFFORD NUMBER HUNDRED FOUR
 - 106. STAFFORD NUMBER HUNDRED FIVE
 - 107. STAFFORD NUMBER HUNDRED SIX
 - 108. STAFFORD NUMBER HUNDRED SEVEN
 - 109. STAFFORD NUMBER HUNDRED EIGHT
 - 110. STAFFORD NUMBER HUNDRED NINE
 - 111. STAFFORD NUMBER TWENTY
 - 112. STAFFORD NUMBER TWENTY ONE
 - 113. STAFFORD NUMBER TWENTY TWO
 - 114. STAFFORD NUMBER TWENTY THREE
 - 115. STAFFORD NUMBER TWENTY FOUR
 - 116. STAFFORD NUMBER TWENTY FIVE
 - 117. STAFFORD NUMBER TWENTY SIX
 - 118. STAFFORD NUMBER TWENTY SEVEN
 - 119. STAFFORD NUMBER TWENTY EIGHT
 - 120. STAFFORD NUMBER TWENTY NINE
 - 121. STAFFORD NUMBER THIRTY
 - 122. STAFFORD NUMBER THIRTY ONE
 - 123. STAFFORD NUMBER THIRTY TWO
 - 124. STAFFORD NUMBER THIRTY THREE
 - 125. STAFFORD NUMBER THIRTY FOUR
 - 126. STAFFORD NUMBER THIRTY FIVE
 - 127. STAFFORD NUMBER THIRTY SIX
 - 128. STAFFORD NUMBER THIRTY SEVEN
 - 129. STAFFORD NUMBER THIRTY EIGHT
 - 130. STAFFORD NUMBER THIRTY NINE
 - 131. STAFFORD NUMBER FORTY
 - 132. STAFFORD NUMBER FORTY ONE
 - 133. STAFFORD NUMBER FORTY TWO
 - 134. STAFFORD NUMBER FORTY THREE
 - 135. STAFFORD NUMBER FORTY FOUR
 - 136. STAFFORD NUMBER FORTY FIVE
 - 137. STAFFORD NUMBER FORTY SIX
 - 138. STAFFORD NUMBER FORTY SEVEN
 - 139. STAFFORD NUMBER FORTY EIGHT
 - 140. STAFFORD NUMBER FORTY NINE
 - 141. STAFFORD NUMBER FIFTY
 - 142. STAFFORD NUMBER FIFTY ONE
 - 143. STAFFORD NUMBER FIFTY TWO
 - 144. STAFFORD NUMBER FIFTY THREE
 - 145. STAFFORD NUMBER FIFTY FOUR
 - 146. STAFFORD NUMBER FIFTY FIVE
 - 147. STAFFORD NUMBER FIFTY SIX
 - 148. STAFFORD NUMBER FIFTY SEVEN
 - 149. STAFFORD NUMBER FIFTY EIGHT
 - 150. STAFFORD NUMBER FIFTY NINE
 - 151. STAFFORD NUMBER SIXTY
 - 152. STAFFORD NUMBER SIXTY ONE
 - 153. STAFFORD NUMBER SIXTY TWO
 - 154. STAFFORD NUMBER SIXTY THREE
 - 155. STAFFORD NUMBER SIXTY FOUR
 - 156. STAFFORD NUMBER SIXTY FIVE
 - 157. STAFFORD NUMBER SIXTY SIX
 - 158. STAFFORD NUMBER SIXTY SEVEN
 - 159. STAFFORD NUMBER SIXTY EIGHT
 - 160. STAFFORD NUMBER SIXTY NINE
 - 161. STAFFORD NUMBER SEVENTY
 - 162. STAFFORD NUMBER SEVENTY ONE
 - 163. STAFFORD NUMBER SEVENTY TWO
 - 164. STAFFORD NUMBER SEVENTY THREE
 - 165. STAFFORD NUMBER SEVENTY FOUR
 - 166. STAFFORD NUMBER SEVENTY FIVE
 - 167. STAFFORD NUMBER SEVENTY SIX
 - 168. STAFFORD NUMBER SEVENTY SEVEN
 - 169. STAFFORD NUMBER SEVENTY EIGHT
 - 170. STAFFORD NUMBER SEVENTY NINE
 - 171. STAFFORD NUMBER EIGHTY
 - 172. STAFFORD NUMBER EIGHTY ONE
 - 173. STAFFORD NUMBER EIGHTY TWO
 - 174. STAFFORD NUMBER EIGHTY THREE
 - 175. STAFFORD NUMBER EIGHTY FOUR
 - 176. STAFFORD NUMBER EIGHTY FIVE
 - 177. STAFFORD NUMBER EIGHTY SIX
 - 178. STAFFORD NUMBER EIGHTY SEVEN
 - 179. STAFFORD NUMBER EIGHTY EIGHT
 - 180. STAFFORD NUMBER EIGHTY NINE
 - 181. STAFFORD NUMBER NINETY
 - 182. STAFFORD NUMBER NINETY ONE
 - 183. STAFFORD NUMBER NINETY TWO
 - 184. STAFFORD NUMBER NINETY THREE
 - 185. STAFFORD NUMBER NINETY FOUR
 - 186. STAFFORD NUMBER NINETY FIVE
 - 187. STAFFORD NUMBER NINETY SIX
 - 188. STAFFORD NUMBER NINETY SEVEN
 - 189. STAFFORD NUMBER NINETY EIGHT
 - 190. STAFFORD NUMBER NINETY NINE
 - 191. STAFFORD NUMBER HUNDRED
 - 192. STAFFORD NUMBER HUNDRED ONE
 - 193. STAFFORD NUMBER HUNDRED TWO
 - 194. STAFFORD NUMBER HUNDRED THREE
 - 195. STAFFORD NUMBER HUNDRED FOUR
 - 196. STAFFORD NUMBER HUNDRED FIVE
 - 197. STAFFORD NUMBER HUNDRED SIX
 - 198. STAFFORD NUMBER HUNDRED SEVEN
 - 199. STAFFORD NUMBER HUNDRED EIGHT
 - 200. STAFFORD NUMBER HUNDRED NINE

CITY OF LEWISTOWN
FERGUS COUNTY, MONTANA

Scale 1"=400'

PREPARED BY
MORRISON-MAIERLE, INC.
 FEBRUARY, 1962

LEWISTOWN, MONTANA
Blocks Surveyed

	Old Plantings														Court House	New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18						
ZONE II BROADLEAF TREES																								
Acer negundo	16	4		27	8	5	3	2		11		1	2			1	1	9			90	90	13.139	1.682
Betula papyrifera											2					3					5	5	.730	.093
B. pendula gracilis					6		1		4	1	1	1		5	7	2	2	3			33	33	5.109	.654
Elaeagnus angustifolia										1				2		3					6	6	.876	.112
Hedges																50'					10	10	1.460	.187
Individuals + Hedge Conversion																					16	16	2.336	.219
*Populus angustifolia			4				3			3											10	10	1.460	.187
P. deltoides	4	2	1							6	2	1									16	16	2.336	.299
P. tacamahaca								4	3			8									15	15	2.190	.280
Quercus macrocarpa											1										1	1	.146	.019
Salix alba	1	1	1											1	1	2	1	2			10	10	1.460	.187
S.a. 'Sericea'										1											1	1	.146	.019
Sorbus aucuparia	3	1					1	1	3			2	2	1	1		1				16	16	2.336	.299
*Tilia americana															2						2	2	.292	.037
Ulmus americana		2		5		1	1			1	1	4	1		2	2	3	1			24	24	3.504	.448
																						241	35.182	4.503
ZONE II.5 BROADLEAF TREES																								
Fraxinus pennsylvanica	8	20	7	6	17	22	21	12	24	17	19	19	22	8	24	6	6	8			264	264	38.540	4.933
																						264	38.540	4.933
ZONE III BROADLEAF TREES																								
Acer platanoides										1					9						10	10	1.460	.187
A.p. 'Crimson King'															1						1	1	.146	.019
Acer saccharinum						2	1					1		2	2						8	8	1.168	.149
Aesculus hippocastanum									1						5						6	6	.876	.112
Populus alba					3					1							1				5	5	.730	.093
Robinia pseudoacacia						1															1	1	.146	.019
Tilia cordata		1																			1	1	.146	.019
																						32	4.672	.598
ZONE IV BROADLEAF TREES																								
Gleditsia triacanthos															1						1	1	.146	.019
G.t. inermis										1											1	1	.146	.019
Malus - apples	2	2	6			4	4		1	2	2	6	11	8		5	7	12			72	72	10.511	1.345
Malus - flowering crabs	3			1			5	3	6	1	2		1	3	4	5	4	5			44	44	6.423	.822
Salix caprea																2					2	2	.292	.037
Ulmus pumila						2		8		4		6						3			23	23	3.358	.430
																						143	20.876	2.672
ZONE V BROADLEAF TREES																								
X Populus canadensis						2						3									5	5	.730	.093
																						5	.730	.093

LEWISTOWN, MONTANA

Blocks Surveyed

	Old Plantings														Court House	New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18						
ZONE II CONIFEROUS TREES																								
Abies lasiocarpa															1						1	1	.373	.019
Picea engelmanni	15	3	2		5	1	16	10	5	3		3	11	4	11	27					116	116	43.284	2.167
P. glauca		2		2		2	7		5	2	2	10	4	6	4	1					47	47	17.537	.878
P. pungens						2					2	4						2			10	10	3.731	.187
P. sp.	10	3	1	1	2						2	2		6	1			27			55	55	20.522	1.028
																						229	85.448	4.279
ZONE V CONIFEROUS TREES																								
Larix occidentalis															1						1	1	.373	.019
Pinus ponderosa								1									1	1			3	3	1.119	.056
Pseudotsuga menziesii	9				1	9			1		3	1		8				3			35	35	13.060	.654
																						39	14.582	.729

Blocks Surveyed

[illegible]

LEWISTOWN, MONTANA

Blocks Surveyed

	Old Plantings														Court House	New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Shrubs	% of Total Plant Popula- tion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18						
ZONE II CONIFEROUS SHRUBS																								
Juniperus communis				1	1	1								2	1						6	6	4.511	.112
J. horizontalis														1							1	1	.752	.019
J.h. 'Plumosa'																1					1	1	.752	.019
Pinus mugo																	3				3	3	2.256	.056
P.m. mughus																		1			1	1	.752	.019
Taxus canadensis												2									2	2	1.504	.037
Thuja occidentalis					2						2			2							6	6	4.511	.112
T.o. pyramidalis				1	2				7		2			1		2					15	15	11.278	.280
																						35	26.316	.654
ZONE IV CONIFEROUS SHRUBS																								
Juniperus chinensis 'Pfitzeriana'				2							10							5			17	17	12.782	.318
J. sabina					1	3			2			1		2			4	5			18	18	13.534	.336
J.s. 'Tamariscifolia'														2			2	10			14	14	10.526	.262
																						49	36.842	.916
ZONE V CONIFEROUS SHRUBS																								
Juniperus scopulorum	1	2	3	2					4		1	2		2	2	6	7	17			49	49	36.842	.916
																						49	36.842	.916
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																								
Juniperus sp.						1															1	1		

LEWISTOWN, MONTANA

Blocks Surveyed

	BLOCKS SURVEYED														Court House	New Plantings			Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	Total Vines & Ground Covers	Total Plant Popula- tion
	1	2	3	4	5	Old Plantings				10	11	12	13	14		16	17	18						
ZONE III VINES AND GROUND COVERS																								
Parthenocissus quinquefolia		2	2		3		1	2	5	1	1	4			2	2	2			27	<u>27</u>	<u>34.615</u>	<u>.504</u>	
ZONE IV VINES AND GROUND COVERS																								
Lonicera japonica 'Halliana'								1		2	1									4	4	5.128	.075	
Lycium halimifolium		1															3			4	<u>4</u>	<u>5.128</u>	<u>.075</u>	
ZONE V VINES AND GROUND COVERS																								
Clematis ligusticifolia			3			1			4			4				2	2			14	14	17.949	.262	
Vinca minor															2					2	<u>2</u>	<u>2.564</u>	<u>.037</u>	
ZONE V.5 VINES AND GROUND COVERS																								
Clematis jackmani V-VI		2	2		3		1	2	5	1	1	4			2	2	2			27	<u>27</u>	<u>34.615</u>	<u>.504</u>	
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																								
Humulus lupulus														1						1	<u>1</u>			

Species observed growing in Lewistown but not recorded in the survey.

Acer rubra ZONE III BROADLEAF TREE
 Aristolochia durior ZONE IV Vine
 Berberis thunbergi ZONE V BROADLEAF SHRUB
 Populus tremuloides ZONE I BROADLEAF TREE
 Prunus persica ZONE V BROADLEAF TREE

Appendix Table 13. Augusta Survey Data.

AUGUSTA, MONTANA
Blocks Surveyed

	1	2	3	4	Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
ZONE II BROADLEAF TREES										
Acer negundo			4	1			5	5	4.000	.717
Betula pendula gracilis				3			3	3	2.400	.550
*Populus angustifolia				1			1	1	.800	.183
P. deltoides	3	3	4	5			15	15	12.000	2.752
P. nigra	2		5				2	2	1.600	.367
Salix alba	24	2	6	6			38	38	30.400	6.972
*S.a. 'Sericea'	2		11	8			21	21	16.800	3.853
Ulmus americana			1	2			3	3	2.400	.550
								88	70.400	16.147
ZONE II.5 BROADLEAF TREES										
*Fraxinus pennsylvanica	2	1	1	2			6	<u>6</u> 6	<u>4.800</u> 4.800	<u>1.101</u> 1.101
ZONE III BROADLEAF TREES										
Populus alba				3			3	<u>3</u> 3	<u>2.400</u> 2.400	<u>.550</u> .550
ZONE IV BROADLEAF TREES										
Malus sp. - apple fruit trees		5	3	2			10	10	8.000	1.835
Malus sp. - flowering crabs	2		4	5			11	11	8.800	2.018
*Sorbus hybrida (intermedia X aucuparia)	1						1	1	.800	.183
Ulmus pumila				6			6	<u>6</u> 28	<u>4.800</u> 22.400	<u>1.101</u> 5.138

AUGUSTA, MONTANA

AUGUSTA, MONTANA	Blocks Surveyed				Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Conifer- ous Trees	% of Total Plant Popula- tion
	1	2	3	4						
ZONE II CONIFEROUS TREES										
Picea engelmanni			5	3			8	8	30.769	1.468
P. pungens			1	4			5	5	19.231	.917
Picea sp.		4	8				12	<u>12</u>	<u>46.154</u>	<u>2.202</u>
								25	96.154	4.587
ZONE VII CONIFEROUS TREES										
Pinus contorta latifolia			1				1	<u>1</u>	<u>3.846</u>	<u>.183</u>
								1	3.846	.183

AUGUSTA, MONTANA

AUGUSTA, MONTANA	Blocks Surveyed							Total Indivi- dual	Total all	% of Total Broad- leaf	% of Total Plant Popula- tion
	1	2	3	4	Total Hedge Footage	Hedge Conver- sion		Plants	Plants	Shrubs	
ZONE II BROADLEAF SHRUBS											
Caragana arborescens		2		5				7	7	1.857	1.284
Hedges		20'	35'	100'	155'	103			103	27.321	18.899
Individuals + Hedge Conversion									110	29.178	20.183
Cornus stolonifera			2	9				11	11	2.918	2.018
Prunus cistena				1				1	1	.265	.183
P. virginiana	2	5		14				21	21	5.570	3.853
Ribes alpinum				1				1	1	.265	.183
R. aureum		1	3	5				9	9	2.387	1.651
Sorbaria sorbifolia			5					5	5	1.326	.917
Syringa villosa				1				1	1	.265	.183
									159	42.175	29.174
ZONE III BROADLEAF SHRUBS											
Lonicera tatarica	3	2	6	15				26	26	6.897	4.771
Rhus typhina			1					1	1	.265	.183
Syringa vulgaris	6	18	12	17				53	53	14.058	9.725
Hedges	70'		40'	75'	185'	123			123	32.626	22.569
Individuals + Hedge Conversion									176	46.684	32.294
Viburnum opulus			1					1	1	.265	.183
									204	54.111	37.431
ZONE IV BROADLEAF SHRUBS											
Cotoneaster acutifolia	1		2	5				8	8	2.122	1.468
Salix incana				1				1	1	.265	.183
Spiraea vanhouttei								2	2	.531	.367
									11	2.918	2.018
ZONE V BROADLEAF SHRUBS											
Betula occidentalis	1			1				2	2	.531	.367
Syringa persica			1					1	1	.265	.183
									3	.796	.550
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED											
Philadelphus sp.	3							3	3		
double flowers			2					2	2		
single flowers			1	6				7	7		
Ribes sp.	1							1	1		
Salix sp.				1					1		
									14		

AUGUSTA, MONTANA

AUGUSTA, MONTANA	Blocks Surveyed						Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	1	2	3	4	Total Hedge Footage	Hedge Conver- sion				
ZONE III VINES AND GROUND COVERS										
Parthenocissus quinquefolia	1		2				3	<u>3</u> 3	<u>17.647</u> 17.647	<u>.550</u> .550
ZONE IV VINES AND GROUND COVERS										
Lycium halimifolium				1			1	1	5.882	.183
Polygonum cuspidatum			2	1			3	<u>3</u> 4	<u>17.647</u> 23.529	<u>.550</u> .734
ZONE V VINES AND GROUND COVERS										
Clematis ligusticifolia		2	6	1			9	<u>9</u> 9	<u>52.941</u> 52.941	<u>1.651</u> 1.651
ZONE V.5 VINES AND GROUND COVERS										
Clematis jackmani			1				1	<u>1</u> 1	<u>5.882</u> 5.882	<u>.183</u> .183
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED										
Humulus lupulus	2	2	3	3			10	10		
Hedges		40'			40'	56		<u>56</u> 66		

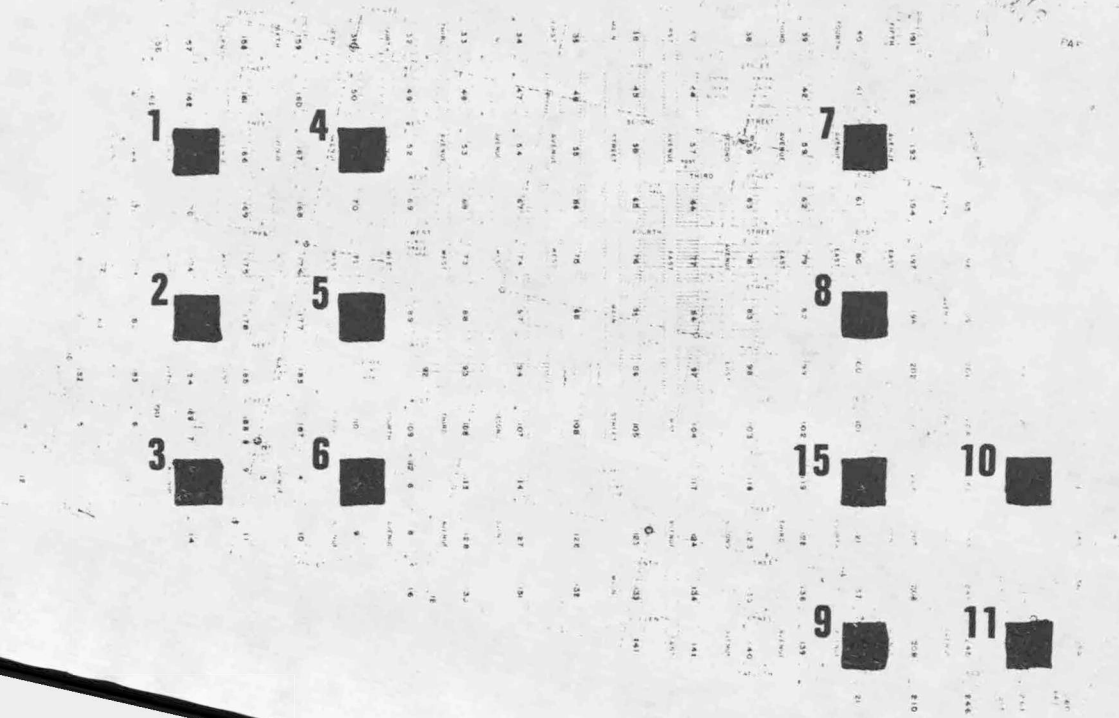
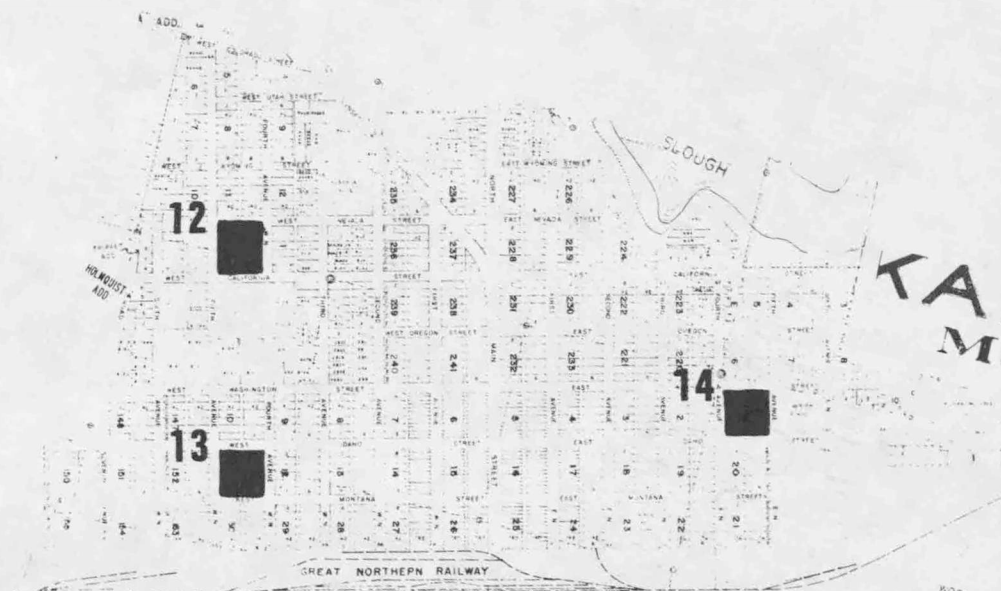
Species and varieties observed in Augusta but not recorded in the survey.

Acer saccharinum ZONE III BROADLEAF TREE
 Artemisia abrotanum ZONE V BROADLEAF SHRUB
 Elaeagnus angustifolia ZONE II BROADLEAF TREE
 Prunus armeniaca ZONE V BROADLEAF TREE
 Shepherdia argentea ZONE II BROADLEAF SHRUB

Appendix Figure 11. Map of Kalispell, Montana. Blocks surveyed indicated by shading.

Appendix Table 14. Kalispell Survey Data.

MAP
OF
KALISPELL
MONTANA



KALISPELL Blocks Surveyed																Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Popula- tion
Older Plantings									10-20 Year Old Plantings					141/	152/						
1	2	3	4	5	6	7	8	9	10	11	12	13									
ZONE II BROADLEAF TREES																					
Acer negundo	4	22	2	19	3	4	3	3	3	2		4			1			70	70	8.872	2.249
Betula papyrifera		1	6		1	3	3	1		3	1	11	3		2	1		36	36	4.563	1.156
B. pendula gracilis			2	4					1	1	2		1					11	11	1.394	.353
Elaeagnus angustifolia					1			1				3						5	5	.634	.161
*Populus acuminata								1										1	1	.127	.032
*P. deltoides					4													4	4	.507	.128
P. nigra 'Italica'							1											1	1	.127	.032
*Quercus macrocarpa						2		5										7	7	.887	.225
Salix alba		2								1								3	3	.380	.096
S.a. 'Tristis'			1			2					1	2						6	6	.760	.193
*Sorbus aucuparia	3	2	3	3	6	2	5	1	1	1	8	1						36	36	4.563	1.156
*Tilia americana																3		3	3	.380	.096
Ulmus americana			1	8			5	4	4		3	2	10	6				43	43	5.450	1.381
																			226	28.644	7.260
ZONE II.5 BROADLEAF TREES																					
Fraxinus pennsylvanica	4	13	6	3	8	3	1		1	3		2	3	4	7			58	58	7.351	1.863
																			58	7.351	1.863
ZONE III BROADLEAF TREES																					
*Acer platanoides	10	13	3	16	5	10	23	23	2	4		12		16	33			170	170	21.546	5.461
*A.p. 'Crimson King'													1					1	1	.127	.032
*A.p. 'Harlequin'											1							1	1	.127	.032
*A.p. 'Schwedleri'								1										1	1	.127	.032
*Acer rubrum								1										1	1	.127	.032
A. saccharinum		2		1	1			2	1			1			1			9	9	1.141	.289
*A. saccharum							1											1	1	.127	.032
*Aesculus hippocastanum		2					1	1		1					1			6	6	.760	.193
Populus alba									3	1								4	4	.507	.128
*Prunus avium					6	4	1		1	2	1	2			6			23	23	2.915	.739
P. cerasus	5	4	2				3		1	4	2	1						22	22	2.788	.707
Robinia pseudoacacia				2									1					3	3	.380	.096
*Tilia cordata							2			1	1							4	4	.507	.128
																			246	31.179	7.902
ZONE IV BROADLEAF TREES																					
*Catalpa speciosa								6		2								8	8	1.014	.257
*Crataegus oxyanthus pauli							1			4			1					6	6	.760	.193
Gleditsia triacanthos inermis						1			1									2	2	.253	.064
*Juglans nigra								1										1	1	.127	.032
Malus - apple	1	5	20	6	21	5	6	3	13	10	12	11	15	8				136	136	17.237	4.369
Malus - flowering crab		1	1	1			1	2		2	1	2	3					14	14	1.774	.450
Morus alba 'Tatarica'												2						2	2	.253	.064
Populus trichocarpa			1															1	1	.127	.032
*Pyrus communis							1		1	3								5	5	.634	.161
Syringa amurensis japonica								1										1	1	.127	.032
Ulmus pumila	12	5	14	5	1	17				9	11	7	1	1				83	83	10.520	2.666
																			259	32.826	8.320
BROADLEAF TREES ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																					
Ulmus X rubra japonica						2		1										3	3		

1/ Mixed business and residences.
2/ School yard.

Kalispell

Blocks Surveyed

Kalispell	Blocks Surveyed															Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	Older Plantings									10-20 Year Old Plantings											
	1	2	3	4	5	6	7	8	9	10	11	12	13	141/ 152/							
ZONE II CONIFEROUS TREES																					
Abies lasiocarpa										1							1	1	.599	.032	
Picea engelmanni	1		2			1		7					2				13	13	7.784	.418	
P. glauca	5				1	2		22				6	1				26	26	15.569	.835	
P. pungens		2					3		4	8		2	2				21	21	12.575	.675	
P. sp.	1	1	4		1	4		6	5	7	10		10	1	1		51	51	30.539	1.638	
																	112	112	67.066	3.598	
ZONE V CONIFEROUS TREES																					
Larix occidentalis							2										2	2	1.198	.064	
Pseudotsuga menziesii	3	10		2		1	1	9	1		6	12	6	2			53	53	31.737	1.703	
																	55	55	32.934	1.767	

1/ Mixed business and residences.

2/ School yard.

Listspell	Blocks Surveyed															Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion	
	Older Plantings					10-20 Year Old Plantings					14 1/2		15 1/2									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14 1/2	15 1/2							
ZONE II BROADLEAF SHRUBS																						
Caragana arborescens						1			4	1		2			1			9	9	.518	.289	
Hedges	80'			265'					20'	140'	50'	115'	50'		60'		880'	587	587	31.774	18.856	
Individuals + Hedge Conversion																		596	596	34.292	19.145	
Cornus alba 'Sibirica' argenteo marginata												1						1	1	.058	.032	
Cornus stolonifera					3				1				1					5	5	.288	.161	
Physocarpus opulifolius												1	2					3	3	.173	.096	
Prunus cistena			1									2						2	2	.115	.064	
*P. skinneri	1											2						3	3	.173	.096	
P. virginiana						1	2	1	3				1		1			9	9	.518	.289	
Hedges				10'													10'	7	7	.403	.225	
Individuals + Hedge Conversion																		16	16	.921	.514	
Prunus tomentosa											1							1	1	.058	.032	
Ribes alpinum Hedges									60'									40	40	2.301	1.285	
R. aureum														1				1	1	.058	.032	
Sorbaria sorbifolia				1														6	6	.345	.193	
Tamarix pentandra								1	5									8	8	.460	.257	
Viburnum trilobum												1						1	1	.058	.032	
																		683	683	39.298	21.940	
ZONE III BROADLEAF SHRUBS																						
Lonicera tatarica	4			1	3	6	1	2	3	2	1	2			3	3	4		35	35	2.014	1.124
Rhus typhina				3									2						3	3	.173	.096
R.T. dissectifolia												1	2						3	3	.173	.096
Sambucus canadensis aurea						1													1	1	.058	.032
Syringa vulgaris	12	25	20	22	21	21	12	22	16	9	23	14	18	21				259	259	14.902	8.320	
Hedges	110'					160'	30'	100'	80'		10'	10'						340	340	19.563	10.922	
Individuals + Hedge Conversion																		599	599	34.465	19.242	
Symphoricarpos alba									1	1								2	2	.115	.064	
Viburnum lantana															2			2	2	.115	.064	
V. opulus			1					1							1			3	3	.173	.096	
																		648	648	37.284	20.816	
ZONE IV BROADLEAF SHRUBS																						
*Chaenomeles japonica									2									2	2	.115	.064	
Cornus racemosa									1									1	1	.058	.032	
Cotoneaster acutifolia																	5	5	5	.228	.161	
Crataegus douglasii						3		3										6	6	.345	.193	
Hedges									60'									60'	40	2.301	1.285	
Individuals + Hedge Conversion																		46	46	2.646	1.478	
*Daphne mezereum									1			1						2	2	.115	.064	
*Forsythia ovata	1		2						1	4			2					10	10	.575	.321	
*Hydrangea arborescens grandiflora									11	6	1				1			19	19	1.093	.610	
H. paniculata 'Grandiflora'										3								3	3	.173	.096	
Ligustrum vulgare													3					3	3	.173	.096	
*Salix incana												2						2	2	.115	.064	
Sambucus racemosa										1	1							2	2	.115	.064	
Spiraea billardi													1					2	2	.115	.064	
Spiraea thunbergi										2		1			1			4	4	.230	.128	
S. vanhouttei	5	10	4	4	13	11	7	15	5	1	10	6	16	10	14			131	131	7.537	4.208	
																		232	232	13.349	7.433	
ZONE IV.5 BROADLEAF SHRUBS																						
Prunus triloba multiplex									1		1							2	2	.115	.064	
																			2	.115	.064	
ZONE V BROADLEAF SHRUBS																						
Artemisia abrotanum hedges											35'			90'			125'	83	83	4.776	2.666	
Berberis thunbergi					1			1									55'	55'	37	2	.115	.064
Hedges																			37	2.129	1.189	
Individuals + Hedge Conversion																		39	39	2.244	1.253	
Berberis thunbergi 'Atropurpurea'									9									9	9	.518	.289	
Deutzia scabra														1				1	1	.058	.032	
*Hypericum calycinum													1					1	1	.058	.032	
*Kolkwitzia amabilis			1		1				3			2						7	7	.403	.225	
Spiraea bumalda									1									6	6	.345	.193	
Syringa persica	2	3				2	1		5		3		2	3	3	5		24	24	1.381	.771	
*Weigela florida												1	1					2	2	.115	.064	
																		172	172	9.896	5.523	
ZONE VII BROADLEAF SHRUBS																						
Caryopteris incana	1																	1	1	.058	.032	
																			.058	.032		
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																						
Buddleia sp.	1								2									3	3			
Philadelphus sp.		2			4	2	2	4	3		3	2			1			23	23			
double flower						1			2									3	3			
*Prunus sp. - plums	2	2	8	1		3	1	1	8	9	4	5		3				47	47			
prunes																		3	3			
plum-cherry hybrid				1														1	1			
*Unidentified shrub								1										1	1			
																		81	81			

1/ Mixed business and residences.
2/ School yard.

Kali spell

Blocks Surveyed

	10-20 Year Old Plantings									Total Hedge Footage	Hedge Conversion	Total Individual Plants	Total all Plants	% of Total Broad-leaf Shrubs	% of Total Plant Population
	1	2	3	4	5	6	7	8	9						
ZONE II CONIFEROUS SHRUBS															
Juniperus communis							1					1	1	.308	.032
*Upright							1					1	1	.308	.032
Juniperus horizontalis									2	3		5	5	1.538	.161
blue									1			1	1	.308	.032
blue hedges									10'			3	3	.923	.096
Individuals + Hedge Conversion											10'		4	1.231	.128
Pinus mugho							6	1				7	7	2.154	.225
P.m. mughus							2	2				6	6	1.846	.193
Thuja occidentalis	1	1		2			4	6				21	21	6.462	.675
T.o. 'Globosa'		2	2	2			3	3	5	5	4	34	34	10.462	1.092
T.o. pyramidalis		2	2		4	2	10	12	4	10	8	81	81	24.923	2.602
													160	49.231	5.140

ZONE IV CONIFEROUS SHRUBS

Juniperus chinensis																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</
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ZONE V CONIFEROUS SHRUBS

*Chamaecyparis lawsoniana															
Upright blue												1	1	.308	.032
Juniperus scopulorum	2				1		13	8	5	2	1	1	1	10.462	1.092
J.s. blue		1										1	1	.308	.032
Thuja orientalis	2							2		1	2	7	7	2.154	.225
													43	13.231	1.381

CONIFEROUS SHRUBS ZONE NOT KNOWN
OR SPECIES UNIDENTIFIED

Juniperus sp.		3						2	1			6	6		
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1/ Mixed business and residences.

2/ School yard.

Kalispell

Blocks Surveyed

Kalispell	Blocks Surveyed													Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Cover	% of Total Plant Popula- tion	
	Older Plantings								10-20 Year Old Plantings											
	1	2	3	4	5	6	7	8	9	10	11	12	13	141/ 152/						
ZONE II VINES AND GROUND COVERS																				
Celastrus scandens													1				1	1	1.064	.032
Vitis riparia					1					2	3	3					9	9	9.574	.289
																	10	10.638	.321	
ZONE III VINES AND GROUND COVERS																				
*Campsis radicans									1								1	1	1.064	.032
Parthenocissus quinquefolia			4		3	5	5	2	5		1	2	1		1		29	29	30.851	.932
																	30	31.915	.964	
ZONE IV VINES AND GROUND COVERS																				
*Clematis texensis									1								1	1	1.064	.032
Lonicera japonica halliana																	1	1	1.064	.032
Lycium halimifolium			1		2		1										4	4	4.255	.128
Parthenocissus tricuspidatum													6				6	6	6.383	.193
Polygonum cuspidatum							1						1				2	2	2.128	.064
Solanum dulcamara										1		2	5	1	1		10	10	10.638	.321
Hedges							30'									30'	6	6	6.383	.193
Individuals + Hedge Conversion																	16	16	17.021	.514
																	30	30	31.915	.964
ZONE V VINES AND GROUND COVERS																				
*Clematis crispa												1					1	1	1.064	.032
C. ligusticifolia						2				1	1			2			6	6	6.383	.193
Vinca minor									1			1					2	2	2.128	.064
																	9	9	9.574	.289
ZONE V.5 VINES AND GROUND COVERS																				
Clematis jackmani		1					1	4	2		1	2	3	1			15	15	15.957	.482
																	15	15	15.957	.482
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED																				
Echinocystis lobata hedge												25'			25'		5		5	
Humulus lupulus						4		1									6	6		
Rosa - climbing		2	2	1		1	1	10	4	4		3	1	1	1		31	31		
																		42		

Species and varieties observed in Kalispell but not recorded in the survey.

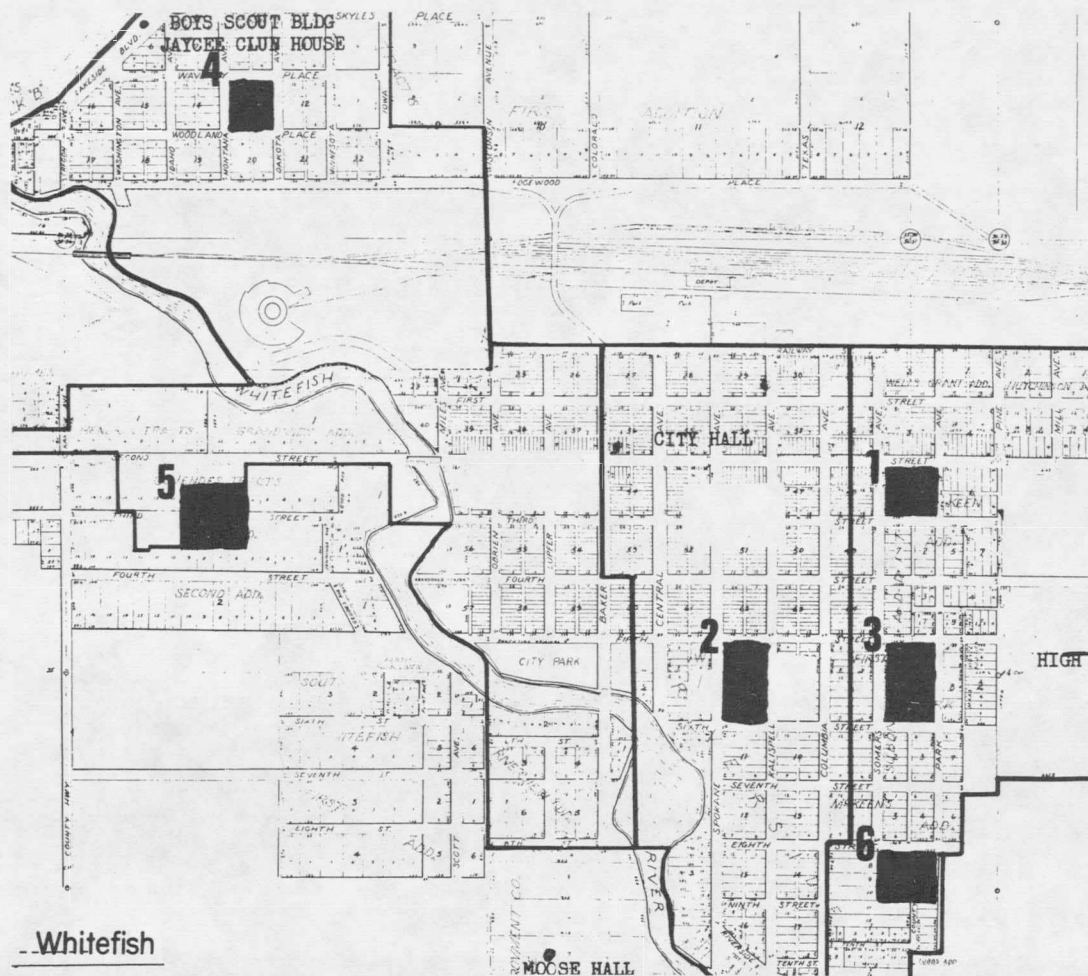
- * Acer pseudo - platanus ZONE V BROADLEAF TREE
- Betula occidentalis ZONE IV BROADLEAF SHRUB
- Celtis occidentalis ZONE II BROADLEAF TREE
- *Corylus americana ZONE IV BROADLEAF SHRUB
- Euonymus alatus ZONE III BROADLEAF SHRUB
- Gleditsia triacanthos inermis 'Sunburst' ZONE IV BROADLEAF TREE
- Juniperus chinensis 'Pfitzeriana Aurea' ZONE IV CONIFEROUS SHRUB
- Pinus contorta latifolia ZONE VII CONIFEROUS TREE
- P. nigra austriaca ZONE IV CONIFEROUS TREE
- P. ponderosa ZONE V CONIFEROUS TREE
- Populus tremuloides ZONE I BROADLEAF TREE
- *Prunus armeniaca ZONE V BROADLEAF TREE
- *P. persica ZONE IV BROADLEAF TREE

1/ Mixed business and residences.

2/ School yard.

Appendix Figure 12. Map of Whitefish, Montana. Blocks surveyed indicated by shading.

Appendix Table 15. Whitefish Survey Data.



- Whitefish

	W H I T E F I S H Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	Older Plantings				Mixed New & Old							
	1	2	3	4	5	6						
ZONE I BROADLEAF TREES												
Populus tremuloides			3	5	3				11	<u>11</u> 11	<u>3.571</u> 3.571	<u>.863</u> .863
ZONE II BROADLEAF TREES												
Acer negundo	3	6	6	4		3			22	22	7.143	1.727
Betula papyrifera	10	8	7	6	14	1			46	46	14.935	3.611
B. pendula gracilis			1		1	1			3	3	.974	.235
Malus baccata			1						1	1	.325	.078
Salix alba		1	3		9	4			17	17	5.519	1.334
S.a. 'Tristis'		1							1	1	.325	.078
Sorbus aucuparia	5	9	9	2		1			26	26	8.442	2.041
S.a. fastigiata				1					1	1	.325	.078
Ulmus americana	1	7							8	<u>8</u> 115	<u>2.597</u> 37.338	<u>.628</u> 9.027
ZONE II.5 BROADLEAF TREES												
Fraxinus pennsylvanicum	24	24	15	9					72	<u>72</u> 72	<u>23.377</u> 23.377	<u>5.651</u> 5.651
ZONE III BROADLEAF TREES												
Acer platanoides	1	8	1		2				12	12	3.896	.942
A.p. 'Crimson King'		2	1		1				4	4	1.299	.314
A.p. 'Schwedleri'			5						5	5	1.623	.392
Acer saccharinum		1		1	1				3	3	.974	.235
Aesculus hippocastanum	1	1				1			3	3	.974	.235
Populus alba			3		3	2			7	7	2.273	.549
Prunus avium					2				2	2	.649	.157
P. cerasus	2		2	1	5	1			11	<u>11</u> 47	<u>3.571</u> 15.260	<u>.863</u> 3.689
ZONE IV BROADLEAF TREES												
Crataegus oxycantha pauli			1						1	1	.325	.078
Malus - apples	5	14	13	9	7	2			50	50	16.234	3.925
Malus - flowering crabs		1	2		1				4	4	1.299	.314
Ulmus pumila	4	2			2				8	<u>8</u> 63	<u>2.579</u> 20.455	<u>.628</u> 4.945

Whitefish	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Trees	% of Total Plant Popula- tion
	Older Plantings				Mixed New & Old							
	1	2	3	4	5	6						
ZONE II CONIFEROUS TREES												
Abies lasiocarpa		1							1	1	.909	.078
Picea engelmanni	4		6		8	23			41	41	37.273	3.218
P. pungens			7						7	7	6.364	.549
P. sp.	1	2	5	5	9	17			39	39	35.455	3.061
										88	80.000	6.907
ZONE V CONIFEROUS TREES												
Larix occidentalis					1				1	1	.909	.078
Pseudotsuga menziesii	1				1				2	2	1.818	.157
										3	2.727	.235
ZONE VII CONIFEROUS TREES												
Pinus contorta latifolia		2	2	1	2	12			19	19	17.273	1.491
										19	17.273	1.491

Whitefish	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Population
	Older Plantings				Mixed New & Old							
	1	2	3	4	5	6						
ZONE II BROADLEAF SHRUBS												
Caragana arborescens	1	1							2	2	.289	.157
Hedges			195'		145'		340'	227		227	32.756	17.818
Individuals + Hedge Conversion										229	33.045	17.975
Physocarpus opulifolius					1					1	.144	.078
Potentilla fruticosa		1								1	.144	.078
X Prunus skinneri		1	5		1					7	1.010	.549
Prunus virginiana		3	2		1					6	.866	.471
Hedges		30'	20'				50'	33		33	4.762	2.590
Individuals + Hedge Conversion										39	5.628	3.061
Prunus tomentosa			2							2	.289	.157
Rhamnus cathartica		1								1	.144	.078
Ribes aureum hedges					20'		20'	13		13	1.876	1.020
Sorbaria sorbifolia			1	2		5				8	1.154	.628
Hedges		20'					20'	13		13	1.876	1.020
Individuals + Hedge Conversion										21	3.030	1.648
Viburnum trilobum						1				1	.144	.078
dwarf			2							2	.289	.157
										317	45.743	24.882
ZONE III BROADLEAF SHRUBS												
*Euonymus alatus	2								2	2	.289	.157
Lonicera tatarica		9	8		2				19	19	2.742	1.491
Prunus bessyi					1				1	1	.144	.078
Rhus typhina	1								1	1	.144	.078
Syringa vulgaris	25	25	14		7	21	6		98	98	14.141	7.692
Hedges	75'	60'	50'		65'			250'	167	167	24.098	13.108
Individuals + Hedge Conversion										265	38.239	20.800
Symphoricarpos alba					1				1	1	.144	.078
Viburnum opulus		1							1	1	.144	.078
										290	41.847	22.763
ZONE IV BROADLEAF SHRUBS												
Chaenomeles japonica					1				1	1	.144	.078
Cotoneaster acutifolia			1						1	1	.144	.078
Forsythia ovata	1	1	1	1		1			5	5	.722	.392
Hydrangea arborescens grandiflora	4	1	1						6	6	.866	.471
Salix incana				1					1	1	.144	.078
Spiraea billiardii			2						2	2	.289	.157
S. thunbergii					2				2	2	.289	.157
S. vanhouttei	4	8	10		1	2			25	25	3.608	1.962
										43	6.205	3.375
ZONE V BROADLEAF SHRUBS												
*Acer glabrum				9					9	9	1.299	.706
Amelanchier alnifolia			2	4	1				7	7	1.010	.549
Berberis thunbergii 'Atropurpurea'						2			2	2	.289	.157
Deutzia hispida			1						1	1	.144	.078
Hypericum calycinum			1						1	1	.144	.078
X Prunus bliriceana		1				1			2	2	.289	.157
Robinia kelseyi			1						1	1	.144	.078
Sorbus scopulina			1						1	1	.144	.078
Apiraea bumalda	1	7	2		1				11	11	1.587	.863
Syringa persica		1			3				4	4	.577	.314
Weigela florida	1		3						4	4	.577	.314
										43	6.205	3.375
BROADLEAF SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
*Fuchsia aff. magellanica			1						1	1		
Philadelphus sp.	5	2	3		2				12	12		
Prunus sp.	1	2	2		1				6	6		
Ribes sp.	2	5	4						11	11		
Hedges					25'	25'	25'	17		17		
Individuals + Hedge Conversion										28		
Salix sp.					1	1			1	1		
Unidentified shrub						2			2	2		
										50		

Whitefish	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Broad- leaf Shrubs	% of Total Plant Popula- tion
	Older Plantings				Mixed New & Old							
	1	2	3	4	5	6						
ZONE II CONIFEROUS SHRUBS												
Juniperus communis	9	67	2		5	1			84	84	59.155	6.593
Pinus mugho mughus		2							2	2	1.408	.157
Thuja occidentalis	2	3	8			1			14	14	9.859	1.099
T.o. 'Globosa'			5						5	5	3.521	.392
T.o. pyramidalis	4	3	6	2	1				16	16	11.268	1.256
										121	85.211	9.498
ZONE IV CONIFEROUS SHRUBS												
*Juniperus chinensis	1								1	1	.704	.078
J.c. 'Pfitzeriana'			4						4	4	2.817	.314
Juniperus sabina 'Tamariscifolia'		1							1	1	.704	.078
Juniperus squamata meyeri						3			3	3	2.113	.235
										9	6.338	.706
ZONE V CONIFEROUS SHRUBS												
Juniperus scopulorum	3	1	5	1					10	10	7.042	.785
columnar blue					2				2	2	1.408	.157
										12	8.451	.942
CONIFEROUS SHRUBS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Juniperus sp.		4							4	4		

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Whitefish	Blocks Surveyed						Total Hedge Footage	Hedge Conver- sion	Total Indivi- dual Plants	Total all Plants	% of Total Vines & Ground Covers	% of Total Plant Popula- tion
	Older Plantings				Mixed New & Old							
	1	2	3	4	5	6						
ZONE II VINES AND GROUND COVERS												
Arctostaphlos uva-ursi		1			1				2	<u>2</u>	<u>9.524</u>	<u>.157</u>
										2	9.524	.157
ZONE III VINES AND GROUND COVERS												
Parthenocissus quinquefolia	2	1							3	<u>3</u>	<u>14.286</u>	<u>.235</u>
										3	14.286	.235
ZONE IV VINES AND GROUND COVERS												
Lonicera japonica 'Halliana'			1						1	1	4.762	.078
Polygonum cuspidatum		1							1	<u>1</u>	<u>4.762</u>	<u>.078</u>
										2	9.524	.157
ZONE V.5 VINES AND GROUND COVERS												
Clematis jackmanii	7	1	5		1				14	<u>14</u>	<u>66.667</u>	<u>1.099</u>
										14	66.667	1.099
VINES AND GROUND COVERS ZONE NOT KNOWN OR SPECIES UNIDENTIFIED												
Humulus lupulus					1				1	<u>1</u>		

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Species observed in Whitefish but not recorded in the survey.

Aristolochia durior ZONE IV
 Crataegus douglasii ZONE IV
 Juglans nigra ZONE IV
 Populus nigra italica ZONE II
 Prunus cistena ZONE II
 Robinia pseudoacacia ZONE III
 Tilia americana ZONE II

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