UNIVERSITY OF WASHINGTON

ARBORETUM BULLETIN

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WINTER, 1971

President's Message

This issue of the Arboretum *BULLETIN* is the fourth issue with the new face and new format and we appreciate our many members who have taken the time to express their approval of these changes. The Editorial Board is continuing in their efforts to improve the character and technical aspects of this publication and they welcome suggestions and contributions. We want this to be a truly fine and representative publication and this best can be accomplished by the membership contributing along with the Arboretum staff and the *BULLETIN* Editorial Board, all working towards continued improvement. In this connection it has been apparent for some time that our advertisers and advertising revenue has been diminishing. Your Foundation has taken action to remedy this situation by recently hiring Mrs. Kay Carson as a part time employee responsible for Foundation and Unit Council public relations and also for the upgrading of advertising revenue for the *BULLETIN*. Mrs. Carson has had previous publication experience with the Medical Research Foundation of Oregon. All the help and cooperation you can give Mrs. Carson in her new duties for the Foundation will be greatly appreciated.

This quarterly *BULLETIN* carries a story of major importance to the Arboretum Foundation. It is heartwarming to have the Foundation be a recipient of gifts and bequests, but, when we are the major beneficiary of an Estate the size of Mr. Jack Roderick Tolmie's it is a truly gratifying happening. The Foundation was notified in October that we were the major beneficiary of the Estate of our member Mr. Jack Roderick Tolmie. Although a definite amount has not been established, as the Estate has not been closed, it should exceed $200,000. One of the provisions of Mr. Tolmie's will is that the bequest be known as the "Dr. William Fraser Tolmie Memorial Fund." It is further dictated that the Foundation will have large and wide discretion in the use of the funds as to where they can best be used to serve the Arboretum. Because of the size and importance of this bequest I have appointed a special committee to study the possible uses and make recommendations to the Executive Committee in this regard.

Our December 3rd meeting of the Trustees featured the winners and the runner-ups of the Arboretum Photography Contest. There were many entries making for a successful undertaking.

The Officers and Trustees of the Foundation join with me in wishing you a New Year filled with Health and Good Fortune.

Robert J. Behnke

THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

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White River Range District,
U.S. Forest Service Photo

John Roderick Tolmie

1897-1970

John Roderick Tolmie, the only child of Roderick Finlayson and Elizabeth Edwards Tolmie, was born in Seattle, Washington March 19, 1897. When very young a severe attack of rheumatic fever resulted in an enlarged heart and a delayed entrance to school until 1905. In 1911 he went to Broadway High School in Seattle, and in 1915 enrolled in the University of Washington, graduating Summa cum laude with a B.S. in Electrical Engineering in 1918.

During World War I, he spent some time in the Puget Sound Navy Yard with a group of University of Washington students, returning at the end of the war to the University where he taught in the Electrical Engineering Department for approximately two years. He then entered the services of the Pacific Telephone and Telegraph Company as a transmission engineer. During World War II he was drafted for engineering work on the Manhattan Project at the University of California at Berkeley, returning at the end of the war to Pacific Telephone and Telegraph Company in Seattle.

He published the following papers in the PROCEEDINGS OF THE INSTITUTE OF RADIO ENGINEERS: "Three Dimensional Vacuum Tube Characteristics", "Analysis Vibrato", and "Charts for Graphic Solution of π Networks". He also invented and patented a five electrode vacuum tube for very high frequency push-pull amplification. He sold the patent to R.C.A. who used the tube as a final power amplifier in T.V. transmitters.

After his return to Seattle, he developed a consuming interest in the study of Botany in which he became very proficient. John was the only male Tolmie living at the time of his death. His grandfather William Frasier Tolmie, M.D., was an early pioneer in Oregon, Washington and British Columbia and was also a botanist and fur trader in employ of the Hudson's Bay Company. ▲

*Tyng Libby**

*Mr. Tyng Libby, a retired transmission Engineer for Pacific Northwest Bell now residing in Palm Springs, California, was a friend and co-worker of Mr. Tolmie's.

Editorial Comment:
These two articles are presented to acquaint our readers with the man who has been such a generous benefactor of the Arboretum and with the man for whom the Memorial is to be named. For those who wish to read further, much is available including an excellent article "William Fraser Tolmie – Meredith Gardiner Physicians, Traders, Naturalists" by Mrs. O.B. Thorgrimson, ARBORETUM BULLETIN, Vol. XIV, No. 2, p. 7 and Dr. Tolmie's *Journals* published in 1963 by Mitchell Press Limited, Vancouver, Canada.

William Fraser Tolmie

Photo: THE BEAVER, Hudson Bay Co. 268,2, p. 29.

Gordon D. Marckworth

William Fraser Tolmie was born at Inverness, Scotland, February 3, 1812. He was educated in Edinburgh and studied medicine at the University of Glasgow, where he received his M.D. degree in 1832 at the age of 20.

In May 1670 a charter was granted to the Hudson's Bay Company giving it imperial power over all land tributary to and west of Hudson's Bay. It was the policy of the company to establish trading posts at convenient points across the continent where the Indians could bring their furs in exchange for the white man's goods. The Company used great care in selecting the men to head these posts.

One of the most important posts was Fort Vancouver, located on the Columbia River near the mouth of the Willamette River. In 1824 a young Canadian doctor of Scottish descent, John McLaughlin, was sent to Fort Vancouver as Chief Factor. He not only had to take care of the fort but had to look after the health of the Indians who, at that time, were suffering from malaria.

In 1832 at the request of Dr. McLaughlin, two young Scottish doctors, Merideth Gairdner and William Fraser Tolmie, were sent out to fill a need. Both were graduates of the University of Glasgow and as both were interested in botany and natural sciences they looked forward to what lay ahead of them.

They left Gravesend in September 1832 in the Company's sailing ship *Ganymede,* headed for Northwest America by way of Cape Horn and the Sandwich Islands. They arrived at Fort George, (Astoria) at the mouth of the Columbia on May 1, 1833, nearly eight months after leaving England. Three days later they reached Fort Vancouver by canoe and reported to Dr. McLaughlin.

When accepting the appointment both doctors thought they would have ample time to study the plants, animals and geology of the region. However, most of their time was devoted to working as a clerk in the store and in caring for the Indian patients. Dr. Gairdner developed tuberculosis and died March 26,

1837. This placed an added burden on Dr. Tolmie.

Soon after his arrival in the Northwest he was sent to the new post at Fort Nisqually. While at Fort Nisqually he spent some time on botanizing trips, including one to Mt. Rainier. He was given a ten-day leave to make the Mt. Rainier trip, which began September 2, 1833, at what is now the Mowich entrance to Mt. Rainier National Park. He took with him five Indians as companions and guides. On the trip he was able to collect medicinal herbs and other plants. For some reason the Indians would not go beyond timber line, which was a disappointment to him. They did climb one peak, which now bears the name, Tolmie Peak, and from its base flows Tolmie Creek.

The trip to the mountain was valuable in many respects. Being the first botanist and white man to visit Mt. Rainier he was able to discover and record many new plants, some of which now bear his name. He also secured the skins of many birds. While at Nisqually he helped in the development of the Puget Sound Agriculture Company, a subordinate of Hudson's Bay Company. He was very active in establishing good farming practice and did much to raise the standards of cattle, horses and sheep by importing thoroughbred stock.

After Dr. Gairdner's death he returned to Fort Vancouver as resident physician and remained there until 1841 when he traveled overland to the Atlantic Coast and then by boat to London. While in Europe he visited France and took a postgraduate course in medicine. He spent two years in Europe and upon his return was placed in charge of the Hudson's Bay Company posts on Puget Sound, with headquarters at Fort Nisqually. He remained there for sixteen years, looking after the company's interest.

In 1846 the Oregon boundary award gave to the Americans title to what is now Washington and Oregon. Three years later the company moved from Fort Vancouver to Victoria, B.C. In 1859 Dr. Tolmie moved to Victoria, where he took over the management of the company and became one of three members of the Board of Management. Years before he had acquired a tract of eleven-hundred acres near Victoria which was known as Cloverdale Farm. There he remained until his death December 8, 1886 at the age of seventy-four.

In 1850 Dr. Tolmie married Jane Work, daughter of John Work, Chief Factor of the Hudson's Bay Company at Victoria. He raised a large family of sons and daughters one of whom became Premier of British Columbia. In Victoria from 1859 until his death, he played a respected role in the affairs of the new land. He was a member of the Legislative Assembly of the Colony of Vancouver Island.

Sunday, June 2: Up about 8 and had an excellent view of a long range of snow speckled mountains, in the peninsula opposite—they run in a N & S direction and to the highest summit, the classical name of Mount Olympus has been given—the foreground is filled with a densely wooded island indented with one or two bays about a mile in length and of which there are several in this part of the Sound. Had a solitary walk in the prairie in the afternoon before dinner, came to a beautiful lake, nearly circular and about 1/4 mile round, the broad leaved Nymphea floated on its unruffled bosom and Flora adorned its margin with a profusion of yellow ranunculi and others unknown—on the sloping grassy banks forming the basin, the oak and a small glossy fresh leaved Pine, something like the Larch vied with each other in number and size, . . . What a pity that a country which so easily could afford subsistence to man is yet uninhabited . . . any nobelman's park in which I have been cannot once be compared either in size, beauty or magnificence.

THE JOURNALS OF WILLIAM FRASER TOLMIE, PHYSICIAN AND FUR TRADER, Mitchell Press Limited, Vancouver, B.C., 1963, p. 196.

FIRST

RECORD TREE

FOR

NEW NATIONAL PARK

*GRANT W. SHARPE**

The record spruce towers 238 feet above Lori Sharpe, the author's daughter. The picture was taken from across the Chilliwack River, 200 feet from the tree.

"Forget that one, there's a bigger one over here," hollered George Douglas. Sure enough, just a few feet away through the thick vine maple was an even larger Engelmann spruce. We didn't know it then, but our find was the largest of its species. In fact, the three of us weren't even looking for spruce.

Our mission was to look at the Chilliwack Valley in the new North Cascades National Park, particularly the associations of western redcedar in the valley bottom. Besides George, a forest ecologist formerly from the University of Washington and now with the University of Alberta at Edmonton, our party included Richard Costello, of Bremerton, an Outdoor Recreation major in the College of Forest Resources at the University of Washington, and myself.

The Chilliwack River begins in Washington and flows northward across the international boundary into British Columbia, where it enters Chilliwack Lake and eventually joins the Fraser River. All routes to the valley from the U.S. side are by trail, making it one of the most isolated valleys in the new park. The only low elevation route is via Chilliwack, B.C., then south over a 20 mile gravel road to Chilliwack Lake. A logging road, open only part way, and only on weekends to the public, parallels the

*Dr. Sharpe is Professor of Outdoor Recreation in the College of Forest Resources, University of Washington, Seattle.

lakeshore but does not reach the head of the lake. A boat ramp on the northern end of the lake permits launching a power boat or a canoe, and unless you have a guarantee of good weather a power boat is recommended. Our first trip was in my 16 foot cargo canoe. Heavy winds, rain and waves made that a memorable trip.

The steep-walled lake is six miles long. At the southern end the Canadian Armed Forces, Chilliwack Base, has been clearing land this past summer for a new provincial park, the Royal Canadian Engineers' contribution to British Columbia Centennial Year. Road access will have a real impact on how the valley will be used. It would seem that a boat-only campground, which would not require an extension of the road, would be less damaging than an auto campground. Close cooperation between the B.C. Parks Branch and the North Cascades National Park will be required to protect the ecological and wilderness values of the valley.

And what a beautiful valley! At its lower end is a level delta or floodplain, formed by centuries of soil deposits where the river enters Chilliwack Lake. Red alder and a variety of paper birch grow near the lakeshore. A bog occurs on the west side of the valley, complete with beaver trails, sphagnum, and the insectivorous plant, the sundew.

The Chilliwack Englemann Spruce and its discoverers. *From left:* George Douglas, Richard Costello, Grant Sharpe. Tape is at 4-1/2 feet above ground. Picture, taken August 22, 1970, looks as if it were out of early 1920's.

→

The beautiful Chilliwack Valley, with British Columbia's Chilliwack Lake at top. Note the three beaver ponds in the photo. The International Boundary which crosses the valley, shows conspicuously at the right. The record spruce is actually dwarfed by the larger redcedar in the valley. Photos by: Grant W. Sharpe

The upriver trail parallels the river, a fact hikers should remember, since a wrong turn could put you in a beaver marsh, as happened to us on our first trip up the valley. A compensating discovery on our detour was the rhododendron, a shrub we hadn't expected in the valley bottom.

All the conditions were right for western redcedar, but we weren't prepared for what we found. Within a half mile of the lake we encountered cathedral-like groves of cedar, a tree type which continues up the valley beyond Indian Creek Shelter, six or seven miles into the National Park. Presumably this valley, with its giant cedars, will receive consideration for natural area status. Groves, colonnades, and individual cedars up to 38 feet circumference are found along the valley floor.

One mile south of the lake is the international boundary. The 16 foot boundary swath is grown over in the valley bottom and no signs tell of its location. Park Superintendent Roger Contor says new signs are currently being made, however, which will inform the hiker of the Park boundary and border crossing.

The river was clear but showed no evidence of trout. Instead, in late August we encountered hundreds of Kokanee salmon going upstream to spawn, their red bodies washing back downstream, providing food for the black bears whose tracks were seen on the river bars. On a later trip, in October of this year, we found larger sea run salmon spawning.

As mentioned earlier we were looking at cedar associations. After walking past giant redcedars it's easy to see how hikers in the past paid no attention to the big spruce growing at the edge of the trail. This eight-foot-diameter spruce is small compared to its larger cedar associates in the valley.

Englemann spruce ranges throughout the Rocky Mountains, extending into the Cascades, with a small isolated stand in the Olympic Mountains. The previous record tree, found in 1967, was in the Olympics.

The current Chilliwack River record holder is about one quarter-mile from the international boundary. It stands 238 feet tall, has a crown spread 49 feet across, and a circumference of 25.6 feet 4-1/2 feet from the ground. The American Forestry Association point system gives this tree a total of 557, or 77 points over the previous record holder in the Olympics. ↟

Preserve from too great and continuing rains (if they happen), snow, and frost, your choicest anemonies and ranunculus's sow'd in September or October for earlier flowers: also your carnations, and such seeds as are in peril of being wash'd out, or over-chilled and frozen; covering them under shelter, and striking off the snow where it lies too weighty. . . .

John Evelyn — Kalendarium Hortense (1664)

USE OF SOLAR ENERGY

LEO J. FRITSCHEN

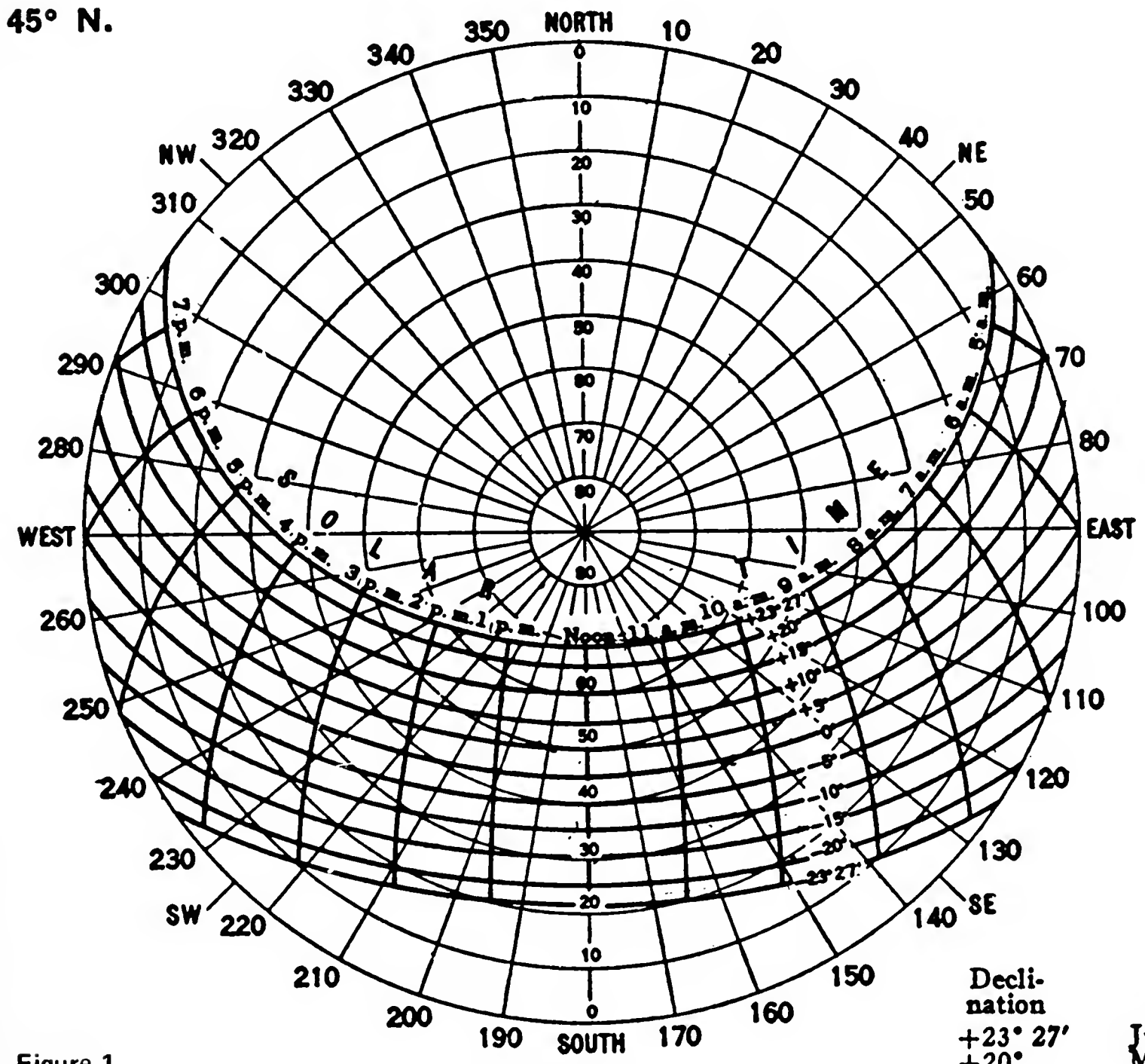
Introduction

The 1969 winter issue of this bulletin contained an article which described in general terms the effect radiation, air temperature, relative humidity and wind speed have upon the microclimate (Fritschen, 1969). This article suggested that proper selection of building site and building materials could enhance the comfort of a home. Although many climatic factors add to the comfort of a home, by far the most important is solar energy. Therefore, this article is devoted to the physical considerations of the proper use of solar energy around the home.

The Sun's Travels

The planning of the optimum use of solar energy requires knowledge of the exact location of the sun at any time of the day and year. The elevation of the sun above the horizon (altitude) and the horizontal location with respect to north (azimuth) are obtained from Figure 1.

SOLAR ALTITUDE AND AZIMUTH



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Figure 1

Solar altitude and azimuth at various times of the year for 45 degrees north latitude.

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*Dr. Fritschen is Associate Professor, Forest Meteorology, College of Forest Resources, University of Washington.

These facts are given for 45 degree north latitude, and with minor exceptions are valid for the Seattle area. For example, if one wanted to know the solar altitude and azimuth at 10:00 a.m. on March 21, one would read the values associated with the insection of the 10:00 a.m. and the zero degree declination lines. The altitude, read from the circles, would be about 38 degrees and the azimuth would be 140 degrees. This means that an eight foot obstacle would cast a shadow of 10.3 feet or that a horizontal overhang would have to be 10.3 feet to completely shade an eight foot wall.

Solar Energy

From the knowledge of the sun's location and its radiation intensity it is possible to compute the maximum amount of solar energy which can be received by surface with various slopes (from level to a vertical wall) and orientations (north, east, or south). Such values excluding cloudiness and atmospheric pollution are given in Figure 2. Values for westerly slopes

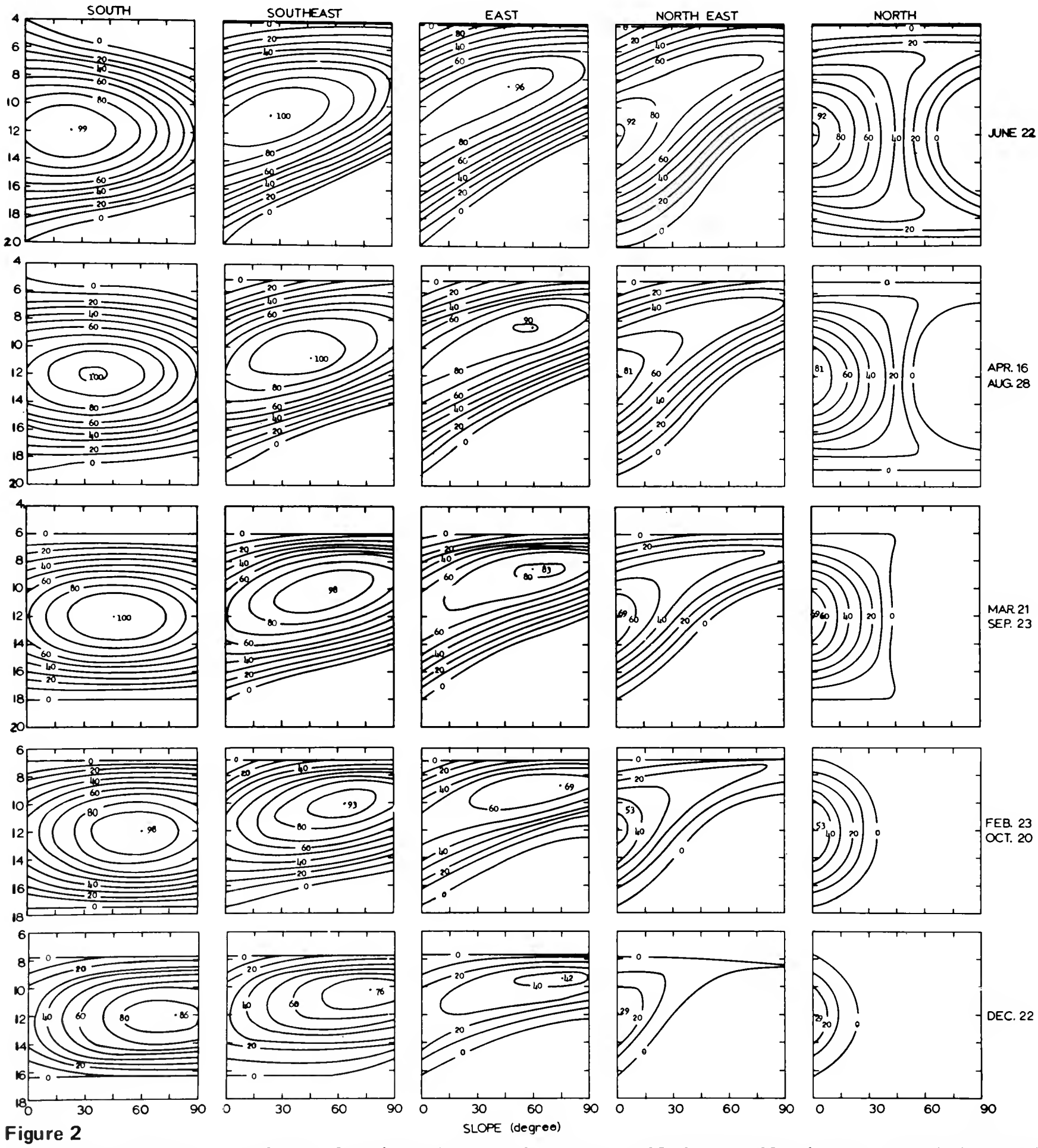


Figure 2

Potential insolation ot surfaces of various slopes and aspects at 46 degrees 48 minutes north latitude with atmospheric transmission coefficient of 0.9. Hours of the day are plotted on the left vertical axis. The aspect of the slope is given along the top and the time of year is given on the right vertical axis. The isolines are in cal cm^{-2} $hour^{-1}$.

are merely mirror images of the easterly slopes. It is interesting to note that for southerly slopes the maximum amount of radiation is received on a level surface during the winter and on a 22 degree slope during the summer. More energy is available on southerly slopes than northerly slopes.

Practical applications of solar energy information suggest that it would be more economical to have a northerly sloping lawn than a southerly sloping one because more water would be required in watering the southern exposure. Certainly a southern exposure of 22 degrees would be the least desirable for lawns but may be the most desirable if one wanted to raise plants which matured early.

Shifting the emphasis to building construction let us consider the optimum orientation and slope of a gable roof to yield the most solar heat in the winter and the least in the summer. Figure 3 which summarizes the information in Figure 2 may be helpful. It appears that the

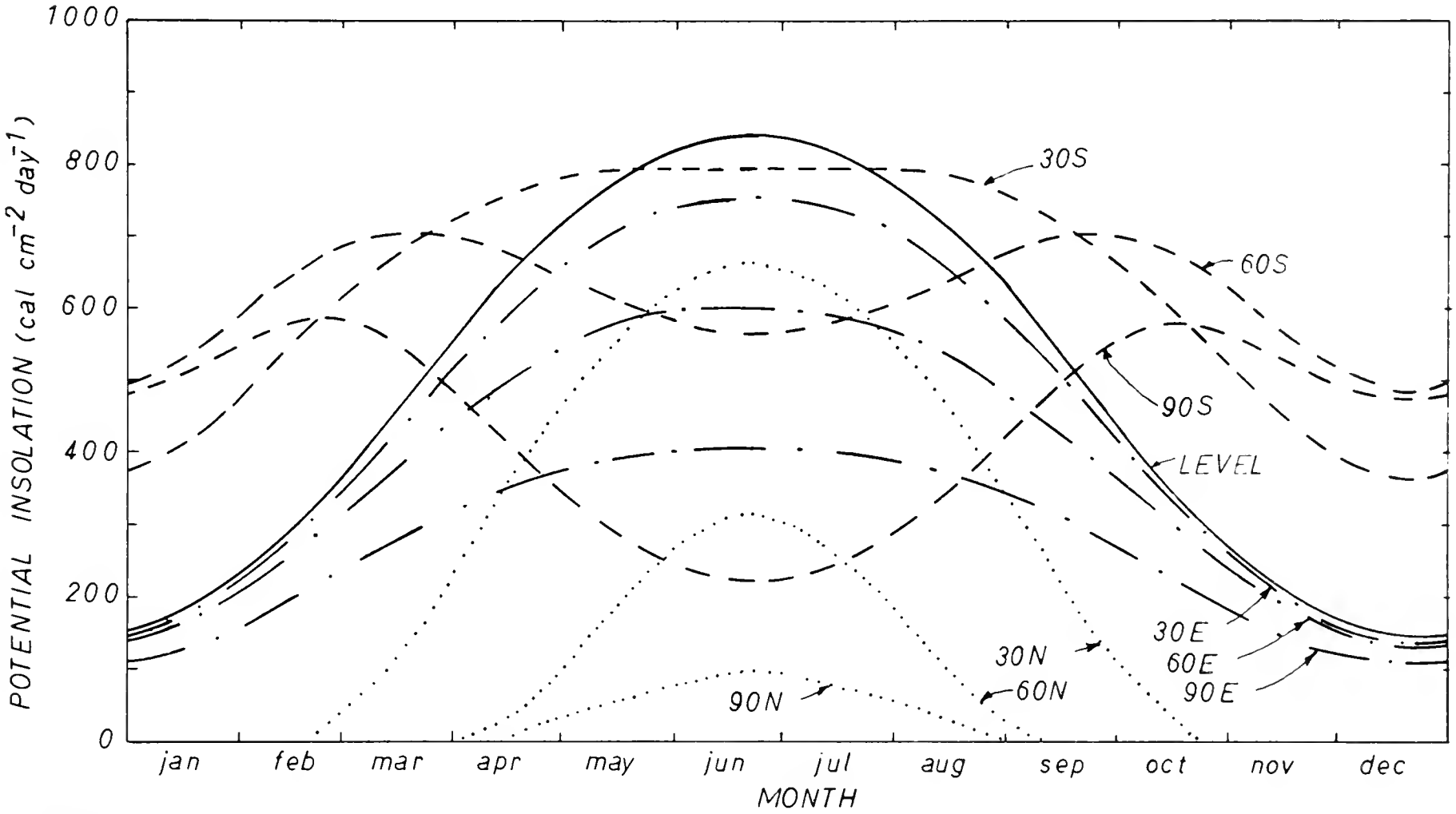


Figure 3

Annual plot of potential insolation of surfaces of various slopes and aspects at 46 degrees 48 minutes north latitude.

level, south 30 degrees, and east and west sloping roof of 30 degrees receives the most energy in the summer. The south facing roof of 60 degrees receives less in the summer and more in the winter than any other surface. Thus, the combination of the 60 degree north and south sloping roof would best fit the criteria. This suggests an A-frame type structure. The ridge pole should also be oriented ENE to WSW to take advantage of the early morning sun and minimize afternoon heating.

Comparison of the potential insolation on vertical walls suggest that the major axis of a house should be east-west or ENE to WSW. This orientation would maximize solar heating of a home through the walls and windows during the winter months with low sun angles and minimize it during the summer months.

Yearly totals of the curves shown in Figure 3 are presented in Table 1. On a yearly basis the east and west facing 45 degree slopes would receive 87 percent as much radiation as a horizontal surface, while the south facing 45 degree slope would receive 135 percent and the north facing 45 degree slope would receive 25 percent or the radiation received by horizontal surface.

TABLE 1

Yearly Potential (calories cm^{-2} $year^{-1}$)

Solar Insolation of Surfaces of Various Slopes and Aspects

Aspects	Slope (degree)						
	0	15	30	45	60	75	90
South	9,871	11,833	12,999	13,322	12,735	11,321	9,181
Southeast	9,871	11,199	11,907	11,967	11,303	10,076	8,289
East	9,871	9,634	9,184	8,577	7,769	6,726	5,536
Northeast	9,871	7,986	6,048	3,671	3,419	2,648	2,571
North	9,871	7,256	4,553	2,435	1,046	497	315

Surface Reflection

The amount of energy available at a surface is not the only factor to consider, the reflection property of various materials is also important. Reflection coefficients for solar radiation of various materials are presented in Table 2.

TABLE 2

Reflection Coefficients for Solar Radiation

Surface Material	Percent Reflection
Snow, fresh fallen	75 - 95
Snow, several days old	40 - 70
Ice, sea	30 - 40
Sand dunes, dry	35 - 45
Sand dunes, wet	20 - 30
Soil, dark	5 - 15
Soil, moist gray	10 - 20
Soil, dry clay	20 - 35
Concrete	17 - 27
Road, blacktop	5 - 10
Desert	25 - 35
Savanna, dry season	25 - 30
Savanna, wet season	15 - 20
Chapparal	15 - 20
Meadow, green	10 - 20
Forest, deciduous	10 - 20
Forest, coniferous	5 - 15
Tundra	15 - 20
Crops	15 - 25
White paint	80
Gray paint	25
Black paint	3
Galvanized iron	35

Most dry surfaces reflect more solar radiation than do wet surfaces. Light colored surfaces reflect more than dark surfaces. Polished metals reflect more than dull metals.

The choice of material color to be used around the home is dependent upon the materials location. For example, light colored concrete will reflect more solar radiation than dark concrete. However, if the concrete is located on the south side of the home in view of large windows more solar radiation will be reflected into the home from the lighter colored patio. In the summer this would increase the air conditioning requirement. On the other hand a dark colored patio would absorb more radiation and would create a hotter environment outside but this heat would not pass through the windows into the home.

Similarly, light colored roofs reflect more solar radiation than do darker roofs. Thus less insulation would be required in a roof which was lighter in color.

Let us now apply the reflection information to window shades with the idea of minimizing the amount of heat which will penetrate the inside of a home. Remember that lighter objects reflect more solar radiation and that solar radiation or visible light will pass through glass but long wave radiation or heat energy will not. Material combinations in order of increasing shade effect are listed below (Olgyay, 1962):

A. Inside of the window
   1. Roller shade, dark to medium to light
   2. Venetian blinds, fully drawn

(Continued on p. 30)

One of the most vital activities on earth—

THE PROCESS OF PHOTOSYNTHESIS

Peter K. Nelson

ONE of the more obvious of the many characteristics that distinguish living organisms from non-living is that living things do things—they carry on many functions and activities and these require that energy be expended. Energy cannot be created—it can only be transformed from one form into another. Even in the atomic bomb or in atomic power plants energy is produced only by the transformation of matter into energy. Unfortunately, the conditions for thus transforming matter are very special, and for the most part highly inimical to life, so we cannot obtain the energy we need for our bodily functions and activities in this way.

There is, however, a source conveniently far enough away that we do not risk danger from its harmful aspects, yet near enough that the energy released from it can reach us in sufficient amounts; in this source, the sun, matter is being transformed into energy in tremendous amounts and at a remarkably uniform rate. The energy released by the sun pours out into space and bathes the earth and the other planets. This flood of energy reaches us as radiant energy, mostly light, and it is there for the taking. But, there is a catch—it is no simple matter to capture energy in the form of light, and transform it into the chemical energy needed by living cells. Not only must it be caught and transformed, the energy also must be put into a form in which it can be stored. Animals and fungi lack the ability to do this; only green plants and a few comparatively rare colored bacteria are able to carry out the process. As a result, animals, including man, are wholly dependent upon the green plants for the entire supply of energy they need to function—to move about, to grow, and to reproduce.

*Dr. Peter K. Nelson, is Associate Professor in the Biology Department at Brooklyn College. This article reprinted from the Brooklyn Botanic Garden's PLANT AND GARDENS is presented here with their permission.

The "trap" that plants use to catch and transform light energy coming to earth from the sun is a remarkable chemical compound, chlorophyll. This is the pigment which gives green color to leaves (the word *chlorophyll* literally means green leaf). Molecules of chlorophyll absorb light, especially blue and red wave lengths and transform it into chemical energy which is stored in the form of carbohydrates. Remarkable and unique though it is, chlorophyll is not able to accomplish the whole process by itself. The job must be done in an intricate series of physical and chemical steps involving various complex chemical substances such as enzymes and pigments called cytochromes. Moreover, these cannot simply be mixed together, but must be arranged in an orderly way so each step in the process will occur in its place.

In most plants the organs in which photosynthesis takes place are the leaves, though it can occur to a greater or less degree in any green part. A cross-section of a typical green leaf shows it to be a sort of sandwich. On the top and bottom are thin membranes: the upper epidermis and the lower epidermis, usually but one layer of cells thick. The "filling" of the sandwich is tissue called *mesophyll*. This is usually differentiated into two parts: an upper layer called the palisade layer because its cells are packed more or less closely together with their longest dimension vertical, much like bricks placed on end; and a lower layer of irregularly shaped, loosely packed cells called, logically enough, the spongy layer. Running through the mesophyll and acting both as a supporting framework and as a conducting system by which fluids enter and leave the leaf is an extensive network of veins. While there are, to be sure, many variations of this basic plan, it is quite astonishing how closely it is adhered to throughout the tremendous variety of

flowering plants.

Any object as thin and spread out as a typical leaf is obviously very subject to drying out. This is to a large extent mitigated by thin layers of waxy material called cutin which are produced by and which cover the outer surfaces of the epidermal layers. This cuticle varies in thickness from species to species. It may be missing entirely in submerged aquatics, and is heavy on leaves of plants growing in hot, dry areas. In one kind of palm it is so heavy that it can be scraped from the leaves and constitutes the valuable carnauba wax of commerce.

Covering the leaves with waxy material conserves water, but poses in its turn another problem—that of exchanging gases between the cells of the leaf and the air. Like all other living cells, with the exception again of certain bacteria, leaf cells require oxygen in order to function, using it to release the energy stored during photosynthesis. Furthermore, carbon dioxide from the air is one of the two raw materials used in photosynthesis, the other being water. So some means for permitting these gases to pass in and out of the leaf is necessary; this is provided by small pores called *stomata* which are found in the epidermal layers. The pores are formed by pairs of sausage-shaped cells, facing one another like parentheses, thus: (). When these cells are filled with water, technically in a state of turgor, they are taut and curved, and the pore between them is open. Gases can then pass freely in and out of the leaf. However, if they lose water, as will happen when the leaf wilts, their stiff facing walls tend to straighten out, narrowing or even closing the pore. Thus the stomata allow for the movement of gases, but at the same time check the loss of water by automatically closing when this is in short supply.*

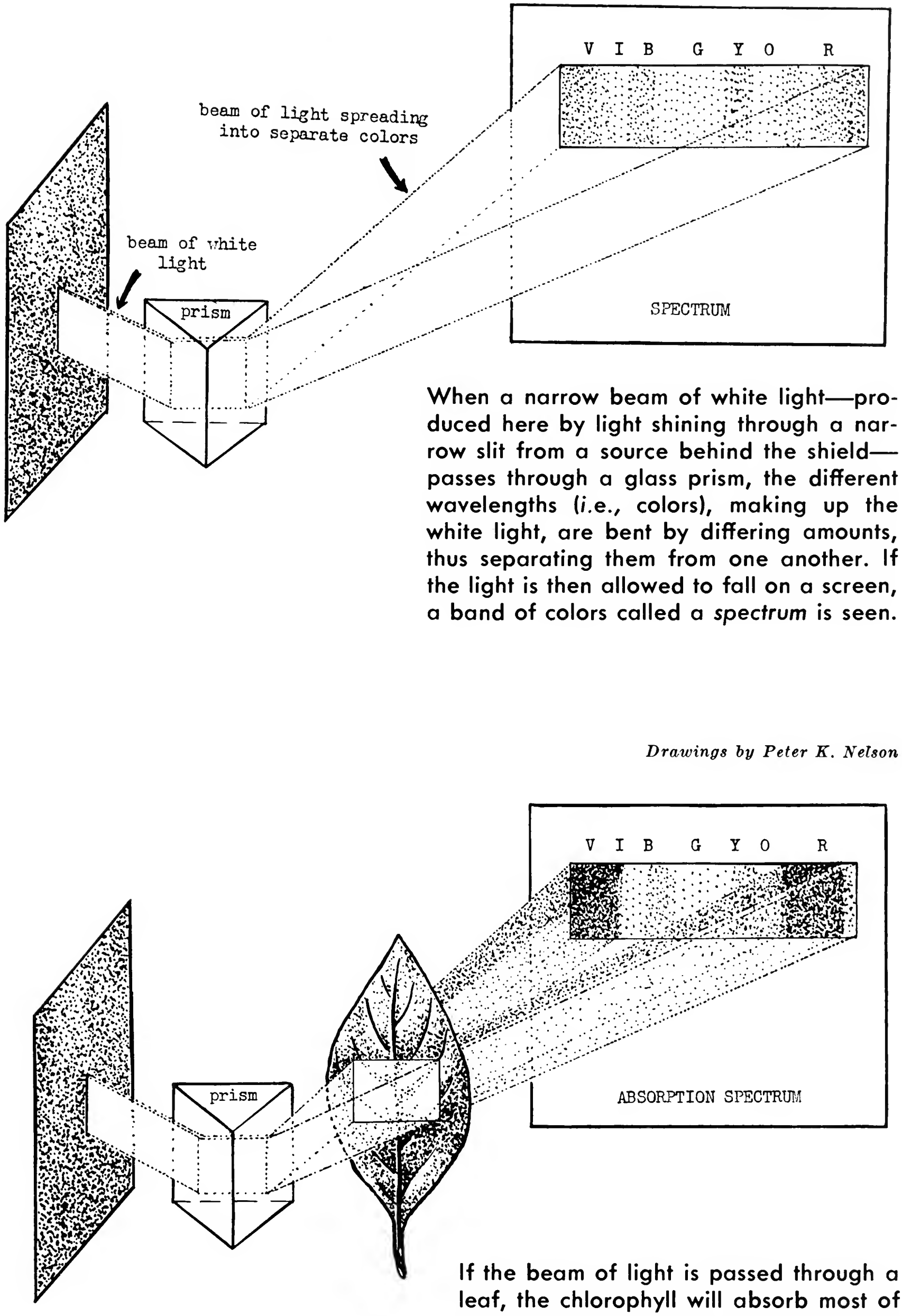
Photosynthesis goes on only in green cells, principally those of the palisade and spongy layers of the leaf. Looking at one of these cells under the microscope we see at once that the chlorophyll is not evenly spread throughout the cell, but is localized in small green bodies embedded in the living substance (cytoplasm) of the cell. In by far the majority of plants these bodies, called chloroplasts, are lozenge-shaped, but in some algae they appear as spiral ribbons, stars, and other forms. Under the microscope they are extraordinarily beautiful. Usually the chloroplasts appear to be a uniform, translucent green when viewed under the microscope, but under certain conditions there is a suggestion that within these bodies themselves the chlorophyll is not uniformly distributed. For years this point was debated until the advent of the electron microscope with its tremendous magnification, which settled the matter without question: within each chloroplast the pigment is arranged in smaller structures called *grana*. In general these grana resemble stacks of coins, or better, stacks of very thin, flat pillboxes. The chlorophyll and other molecules necessary for photosynthesis are located on or in the

(Continued on p. 18)

*It is known that light also has an effect on opening or closing stomata.

ABSORPTION OF LIGHT BY LEAF

The pigments in leaves and other plant parts absorb light differently; some wavelengths are absorbed while others are reflected and/or transmitted. Only the absorbed light is of any use in various processes in the leaf. The diagram on the facing page shows how it is possible to find out which wavelengths are absorbed and which are not. Actually, the diagram is oversimplified for clarity: only the absorption due to chlorophyll is shown. Other pigments in the leaf would absorb other colors. So far as a plant is concerned, the source of light is immaterial—it is only necessary that the wavelengths of light absorbed to carry out a certain process be present.



When a narrow beam of white light—produced here by light shining through a narrow slit from a source behind the shield—passes through a glass prism, the different wavelengths (*i.e.*, colors), making up the white light, are bent by differing amounts, thus separating them from one another. If the light is then allowed to fall on a screen, a band of colors called a *spectrum* is seen.

Drawings by Peter K. Nelson

If the beam of light is passed through a leaf, the chlorophyll will absorb most of the red and violet light. This will result in dark bands in the red and violet parts of the spectrum, which is now called an *absorption spectrum*.

(Continued on p. 18)

Winter in t

View north from road edge outside north gate. *Alnus rubra* group on left. *Salix* species in center.

Cryptomeria japonica from outside service entrance to Japanese Garden.

View towards tea house in Japanese Garden. *Pinus Thunbergie* on left; *Acer rufinerve* in center.

Pinus mugo plants or
Euphorbia veneta (Wulf

Photos by:
B.O. Mulligan, January 28, 1969

e Arboretum

Douglas fir tree on rock garden.

Looking north along road on west side of Japanese Garden, near service gate. *Albies Ernestii* on right; *Chamaecyparis Lawsoniana* beyond it.

Around the glistening wonder bent
The blue walls of the firmament,
No cloud above, no earth below, —
A universe of sky and snow!
-- John Greenleaf Whittier

st side of rock garden.
in center.

View north in Japanese Garden on west side of lake.

walls of the "pillboxes" (technically called *thylakoids*) that make up the grana. Experiment has shown that the complete job of photosynthesis can be performed by the grana. Even if they are broken, the pieces can carry out the work—within certain limits. If the membranous walls of the grana are broken into pieces that are too small, that is, less than could contain about 300 chlorophyll molecules, they can no longer completely perform photosynthesis. This fact, with much other experimental evidence, has led to the idea of the photosynthetic unit, in other words, the chlorophyll and other necessary molecules are arranged in clusters or groups, each of which constitutes a complete machine for performing photosynthesis. At the present, work is being carried on to determine more precisely the size and composition of these units, as well as their relation to the membranes of the grana. It is not certain as yet whether they are lined up on the surfaces of the membranes, or whether they are packed together somewhat like tiles or pieces of a mosaic to actually form the membranes.

Having examined at some length the physical plant in which photosynthesis goes on, let us look a little further at the process itself. Of necessity we can take only a broad, and to some extent superficial view, since to examine photosynthesis in all its details, even incompletely known as they are at present, would involve us in physical and chemical discussions far too lengthy and complex to go into here. For those who wish to pursue the matter, several excellent and reasonably up-to-date references are given at the end of this article. I say reasonably up-to-date because, after several hundred years during which almost no progress was made in our understanding of photosynthesis, at the present time knowledge is advancing at such a rate it is difficult to keep pace with it.

The over-all process of photosynthesis seems deceptively simple: green plants combine carbon dioxide from the air and water in the presence of light to produce carbohydrates and oxygen. During the process the energy of the light is stored in the carbohydrates. Our understanding of the process is this: when the chlorophyll absorbs light it is able to then split water into hydrogen and oxygen. The oxygen is released, literally as a waste product, and the hydrogen is combined, not directly with the carbon dioxide, but with an intermediate substance. A certain amount of an energy-storing compound called ATP is also formed. This is the only part of the process that needs light; once it has been done, the rest can proceed in darkness.

The intermediate compound, with the help of energy stored in the ATP, transfers the hydrogen it received during the light reaction to carbon dioxide. This is accomplished in a series of very involved chemical steps, but we need only be concerned with the end result—production of carbohydrates (sugars). The simple carbohydrates first produced can then be manipulated chemically to give a number of other more complex carbohydrates, such as cane sugar and starch, and, with further chemical processing into more complex materials, such as cellulose, fats and proteins. By recombining the carbohydrates with oxygen, living cells get back the carbon dioxide and water which were the starting materials, and the energy stored is released to be used. In addition, the carbohydrates and their derivative materials are the building blocks from which the living cells themselves are built up.

For Further Reading

Harvesting the Sun, edited by San Pietro, Greer and Army. Academic Press. 1967.

Photosynthesis, by Rabinowitch and Govindjee. John Wiley and Sons, 1969. (This is available in paperback.)

In *Scientific American* magazine:

E. I. Rabinowitch and Govindjee: *The Role of Chlorophyll in Photosynthesis,* Sci. Am. 213 (1965), pp. 74-83.

J. A. Bassham: *The Path of Carbon in Photosynthesis,* Sci. Am. 206 (1962), pp. 88-100. ♦

WHO WERE THEY?

*PHYLLIS D. ZOLL**

Believing that "Hortus amateurus" can no longer with a clear conscience collect specimens in the old established way of picking, pressing and mounting botanical subjects, I have for some years with the aid and collaboration of my husband, George, been using a camera to collect an extensive library of wild flower slides. Such a collection, except for esthetic consideration, is meaningless if the identity of each subject is unknown or given some common name. No matter how picturesque or descriptive such names may be they vary from place to place. A single plant may have several current common names. For this reason I have used the scientific names in my catalog.

Curiosity led me to do some research regarding the people whose names are associated with so many of our West Coast plants. Among the first botanical collectors was Dr. Archibald Menzies. A surgeon-naturalist, he was aboard the "Discovery" with Capt. Geo. Vancouver's expedition of 1791-95. His collection is preserved at Kew, at the Natural History Department of the British Museum and probably elsewhere. Many new species were described from this collection in "Flora Americas Septentrionalis-1814" by Frederich Pursch. Commemorating the name of Menzies we have among others: *Arbutus Menziesii* (Madrone), *Delphinium Menziesii* (Field Larkspur), *Pseudo-tsuga Menziesii* (Douglas Fir). For Vancouver we have *Vancouveria hexandra* (Inside-out Flower).

The Lewis and Clark expedition sent out by President Jefferson to the mouth of the Columbia River (1804-06) is familiar to anyone with the slightest knowledge of U.S. History. However, it is not so well known that it was in a shop in Philadelphia devoted to Flora and Ceres owned by Bernard M'Mahone that the idea to explore the Northwest was incubated and hatched. M'Mahone was a friend of Thomas Jefferson and Frederick Pursch as well as Meriweather Lewis. Among our native shrubs is the genus Mahonis. Although there is a tendency among modern botanists to lump our variety into the genus *berberis* it would be sad to lose this historical connection and I feel sure that at least here in the Northwest, the "Oregon grape" will be always known as *Mahonia aquifolium* and the lower growing species as *M. nervosa.*

Although the collection made on this expedition was not large the specimens brought back were also described by Pursch in the aforementioned publication. Of special interest was a plant with a fleshy root that seemed to defy destruction, at least by boiling water. We know this plant as a genus of the Purslane family, one of the several species in Washington and Oregon and adjoining areas. Because it thrived and bloomed even after this severe treatment, Pursch named it *Lewisia rediviva*—other species are *L. Columbiana, L. catyledon, L. Leana, L. oppositifolia, L. triphylla* and *L. Tweedyi*, which is one of the world's rarest plants having a very limited natural habitat.

While little mention is given to William Clark in the literature pertaining to botany, we do have a charming garden annual, *Clarkia*. The seeds of *Clarkia pulchella* travelled to England where various forms were developed and returned to adorn the flower gardens of its native land. In its indigenous form this *Clarkia* could qualify as one of the oddest looking blossoms. At first glance the petals appear to have been torn to ribbons. The wild godetias whose petals are not ragged are classified as several species of *Clarkia* and are referred to as Farewell to Spring because they bloom in June.

Except for Great Britain, foreign explorations along our Pacific Coast did not contribute much of scientific knowledge botanically. There are some exceptions that are outside the scope of this article. Of interest to us is the fact

(Continued on p. 31)

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*Mrs. George D. Zoll is a member of Unit 55, the Sally Bunge Unit.

The Arboretum Bulletin
Vol. XXXIII, No. 4 Seattle, Wn. Winter, 1971

ARBORETUM FOUNDATION OFFICE HOURS

9 a.m. to 4:30 p.m., Monday through Friday
Phone EAst 5-4510

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BULLETIN EDITORIAL BOARD

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SPECIAL NOTICE

To keep membership in the Arboretum Foundation in good standing, dues should be paid during the month payable. Active memberships more than three months in arrears will be dropped and The Bulletin will be discontinued.

MEMBERSHIP BLANK

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The Arboretum Foundation,
University of Washington Arboretum
Seattle, Washington

I hereby apply for membership in the Arboretum Foundation and remittance for same is enclosed to cover dues for the next succeeding 12 months.

Name _____

Street _____ Phone _____

City, State _____ Zip _____

UNIVERSITY CLASSES

Open to Foundation members and the public in general are classes coordinated and supervised by the University of Washington College of Forest Resources. For additional information, phone 543-2730.

THE CULTIVATED CONIFER

Joseph Witt, Assistant Director of the Arboretum, will discuss the great wealth of coniferous trees and shrubs that can be grown in western Washington gardens. Emphasis will be on identification and culture. Classes will meet at the Craft Room, Museum of History and Industry; limited to 25. Tuesdays, Jan. 12, 19, 26; Feb. 2, 9, 16; 10 a.m. - Noon. 6 sessions, $10.

THE WORLD OF INSECTS AND HOW TO LIVE IN IT

Dr. Robert Gara, Associate Professor of Entomology, will present a lab and field class for the amateur entomologist. The class will have two parts: the first dealing with insect identification and taxonomy; the second, with control, including both biological and chemical methods. Saturdays, Jan. 23 through March 6; 10 a.m. - Noon. 7 sessions, $20.

GRAFTING ORNAMENTALS

Richard Van Klavern, Arboretum Propagator, will teach how to graft woody plants for the garden. Materials will be furnished. Arboretum greenhouse; limited to 10. Thursdays, Feb. 11 and 25; 1-3 p.m. 2 sessions, $16.

PRUNING ORNAMENTALS

Chico Narro, Arboretum Nursery Foreman, will demonstrate pruning techniques for trees and shrubs. Arboretum Greenhouse; limited to 30. Saturdays, Feb. 27 and March 13. 2 sessions, $5.

Attention is also called to the University of Washington College of Forest Resources Arboretum and Arboretum Education Advisory Committee sponsored lecture series at the Pacific Science Center. Dates to remember are January 12, January 26, February 23, March 9 and April 27. For further information call Office of Short Courses and Conferences, University of Washington, 543-5280.

Arboretum Foundation Unit Council sponsored meetings of the ROCK GARDEN STUDY GROUP and the ARBORETUM EXPLORERS continue to meet on the fourth Monday and Wednesday of the Month. For further information please call the Arboretum Foundation office — EA 5-4510.

Dr. Schmitz' Book

The editing of Dr. Henry Schmitz' book on the history of the University of Washington College of Forestry and the Arboretum which was interrupted by his untimely death is about to be completed. In it details of early citizen and College of Forestry concern about the ecology and conservation of the state's forest resources and the Arboretum are recited together with a fascinating amount of local history and fruitful effort on the part of the College of Forestry, the City of Seattle and civic-minded individuals.

To preserve this local history the Arboretum Foundation has agreed to under-write the publication of the book. This should be early next Spring.

Watch for future announcements!

Gordon D. Marckworth

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (September 1, 1970 through November 30, 1970): *Contributing* — Edwin A. Well. *Sustaining* — Mrs. John E. Graham. *Annual* — Mrs. Richard C. Anderson, Mrs. Rodney Batura, Ellen Beaty, Mr. & Mrs. Arthur Bestor, Mrs. Frank P. Brancto, Mrs. William Brinkley, Robert T. Buchanan, Mrs. Keith Campbell, Mrs. W. L. Chilcutt, Mrs. Herbert S. Church, Mrs. William F. Cottrell, Mrs. Robert Couch, Mrs. Harrill Dabney, Mrs. Arthur E. Dell, Mrs. Frank J. DeMartini, Jr., Mrs. Harry Doonan, Mrs. George E. Eaton, Mrs. Otto K. Flach, Mrs. Harry L. Garrison, Mrs. A. F. Ghiglione, Mrs. Carroll Gilbert, Mrs. E. W. Greiner, Mrs. Ronald F. Hamilton, Jr., Miss Lesley M. Heathcote, Mrs. Roger H. Heimdahl, Mrs. John F. Humphrey, Mrs. Jack B. Hunter, Amelia M. Johnson, Mrs. C. O. Johnson, Arthur Harold Keighley, Mrs. James F. Kelly, Mrs. H. W. Kirschner, Mrs. John Knutson, Mrs. A. J. Krininger, Mrs. Laurel Krueger, Mrs. Craig A. Lancaster, Mrs. Jack M. Lay, Mrs. D. B. Lewis, Mrs. A. W. Lucas, Mrs. James H. Lynch, Mrs. Donald McClary, Mrs. B. H. McIvorn, Mrs. Clyde Nobles, Mrs. Frank B. Norman, Mrs. Ormond Nugent, Mrs. Richard N. Parker, Mr. & Mrs. Joseph E. Pendergast, Zelda C. Ramsey, Renton Public Library, Mrs. Robert Reverman, Mrs. A. N. Rongstad, Mrs. Margaret M. Schilling, Mrs. Alfred A. Schlegel, Mr. & Mrs. Earl D. Scott, Mrs. Alex J. Sepulveda, Mrs. Donald E. Sholberg, Mrs. E. K. Siroky, Agnes S. Sunnell, Professor Miriam Terry, Mrs. Roscoe G. Thomas, Miss Margaret G. Weeks, Mrs. Ronald Weeks, Mrs. Dale L. Yust.

We are also grateful to the following members who have increased their dues to: *Supporting* — Mrs. F. M. Roberts, Mrs. George H. Weyerhaeuser. *Contributing* — Mrs. J. M. Brown, Mrs. M. M. Chism. *Sustaining* — Mrs. Mikal R. Dyrnes, Mrs. T. R. Hewitt, Mrs. Robert C. Manchester.

Some of Our Favorites

Won't You Send Us Yours?

Pinus Albicaulis, White Bark Pine

*REID M. KENADY**

Choosing a favorite plant from the fantastic assortment of greenery in the Pacific Northwest is somewhat akin to selecting a favorite coed from the University of Washington student body. There are many factors to consider. Further, it's an experience to savor and, when properly conducted, deserves prolonged examination utilizing one's esthetic tastes as well as scientific standards of taxonomic and physiologic exactness. Having more or less used this approach, I have determined that my favorite Northwest plant is white bark pine, *Pinus albicaulis.* A month ago, or before I began to write this note, I really had no favorite and instead allowed a full gallery of plants and plant associations to bask in the warmth of my favor. I hope that having chosen a favorite will not bring catastrophe in my next wilderness camp.

White bark pine is found at high elevations from central British Columbia to southern Sierra Nevada of California, in the Rocky

*Mr. Reid Kenady, Associate Director, Institute of Forest Product, University of Washington, is a new member of the *Bulletin* Editorial Board.

Mountains of Nevada and mountains of northwestern Wyoming. In Washington, it occurs generally above 5,000 feet, mostly in the northeastern region of the Cascades. In the Cascades, the species does not appear to develop large, pure stands. Usually it grows in association with subalpine fir *(Abies lasiocarpa),* mountain hemlock *(Tsuga mertinsiana)* or subalpine larch *(Larix lyallii).* Areas that have impressed me because of the great size and beauty of white bark pine growing there include Harts Pass near Winthrop, MacAlester Pass south of the new cross-state highway, Park Creek Pass and the meadows above Whatcom Pass in the North Cascades National Park.

Although white bark pine is normally found at high elevations, it may also occur in unique situations at low elevations where the environmental conditions are similar to the higher zones. Such a situation occurs in the Nooksack Cirque area near Mt. Shuksan. In this narrow, north-facing basin, at the elevation of 3,000 feet, the climatic conditions and competitive relationships between plant species are such that many young white bark pine can be found.

White bark pine can be identified by its stout, stiff needles occurring in bundles of five; its thin, light-colored scaly bark; its purplish-red staminate catkins; and a branching habit which often resembles a deciduous hardwood rather than a conifer. The cones of white bark pine do not open on the tree, but rather the entire cone is shed and seed is released by disintegration of the cone or by rodents.

Perhaps because white bark pine has never been a commercial timber species, and it probably never will, there is relatively little known about its growth, reproduction and ecology. However, as the need develops for better understanding of our alpine regions for ecological and recreational reasons, there will undoubtedly be many studies that will result in new information regarding this and other associated species.

ARBORETUM FOUNDATION PHOTOGRAPHY CONTEST AWARD

Winners and runners-up in the photography contest commemorating the 35th anniversary of the Arboretum Foundation were recently announced. All photos were taken in the Arboretum during the past year. From time to time, we will print some of the winning photographs in the *Bulletin*.

Award Winners:
Left to right — Thomas M. Green III, Best of Show; Suzanne Nancarrow, Best Black and White; David Becker, Best Color; Kenneth Sorrels, Photography Contest Chairman.

Certificate Award Winners:
Barbara Baker, Neil L. Boyd, Martha Dailey, Marty Doherty, H.C. Douglas, Linda Fies, Philip R. Finger, Mrs. Carl F. Gould, Jr., Michael R. Harris, Ann W. Lawrence, Alvin Matsumoto, Ed McConkey, Carol Mihelich, Russell R. Miller, Jeff Murray, Corrie Oliver, Nancy Omlin, Keith Sabado, Marilyn Spielholz, Rob Uncles, Howard A. Wahlen, Tad Wahlen, and George W. Zoll.

Photo by: Joy Spurr

PROPAGATION BY GRAFTING

*Richard Van Klaveren**

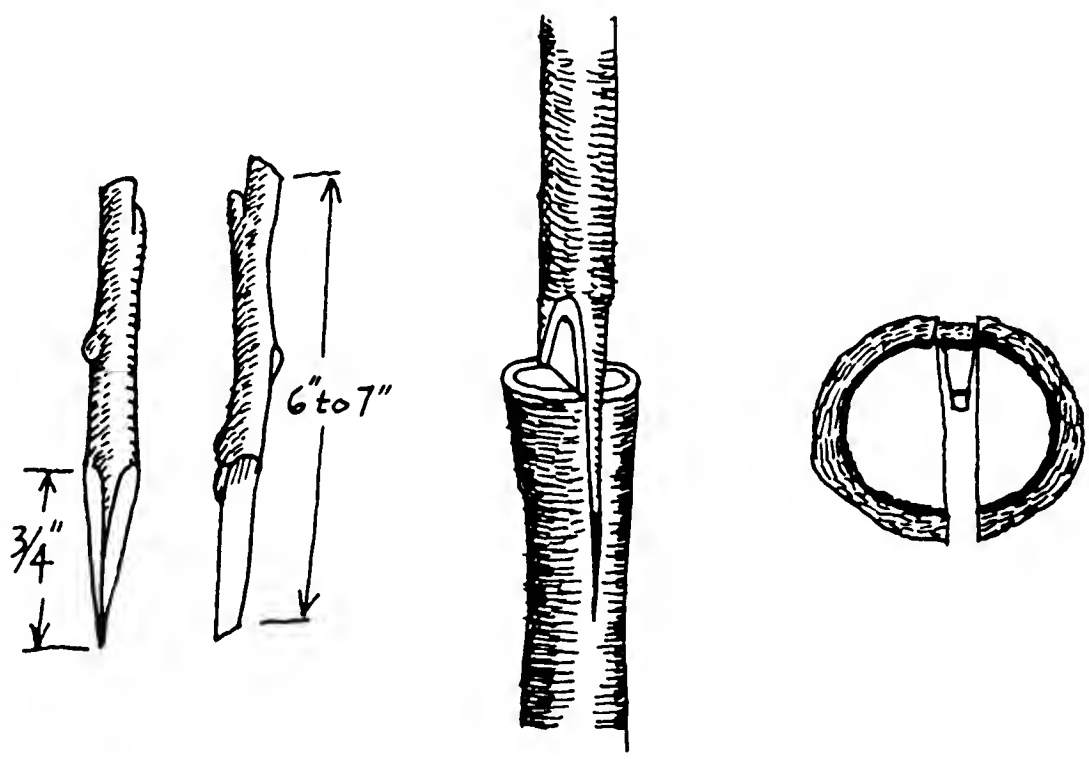
Grafting is a method of propagation in which one plant is transferred to another plant and eventually becomes a part of it. The process is done in the early spring when the buds on the stock (the rooted plant) are beginning to swell and the scion wood (that which is to be transferred) is dormant. Approximately fourteen different types of grafting methods are known, but most widely used is the cleft method to which this article will confine itself.

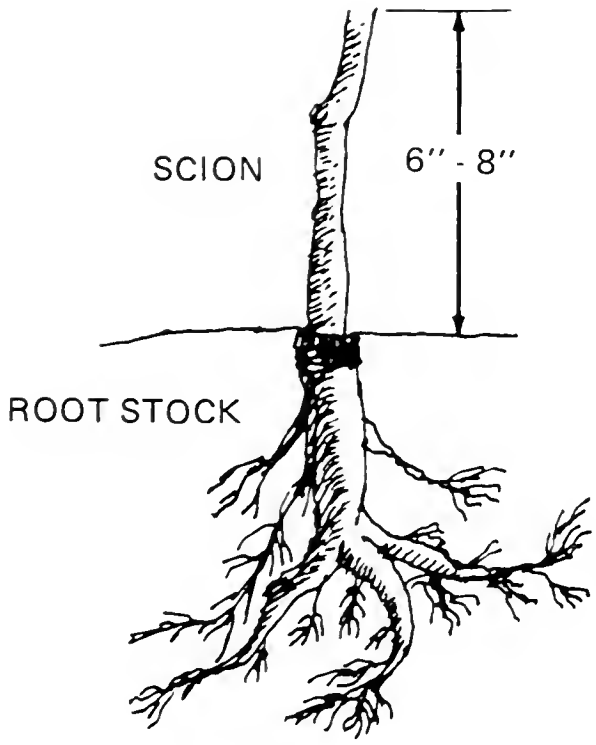
Cleft grafting is the simplest and commonest method. It is used principally for ornamental and fruit trees; however almost any material can be cleft grafted except evergreens, that is, conifers or rhododendrons for which a side graft method is more desirable. Cleft grafting can be done either as a top graft (grafting the scion above the ground level of stock which can be growing either in a pot or in the ground) or as a graft on the root stock itself.

Top grafting is done in the following manner. The root stock is prepared by cutting at the desired height and splitting at the end for three-quarters of an inch. The scion is readied by cutting a six or seven inch section of terminal wood of last year's growth. The end to be inserted in the stock is cut wedge-shaped for three-quarters of an inch and then carefully placed in the split in the root stock. Because the sap flows through the cambium layer, the graft and scion must be lined up exactly together on one side so that the flow of sap runs from stock to scion. Great care must be taken to line the two cambium layers together. The growing tissues of the stock and scion must be flush or in close contact for the best result. The graft is then tied with a rubber band with slight tension and the entire area is covered with bees wax to seal off the wound or to prevent it from bleeding.

Sometimes it is desirable to use a different type of understock, namely roots. This is especially true of syringas which sucker badly. For this reason grafting of *Syringa* is done mostly on the roots and *Ligustrum ovalifolium* (privet) is used as understock. December is the best time for grafting in this instance. The completed graft is placed under glass or plastic cover to prevent dehydration.

The *Ligustrum* root stock is lifted and washed free of soil. The root is then cut and split to a depth of approximately three-quarters of an inch. The scion should be a strong terminal branch of last season's growth six to eight





inches long and about a pencil thick. The scion is cut in a wedge shape also three-quarters of an inch long and inserted into the cut root. Again, great care must be taken to line the two cambium layers together. The graft is then tied with a rubber band and the entire cut area is covered with grafting wax. Exposed grafts invite insects and diseases!

The finished graft is then replanted. The soil in which it is planted must be light and sandy with a small amount of peat. When planting the graft, care must taken that sand or peat is placed as far up as the top of the grafted portion of the plant so that the scion may form its own roots. The completed graft is placed in an enclosure to prevent evaporation of moisture. After about six to seven weeks the graft will have formed a callous. The rubber bands can then cut free to prevent girdling.

At a later date I will discuss whip and tongue grafting, another favorite method which makes a very strong union. This type may be used for almost anything, but is especially recommended for conifers and fruit trees.

The Arboretum Answers

J. A. WITT

These questions, representative of those asked of the Arboretum Staff, are a continuation of a column begun in an earlier issue.

Q. *We want to plant a Eucalyptus tree in our garden but we find that there is conflicting information on their hardiness in the Puget Sound region. Can you suggest a species that will survive here?*

A. In our experience the Snow Gum, *Eucalyptus niphophila*, has been the most satisfactory, although even it was damaged by the cold 1968-69 winter. Cider Gum *E. Gunnii*, has had the reputation of being among the hardiest of the eucalyptus, but we had it cut to the ground in several cold winters. If one could find a source of these trees from high elevations in Tasmania and South Australia they might prove to be tougher than those now in the trade. We are continually testing new species and races hoping to find others that will thrive here.

Q. *What can I do to save my lovely birch tree? Someone peeled off a ring of bark from near the base of the trunk and I think it is going to die.*

A. Maybe not. You can sometimes save a girdled tree if you discover the injury soon enough. The easiest way is to wash off the girdled area with water, trim away any loose bark above and below the wound, then wrap a few layers of plastic film over it, sealing the plastic top and bottom with tape or stout string. An alternate way is to substitute burlap for the plastic and keep the burlap damp.

There are usually enough cambium cells left in the injured area to allow regeneration of the cambium layer under these conditions. Another technique is to bridge-graft over the damaged area, but this is something of a technical problem and I would suggest it only in the case of a very valuable tree.

Q. *A relative of mine from the midwest visited the Arboretum this spring and was taken with several plants that he has never seen grown at home. We would like to ship him some but we wonder if they would grow there. Can you help us decide what to send?*

A. It is very difficult to predict what will grow where. As a guide we use a scheme whereby the country is divided into climatic zones, i.e., Seattle is in Zone 7b or 8a, a relatively mild zone, while Madison, Wisc. is in Zone 5a, much colder. We have a number of books that list plant hardiness by zones for a wide number of species and we would be glad to look up the plants in question. Truthfully, however, your relative could probably get a better answer from a nearby arboretum botanic garden or his State Agricultural Extension Service. There is nothing like local information before sending expensive plants to a doubtful climate.

Q. *What do you do for moles in the Arboretum?*

A. As little as possible! Seriously, though, we don't have any sure-fire method of controlling these pests. I've heard of a dozen different ways to dispose of them and from what I can gather no one method really works for everyone. Poison bait, poisoning the worms in the lawn, gas bombs, mole plants, hungry cats, and mothballs are among the many suggestions, but the only thing we have tried here is injecting a very toxic gas, methyl bromide, into their runs. Methyl bromide is nothing for the average gardener to use, so we really have no solu-

tion to your problem.

Q. *I want to raise some seedlings from my rhododendron plant. It has lots of pods on it but I don't know how to tell when the seed is ripe.*

A. The seed is ripe when the capsules begin to split open at the top. The exact time depends on the individual plant. Some open as early as September; others are still tightly closed in January. We normally allow the capsules to open in a warm dry room, usually in an open-topped box since the tiny seeds fall out and are easily lost. If the capsules are collected green they may not open under this treatment and we then crush or pry them open, but this often means that there is a great deal of chaff with the seed. ↑

Oh the first snowfall!
Who could stay indoors
On such
A glorious day!

Kikaku

ARBORETUM SPOTLIGHT

Have you visited the Winter Garden recently? Dull winter days are brightened by glimpses of plant material which may be flowering there from late November to March. Winter heathers *(Erica carnea* forms), witch hazel *(Hamamelis* species), wintersweet *(Chimonanthus praecox), Sasanqua cammellias* in variety, *Helleborus* and *Sarcococca* species, and *Viburnum Farreri* (fragrans) and *Viburnum x bodnantense* add color and fragrance to the garden. *Rhododendron mucronulatum* splashes its cherry pinkish color on drab winter landscapes. Stop at the Office and pick up a copy of the new leaflet "The Arboretum in Fall and Winter" to help you enjoy your Winter walk!

Unit Conversations

The Couples Units

Each unit of the Arboretum Foundation is a diverse and individual group with its own set of by-laws, its own program, and its own special projects. Membership in the Arboretum Foundation, a minimum unit membership of five, at least four annual meetings and an interest in support of the Arboretum are the only requirements for unit formation; consequently, each unit develops its own unique personality to satisfy its members. Six such Units are called "Couples Units" and the membership is shared by husband and wife.

Of these Couples Units, two (units 32 and 81) are "Mountaineer Groups"; Unit #32 was organized in 1956 with Mimi Brandes as its first chairman. Membership here is limited to thirty who are members of the Mountaineers. Care of the South Entrance Rock Garden at the Arboretum is one of its projects and their weeding parties in that area (sometimes including picnic suppers) have been going on there since 1958. Field trips, hiking and camping, slide shows sponsored to raise funds for the Arboretum—these keep its members busy.

Unit #81 began in 1961 with six couples under the sponsorship of Joy and Roger Spurr. Emphasis of programs is on outdoor activities; largely through the intense interest of one of its members, Mrs. Sichler, Unit 81 has become the "Herb Unit" and raises herbs for the annual plant sale (selling over 300 at each sale) and to sell year round in "herb variety boxes" containing 7 or 8 kinds of herbs. This necessitates the ten-plus couples having "herb potting parties" as part of their program every year.

Unit #76 began ten years ago and the unusual name of "Rapid Rooters" indicates their early interest in propagating. They also studied Native Plants and their use in landscaping. One Member's garden, designed by another member, Glen Hunt, Landscape Architect, won the State Nurserymen's Association's annual landscape award one year using native plants in conjunction with Rhododendrons and other materials.

Mrs. Hunt says Unit #76 is on "stand by" just now until the children are grown; but they still meet for a Christmas Party and summer picnics, and many of the members maintain their Arboretum Foundation membership support.

Unit #86, the Prentice Bloedel Unit, was founded March 3, 1966. Its purpose is to study Japanese Gardens and related subjects, and to familiarize members with Japanese Gardens, our own in particular, and to assist in maintaining the garden in the Arboretum as much as possible. The twenty-eight active members meet regularly, and this past year they cleaned the Tea House, held a summer Moon-Viewing Party, and spent Work and Fun Days in the garden. Several Japanese Garden Guides are, naturally, members of Unit 86.

Unit #62, organized in 1963, is composed of 15 couples from all parts of the city and "walks of life". They have combined their love of the Arboretum and gardening with their love of gourmet cooking into a monthly dinner meeting. Besides the usual officers of Chairman, Program Chairman, etc., this unit has a "Gourmet Chairman" who arranges for the cocktails and the gourmet meal. Spring garden tours, summer family picnics, fall collecting parties in the woods, and a Christmas Tree cutting party on a member's property are among their fun times.

One of their members said their purpose is to support the Arboretum and to publicize the Arboretum so they can recruit more people to support it! Last year they held a Gala Party with the price of admission's being a new couples' membership of $5.00 into the Arboretum Foundation. From these couples a new unit was formed.

This newest "Couples Club", Unit #52, started last Spring with nine active memberships and they are an enthusiastic new group with a fun-sounding program planned for the year. Their first meeting was an all-day, family, picnic-affair on Pearl Island where they studied the flora at sea level. The second meeting was an all-day, all-family, summer picnic-type meet-

ing at a ski-club chalet at Crystal Mountain. On a long ardous hike, they studied and identified plant material of the mountain area. They plan to delve into the mysteries of Mushrooms; learn about Our Arboretum and consider the timely topic of the Why's and Why Not's of Spraying. Congratulations and Best wishes to this new unit and SALUTE to all the couples units!

It is really later than you think! April 29th and 30th, 1971 will be here before we know it and we should all be planning and preparing the area for tucking in all those treasures we'll be able to pick up at the Annual Foundation Plant Sale. Whether it be a favorite fresh from the greenhouse, a special tree or shrub from the hand of an expert in that section, a long desired camellia that will be available through our new department, a rare heather, geranium, exotic house plant, or perhaps a long-hunted-for azalea, rhododendron, or perennial, you will want to be thinking about it now. If all you want is a bird house, artistic lantern or some other novelty for your already established yard, you'll be glad to know that the Garden Art department is off to a good start. If you happen to be one of those organized individuals who already knows just what you want, we will again have the popular Special Order department. These are just a few of the offerings that will make Plant Sales days, April 29 and 30, worth waiting for.

It's always more fun to have a hand in something like this and we can use everyone. Do think about donations you and your friends can make to the sale and be choosing now how and where you may want to volunteer your services. Mrs. Fred Clarke, Jr. (Ad 2-1264) who will be this year's chairman or her assistant, Mrs. John Fellows (Ad 2-0280) will be glad to hear from you.

"I heard a bird sing in the dark of
December
A magical thing and sweet to remember
'We are nearer to Spring than we were in
September.'
I heard a bird sing in the dark of
December."

M. Lynes

Book Reviews

Home Garden Magazine's MINIMUM MAINTENANCE GARDENING HANDBOOK, by Walter F. Bruning, and the Editors of Home Garden Magazine. Harper & Row, N.Y. 1970. $6.95.

The title of this book indicates its intent: to help plan, plant, and care for home gardens with the least amount of effort. Practical landscaping advice and information on the latest labor-saving equipment, building and maintenance materials are given in some detail. There are chapters on selection, planting and care of trees, shrubs, flowers, vegetables, and lawns, with lists of desirable plantings, and indicated hardiness zones. Many photographs, line drawings, lists and tables are helpful. The editors have put together 276 pages of varied and useful information.

RUTH GERSHEVSKY

THE GLORY OF THE TREE by Dr. B. K. Boom and H. Kleijn, with 194 Colour Illustrations of Trees of the World by G. D. Swanenburg de Veye, Doubleday & Company, Garden City, N.Y., 1966.

This book is a tug of war between a gifted photographer and two naturalist-taxonomists, conducted on 9x11½ inch superior Dutch bond paper. Although outnumbered, the lens-man wins handily.

The book is intended for "anyone who likes them," (trees, that is) and may, thus, count on a fairly partisan audience. Just as well, because it is shallow and sketchy and will stimulate little thought. The first chapter heading, "What are Trees?", should read "What comes to my mind when I think of Trees?" The second chapter heading, "How Trees Grow," should read, "How Trees Look Like" since it is a stamp collector's approach to the classification of final morphology. The main body of text is devoted to a description of the major tree families and contains anything from botanical description to legendary myths. An occasional myth parades under the disguise of factual information. Thus, in connection with *Populus trichocarpa*, we are told "This is an important species for the paper industry, but the original forests are gone, sacrificed for mankind. Nowadays, we have to be satisfied with cultivated trees."

The color photographs are superb. Close-ups of flowers, cones and foliage alternate with patterns of bark, silhouettes of trees, views of stands. Most pictures represent specimens from parks and arboreta rather than trees growing in their native habitat. Unfortunately, the captions of photographs are dispersed throughout the text and cannot be easily retrieved from an index.

The book contains a list of major botanical gardens in Europe, Canada and the United States; a list of trees shown on postage stamps; an explanatory list of Latin species names; a short bibliography; and a species index.

If you need an aesthetic conversation piece for your natural-history library, this may be a good choice.

REINHARD F. STETTLER

(Continued from p. 12)

B. Outside of the window
   1. Heat absorbing glass
   2. Venetian blind, 2/3 drawn
   3. Vertical fixed fins
   4. Canvas awning, dark or medium
   5. Continuous overhang on the south side
   6. Shading screen
   7. Dense tree performing heavy shade
   8. Venetian blind, white color
   9. Movable louvers, horizontal

When selecting plantings to be planted next to a wall, it is well to remember that the lighter colored walls will cause a greater heat load on the plants than the darker colored walls.

Shade Trees

In northern latitudes where solar energy is low in the winter, use of deciduous shade trees are preferred to evergreen types. However, evergreen trees used as wind breaks can reduce the heat loss from the home and discourage drifting of snow. In the summer, lawn surfaces and tree leaves absorb solar radiation, convert this energy into water vapor via the evaporation process which results in cooling air temperatures. Beyond this, deciduous trees will provide generous shade at the right season.

The proper choice and location of shade trees is important so that they provide maximum shade in the summer and do not interfere with the winter sunshine. The tall slender trees do not produce much shade but do not occupy much space and provide some wind protection. On the other hand, a tall tree with a big crown will provide a great deal of shade while dominating the yard. One wide-spreading tree can occupy a complete garden while several small trees can provide the shade more quickly without dominating the garden. Thus a compromise is necessary to select the type of tree which provides the needed shade in the space available.

Location of the trees to achieve the most efficient shading is important. As an example, let us assume a house with a major east-west axis having a shade tree located at the south-east corner, the south-west corner and the west side of the house. These locations will provide shade on the south-east side during midmorning, the south-west side during midafternoon and the west side during late afternoon. The tree on the west side should be located further from the house than the other trees because of the lower solar altitude in the late afternoon. At midday, the roof overhangs can provide the shade because the solar altitude is high.

In addition a low hedge may be located on the west to filter out the low sun's rays in the late evening.

Patio Protection

In addition to shade trees, vines supported on overhead structures will provide summer shade. While the vines are developing, a lath structure may be used to control the sun. The exact amount of sun may be controlled by size and placement of the lath. Figure 4 shows the hours of sunlight during the summer for various lath spacings orientated north and south.

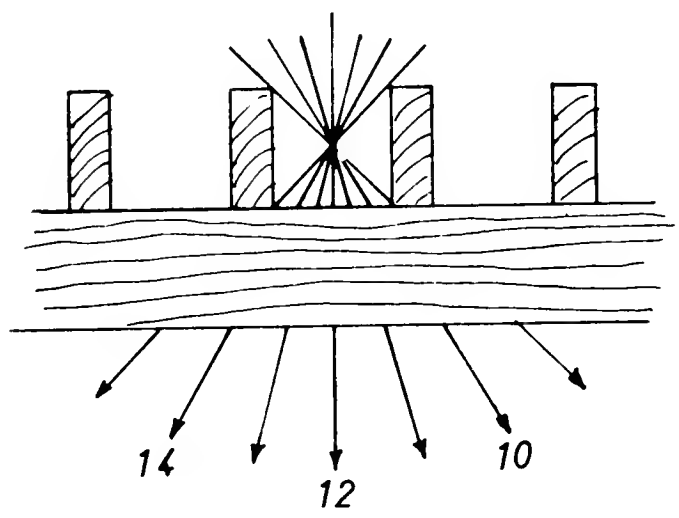


Figure 4
Hours of sunlight penetrating lath structure of different spacings.

Canvas is also versatile for shading. It can be supported overhead with a light structure which will allow it to be extended or folded back as the weather required. When used overhead, care should be taken to prevent warm air from being trapped beneath it. This can be accomplished by locating the overhead shelter two to three feet from the house. The open space also allows light to penetrate for plant growth along the house.

Literature Cited

Fritschen, Leo J., 1969. Microclimate. *Arboretum Bulltin,* University of Washington Arboretum Foundation. pp. 80-85. Vol. XXXII, No. 4 (Winter, 1969).

List, Robert G., 1958. Smithsonian Meteorological Tables. Smithsonian Institute, Washington, D.C. pp.527.

Olgyay, Victor, 1962. Design with Climate. Princeton University Press, Princeton, New Jersey. pp. 190.

I love to see, when leaves depart
The clear anatomy arrive,
Winter, the paragon of art,
That kills all forms of life and feeling
Save what is pure and will survive.

Roy Campbell

Ah the falling snow . . .
Imagine dancing
Butterflies flitting
Through the flakes!

Oeharu

WHO WERE THEY?

(Continued from p. 19)

that the Russian ship "Rurick" (1816) had two naturalists aboard. One of these was Johann Frederick Eschscholtz. Probably the most notable plant described from his collection is *Eschscholtzia Californica* (California Poppy).

In 1833 a Boston fur-trader named Nathaniel Wyeth travelled into the Pacific Northwest. He made a small collection which he gave to Thomas Nuttall who was for many years a professor at Harvard University. A year later these two travelled together from St. Louis to the mouth of the Columbia and then along the coast of California. Nuttall was an interesting personality and popped up at various places always looking for something new to observe. Richard Henry Dana in "Two Years Before the Mast" mentions him, commenting that the sailors dubbed him "Old Curious" because Nuttall, as he walked along the beaches, had a habit of stuffing his pockets with oddments for further study. It is a fitting tribute to such a man that one of our loveliest flowering trees bears his name, *Cornus Nuttallii* has the unusual faculty of blooming in the spring and often, although not so profusely, again in the fall together with its fruit. The autumn foliage turns a deep red. For Wyeth we have "Mule-ears"—*Wyethia amplexicaulis* and "Compass Plant"—*W augustifolia.*

Dr. William Frazer Tolmie was employed by the Hudson's Bay Company and served in the Pacific Northwest from 1833-41. He was the first botanist to climb Mt. Rainier. Many of the specimens of his collection were actually collected by John McLeod another fur-trader. Tolmie gave the collection to William Jackson Hooker who in turn distributed it among other botanists including John Torrey and Asa Gray. A beautiful herbacous plant in our area is *Saxifrage Tolmiei* found along alpine rivulets and on pumice slopes and rocky banks. It was first collected by Tolmie on Mt. Rainier. The "Hairy Cat's ear mariposa" of which there are two forms in Oregon is the *Calochortus Tolmiei.*

Many more people are assoicated with our West Coast plants; some of them are just as interesting. Perhaps at some future time, I shall write another piece for our bulletin.

The United States National Arboretum, Washington, D.C. announces the publication of the second of their irregular series entitled *National Arboretum Contribution No. 2.* This second number, *History, Progeny and Locations of Crabapples of Documented Authentic Origin* of 107 pages, was written and compiled by Roland M. Jefferson, Botanist at the U.S. National Arboretum. It is the most documented treatment of cultivated crabapples—with botanical species, varieties and cultivars—that has ever been published. In addition to detailed notations of origin and source, the work also includes general morphological descriptions, current source locations and genealogical formulae of clones of hybrid origin. Copies are available to botanists and horticulturists by writing to Roland M. Jefferson at the U.S. National Arboretum, Washington, D.C. 20002.

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