ORNAMENTAL POTENTIAL IN THE BIRCHES

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Man is changing his environment at an accelerating rate, usually for the worse. Therefore, it is urgent that he learns to prevent further deterioration and to alleviate existing conditions. Much can be done through wise land-use planning, and by giving proper attention to existing vegetation in the building of highways, factories, shopping centers, parking lots, homes, and churches. In many situations, however, trees and shrubs must be introduced to heal the scars in the landscape caused by man's activities, to act as screens against unsightliness and noise, or to provide shade and beauty.

Although the Forest Service does not conduct research on ornamentals, it is likely to get increasingly involved in the use of native woody plants in parks and greenbelts, along highways, and in other urban areas. Similarly, the Institute of Forest Genetics does not intend to breed ornamental birches, but it might still contribute to landscaping and urban forestry by providing information on the best seed sources for particular locations or sites, and on new varieties developed in the course of genetic research. Therefore, the purpose of this paper is to point out some potential uses of the native birches in environmental improvement, and to suggest research that would further extend their usefulness.

SUGGESTED USES OF BIRCH IN ENVIRONMENTAL IMPROVEMENT

Spoil Bank Plantings

Our native birches have not been used much for planting on spoil banks, slag heaps, and tailings left after mining operations. In Europe, however, birches, particularly *Betula pendula* Roth, have been planted extensively on spoil banks because of their high tolerance of acid soils. Birches have been used on lignite spoil banks in Czechoslovakia and Germany, on coal mine spoils in Bulgaria, Germany, Great Britain, and Holland, and on bauxite spoil banks in Hungary. The ease with which paper birch *(B. papyrifera* Marsh.) colonizes iron and copper mines tailings in this country indicates that it would probably do well in spoil bank plantings within its natural range. River birch *(Betula nigra* L.) has been planted extensively on land strip-mined for coal in the central United States.

Areas With Air Pollution

Studies in Germany have shown that certain species of birch are relatively smoke-resistant and can be planted in the heavily polluted Ruhr area (Gruneklee 1965). Birch was also found to be much more resistant to sulfur dioxide and arsenic trioxide dust escaping from a lead mine near Dresden, Germany, than pine, oak, and fir (Pelz, Beyer, and Bleyer 1963). The European white birch *(B. pendula)* is rated as only slightly susceptible to fluorine damage (Borsdorf 1960), although chronic exposure to air polluted with hydrofluoric acid causes &wading of the trees (Halbwachs and Kisser 1967). Another species, *B. pubescens* Ehrh., was planted with other smoke-resistant trees in shelterbelts established near Leningrad, U.S.S.R. to protect pine stands against air pollution (Podzorov 1961).

When planted in Japan in an area previously denuded by smoke from a copper smelting plant, *B. schmidtii* Reg. proved to be among the most tolerant species (Kurata and Hashimoto 1956). Little work has been done on our native species, but Gordon and Gorham (1963) found that paper birch was moderately resistant to sulfur dioxide released from iron-sintering plants in Ontario, Canada. Thus, at least this species appears promising where air pollution is a problem.

Camp and Picnic Grounds

The white-barked species, particularly paper birch, are esthetically pleasing to most people and therefore popular around campgrounds and picnic areas. Due to their shallow and widespreading root systems, paper birch and gray birch *(B. populifolia* Marsh.) are particularly sensitive to removal or addition of soil around them. This should be kept in mind when camp and picnic grounds are developed. These species also suffer from trampling and soil compaction, and probably should not be used in areas receiving heavy traffic. River birch *(B. nigra L.),* in spite of its attractive cinnamon-colored, shaggy bark, is not widely used; being a flood-plain tree, however, it would seem ideally suited for planting near lakes and rivers.

Problem Sites

Many new homes are built on sites that were stripped of topsoil when the area was prepared for building, on fill, or on sandy soils. Amelioration of such sites through addition of topsoil is often prohibitively expensive. Landscaping these sites is difficult because few trees will grow on the almost sterile soils, where drought may also be a problem. Paper birch, however, will grow on relatively dry, sterile soils. On the other hand, some birches grow well on wet sites. Both paper and yellow birch *(Betula alleghaniensis* Britton) will grow on poorly drained soils; river birch will tolerate occasional flooding; and the shrubby bog birch

(Betula pumila L.) is found in swamps. Thus, our native species of birch are adapted to a wide range of soils, and types suitable for particular sites could undoubtedly be produced through a program of selection and breeding.

Highway Plantings

Natural stands of paper birch along roads and highways are attractive in all seasons, and can be retained if proper care is taken during road construction. Because this species is sensitive to excavation, filling, and changes in drainage patterns, ignorance on the part of planners and roadbuilders as to how much disturbance it can tolerate often has sad results. Birches are commonly planted along roads in northern Europe, and I see no reason why we cannot do the same in this country. Some research on methods of planting and maintaining birch along highways will probably be needed for these to be successful.

Other Landscape Plantings

Relatively few species have been used in landscaping in the past, partly because nurseries tend to be conservative and grow only the well-known varieties. Fortunately, the current trend is toward more diversity in landscape design, including more and different ornamental trees and shrubs. The birches can certainly contribute here—they vary widely in size, appearance, site preference, and shade tolerance.

Although birches have been largely ignored by landscape architects in the past, they possess many features that qualify them for widespread use as ornamentals. For instance, several species fill the need for smaller, finer-textured trees that has been brought about by the change in architecture to lower, ranch-type houses. Most of them also give fairly light shade, which makes it easier to grow grass under them. Another advantage of the birches is that they are hardy in the northern parts of the country, where the choice of ornamentals is much more limited than farther south. And most have attractive yellow autumn foliage, a fact often overlooked by landscape designers. Whether planted as individuals, small groups, or large stands, our native birches have much to offer for landscape improvement.

POTENTIAL SOURCES OF ORNAMENTAL BIRCHES

Natural Variation

A potentially valuable but largely untapped source of ornamentals, is the natural variation present in our native birches. Intraspecific variation is common in most species; *all* we have to do is recognize types suitable for particular purposes and propagate these.

Variation may, for example, be in tree form. A fastigiate variety of *B. pendula* is already used in the trade, but narrow-crowned types also exist in paper birch. Several weeping forms of *B. pendula* are used commercially, but a similar semiweeping type is available in paper birch. A short, broad, and dense type of paper birch has also been found. Branching habit varies widely in yellow birch and other species. Again, desirable types can be selected and propagated.

The bark of the birches varies greatly in color and texture. Paper birch bark can be either smooth and white or rough and gray. Some paper birches have shaggy, reddish bark, others have smooth, shiny, reddish-brown bark. Yellow birch bark may be peeling or it may be tight and smooth.

Hybrids

Another source of diversity in birches is hybridization. Natural hybridization is common in the birches, and some of the hybrids combine desirable features of the parents or provide new character combinations. For example, the hybrid *(B.* x *jackii* Schneid.) between sweet birch *(B. lenta L.)* and bog birch is multi-stemmed and intermediate in size. An unusual type of bark can be found in natural hybrids between yellow and paper birch. The natural hybrid *(B.* x *sandbergii* Britton) between bog birch and paper birch may not resemble either parent in size, form, or bark characteristics. If particular character combinations cannot be found in the natural hybrids, they can sometimes be produced through controlled crosses.

Induced Variation

If natural variation and hybrids do not provide enough desirable types, it is possible to induce variation in various birches through treatments with chemicals or ionizing radiation. Whole plants, plant parts, or just seeds or pollen may be treated. Although only exploratory studies have been made so far, pollen irradiation has been found to be an efficient means of inducing variation in river birch. Of the numerous variants produced, dwarfs, seedlings with different leaf shapes, and seedlings with variegated leaves may be useful as ornamentals; the more extreme types probably will find only limited use as specimen trees or curiosities.

RESEARCH NEEDED

We already know a good deal about some birches and their uses in environmental improvement, but a number of problems require further attention. Work is needed on propagation by cuttings or other cheap and reliable means. Birch can be grafted readily, but this method may be too expensive for mass production of desirable types.

As mentioned previously, research is needed on methods of planting and maintaining birch. Heat injury has been responsible for losses in some of our plantings. Since larger seedlings seem to survive better than smaller ones, this may be related to bark thickness.

Studies should be made of how birches react to heavy grass competition, and, if competition has to be controlled, what chemical or mechanical means should be used. We also need to know more about the site requirements of certain species, their performance in relation to soil fertility and moisture content, and their tolerance of excess moisture or drought. The extent to which birches can be used in

ornamental plantings outside their natural range should also be investigated.

There are some insect problems requiring attention. The bronze birch borer *(Agrilus anxius* Gory) attacks most Eurasian birches, but also attacks paper birch in the southern part of the range of this tree. Birch leaf miner *(Fenusa pusilla* Lep.) is a serious pest of gray and paper birch. To my knowledge 'there has been no search for trees resistant to these insects. If resistant varieties or hybrids can be developed, the use of the birches as ornamentals can be greatly expanded.

CONCLUDING REMARKS

In summary, the birches have a high potential for use in environmental improvement, and their high degree of natural variation offers much promise for genetic improvement. Promising new birch types will probably continue to appear in our natural variation, hybridization, and radiation studies, but because the use of some of these types is outside our responsibility, we are turning them over to the Agricultural Research Service and State Agricultural Experiment Stations for testing and further development.

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