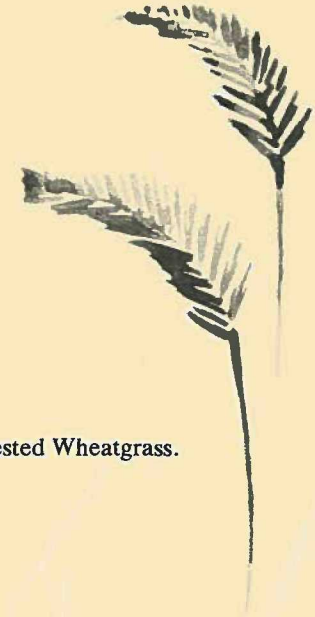
DAVIDSONIA

VOLUME 6 *NUMBER 2* *Summer 1975*

Cover

A naturally occurring hybrid stand of *Elymus*, Wild Rye Grass.



Agropyron pectiniforme, Crested Wheatgrass.

DAVIDSONIA

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Grass — The Staff of Life

Grass is the forgiveness of nature — her constant benediction. Fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Streets abandoned by traffic become grass-grown like rural lanes, and are obliterated. Forests decay, harvests perish, flowers vanish, but grass is immortal. Beleaguered by the sullen hosts of winter, it withdraws into the impregnable fortress of its subterranean vitality, and emerges upon the first solicitation of spring. Sown by the winds, by wandering birds, propagated by the subtle horticulture of the elements which are its ministers and servants, it softens the rude outline of the world.

John James Ingalls

Grasses are among the most abundant and widespread plants in the world. The grass family (Poaceae) is one of the largest families of flowering plants; it contains approximately 600 genera and 7,500 species, of which more than 150 genera and 1,500 species can be found in North America. Grasses are found almost everywhere. They occur in the Arctic and in the Tropics, and from sea level to above timberline. They are, of course, the predominant form of life on prairies and grasslands, which cover large regions of the earth's surface.

The variety of grasses is considerable. They may grow to more than a hundred feet in height (bamboos) or to less than an inch. They may be annual or perennial, woody or herbaceous. They are adapted to a great assortment of habitats from deserts to marshes, from forests to plains, and from rocky cliffs to shifting sands. There are few landscapes of which they do not form a part.

Grasses are not only abundant, but are of primary importance to man. Some members of the grass family form the staple food of most of the earth's population. The crop grains — rice, wheat, oats, barley, corn, rye, millet and sorghum — have in many cases been cultivated for thousands of years, some of them for so long that we no longer know with any certainty how they originated. Sugarcane, a tropical grass, is the source of most of the world's refined sugar. The value of grasses is not confined to crops for human consumption. Many species of grasses are used as forage for domestic animals. Wildlife species rely on grasses and related grasslike plants for food, and often for shelter as well. In tropical countries, the woody grasses (Bamboos) are used for food and for making poles and posts, furniture, tools, woven articles, and a great variety of other things. The fibrous roots of grasses, and often their rhizomes or stolons, make these plants among the best soil stabilizers known; their disappearance through overgrazing or other forms of land misuse has resulted in soil loss and decreased productivity in many parts of the world. Grasses are used widely in the western world for lawns, and many are grown as ornamentals. If grasses were to vanish from the land, the world would indeed be a less hospitable place for human beings than it is.

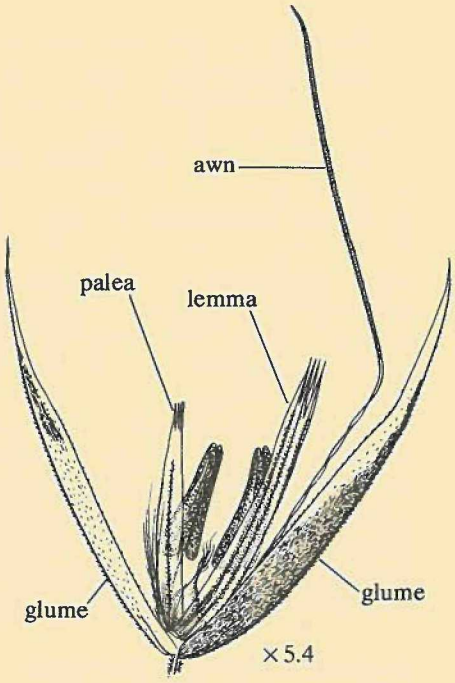
What is a Grass?

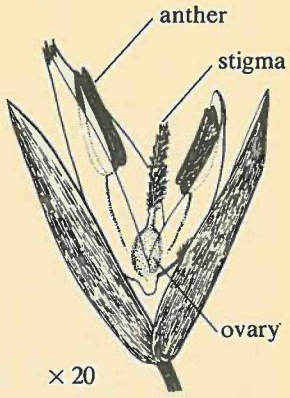
Grasses, like roses or lilies, are flowering plants. Their flowers are gathered into plumelike or spikelike heads and are minute and inconspicuous. Grasses are pollinated by the wind, and have no need of the bright petals, nectar or fragrance of insect-pollinated flowers.

A flowering head of grass is made up of many little groups of flowers called *spikelets*. At the base of each spikelet is a pair of bracts which are called *glumes*. Inside the glumes are the flowers, each of which is enclosed in its own pair of bracts, the *lemma* and the *palea*. From one grass species to the next there is tremendous variation on this basic design. The spikelets may be stalked, as in oats and brome grasses, or stalkless and set close to the stem as in wheat and timothy. Within the spikelet there may be a single flower or several. The glumes may be large enough to completely conceal all the flowers in the spikelet, or they may be small so that the individual flower bracts can be seen above them. The glumes, the lemma and the palea may assume many different forms. They may be stiff or papery, hairy or smooth, and sometimes they carry long slender bristles called *awns*.

The individual flowers have two or three large anthers dangling from slender threadlike stalks. Each anther contains thousands of dustlike pollen grains, which fall out in drifts with every whisper of the wind. The ovary of the flower is concealed within the lemma and the palea; at its tip are the stigmas, where the pollen lands. The stigmas often extend out of the flower, and are long and plumelike to catch the pollen as it floats by. There are no petals or sepals on a grass flower. The two or three little papery scales called *lodicules*, which can sometimes be seen beside the ovary, appear to be all that remains of them.

At right are shown the spikelets of two native grass species, *Calamagrostis purpurascens* or Purple Small Reed Grass (above) and *Agrostis thurberiana* or Thurber's Bent Grass (below). Both these species have only a single flower in each spikelet. In the *Calamagrostis* flower, the lemma has a long bent awn attached low on its outer surface. These awns, found on many grass flowers, often twist and untwist as they become wet or dry, and are an effective aid to seed dispersal.





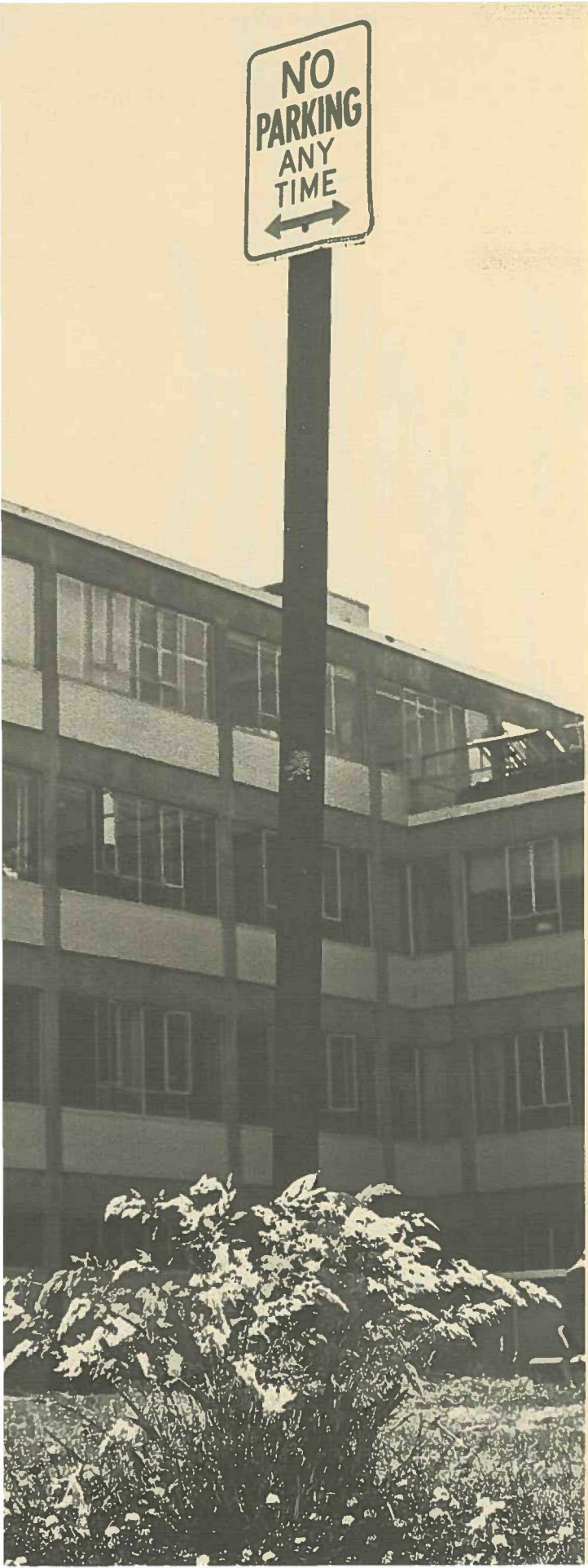
Opposite: *Triticum* × *aestivum*, the cultivated wheat.

Grasses of the Campus

GERALDINE A. GUPPY and ROY L. TAYLOR

The word "grasses" conjures up an image of long slender leaves and inconspicuous flower heads in shades of brown and green. The subdued colours give the impression that all grasses are alike, but this is misleading. A closer look at the plants reveals that hardly any two grasses are truly the same, and that a great range of minute but constant differences exist. Grasslike plants in British Columbia fall into three closely related groups. The "true grasses"(family Poaceae) are the largest and most important of these groups, and are familiar to everyone. True grasses have no sepals or petals, the only remaining traces of these being the papery lodicules at the base of each tiny flower. Their stems are usually hollow, and the leaves two-ranked (coming off the stem opposite one another, first on one side and then on the other). Grasses are a ubiquitous and adaptable plant family of worldwide distribution. The second group, the sedges (family Cyperaceae) are similar to the true grasses in many ways; they too lack petals and sepals. However, their stems are usually solid and often triangular in cross section. This last feature can readily be detected by rolling the stem between the fingers. The leaves are three-ranked; that is, when viewed from directly above they come off the stem in three different directions. The sedges are also a very large and widespread family, and are frequently encountered in wet places. The Rushes (family Juncaceae) form the third and smallest group. Though these plants also have inconspicuous flowers and slender grasslike leaves, they are unlike the above two groups in that they have a true perianth (sepals and petals). In fact, the flower structure of rushes in many ways resembles that of members of the Liliaceae, except that the flower parts are not large and showy, but small, bractlike and brown. In habit, however, they closely resemble the sedges and grasses.

Poa pratensis, Kentucky Blue Grass, is extensively used in lawns and pastures. In spite of its name, this grass is not a native of Kentucky. It came originally from Europe, and was later carried by pioneer settlers to the New World.



Grasses and their relatives are visible almost everywhere in temperate climates. The campus of the University of British Columbia is no exception. In the central core of the campus the dominant impression is one of closely-mowed, well-kept lawns and neat flower beds, but in more outlying areas the sharp eye may pick out flowering grasses of a dozen different kinds growing together. Early summer is the best time to see them. They may be found along roadways, in unmown corners of lawns, sometimes in flower beds, and abundantly along the edges of the playing fields. The wide road margins of Chancellor Boulevard, Sixteenth Avenue and Marine Drive are excellent places for grasses, as are the steep cliffs of Marine Drive Foreshore Park, which forms the boundary of much of the campus. Though the flowering plumes of grasses are seldom seen in lawns, they may bloom as attractively as any when the opportunity arises. Three years ago, when a strike resulted in acres of unmown grass throughout the City of Vancouver, all the lawn grasses produced flowers and seeds — even the golf greens!

Grasses that are permitted to grow and bloom freely have a delicate beauty quite different from the clipped, formal appearance of a lawn, and they may also be of practical value. At a recent meeting of the American Association of Botanical Gardens and Arboreta (AABGA), Dr. Robert Goodland of the Cary Arboretum in New York presented a paper on the maintenance of lawns, and the associated energy costs of this maintenance. A properly cared for lawn requires a considerable output of energy in the form of fertilizer, pesticides and mowing. Dr. Goodland went on to discuss possible substitutes for the traditional lawn, in particular the natural grassland meadow. Such meadows are left almost untouched, being permitted to develop as they would in nature. They are allowed to grow up naturally for most of the year, but are mowed once or twice in each growing season. This keeps down unwanted growth of woody plants, discourages fires, promotes distribution of seed, and encourages continued grass growth, which in turn encourages birds and small mammals by providing food and shelter. A formal lawn is a radical departure from the natural growth habit of grasses — so much so, that relatively

Holcus lanatus (Yorkshire Fog), an introduced grass, is a very adaptable species.

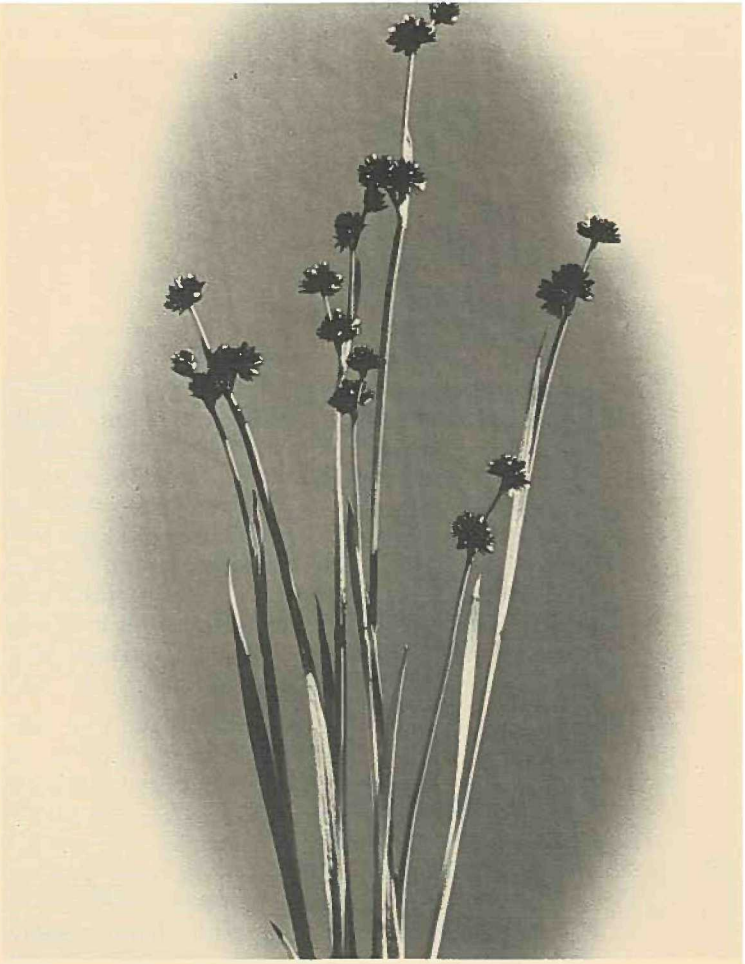
few species can adapt to it. Those that do so must be able to withstand crowding, as well as frequent cropping of their foliage. Natural meadows require much less stringent management than lawns. They are not treated with fertilizers or pesticides, but the grasses and other associated plants and animals are permitted to reach a natural ecological balance. A program to test the natural meadow concept has been undertaken by the Cary Arboretum in conjunction with IBM, at a research park development belonging to the latter organization. Longwood Gardens of Kennett Square, Pennsylvania, have also made use of the natural meadow concept along the edges of their main gardens, often interspersing the meadow natural grassland areas with informally landscaped woodlands. At the University of B.C. a similar concept has been incorporated into the landscaping of the new Museum of Anthropology. Natural grassland meadows form an extension of the ethnobotanical plantings surrounding the outdoor village sites adjacent to the main building of the Museum.

Natural meadows have an advantage over lawns in that each of the grass species present is allowed to reach its full development, and the differences between different species — as well as the great variety that exists among grasses as a whole — can be readily appreciated. In British Columbia there are about 300 species of grasses. The grass family is divided into fourteen tribes, of which ten are found within the province. Some of the more abundantly represented of these tribes are the Aveneae (including oats), the Festuceae (containing fescues, brome grasses and blue grasses), the Agrostideae (including timothy, needlegrasses, and redtop and other bentgrasses), and the Hordeae (containing dune grasses, wheat grasses, wheat itself, rye, and barley). All of the grasses and grasslike plants found in the province are herbaceous, and most of them are perennial. In the Coastal Douglas Fir and Coastal Western Hemlock Biogeoclimatic Zones (the coastal forests, of which the natural vegetation on the University campus forms a part), there are about 175 species of grasses, 85 species of sedges and 20 species of rushes of which about 27% have been introduced. Within each of these groups are plants of varied shape and form. Among the sedges are *Scirpus*, which includes the American Great Bulrush with its enormous pith-filled leaves; *Eriophorum*, the cotton grasses, whose plumy heads are a common sight in wet places, especially in northern regions of the province; and *Carex*, the true sedges, which are common on tidal flats along the coast and in many other habitats. The rushes include *Juncus* (the true rushes), and *Luzula* (the wood-rushes) with loose, delicate flower heads. The true grasses, of course, display an almost bewildering variety. Some of our species grow waist- or shoulder-high, others may scarcely reach ankle-height. The flower heads may be soft and feathery to the touch as in *Holcus* (Yorkshire Fog), or stiff and rigid as in Timothy, or spiky and prickly as in the Needle Grasses. Grasses of the latter group will be well known to those who have hiked in the interior of the province, and have later returned home to spend hours removing the tenaciously adhering seeds from their socks.

On the campus itself there are perhaps 40 species of grasses, sedges and rushes that are commonly encountered. Some of these are specific to particular habitats, others may be found wherever there is an undisturbed corner. All of them have a quiet beauty of their own. A selection of them is presented on these and subsequent pages.

Opposite: A stand of Common Timothy, *Phleum pratense*. This striking grass, with its dense spike-like flower heads, is one of our most important and valuable hay grasses. It originated in Europe, but was first brought into cultivation in New England. It grows best on clay soils and is well adapted to the cool humid climate of the Pacific coast.

Three representatives of the rush family (Juncaceae) are shown here: *Luzula parviflora* ssp. *parviflora*, Small-flowered Wood-rush (below left); *Juncus effusus* var. *gracilis*, Slender Common Rush (below right); and *Juncus ensifolius* var. *montanus*, Sword-leaved Rush (right). The stem of rushes have traditionally been used for weaving; the name *Juncus* derives from the Latin *jungere*, to bind.



Sedges often have separate male and female flowers. In this they are unlike grasses, whose "perfect" flowers each contain both stamens and pistils. Sometimes male and female sedge flowers are found on separate plants, but more often they are contained in the same flower head — staminate flowers above, and pistillate flowers below. Their delicate colours are frequently eye-catching at close range, the styles and stigmas silvery and the dangling anthers a dull gold.

Carex lyngbyei, Lyngbye's Sedge (left), and *Scirpus lacustris* ssp. *validus* var. *validus*, the American Great Bulrush or Tule (below).

On the campus, sedges are commonly seen on low areas of ground where rain pools form. *Scirpus*, while not found on the campus proper, may be seen at the base of the Point Grey Cliffs.

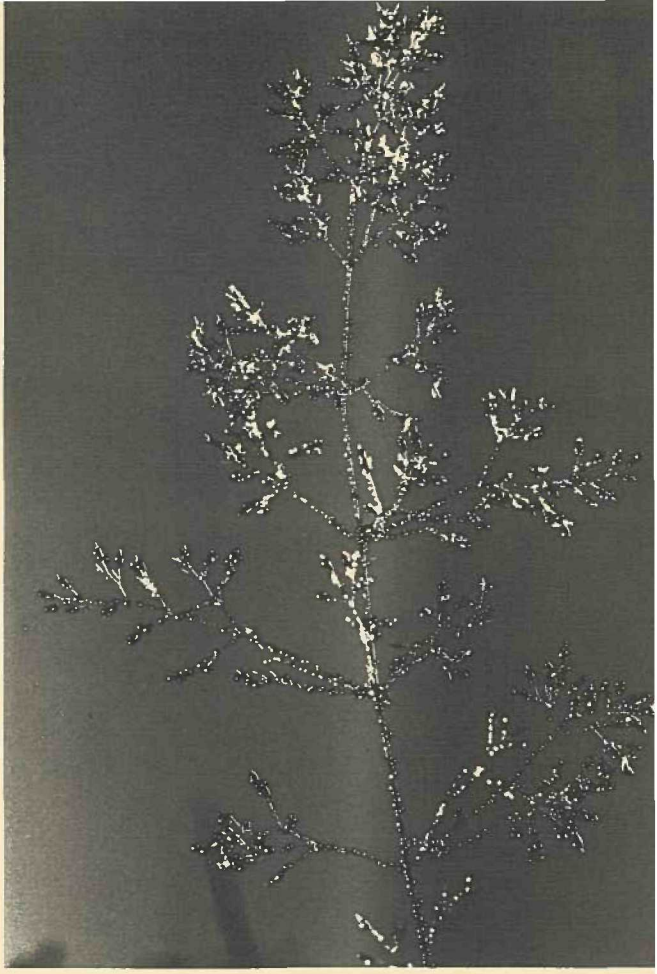
Holcus lanatus, known commonly as Yorkshire Fog or Velvet Grass, is one of the most widespread adventive grasses found in North America. It is thought to have been brought to this continent in the early part of the 18th Century. In open sites on damp ground, it establishes itself so readily that it is regarded by many people as a troublesome weed. Its value as a forage plant is somewhat uncertain. In 1932 this species appeared on a list of plants reported to be capable of causing hydrocyanic acid poisoning in livestock. The report has never been corroborated, however, and *Holcus lanatus* continues to be used to a limited extent for forage and hay.

This grass is a member of the *Aveneae* (oat tribe). Each of its spikelets contain two flowers; the upper flower carries a small, sharply curved awn like a minute fishhook. The stems and leaves are covered with fine velvety hairs, hence the common name.

Yorkshire Fog is an interesting grass because of the variation in form shown by the flower heads as they proceed through the different stages of flowering. Initially the branches of the inflorescence lie close to the main stem, forming a narrow plume; as the flowers reach full development, the lowermost first, the branchlets begin to open out and become horizontal (above right). When the grass is in full flower, with all the branchlets at right angles to the main stem, the inflorescence is delicate and feathery in appearance (opposite). As the seed begins to ripen the branches of the inflorescence again close up to form a compact narrow head (below right).

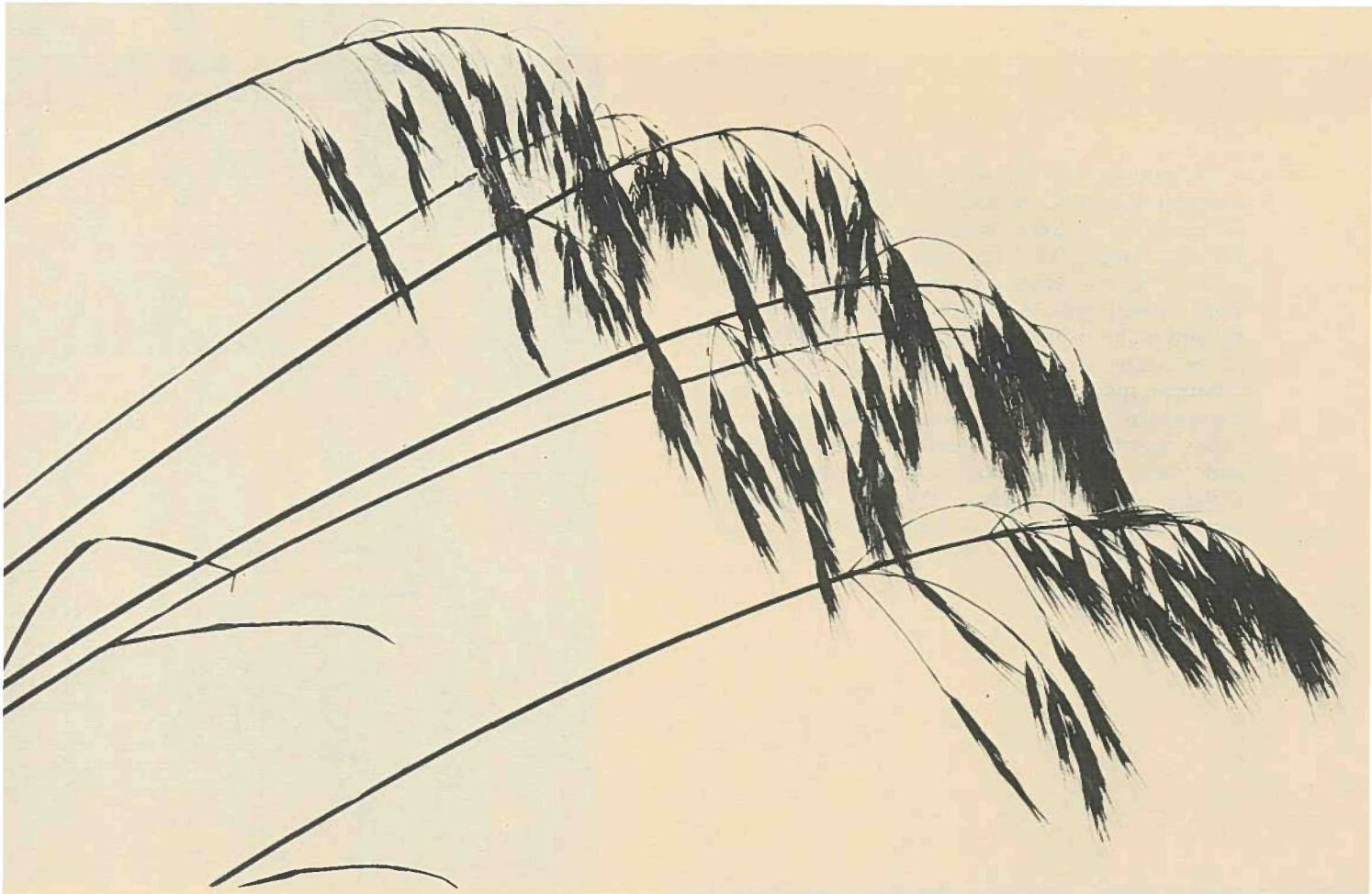
"All flesh is grass...surely the people is grass."
Isaiah 40:6

A common escape from lawns which is often encountered on all parts of the campus is *Agrostis tenuis*, Colonial Bent Grass (shown at right and on the page opposite). The name commemorates the period when it first appeared on this continent. Bent Grasses are not much used for hay, but several species make excellent lawn grasses. Colonial Bent Grass is a fine-textured grass which spreads by short creeping rhizomes to form a thick dense turf. A competitive species, it often comes to dominate the other grasses in a mixed planting. It does well on a wide range of soils, though a fertile loam is best. It will grow on acid soils that will not support Kentucky Blue Grass. This grass is best adapted to a cool humid climate.



Anthoxanthum odoratum, Sweet Vernal Grass (left), is a perennial grass of fairly small stature with characteristically large, stiff-looking spikelets grouped into small loose flower heads. It has dangling yellow anthers and long, cobwebby stigmas that are very conspicuous when the grass is at its peak of flowering.

It is a weedy species and is of little commercial value, though sometimes included in meadow plantings. When dried the plants have a sweet haylike fragrance.



Brome grasses are a large and versatile group of grasses. They include some of our most important forage plants and some of our worst weeds. Different kinds of bromes are adapted to different climates. Many are resistant to drought and extremes of temperature. A widely used hay species, *Bromus inermis*, has also been used for controlling soil erosion and stabilizing roadbanks. Bromes belong to the *Festuceae* or fescue tribe, along with fescues and blue grasses.

Drooping Brome Grass or *Bromus tectorum* (above) is an introduced annual, and one of the commoner weedy species in the Vancouver area as well as elsewhere. This grass is one of a group of bromes that is little liked by ranchers and stockmen because of the long serrated awns on the flowers. These awns sometimes pierce the mouths and noses of grazing sheep and cattle, and have been known to cause serious injury. A closely related species, *B. rigidus*, has the common name of Ripgut Brome Grass. Even the weedy brome species, however, are palatable to livestock when the plants are young.

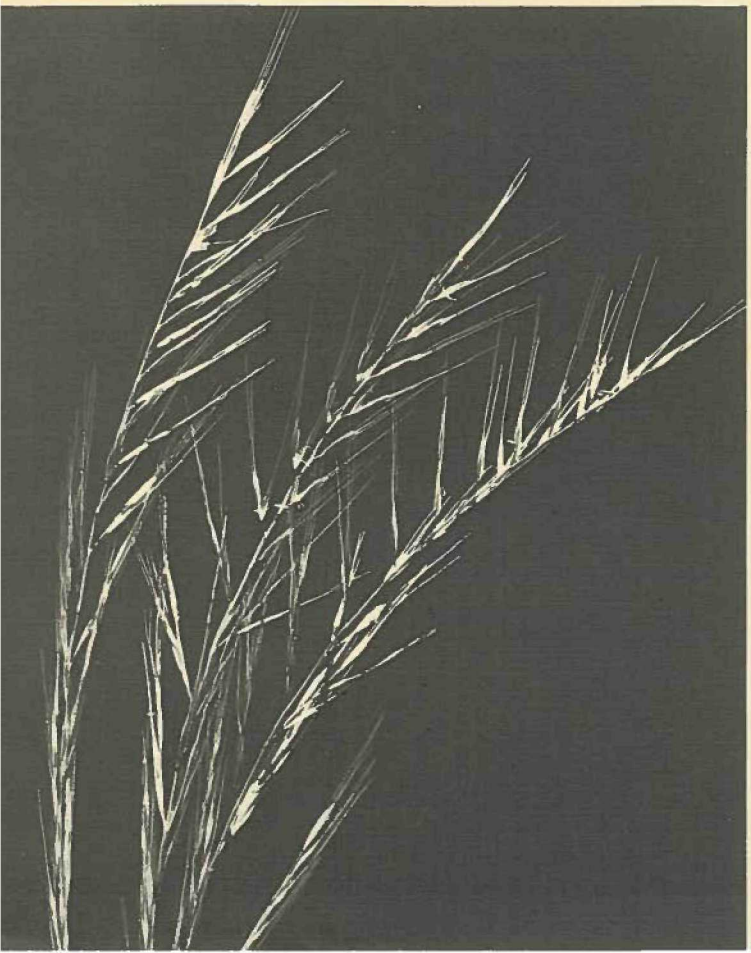
Also shown opposite is a native perennial species, Pacific Brome Grass (*Bromus pacificus*). A tall graceful plant, it has only small awns on its flowers. It can be found along the Pacific Coast from Alaska to Oregon, and often grows near woodlands, thickets and other damp cool places.

Arrhenatherum elatius, False Oat Grass (above), is a hardy perennial bunch grass much used for grazing and hay. It grows to five feet in height, and produces flowers in open loose heads like those of cultivated oats. The spikelets each contain two flowers, the lower one of which carries a long bent awn which rapidly untwists itself when wetted. This grass grows best in sandy or gravelly soils.

Aira caryophyllea, Silver Hair Grass (left), is a minute, delicate annual with silvery shining spikelets. In the photograph at left it is shown about one and a half times life size. It is often found on open dry ground or in waste places.

The two grasses illustrated on this page both have slender, narrow flower heads. At right is *Lolium multiflorum*, Italian Rye Grass. The symmetrically arranged spikelets give its flower spikes a zigzag, herringbone appearance. This annual or short-lived perennial grass is native to the Mediterranean, and is an important hay and pasture plant in the Pacific Northwest and in other areas with cool summers and mild winters. It is also used in erosion control. It hybridizes readily with its close relative, Perennial Rye Grass (*L. perenne*).

Lolium belongs to the *Hordeae* (barley tribe), together with barley, rye and wheat. All the members of this group have spikelets set close to the main stem, and several, including *Lolium*, have brittle and easily shattered seeds. *Lolium* is the old Latin name for darnel, a weedy and possibly poisonous member of the genus, which has been known since Biblical times.



At left is the Rattail Vulpia, *Vulpia myuros* var. *myuros*. Vulpias are closely related to fescues, differing mainly in that they are annual whereas the latter are perennial. Though fescues are good forage plants, vulpias are in general rather weedy. This species may be seen on the campus growing around the bases of some of the temporary buildings, and in other places where the soil is poor. The long slender awns on the flowers are clearly visible.

The B.C. Native Garden "Grass" Display

ROY L. TAYLOR

One of the goals of the Botanical Garden at the University of British Columbia is to develop a collection of plant materials native to British Columbia. This collection will enable us to fulfill an objective originally set out for the Garden; namely, to acquire a knowledge of the growth and cultivation requirements of our native plant species.

Our initial emphasis in the development of the B.C. Native Garden has been on the acquisition of material of the woody plant species of British Columbia; however, at the same time, we are concerned with increasing our knowledge of herbaceous species. One special component of the herbaceous flora of British Columbia is the group that includes grasses and grass-like plants. Too often, I believe, these plants have been overlooked in the development of ornamentals, and the development of the "grass garden" is an attempt to overcome this deficiency. When we set out to establish the "grass garden," we were faced with two principal problems. First, how could we best display the plants so that people can see what the grasses and their close relatives look like in cultivation; and secondly, how could we maintain the collection in such a way that it would not require a high degree of maintenance? This latter problem, of course, is paramount when one is dealing with highly rhizomatous species of grasses or sedges, which if not confined in some way may cover extensive areas.

In the upper end of the B.C. Native Garden, an area underneath power lines which cannot be used for the development of woody species was selected as the site for the "grass garden." To overcome the problems of creeping rhizomatous species and to provide a good site for display, excavation of the area was initiated, a six-inch gravel base was put down, then water catchment basins made of cement were placed in a random fashion in the area to provide an aesthetically pleasing arrangement of plant materials. It is not a large garden component, but contains nearly 150 specimens of grasses or grass-like plants in their various planters. Figure 1 shows the Garden in the course of construction. Two types of casements were used: one was 12 inches in depth, and the other 24 inches. Those which were only 12 inches in depth were placed one on top of the other in order to have planters in the Garden at a uniform height, and this can be seen in Figure 1. Figure 2 clearly shows the 18 inch by 12 inch deep casements placed one on top of the other, and one can see how the bottom casement is embedded in the gravel substratum in order to provide adequate drainage for the plants.

After placement of the containers was completed, the whole Garden area was filled with a standard soil mix relatively high in sand, to provide adequate drainage of the plants in the area. In

FIGURE 1.

Figure 3 one can see a nearly completed segment of the Garden, showing the containers filled with soil and in some cases already planted, and the intervening areas filled with the same soil mix. We did not attempt to include different soil types, in spite of the fact that various grasses do grow in quite different soil mixtures. We found that the plants do well whether they are dryland species or adapted to wetter climates. Time will tell whether we will have to establish some containers with special soil mixes to provide for those species with unusual requirements. However, one of our goals is to show that the home owner can indeed use grasses or grass-like plants effectively in a garden environment and for this reason we have not made use of special soil mixes.

FIGURE 2.

FIGURE 3.

Figure 4 shows the Garden after one year of growth. To help reduce the maintenance costs of weeding in and around the containers we have added about three inches of bark mulch on top of the pathway areas and between the containers. It has worked quite successfully in reducing the weed problem and permits not only convenient hand roguing, but also (if care is taken) chemical control of weeds. The Garden is now approaching two years in age, and the plants appear to be flourishing. Already we have had to ensure that seed heads are removed prior to shedding to decrease self-seeding in other containers. The rhizomatous species have spread throughout the containers, but appear to be well-contained. The Garden is most interesting when morning or late-evening light filters through the flowering culms. I think there is promise that some of these interesting natives may take their place in future gardens.

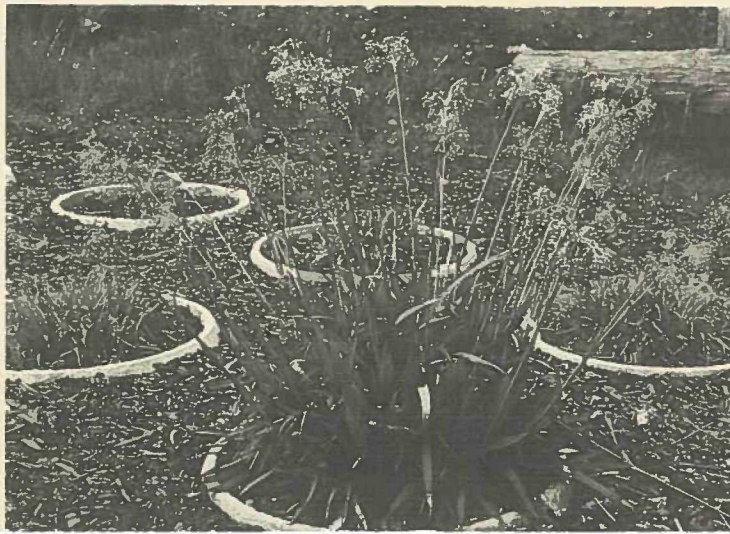


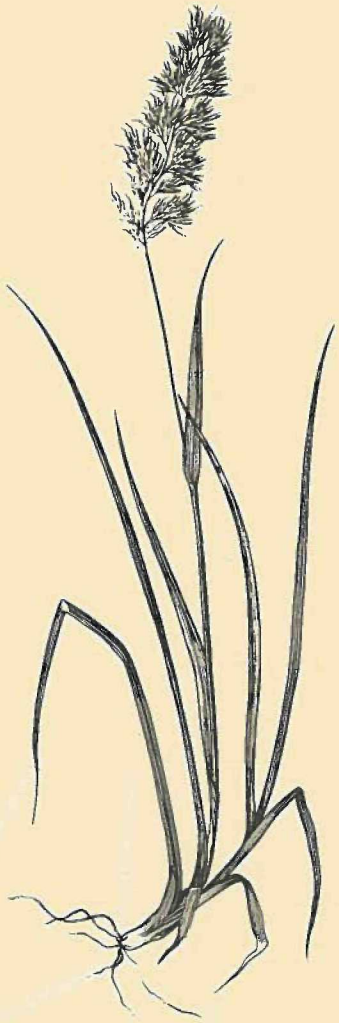
FIGURE 4.

An Obeisance to Grass

Of all that lives and grows
Most humble is the grass.
High pride is in the rose
And vanities that pass
Are clothed in arrogance.
As blood is in the heart,
As strength is in the sea,
So grass is in the earth,
And sings as bright a song —
As pure and humble mirth —
As sings in blood the heart,
As sings in strength the sea.

For grass is sea and sun,
Is dust of earth in song,
Is blood in vein and bone:
Most humble and most strong.

John Howland Beaumont



Calamagrostis purpurascens ssp. *tasuensis*, the endemic Purple Small Reed Grass of the Queen Charlotte Islands × 0.4.

Climatological Summary*

Data 1975	APRIL	MAY	JUNE
Mean temperature	6.9°C	11.3°C	13.5°C
Highest temperature	15.6°C	21.7°C	25.6°C
Lowest temperature	0°C	4.4°C	7.8°C
Grass minimum temperature	−6.7°C	−2.2°C	1.7°C
Total rainfall/No. days with rainfall	27 mm/9	43 mm/10	42 mm/10
Total snowfall/No. days with snowfall	0	0	0
Total hours bright sunshine/possible	176.5/404.0	249.7/468.0	211.8/482.3
Max. wind speed in km for 1 hour/direction	21/SE	27/SE	21/N & E
Mean kilometers of wind at 1 m	125.2 km	132.0 km	137.3 km
Mean kilometers of wind at 13 m	177.0 km	179.6 km	188.1 km

**Site: The University of British Columbia, Vancouver, B.C., Canada*
Position: lat. 49° 15'29"N; long. 123° 14'58"W. Elevation: 104.4 m

Opposite: *Glyceria elata* (Tall Manna Grass), a valuable forage plant in the Pacific Northwest.

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