



Apple trees near good cover make an ideal habitat combination for many species during fall and winter.

Food and Cover For Wildlife*

Many Woody Plants Provide Both These Necessities on a More Permanent Basis

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THE improvement of the environment as a means of increasing wildlife is given by Leopold (5) as the last step in the sequence of measures used in any region. It is only during the last two decades that anything has been done with song birds along that line in this country, and only during a much shorter time has anything been done for the environment of game species.

Although annual food patches have a very definite and valuable place in wildlife management, for some uses plantings with woody species have many advantages over those made with herbaceous materials. Many of the woody plants produce a large volume of food material per unit of ground area; they are especially valuable in erosion control; they require little care and, what is most important, persist for years. Many woody species have a high ornamental value and the conifers are, of course, the *best* group of cover plants.

Permanent plantings have many uses in wildlife work. In areas where clean farming is the rule and where woodlots are heavily grazed, they are a necessity for both food and cover. (3) In sections which are forested but which lack food, they are equally valuable. Where hardwoods cover large areas and winter protection is needed, coniferous plantings provide this and, at the same time, can be made to produce timber or Christmas trees. These permanent plantings can

be made to serve as very effective escape covers in regions of heavy hunting. They are also favored nesting sites for both song and game birds especially in farming areas. With the pheasant they also help to provide more crowing territories



The wild grape makes a fine cover tangle and provides abundant food.

and hence increase the potential rate of increases on a given area.

When the question of plant characteristics is raised, there is little information available. Most of the work done on the woody plants has been either from the standpoint of timber produc-

tion or of landscape work. With the conifers used in forestry there is fairly good information available on the periods between seed crops, their volume production, etc., but with the hardwoods this is practically lacking. The landscape approach in work with the shrubs and trees has been most concerned with colors, sizes, shapes and soil requirements and, since they are not attractive ornamentals, many of our best food species are not considered. In other words, the information most needed from a wildlife standpoint has yet to be obtained with most species.

Whether a given plant is adapted to use at a particular location depends on a number of things. On many of the plants which are apparently ideal, there is no information. It seems dangerous to rely on foreign information as applying to our conditions. As an instance, European literature on shrub planting for wildlife almost universally recommends privet, but the writer has never been able to observe any bird or mammal eating the fruit and has only had records of the cedar waxwing using it.

The next consideration is whether or not the plant will be hardy. Winter temperature is the greatest factor in deciding this. Such a textbook as Rehder's *Manual of Cultivated Trees and Shrubs* gives the zone limiting the northern range of each species and many of its other known characteristics. We must know whether a fruit-bearing plant will afford food when it is most needed by wildlife. In the northern states the most critical time is, of course, in winter, and there is little use in plant-

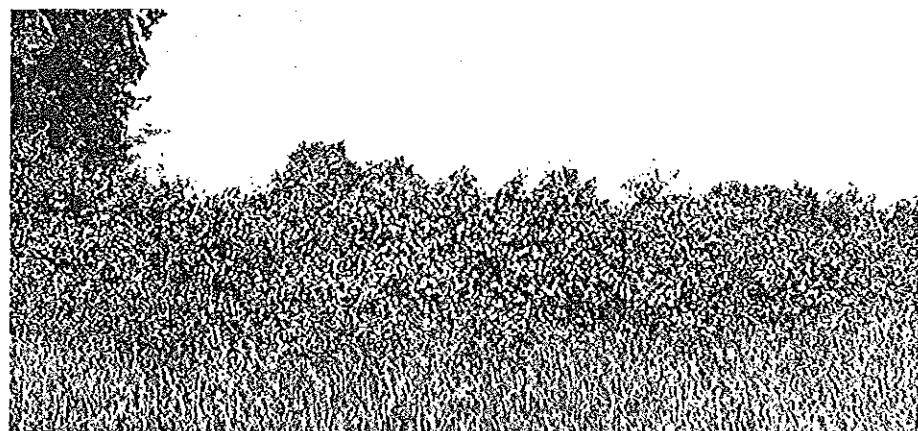
*This paper applies particularly to North-eastern United States.
Presented at the North American Wildlife Conference (1936).

ing a species the fruit of which is all gone by summer or early fall. Also a species which holds its fruit well into the winter in one region may lose it by early fall in another, so local information is very necessary. The woodbine holds its fruit well into the winter in southern Michigan but never seems to do this in Massachusetts.

To be of the most value for food, a species must fruit regularly and in sufficient quantity to be important. Whether the fruit decomposes early or, as in the case of some of the hawthorns, remains plump, firm, and bright over winter is another very important point. Competition for the available food increases as winter advances, and a fruit available in late winter or early spring is especially valuable.

Many species will grow only on certain types of soil, but little is known about this phase. Some kinds of plants require cultivation of the soil or won't thrive in competition with grass and weeds. Since most of the observations have been made under more or less artificial conditions, we know little about this. Some species, of course, carry diseases or pests that affect agricultural crops. An example of this is the common barberry which is the alternate host for wheat rust. The closely related Japanese barberry is immune to this rust.

Granted that we can grow a given species of plant, we are usually still in the dark as to the nutritive value of the fruits. We need for many species studies similar to those of Maynard et al. on the values of various kinds of



The bittersweets are well adapted to stone wall plantings.

browse to deer. (6) Generally speaking, the nuts such as the hickories, hazel, beechnut, butternut, and black walnut have a very low water content, about twice the protein content of corn, very high fat and very low carbohydrate contents. The acorns and chestnuts are much lower in protein and higher in carbohydrate contents. These hard-

shelled nuts are, of course, mainly limited to use by the squirrels.

The few pulpy fruits on which analyses have been made show a high water content, a protein content similar to that of corn, varying amounts of fat, and



A natural food and cover patch, dogwood (*Cornus obliqua*) beneath apple trees.

carbohydrate contents approximately like corn. The available analyses are not strictly comparable between groups because they come from two sources and the methods of computing percentages are obviously different with the carbohydrates and apparently with water. Table I gives some of the available information on nuts and fruits with that for corn and grasshoppers given for comparison.

These few analyses show that the materials covered are valuable foods for wildlife when considered from the usual standard of chemical makeup.

One of the greatest values of fruits

as astringents or vermifuges. (5) The use of a plant species as food by wildlife must be taken as an empirical measure of its value. Table II is an attempt to summarize some 52 references on food habits including such outstanding pieces of work as that of Stoddard on the Bobwhite quail, Kelso on ruffed grouse foods in the Northeast, the work of the New England Ruffed Grouse investigation, etc. (4)

Some of the outstanding plants in this list have known characteristics which are very valuable from a wildlife management standpoint.

The black chokeberry, *Aronia melanocarpa*, usually bears only light crops, but a group growing on a cinder dump in a railway grade and loaded with fruit suggests its use on abandoned roadbeds. It can be propagated by dividing plants or from seed stratified 90 days at 32-41° F.

The Japanese barberry bears regularly and heavily and does well on dry soils. It is a valued ornamental on account of its red fruit which is held until spring. It can be grown from seed sown in the fall or stratified until spring.

The hickories, butternut, walnut, and oaks require a long period in which to reach bearing age; but once this is reached, the amount of food produced by a single tree is a real contribution to the welfare of local wildlife. They are grown from seed stratified over winter.

The native bittersweet makes a good cover tangle and produces a fair crop of fruit. The plants are either male or female, but the females produce enough male flowers for fertilization. The oriental bittersweet, *Celastrus articulata*, is more vigorous, bears heavier crops, and holds its fruit longer than the na-

to wildlife is apt to be through the vitamins or other special properties. Little is known about the vitamin requirements of wild animals or of the vitamin contents of any except the domestic fruits. However, from experiments with these, it is reasonable to suppose that the other fruits are a good source of vitamin C. This pre-

vents scurvy, regulates growth, digestion and condition of the heart and prevents blood disorders and bone brittleness. (8) Leopold also suggests that some fruits may be the source of necessary minerals and that others may act

tivo species. Either species is an attractive ornamental. On account of the sex character, they are best propagated from the female plants by layering. They can also probably be grown from root cuttings.

Of the dogwoods the panicle species

of the most striking ornamentals. The species transplants well.

Of the honeysuckles the Maack's or Amur species, *Lonicera Maackii*, shows most promise for wildlife. It is a large, spreading shrub or small tree. Its heavy crops of dark red berries are borne in

September or October and persist well into the winter. The plant makes a very good specimen shrub. The Chinese form, *L. Maackii podocarpa*, is freer growing and its fruits persist longer than the type. The seeds germinate well when stratified over winter, and dormant cuttings are successful.

The apple is by far the most widely used woody food species of the Northeast. The many varieties differ widely in hardness, abundance of fruit produced, vitamin content, etc. The Japanese crab, *Malus floribunda*, shows great promise of use by wildlife. It bears heavily almost every year; its fruits are small; they persist until spring, and it is a common sight at the Arnold Arboretum to see pheasants feeding on the fruit both in and under these trees in winter. *Malus Soularzii*, a hybrid between a crab and the common apple, is remarkable for its vigor and heavy, regular fruit crops. Its fruits are two inches or more in diameter. The plants are best propagated by budding or grafting.

The poplars, black and yellow birch,

seems to be the most promising. It bears well and holds its fruit well in southern Michigan but doesn't seem to do so in Massachusetts. Its fruits are so eagerly sought by the songbirds that heavy crops disappear some years before frosts come. The plants can be grown from seed or cuttings.

The hazelnuts, *Corylus americana* and *C. rostrata*, are adapted to use as woodland borders or as "fillers" in planted groups. Their fruits are attractive human food, the first-named species being larger and easier to husk. The hazels grow well from seed stratified over winter; the plants sucker; they can be easily layered and transplant well.

The hawthorns are an almost endless group as far as species are concerned and are as variable as numerous. At the Arnold Arboretum it seems that species from farther south hold their fruits better than the native ones. Some of the better species for wildlife plantings are *Crataegus monogyna*, *C. oxyacantha* and, as far north as southern Michigan, central New York and central Massachusetts, *C. phaenopyrum*. The seeds of *crataegus* need afterripening for a year at 41-50° F. The plants transplant well.

The silver-berry is a shrub or small tree with leaves silvery on both surfaces. It does well on poor or dry soils and is especially good for use on lake fronts. It is easily propagated by moving the suckers which develop around old plants.

The black alder is a shrub often found in swamps, but it does well on any upland soil which is moderately cool and moist. It holds its bright red fruits well into the winter and is one

TABLE I
Chemical Composition of Some Fruits and Nuts with Corn and Grasshoppers for Comparison

Material	Approximate Per Cent Water	Protein	Fat	Carbohydrates	Nitrogen free extract
Late apples	83.6	.3	.3	15.5	
Blackberry	85.3	1.2	1.1	11.9	
Blueberry	83.4	.6	.6	15.1	
Crab apples	81.1	.4	.3	17.8	
Hawthorn	75.8	2.0	.6	20.8	
Mulberry	82.8	1.2	.6	14.6	
Red raspberry	83.4	1.1	.6	14.4(1)	
Chestnut	33.45	10.19	10.20		42.35
Acorns (dry)	2.38	7.07	4.85		80.97
Butternut	4.5	27.9	61.2		3.4
Black walnut	2.5	30.3	57.8		5.8
Hickory nut	3.97	20.5	64.6		6.4
Hazel nut	3.7	15.6	65.3		13.0
Beech nut	4.0	21.9	57.4		13.2
Chokeberry	5.08	8.72	5.17	77.88	
Frost grapes	11.63	9.49	4.76	70.13	
Nightshade	10.41	13.94	12.53	58.67	
Panicle dogwood	3.61	10.11	18.82	64.70	
Grasshoppers	1.91	71.27	3.54	19.6	
Corn	12.9	9.3	4.3	74.8 (digestible) (10)	

TABLE II
Use of 45 or More Important Northeastern Woody Plants by Wildlife (X indicates known use)

Plant species:	Ruffed grouse	Hungarian partridge	Pheasant	Bobwhite quail	Sharp-tailed grouse	Prairie chicken	Deer (white-tailed)	Moose	Snowshoe hare	Cottontail rabbit	Squirrels	Songbirds
<i>Aronia</i> , chokeberry	X	X	X	X	X					X	X	X
<i>Berberis Thunbergii</i> , Japanese barberry	X	X	X	X	X					X	X	X
<i>Berberis vulgaris</i> , Common barberry	X	X	X	X	X					X	X	X
<i>Betula lenta</i> , black birch	X				X	X	X	X		X	X	X
<i>Betula lutea</i> , yellow birch	X				X	X	X	X		X	X	X
<i>Carya</i> , hickory	X						X			X	X	X
<i>Celastrus scandens</i> , bittersweet	X		X	X	X					X	X	X
<i>Cornus</i> , dogwood	X		X	X	X					X	X	X
<i>Cornus paniculata</i> , panicle dogwood	X		X	X	X					X	X	X
<i>Corylus</i> , hazel	X		X	X	X	X	X	X		X	X	X
<i>Crataegus</i> , hawthorn	X	X	X	X	X	X	X	X		X	X	X
<i>Elaeagnus argentea</i> , silver-berry	X		X	X	X	X		X		X	X	X
<i>Hex verticillata</i> , black alder	X		X	X	X	X				X	X	X
<i>Juglans cinerea</i> , butternut						X	X			X	X	X
<i>Juglans nigra</i> , black walnut						X	X			X	X	X
<i>Juniperus communis</i> , pasture juniper		X				X	X			X	X	X
<i>Juniperus virginiana</i> , red cedar				X		X	X			X	X	X
<i>Lonicera</i> , honeysuckle				X		X	X			X	X	X
<i>Malus</i> , apple	X		X	X	X	X	X		X	X	X	X
<i>Myrica</i> , bayberry	X	X	X	X	X	X	X			X	X	X
<i>Parthenocissus quinquefolia</i> , woodbine	X		X	X	X	X	X			X	X	X
<i>Populus</i> , poplar	X				X	X	X	X	X	X	X	X
<i>Prunus serotina</i> , black cherry	X		X	X	X	X	X			X	X	X
<i>Quercus</i> , oak	X				X	X	X		X	X	X	X
<i>Quercus alba</i> , white oak			X			X	X			X	X	X
<i>Quercus borealis</i> , red oak						X	X			X	X	X
<i>Rhus</i> , sumach	X			X	X	X	X			X	X	X
<i>Rhus copallina</i> , winged sumach	X		X	X	X	X	X			X	X	X
<i>Rhus glabra</i> , smooth sumach	X	X	X	X	X	X	X			X	X	X
<i>Rhus hirta</i> , staghorn sumach	X				X	X	X			X	X	X
<i>Robinia pseudoacacia</i> , black locust	X			X	X	X	X			X	X	X
<i>Rosa</i> , rose	X		X	X	X	X	X	X	X	X	X	X
<i>Rubus aculeatissimus</i> , red raspberry	X		X	X	X	X	X			X	X	X
<i>Rubus allegheniensis</i> , blackberry	X	X	X	X	X	X	X			X	X	X
<i>Smitlax</i> , green brler	X				X	X	X			X	X	X
<i>Solanum Dulcamara</i> , deadly nightshade	X		X	X	X	X	X			X	X	X
<i>Sorbus</i> , mountain ash	X				X	X	X			X	X	X
<i>Symphoricarpos racemosus</i> , snowberry	X	X	X	X	X	X	X			X	X	X
<i>Taxus canadensis</i> , ground hemlock						X	X			X	X	X
<i>Thuja occidentalis</i> , white cedar						X	X		X	X	X	X
<i>Tsuga canadensis</i> , hemlock						X	X		X	X	X	X
<i>Vaccinium</i> , blueberry	X	X	X	X	X	X	X			X	X	X
<i>Viburnum Opulus</i> , highbush cranberry	X		X	X	X	X	X			X	X	X
<i>Vitis</i> , grape	X	X	X	X	X	X	X			X	X	X

sometimes regarded as "weeds" in forestry, provide buds and catkins which are very attractive to the ruffed and sharp-tailed grouse. Enough should be left in forest stands to provide for this use.

The black cherry is a timber tree which, when allowed to develop a large crown, produces heavy crops of fruit nearly every year. The fruit falls from August to October but remains usable on the ground for some time. The tree is fast growing, but is regularly attacked by the tent caterpillar, a serious enemy of commercial orchards. The plants are grown from seed after ripened 60-90 days at 40° F.

The black locust has many uses. It is a very good species for posts; it is being widely used in erosion control; it is a legume and hence a soil improver and produces good crops of small, bean-like seeds which fall from the pods during winter. The plants are easily grown from seed stratified over winter or scalded with boiling water before sowing.

The nightshade, a half-woody climber, does well in either swamp or upland soils. It ripens its red berries from August to October and they persist well into the winter. This is an outstanding pheasant food. It can be reproduced by either root or stem cuttings.

The highbush blueberry, *Vaccinium corymbosum*, is an acid soil plant of either the swamps or uplands. It produces good fruit crops nearly every year and needs no introduction as a

human food. The fruits fall by the middle of October, but the dried berries are available from the ground for some time after. The plants sucker freely and transplant well.

The highbush cranberry is especially recommended for moist sites in acid soils. The bright red fruits ripen in August or September and persist until spring. The plant is a valuable ornamental but is subject to aphid attacks. Propagation is by means of suckers, layers, or from seed which, however, requires a special after-ripening treatment.

The various species of wild grape need no recommendation as food for the game and song birds. The fruits fall with heavy frosts, but pheasants have been found digging through 8 inches of snow to get the dried fruits in February. The vines are especially useful running over fences, walls, steep banks, etc. The plants can be easily reproduced by cuttings. (4)

Among the conifers suited for cover plantings, white and red pine succeed on all but the sandiest soils where jack and Scotch pine can be used. Norway and white spruce do well only on the better soils, avoiding sands at one extreme and clays or wet locations at the other. Douglas fir grows well in the northeastern states, but is apt to be killed in some locations, at least, by a disease of the needles. Where conifers are planted for cover and timber production is not an object, wide spacings such as twenty feet between trees allow them to keep their lower branches alive

to the ground and provide cover for a much longer period.

In conclusion, we can say that from the standpoint of information on food production from woody plants, use of the fruits by wildlife and nutritive value to wildlife, we are just making a beginning. It will be years before we will know the complete answers to many of the important questions involved and, in the meantime, we will have to be guided by experience and the little other information that is available.

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