

Weeds and Man

By Robert F. Betz

There is probably no word used to describe plants which is subject to such a variety of meanings as is the word "weed." To most people who have little or no acquaintance with nature, any wild plant that has not been specifically planted is a "weed." Others consider a weed to be a plant that is out of place and growing where it is not wanted. To the grain farmer, the foxtail grasses and pig-weeds which grow among his crops and compete with them for nutrients and moisture are especially singled out as "weeds"; to the gardener, the smartweeds and lamb's quarters which he must continually pull in order to prevent them from overrunning his flower beds are "weeds"; and to the rancher who raises livestock, any plant which his animals cannot eat or refuse to eat, such as thistles or mullein, are "weeds." To others, any plant with inconspicuous flowers is called a "weed," whereas the term "wild flower" is reserved for those wild plants with beautiful and colorful flowers. All of the above uses of the term "weed" hinge on man's evaluation and his use of nature for his own ends. A more objective approach is to define a weed in terms of its place in a plant community.

AN ECOLOGICAL CONCEPT OF WEEDS

While the subject of plant succession is complex, a brief explanation of the process may help one to gain an ecological understanding of weeds. If a field is taken out of cultivation and left to develop unhindered, the vegetation will progress through a series of stages, called *succession*, during which various species will reach peaks of abundance while others decline. Eventually certain species will gain dominance over all others, gradually crowding them out, and will tend to perpetuate themselves indefinitely. This final stage is called the *climax vegetation* and may be, for example, a forest or a prairie. This succession to the climax vegetation may take centuries, and its outcome depends upon many factors, including climate, soil, and the species that are present or absent in the area. Once the climax stage is reached, the community is characterized by its relative stability and its ability to perpetuate itself. This was the condition of the land in Illinois before it was settled by the white man, with most of the vegetation approaching a climax or near-climax state. When such a climax vegetation is disturbed or destroyed, whether by natural forces such as fire and destructive floods, or by man's activities such as plowing or excessive trampling, a secondary succession will occur. If nothing interferes with this succession, the climax vegetation will again be restored.

The early stages in this secondary succession are usually composed of annual, biennial, or short-lived perennial plants, all of which produce abundant seed (some even in depauperate specimens that flower in spite of repeated mowing) which germinate easily, grow quickly on disturbed soil that has been plowed or trampled, and cannot stand the intense competition of the long-lived perennials which appear in the later stages of succession. For these fast-growing plants — both native and foreign — that spontaneously invade and grow in disturbed soil in the early stages of plant succession, we might use the term "weed." A few woody plants, such as box-elder and cottonwood trees, Japanese barberry, and some honeysuckles are just as much weeds as are the ragweeds and crabgrasses. They are plants which are opportunists — able to grow in disturbed soil such as freshly dug ditches, alluvial soils along rivers and streams, over-grazed and degraded woodlands — but which are soon eliminated by the more long-lived trees such as oaks and sugar maple which appear in the near-climax and climax stages of succession.



Cichorium intybus
common chicory or blue sailors

Even before civilized man destroyed the climax vegetation, there were probably scattered and isolated areas of disturbance — freshly deposited alluvium of rivers, eroding banks of streams, landslides, diggings of gophers and badgers, and the trampled and compacted earth around the water-holes used by bison and other hoofed animals. On and around these naturally disturbed sites there were a relatively few “native weeds” which were indigenous to the region. Here in Illinois, the greater ragweed, *Ambrosia trifida*, may have been such a native weed with its natural habitat being the alluvial floodplains of rivers. Eroding stream banks may have been one of the natural habitats of the tinted spurge, *Euphorbia commutata*. It is probable that there are very few species of these native weeds (at least in Illinois) and that in presettlement days they represented only a very minor part of the native vegetation. However, when the Europeans entered the region, they not only destroyed and seriously disturbed the climax vegetation, but they unwittingly brought with them a host of weeds from other geographical regions. Included among these “foreign weeds” were some which had evolved for thousands of years in the cultivated fields of the peoples of the Eurasian Middle East. When the Indians came into the area earlier, they, too, must have brought weeds that had probably evolved with the agriculture of the Indians of Central and South America.

THE ORIGIN OF AGRICULTURAL WEEDS

Prior to the Neolithic Age during which man began to domesticate animals and cultivate plants, the ancestors of present-day crop plants and of weeds were members of natural plant communities somewhere in the world. As man discovered uses for some of these plants, he took them out of the natural communities and grew them under semi-natural or artificial conditions, first on dump-heaps around the villages and finally in cultivated fields and gardens. As man consciously selected for cultivation those plants which exhibited certain characteristics which interested him, he also, unwittingly, “selected” the characteristics of the weedy plants that moved into his cultivated fields from the surrounding natural communities. The type of agriculture that was practiced by man in early times—and even up to relatively recent times—favored those weeds which most closely resembled the cultivated crops in their height, rate of growth, the size and shape of their seeds, and their time of bloom and setting of seed. Also, because of yearly plowing of the fields, there was a tendency to favor plants which were annual rather than perennial. In some cases, these weedy plants became so adapted to being cultivated with a crop plant that they could no longer exist independently and ceased to grow in the wild state. Thus certain weeds have become, in effect, “cultivated” plants and even tend to disappear from a region when the crop plant is no longer grown. An example is corn cockle, *Agrostemma githago*, which is closely associated with wheat or rye fields and has almost ceased to be found in Illinois as the cultivation of these crops has diminished.

Even before man began to cultivate plants, it was possible for new varieties and strains of plants to occur, either as a result of mutation, of hybridization between distinct species, or as a result of spontaneous changes in the numbers of chromosomes in reproductive cells (polyploidy and aneuploidy). However, there were few opportunities for such new plants arising in undisturbed natural communities to find a place in which they could perpetuate their kind. The destruction of native plant communities throughout the world by man has probably been one major stimulus to the creation of weeds, by providing new habitats for them to occupy and in which to maintain themselves and by increasing opportunities for hybridization and chromosome changes to occur.

Under natural conditions, two distinct species may be prevented from interbreeding because they live in completely different habitats; if occasional interbreeding between them does occur, the re-

sulting hybrid offspring can find no suitable place to grow because they are unable to compete with either of the parent species in their own undisturbed habitats. However, in clearing and cultivating the land, man not only destroys previous geographical and ecological barriers to the hybridization of these two species, but also provides a new habitat in which some of the variable hybrid offspring, if fertile, may be able to flourish. In Great Britain, for example, there are two native species of hawthorns which hybridize freely and form fertile hybrids: *Crataegus monogyna*, of open scrub areas, and *Crataegus oxyacantha*, of damp woodlands. It has been observed that the amount of hybridization is related in some way to the extent of disturbed woodlands. It is possible that one or both of these parent species eventually may be unable to persist because of destroyed habitats. This is especially true of *C. oxyacantha*, since the damp woodlands where it grows are rapidly disappearing.

Similarly, in the case of weeds, the parent species may no longer exist. Of course, it is remotely possible that some of the original wild strains from which Eurasian weedy plants have arisen could still exist in the wilder parts of Eurasia. On the other hand, the more abundant weedy strains, growing in disturbed habitats, may have crossed with the wild strains growing on undisturbed soil, developing new and more aggressive strains which have replaced the parent species. It would seem that the almost complete destruction of the native plant communities in Eurasia would leave very little habitat now suitable for the genetically unchanged "wild" Eurasian strains.

A few species of weeds are circumpolar, that is, they originally seem to have been members of natural plant communities both in northern North America and northern Eurasia, and have evolved on both continents. In some species there are now visible differences between the varieties that are found on the different continents. The Eurasian variety of selfheal, *Prunella vulgaris* var. *vulgaris*, for example, tends to have leaves that are relatively broader than those of the American variety, *Prunella vulgaris*, var. *lanceolata*, and differs in other ways. In most circumpolar plants, however, the Eurasian variety does not differ substantially in its appearance, but may differ in habitat. (An example is cleavers, *Galium aparine*, which in North America is a modest component of woodland vegetation, while the European strain — whether in Europe or in North America, where it has been introduced — is found on dump heaps and dirt piles.) It may be surmised that because Eurasian strains have coexisted with man's civilization for thousands of years, they have become especially adapted to living in disturbed habitats.

GEOGRAPHICAL ORIGINS OF OUR MIDWESTERN WEEDS

While certain weedy plants seem to have been indigenous to the Chicago region, most of our present-day weeds have come from other parts of North America and from other parts of the world. Of the approximately 400 weeds found in the Chicago region, nearly 70% of them are from Eurasia, about 25% are from parts of North America (especially the semi-deserts of the Southwest), and about 5% are from eastern Asia and elsewhere.

Most of the weeds of Eurasian origin can be traced to the desert and semi-desert areas of the Middle-East — Iraq, Iran, Pakistan, Arabia, Turkestan, and southern Russia — and are just as weedy in Europe and in parts of eastern Asia as they are in North America. It is unfortunate that many of our botanical works cite the continent of Europe as the source for many of our common weeds, and, in fact, a number of the European botanists assume that these plants are indigenous to Europe. It is now becoming apparent from the study of pollen grains obtained from borings in peat bogs in northern Europe, that many of the weeds that were assumed to be native there did not

make their appearance until after the first agriculturists arrived in early Neolithic times. Since Europe has been settled by agricultural man for a much longer period of time than North America, it would stand to reason that a higher portion of the present-day flora of Europe would be foreign and, in most cases, weedy.

After 130 years of agricultural settlement in the Chicago region, approximately 20% of our flora (about 400 of approximately 1900 species found here at present) is composed of weedy, non-indigenous plants. After 4,000 years of agricultural settlement, the British Isles have approximately 55% of their flora (1,100 of 2,000 species) consisting of weedy, non-indigenous species. During each decade, new occurrences of weedy species are reported in the Chicago region, and in the future the percentage of non-native weeds will continue to increase as it has in almost every other region settled by man.

Some idea of the rate of introduction of these weeds into Illinois can be gained by noting that in a list of plants compiled by S. B. Mead in *The Prairie Farmer* for 1846, only about one-fourth of the present number of weeds were reported as occurring in this area. Between 1850 and 1950, approximately 285 additional weedy plants were reported in Illinois, an increase of about 28 plants per decade. With increased commerce between all parts of the world, it is possible that as many as 50-100 additional weeds could be reported in our area during the next three decades (to 2,000 A.D.). However, the increasing use of 2,4-D and other herbicides, as well as factors presently unforeseen, may prevent this number from being introduced. One thing is almost certain: with the continual destruction of native plant communities, continued degradation of the landscape, lowering of the water table, and increased world commerce, the number of species of weeds found in the Chicago region will gradually increase. In fact, our flora may someday differ very little from that of London or Peiping. From some points of view, this is not a pleasant prospect.

Not only has there been an increase in the number of species of weeds occurring in the Chicago region, but with time there has been an increase in the percentage of ground which they occupy. When settlement began, most of Illinois was covered with native vegetation in the climax and near-climax stages of succession. In less than 150 years, modern man has succeeded in destroying some 95% of this native vegetation in our state and has replaced it with buildings, paving, cultivated crops, landscaping, and, unintentionally, weeds. Whereas there were almost no weeds when the first settlers came, weeds introduced from all parts of the world now compose at least 95% of the unstable and constantly changing vegetation that occupies nearly every roadside, vacant lot, abandoned field, and other disturbed area.

Some of the plants which were introduced into North America by man for useful purposes have escaped from cultivation to become weeds. The white sweet clover, *Melilotus alba*, was introduced from Europe for use as fodder; asparagus, *Asparagus officinalis*, from Europe as a food plant; hemp or marijuana, *Cannabis sativa*, from Asia for its fibers; and horehound, *Marrubium vulgare*, from Europe for its medicinal or supposed medicinal qualities. From eastern Asia the white mulberry, *Morus alba*, was brought to supply leaves for the culture of silkworms. Catalpa, *Catalpa speciosa*, was brought to our area from the southern states as a source of wood for railroad ties and fencing. The Osage orange, *Maclura pomifera*, (another plant from the southern states) and, more recently, the multiflora rose, *Rosa multiflora*, (from eastern Asia) were introduced as "living fences or hedges" because of their thorns and their ability to develop into a thick hedge. The orange day-lily, *Hemerocallis fulva*, (from Eurasia) was grown in gardens and cemeteries because of its colorful flowers.

Many weeds have been introduced accidentally by the importation of impure grain seed contain-

ing weed seed, as is the case with tumble mustard, *Sisymbrium altissimum*, from Eurasia; other seeds have been introduced in ballast that was dumped from boats and trains, and seeds even have been carried in the shoes or cuffs of travelers.

Of course, every part of the world that has been settled by man has been disturbed and invaded by exotic weeds. A number of weeds from North America, such as horseweed, *Erigeron canadensis*, and peppergrass, *Lepidium virginicum*, have been introduced into Eurasia. The East Indian balsam, *Impatiens glandulifera*, has been introduced into England; the Eurasian yellow star-thistle, *Centaurea solstitialis*, into South America; and the South American Jerusalem cherry, *Solanum pseudo-capsicum*, into Europe. The tropical regions of the earth have their own particular types of weeds, too. For example, the tropical milkweed, *Asclepias curassavica*, from the American tropics is now found throughout the tropical regions of the earth as a weed.

WEED COMMUNITIES AND HABITATS

The communities in which weeds grow tend to be unstable. For this reason the vegetation may change in composition from year to year, sometimes very drastically. The major dominant at one time may be short ragweed, at another time lamb's quarters, and at another time, Queen Anne's lace. Since pre-Civil War days when the groves and prairies of the Illinois country began to be destroyed, certain weedy species have invaded, become serious pests for a time, but then have subsided and sometimes even died out. In the early days of settlement, dog fennel, *Anthemis cotula*, was a pest and blanketed the roadsides with its small white flowers. Later the Canada thistle, *Cirsium arvense*, became a pest, and laws were enacted to eradicate it. After World War II, the Mexican fireweed, *Kochia scoparia*, invaded the Chicago area, became a pest, and still grows in almost every vacant lot of the inner city. Others that have been or are becoming pests today are the nodding foxtail grass, *Setaria faberii*, in corn and soybean fields; hedge garlic, *Alliaria officinalis*, in disturbed forests; and the musk thistle, *Carduus nutans*, in meadows and pastures.

Similar cases in which certain weeds have reached sudden peaks of abundance elsewhere occurred after the Great Fire of London in 1666, when the London rocket, *Sisymbrium irio*, attained high populations among the ruins of the city. After World War II, London was again overrun by a weed, this time the fireweed, *Epilobium angustifolium*, which grew in great quantities on the "blitzed" areas.

Weeds, characteristically, are not tied to a few specific conditions, but have wide ecological tolerances; they generally grow in many types of soil, in full or partial sunlight, and some can resist trampling and mowing. However, some of them do exhibit preferences and are more likely to be found growing in definite situations. In the Chicago region, some species, such as dog fennel, *Anthemis cotula*, are frequently found in moist places that have much organic matter in the soil, as around barnyards or on roadsides saturated with manure. Some species, like chicory, *Cichorium intybus*, prefer gravelly clay that is denuded of topsoil; others, such as the sandbur grass, *Cenchrus longispinus*, prefer sandy soils. Kentucky blue grass, *Poa pratensis*, is still present after overgrazing; wild parsnip, *Pastinaca sativa*, and many others can tolerate annual mowing; the common knotweed, *Polygonum aviculare*, persists in spite of severe trampling and the consequent compacting of the soil. The European buckthorn, *Rhamnus cathartica*, is found in disturbed and degraded woodlands, while the bladder campion, *Silene cserei*, thrives on the cinder ballast of railroads.

Certain weeds are primarily inner-city weeds, growing in the cracks of sidewalks as does the Mexican tea, *Chenopodium ambrosioides*, or under porches and in dark gangways as does the common day flower, *Commelina communis*. Others are primarily suburban, growing best in closely mowed lawns,

as for example, the red-stalked plantain, *Plantago rugelii*. Another, the rush cat-tail grass, *Heleochloa schoenoides*, even grows in the oil-soaked ground around factories.

Some weeds in the Chicago area tend to be less aggressive and are rarely recorded here, such as the Scotch thistle, *Onopordum acanthium*; the strawberry clover, *Trifolium fragiferum*; the puncture vine, *Tribulus terrestris*; and the scarlet pimpernel, *Anagallis arvensis*. A constant search of railroad tracks and yards, city dumps, and stockyards will reveal some rare and interesting weeds which may even be new additions to the flora of the Chicago area or of Illinois.

THE FUTURE OF WEEDS

Although humans may have some disdain for them, weeds are in many ways a mirror of man and his activities. If they are aggressive and coarse, tending to replace the more desirable native plants, is it not because we have created the disturbed habitats which require that plants be tough and adaptable if they are to survive? The Illinois countryside was once a beautiful mosaic of prairies and forests, with diverse habitats for countless blooming flowers and abundant animals; the air was pure, and clear meandering streams and rivers flowed over gravel bottoms. Today "civilized" man has "improved" the countryside by manipulating the topography until we have a degraded landscape, its barren soils populated by weedy plants and weedy animals; polluted streams have silted bottoms washed from the surrounding eroded fields, and the atmosphere is dust-filled and smoky.

What might happen now if man and his activities were to begin slowly to disappear? It is possible that the native plants of the climax vegetation which have become naturally adapted to live in this geographical area and under this climatic regime might slowly increase in numbers, eventually replacing the foreign weeds that have been introduced. Such weeds probably would be unable to survive the intense competition of the native plants of the forest and prairie without man's continual though unintentional "protection." After two or three centuries a botanist might even consider it rare to find a dandelion, an ox-eye daisy, or a red clover.

Of course, in all probability man and his activities will not diminish sufficiently for this to happen. In fact, he will undoubtedly continue to increase, and as he disturbs even greater expanses of land, the last remaining native vegetation will probably be destroyed and replaced by buildings, pavement, croplands, and weeds.

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<i>Climatological Summary</i>			
<i>Data</i>	<i>February</i>	<i>March</i>	<i>April</i>
<i>Average mean temperature</i>	23.8° F	42.6° F	51.3° F
<i>Highest temperature</i>	53° F	77° F	80° F
<i>Lowest temperature</i>	—3° F	10° F	20° F
<i>Days maximum below 32° F</i>	10	0	0
<i>Days minimum below 0° F</i>	4	0	0
<i>Precipitation</i>	1.40"	1.36"	2.51"