# *Gleditsia triacanthos* L. Honeylocust

**Leguminosae Legume family**

**Robert M. Blair**

Honeylocust ***(Gleditsia triacanthos),*** also called sweet-locust or thorny-locust, is a moderately fast growing tree commonly found on moist bottom lands or limestone soils. Because it has proven very hardy and tolerant of drought and salinity, it is widely planted for windbreaks and soil erosion control. The thornless variety has been planted to replace the elm in many urban areas. The wood is dense, hard, and durable but used only locally. Honeylocust pods are sweet and eaten by livestock and wildlife. The tree is relatively short lived, reaching the age of 125 years.

## Habitat

### Native Range

Honeylocust (fig. 1) is found scattered in the East-Central United States from central Pennsylvania westward to southeastern South Dakota, south to central and southeastern Texas, east to southern Alabama, then northeasterly through Alabama to western Maryland. Outlying populations of the species may be found in northwestern Florida, west Texas, and west-central Oklahoma. It is naturalized east to the Appalachian Mountains from South Carolina north to Pennsylvania, New York, and New England *(11)*. Honeylocust attains its maximum development in the valleys of small streams in southern Indiana and Illinois.

Honeylocust, especially the thornless form, is widely cultivated as an ornamental and shade tree in all countries having a temperate climate.

### Climate

In the western portion of its range honeylocust grows in a subhumid climate while in the middle and eastern portions the climate is humid. Normal annual precipitation varies from about 510 mm (20 in) in South Dakota and Texas to more than 1520 mm (60 in) in southern Louisiana, Mississippi, and Alabama. Average annual snowfall varies from none to 102 cm (40 in). Length of the growing season varies from about 150 days in the north and northeast to more than 300 days in the southern extremities of the range.

The author is Research Ecologist (retired), Southern Forest Experiment Station, New Orleans, LA.

Honeylocust is tolerant of low temperatures and in the north it is hardy at -29" to -34" C (-20" to -30" F) *(10)*. Northern races harden-off and become dormant relatively early, while growth of southern races continues later into the year. Southern races are subject to frost damage when planted in the north (7). Honeylocust also may suffer frost damage or dieback because of its indefinite or indeterminate annual growth pattern *(4)*. Twigs may continue to elongate until stopped by cold, whereupon the tender terminal internodes are killed by the first frosts. New growth in the spring then comes from the lower lateral buds.

### Soils and Topography

Honeylocust is found most commonly on soils in the orders Alfisols, Inceptisols, and Mollisols that originate from limestone or the rich alluvial floodplains of major rivers and streams. Growth is poor on gravelly or heavy clay soils and honeylocust often fails on shallow soils. Although ample soil moisture is necessary for best growth, the species is very resistant to drought. Because of this, it is a valuable species for shelterbelt planting in the Great Plains,

On 20 drought-resistant species of seedlings tested, honeylocust ranked third in alkali tolerance (7). The species is also tolerant of acid soils *(26)*, but best development is usually on soils having a pH between 6.0 and 8.0. From tests incorporating artificially salinized soils, young honeylocusts were found to be tolerant of soil salinity *(13)*. Seed germination was little influenced by as much as 0.20 percent of sodium chloride in the dry weight of soil (2). Salt tolerance has particular economic importance in the North where runoff from highway de-icing salts can damage plantings, and also where plantings are desired on saline soils in arid states. Whether honeylocust can tolerate the cumulative effects of salinity over a period of years is still unknown.

Typically, honeylocust is a bottom land species, most commonly found only on moist fertile soils near streams or lakes. Although it is not common anywhere in the Mississippi River Delta, it frequently grows on low clay ridges and flats in first bottoms and on the secondary flood plains along the Missouri River tributaries in Nebraska.

Over its range honeylocust grows naturally below a maximum elevation of 610 to 760 m (2,000 to 2,500 ft), although the general upper elevational limit for the species is reported as 1520 m (5,000 ft). A 20-year-old plantation growing at 2100 m (6,900 ft) in

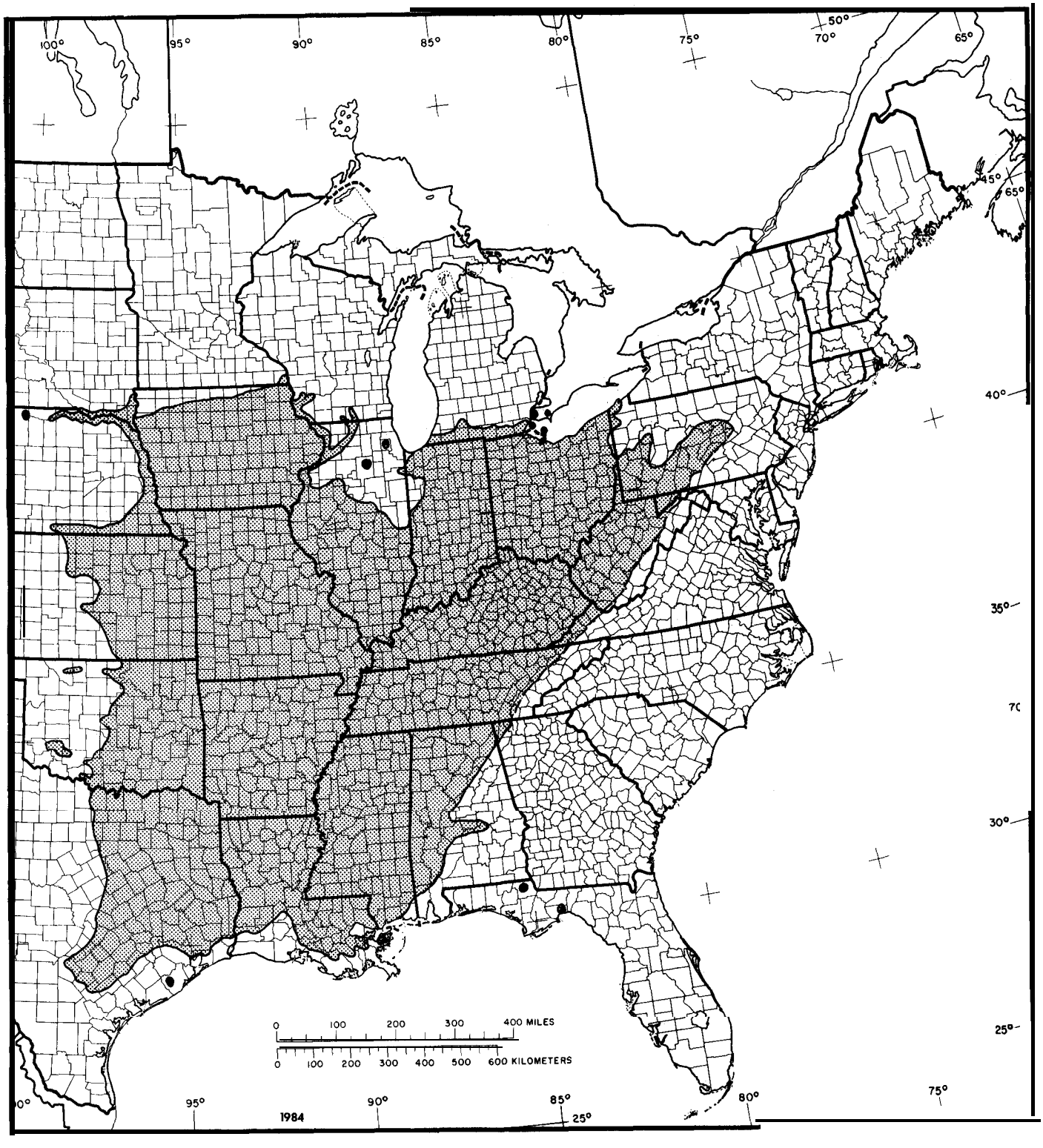


**Figure 1--The** *native range of honeylocust.*

Colorado had "good" survival, but trees averaged only 2.4 m (8 ft) in height (7).

### Associated Forest Cover

Throughout its range, honeylocust generally occurs only as a minor component of natural forest stands. It is included in four forest cover types in the United States *(19)*. It is an associated species on lowland sites in Bur Oak (Society of American Foresters Type 42), especially in the more southerly portions of the type range, and in Willow Oak-Water Oak–Diamondleaf Oak (Type 88). It is a minor associate in Sweetgum-Willow Oak (Type 92) and Sugarberry–American Elm-Green Ash (Type 93). Mesophytic species commonly associated with honeylocust include red maple *(Acer rubrum)*, persimmon ***(Diospyros uirginiana),*** blackgum *(Nyssa sylvatica)*, pecan *(Carya illinoensis)*, boxelder *(Acer **negundo),*** Kentucky coffeetree ***(Gymnocladus** dioicus)*, black walnut *(Juglans nigra)*, oaks ***(Quercus*** spp.), elms *(Ulmus* spp.), ashes ***(Fraxinus*** spp.), and hickories *(Carya* spp.).

## Life History

### Reproduction and Early Growth

**Flowering and** Fruiting-Flowering occurs in late spring, the average date being about May 10 in the southern limit of the range and June 25 in the north *(7)*. Honeylocust leaves are nearly full grown when the flowers are produced, which is usually late enough in the year for the seed crop to escape frost damage.

The species is polygamo-dioecious; flowers are borne in axillary, dense, green racemes (24). Racemes of staminate flowers are 5 to 13 cm (2 to 5 in) long, pubescent, and often clustered. The calyx is campanulate, with five elliptic-lanceolate lobes; there are four to five petals, erect, oval, and longer than the calyx lobes; and up to 10 stamens, inserted on the calyx tube. The pistil is rudimentary or absent in the staminate flowers. Pistillate racemes are 5 to 8 cm (2 to 3 in) long, slender, with few flowers, and usually solitary. The pistils are tomentose, the ovary nearly sessile, and the style short; there may be two ovules or many. The stamens are much smaller and abortive in pistillate flowers.

Seeds, borne in long (15 to 41 cm, 6 to 16 in), flat, indehiscent, and often twisted pods, ripen about mid-September in the southern portion of the range and around mid-October in the north. Soon after fruits mature they begin falling and dissemination often continues into late winter.

**Seed Production and Dissemination—**Honeylocust begins bearing seed at about 10 years of age, optimum production occurring between 25 and 75 years. Trees continue to bear fruit up to about 100 years of age (7). They generally bear fruit each year and produce abundant seed crops every year or two.

Honeylocust seeds, like those of many leguminous species, have impermeable coats and thus remain viable for long periods of time. Under natural conditions, individual seeds become permeable at different periods following maturation so that any one crop is capable of producing seedlings over a period of several years.

The seeding range or natural dispersal of honeylocust seeds is not extensive. The pods, however, are readily eaten by cattle, whereby seeds are scattered in the feces. Undoubtedly seeds are also disseminated by birds and other mammals that feed on the fruit. Cleaned seeds average about 6,170/kg (2,800/lb), with a commercial purity of 95 percent and a soundness of 98 percent (24). Viability can be retained for several years when seeds are stored in sealed containers at 0" to 7° C (32° to 45" F) (3).

**Seedling** Development-Germination is thought to be enhanced when seeds are eaten and passed undigested by birds and mammals (7). Passage through the digestive system apparently softens the impermeable seedcoat. Enhanced germination can also be achieved by mechanically scarifying the seeds or soaking them in concentrated sulfuric acid or hot water (88° C, 190" F) for 1 to 2 hours. When hot water is used the water and seeds should be allowed to cool to room temperature or until seeds swell (3). Treated seeds should be sown promptly and not stored. Germination is epigeal.

Honeylocust seedlings show a growth pattern characteristic of deciduous hardwoods with sympodial growth. Persistent terminal buds are not formed and the shoot tip often dies and falls off *(5)*.

Nursery-grown seedlings from pretreated seeds attain suitable size-30 cm (12 in) or more in height—for field planting in 1 year (3). In southern Michigan, first-year seedlings grown in pots reached a height of 37 cm (14.6 in) by September 21, just before leaf abscission (5). The average root-to-shoot ratio was 2 to 3. Stem growth was slow in the spring but rapid in early summer and fall. Only 60 percent of the height growth was attained by mid-July. In an additional study in southern Michigan, nursery seedlings grown 3 years in pots and nearly two growing seasons outplanted in the field averaged 22 mm (0.9 in) in trunk diameter *(16)* by early autumn. The following year trunk diameter increased 4 mm (0.15 in>.

Dormant nursery-grown seedlings can be stored, barerooted, at about 0° C (32" F) for several weeks before outplanting with no appreciable loss in survival rate *(15)*.

**Vegetative Reproduction-Honeylocust coppices** freely. Propagation, particularly of high quality clonal stock, can be achieved by grafting, budding, and cuttings from hardwood, softwood, and roots (7). Root cuttings appear to be the best method of reproducing desirable strains in large quantities at reasonable cost. At times other species or varieties are grafted onto the rootstock of honeylocust (24).

Honeylocust thorn production usually diminishes gradually and finally ceases in the upper and outer crown growth as the tree ages. Thorns may still be produced on the lower trunk and on lower-trunk and limb sprouts. Typical trees, 10 years old or more, show a definite thornless region in the upper and outer shoot growth. When hardwood cuttings for propagation are taken from this thornless area, the scions generally remain thornless (6). Tree breeders can control the sex of scions from honeylocust by selecting unisexual budwood when taking cuttings. Certain branches bear only one type of flower, and trees from cuttings from those branches will bear only that type *(14)*.

### Sapling and Pole Stages to Maturity

**Growth and Yield-In** natural stands, honeylocust (fig. 2) attains a height of 21 to 24 m (70 to 80 ft) and a d.b.h. of 61 to 91 cm (24 to 36 in). On the best sites, trees may be 43 m (140 ft) in height and 152 to 183 cm (60 to 72 in) in d.b.h. On poor sites trees are stunted, wide-branched, and often covered with thorns. In eastern Nebraska, 18- to 35-year-old honeylocust in plantations grew an average of 4.6 cm (1.8 in) in diameter each 10 years.

The average height growth of honeylocust planted in shelterbelts from North Dakota to Texas was 49 cm (19.2 in) per year during the first 7 years (7). This was a slower height growth than for plains cottonwood *(Populus deltoides* var. *occidentalis)* and Siberian elm *(Ulmus pumila)* but faster than that of American elm *(U. americana),* green ash *(Fraxinus pennsylvanica),* or hackberry *(Celtis laevigata),* all of which were frequently planted on the same shelterbelt projects. Under favorable conditions the annual diameter growth of young honeylocust is from 8 to 13 mm (0.33 to 0.50 in) (22). The species is an excellent tree for windbreaks.

**Rooting Habit-Honeylocust** is deep **rooted** with a widely spreading and profusely branched root. system and a strong taproot. Deep soils are penetrated as far as 3 to 6 m (10 to 20 ft). The root system is responsive to environmental conditions. For example, in a Missouri study, 4- to 6-year-old saplings on upland clay soil produced root systems that were about twice as long, with laterals covering twice the area, as those of older trees growing in lowland alluvial soil where the water table was higher (7). The generalized, well-developed root system enables this species to grow on both upland and lowland sites.

**Figure** *2-A mature honeylocust in spring. (Courtesy James W. Hanover)*

**Reaction to Competition-Honeylocust** is classed as intolerant of shade, and reproduction becomes established only beneath openings in the forest canopy *(5)*. Both top and root growth are retarded where young trees are subjected to shade; therefore, for survival and optimum development, honeylocust must maintain a dominant position in the forest community. Lower limbs of forest-grown trees die when they are excessively shaded from the

sides, and the dead limbs often are retained for some time.

Honeylocust is occasionally a pioneer on midwest strip-mine spoil banks. It is also a pioneer in rocky limestone glades of Tennessee and Kentucky, where it is often succeeded by eastern redcedar *(Juniperus virginiana).* In northern Ohio, honeylocust was found with shellbark hickory *(Carya laciniosa)* and bur oak *(Quercus macrocarpa)* in the elm-ash-soft maple association on areas that formerly were swampy (7).

**Damaging** Agents-With the increased popularity and plantings of honeylocust, particularly the cultivars of thornless varieties, there has been a corresponding increase in the kinds and numbers of attacking insects. Generally, insect attacks are not fatal but they do weaken the tree and retard growth. Honeylocust is a host of a number of leaf feeders and severe infestations can rapidly defoliate trees. A severe and widely distributed defoliator is the mimosa webworm *(Homadaula anisocentra) (1).* The search for webworm resistant trees has not been productive *(17). Eotetranychus multidigituli,* a spider mite common to the midwest, and other mites feed on honeylocust leaves. Heavy infestations, occurring particularly in hot dry weather, will defoliate a tree. The whitemarked tussock moth *(Orgyia leucostigma),* the honeylocust plant bug *(Diaphnocoris chlorionis) (25),* the leaf hopper *(Empoasca pergandei),* and several other species of pod galls, leaf rollers, leaf hoppers, moths, loopers, bagworms, and beetles feed on honeylocust foliage. The walkingstick *(Diapheromera femorata)* is also included among the many defoliators *(21).*

*Agrilus difficilis,* a flatheaded borer, important west of the Mississippi River, burrows beneath the bark and may eventually girdle the trunk or large limbs *(18).* Several other bark and wood borers attack honeylocust, such as the widely distributed *Xyleborus saxeseni.*

A number of scale insects, such as the European fruit lecanium *(Parthenolecanium corni),* which is widespread and particularly damaging to shade trees, and the cottony maple scale *(Pulvinaria innumerabilis),* injure the bark of honeylocust, especially on small branches, lowering the vitality and growth rate of trees *(18).* Weakened trees become subject to attack and further damage by various species of boring insects and bark beetles.

The twig girdler, *Oncideres cingulata,* prunes small branches and can inflict severe injury on nursery seedlings. Heavy infestations can also severely damage large trees. The larvae of *Amblycerus robiniae,* a bruchid weevil, feed on honeylocust seed *(1).* The female periodical cicada *(Magicicada septendecim)* can damage honeylocust, especially young transplanted trees, by depositing eggs in the twigs.

Honeylocust is subject to few diseases, none of which interfere with its growth, except in isolated situations. The most noteworthy disease is the canker *Thyronectria austro-americana,* which can be fatal. Spiculosa cankers cause loss in merchantable wood volume or cull. Honeylocust is subject to several heart-rot and wood-decay fungi from species of *Fomes* and *Polyporus.*

Few leaf diseases attack honeylocust, and none mar the tree. The most widely distributed is tarry leaf spot caused by *Linospora gleditsiae (9).* In the seedling stage honeylocust is susceptible to cotton root rot *(Phymatotrichum omnivorum),* which is sometimes fatal (7). In shelterbelt planting tests in Oklahoma and Texas it was ranked as highly susceptible to certain *Phymatotrichum* root rots (27). Two other root diseases, *Ganoderma lucidum* and G. *curtisii,* can cause extensive root rot and tree fatality. The incidence of these root rots is not high.

In the southeast Texas area honeylocust was visibly damaged but not killed by air pollution, presumed to be mainly sulfur dioxide. In Illinois the species was ranked as highly resistant to ice damage and in Tennessee it was rated about average in resistance to flooding damage (9). It also appears to be resistant to salt spray when planted near the coast. Honeylocust is considered to be windfirm, but heavy limb breakage from wind was reported in Kansas. Because of its relatively thin bark it is easily damaged by fire (7). Rabbits sometimes inflict damage by gnawing the bark from young trees during the winter.

## Special Uses

Honeylocust fruits are readily eaten by cattle and hogs. The beans of some cultivars contain as much as 12 to 13 percent protein, and the pods contain up to 42 percent carbohydrates *(12,20).* Livestock also eat the young vegetative growth and both the fruit and plants are eaten by snowshoe hares and cottontails. Fruits are also eaten by gray squirrels, fox squirrels, white-tailed deer, bobwhite, starlings, crows, and opossum *(7,8).* Honeylocust is a source of honey during the short flowering period in spring.

Both the common honeylocust and its thornless varieties are planted for erosion control and for wind breaks; the thornless varieties are widely planted as shade and ornamental trees. In many urban areas thornless honeylocust has been planted as a replacement for the American elm (26).

The wood of honeylocust possesses many desirable qualities but is little used because of its scarcity (23).

The sapwood is generally wide and yellowish in contrast to the reddish-brown heartwood, providing an attractive grain. The wood is dense, very heavy, very hard, strong in bending, stiff, resistant to shock, and is durable when in contact with soil. It is used locally for fence posts, and also as lumber for pallets, crating, and general construction.

## Genetics

### Races and Hybrids

The honeylocust has wide genetic variations that have enabled improvement through selection. The northern races show relatively good winter hardiness and southern races bear fruit that is much more nutritious for stock feeding than that found on the trees in the north (6).

A number of horticultural forms have been developed and are widely cultivated, especially for shade and as ornamentals (24). Thornless honeylocust *(Gleditsia triacanthos* var. *inermis* Willd.) is thornless, or nearly so, and slender in habit; bushy honeylocust *(G. triacanthos* var. *elegantissima* [Grosdemange] Rehd.) is unarmed and densely bushy; Bujot honeylocust *(G. triacanthos* var. *bujotii* [Neum] Rehd.) has slender pendulous branches and narrow leaflets; and dwarf honeylocust *(G. triacanthos* var. *nana* [Loud.] A. Henry) is a small compact shrub or tree. Selected cultivars of the thornless forms have been patented. About 60 percent of the seedlings grown from thornless honeylocust seed are thornless (7).

*Gleditsia x texana* Sarg., the Texas honeylocust, is considered to be a hybrid of G. *aquatica* Marsh. and *G. triacanthos* L. (24). Its range is largely restricted to the Brazos River bottoms in Texas, with additional trees found along the Red River in Louisiana and occasionally along the Mississippi River in Indiana and Mississippi.

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