

seasonal and year-to-year mast production. Also, scout for and retain some vines that provide soft mast such as wild grape, Virginia creeper, and poison ivy. Some of the soft mast species like wild grape can cause problems with timber development, especially on highly productive sites when they are regenerated. However, grape is a valuable wildlife food, and most foresters recognize the need to keep a moderate amount of grape in a stand. If the abundance of grape is seen as a problem for future woodlands regeneration, some grape can be controlled to ensure that it does not overrun a regenerating stand.

To maintain high levels of hard mast, particularly oaks, scout the woods for trees that have abundant acorn crops. Remember that oaks, like many tree species, vary from year to year in their production of nuts. After those good trees have been identified, mark them, and make sure they have plenty of room to grow and flourish. One of the best methods for ensuring their vigorous growth is to use a crown touching release. This is accomplished by removing neighboring trees whose crowns are touching or competing with the crown of your mast tree. You might also remem-

ber that during the marking phase, it is always good to have a mixture of both red and white oak species because white oak acorns are preferred over red oak acorns, but some red oak species, such as scarlet or pin oak, produce acorns on a more consistent basis.

Creating Wildlife Openings

Openings in woodlands that are large enough to provide for the establishment of a new age class can provide significant browse (Figure 2). You can create these openings yourself or they can easily be established using a timber harvest. As these areas rapidly regenerate, they

continued on page 8

Table 1. Preferred native hard and soft mast species for wildlife management in hardwood forests.

Hard Mast Species	
oaks – white oak	White oak is highly preferred due to its palatability and medium size.
oaks – red and white	Mix white and red oak species, especially those with small to medium size acorns. Mixing species helps ensure consistent year-to-year production. Species with especially large acorns, such as bur oak and overcup oak, are less preferred by a range of species.
American beech hickory, pecan black walnut	Consistent producer of relatively large mast crops. Squirrels love the nuts. Both hickories and pecans provide abundant mast. Preferred by squirrels, Limited use by other game species.
Soft Mast Species	
wild grape dogwood, serviceberry black cherry persimmon berries – black, raspberry	Preferred food for a large number of species. Flowering and fruit production are increased when trees are located on edges of openings Used by songbirds. Highly preferred by a large number of game and non-game species. Edge and early successional foods preferred by a large number of species, Typically can be found in regenerating openings in uplands for the first three to four years.
vines, poison ivy, Virginia creeper	Many times considered nuisances. Various species of vines do contribute to significant soft mast production. Songbirds love the berries and spread them.
blackgum, tupelo	Used by songbirds.

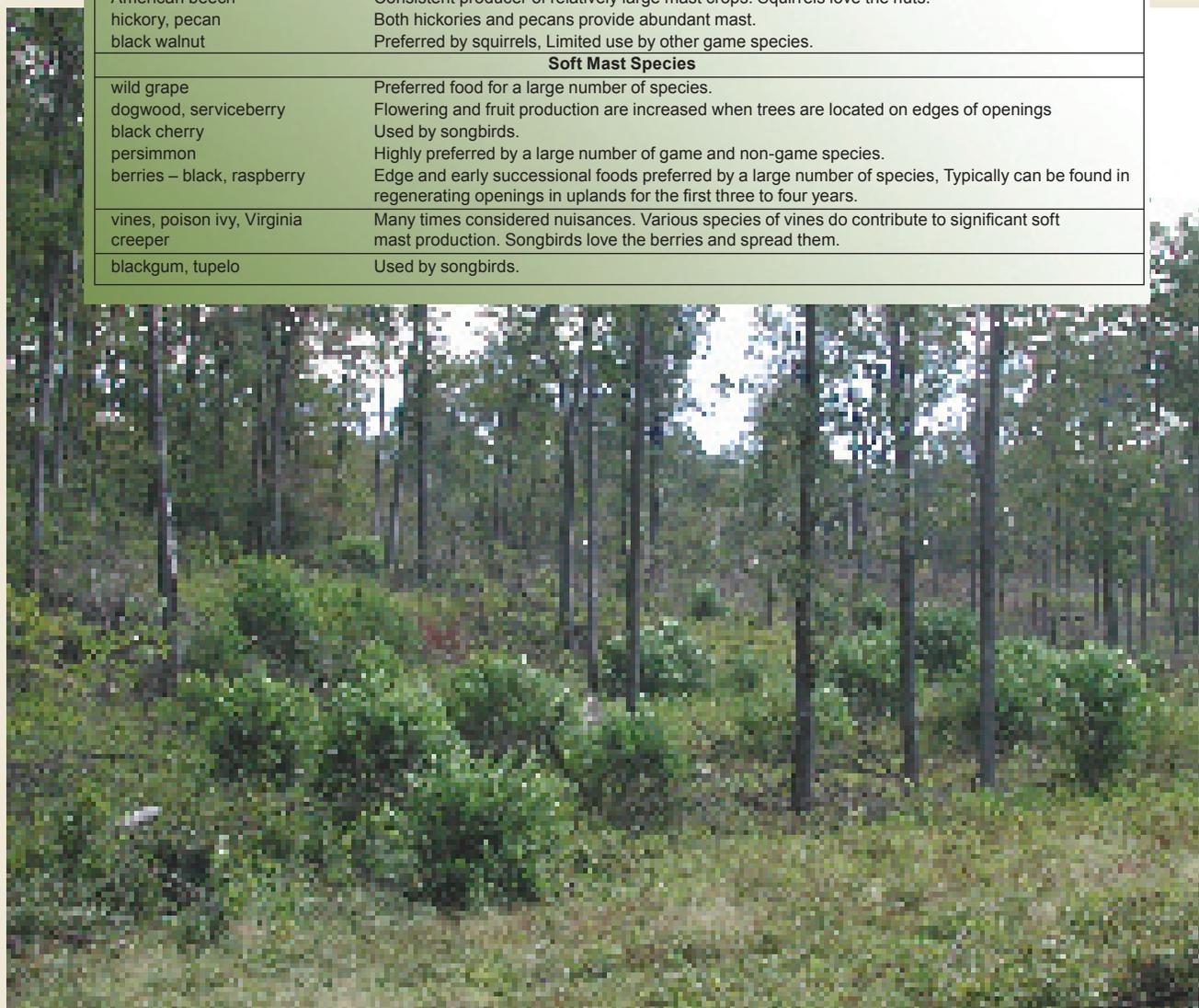


Photo courtesy: Jeff Stringer

Figure 2. Edge of opening showing abundant browse potential.



Figure 3. Snags provide significant habitat for a wide variety of game and non-game species.

Photos courtesy: Tom Barnes

Photo courtesy: John Cox

under this scenario is to allow for regeneration at the ground level but to leave important food and denning or nesting sites.

One critical issue to understand in creating regeneration openings is how and where your woodland is in the larger picture, the surrounding landscape. This is important because how big your woodland is and what the surrounding land is used for can have potentially devastating results for non-target wildlife and exotic pests. Research has shown that if you are creating openings in a large forest covering thousands of acres, the openings have little effect on area-sensitive wildlife species like some songbirds. However, if you have a small woodland, surrounded by agriculture, then the results can be devastating because blue jays, rat snakes, raccoons, and other nest predators can easily find these nests. Furthermore, brown-headed cowbirds can easily find the nests of other songbirds and lay their eggs in the nest. Their young grow faster, get more food, and outcompete the other songbirds, resulting in a net decrease in that species. Finally, openings in woodlands in highly fragmented environments are susceptible to invasion by alien or exotic plants. Tree species such as tree-of-heaven or royal paulownia, vines like oriental bittersweet or Japanese honeysuckle, grasses like Chinese silver grass or Japanese stilt grass, and a host of others, can invade the woods. The possibility of invasion is greatest when your woods and the subsequent openings are close to a source like farmlands, rights-of-ways, industrial areas, and other open areas. The message here is that if your hardwood woodlot is small and surrounded by land uses other than forestry, care must be taken in producing openings.

Snags

Snags (dead trees) are essential habitat for raccoons, bats, and non-game birds. Snags with insects in them are providing food for many species, and the holes excavated or occurring naturally are used as denning sites for raccoons and flying squirrels (Figure 3). In addition, the dead limbs serve as perching sites for various raptors

can also provide dense shrub and small tree habitat for 10 to 15 years before the dominant species close canopy and most of the shrubs and small trees are gone. During the initial phase of regeneration, ruffed grouse and American woodcock will use this habitat for brood rearing or feeding habitat, and non-game species like indigo buntings will find this a favorite hangout. If your primary management objective is wildlife, you will want to keep these openings relatively small, ranging from ¼ to 1 or 1½ acres in size. Openings in the range of 1 to 1½ acres also work well for the regeneration of a range species that satisfies both wildlife and timber objectives and keeps the regenerating size class growing at a rapid rate. In this type of operation, all merchantable trees should be removed, and herbicides should be used to remove all remaining trees of unwanted species down to one to two inches in diameter. Remaining trees of valuable species should be cut, but no herbicides should be applied to those stems so they can resprout and regenerate. Valuable species are those that will meet your long-term management objectives and can vary according to your objective. This treatment is called site preparation for natural regeneration. You are ensuring or preparing the site to maximize growth of the regenerating age class by removing unwanted overtopping trees. If wildlife is a primary objective, then all snags should be retained in the opening, and soft mast trees like flowering dogwood should be left standing. The goal

and other birds of prey. In some cases, snags can be created and, whenever possible, snags should be retained in timber harvests. What is important is that the remaining snags be properly spaced or evenly spread throughout the cut because many wildlife that use snags are territorial and will actively defend individual trees or a group of snags. Remember that snags do represent a danger in the woods, and care should be taken around them. It is not recommended to leave snags where they can fall on roads or trails. If you must remove some snags, the general rule is to leave the largest, relatively sound trees, especially those with cavities already in them. The minimum number left standing should be four trees greater than 6 inches dbh per acre or about 40 trees per 10 acres.

Ensuring Adequate Coarse Woody Debris

Snags don't remain standing forever, and when they come down, they are referred to as coarse woody debris. This is a technical term for rotting logs and branches, and in a well-tended and intensively managed woodland, there are few of them. The best type of debris for wildlife is large logs, and the bigger, the better. Ruffed grouse will use these for drumming sites, and other wildlife will use them to cross streams or store food. Logs also serve as habitat for some herpetofauna (for example, salamanders) and as elevated perch sites for a variety of small animals. If you are logging, you can help wildlife and deal with an aesthetic problem by having the skidder haul cutoffs from the landing back into the woods (Figure 5). This can be particularly valuable in younger hardwood stands where few rotting logs or branches have accumulated. On severe slopes, it is best to orient the logs along the contour and against stumps to minimize erosion problems. If you create slash piles from treetops, leave about 10 percent in piles or short rows to provide patch habitat.

Creating Ponds

One valuable habitat addition that can be created is a ridgetop woodland pond. Often you can create these shallow ponds yourself or if you are



Figure 5. Cutoffs and other woody debris created at a log deck can be distributed back into the woods to create coarse woody debris—the bigger, the better.



Photos courtesy: Jeff Stringer

undertaking a timber harvest logging equipment can be used. These ponds help distribute wildlife more evenly in the environment as most water is usually located at the base of the hills or mountains. In addition, these water sources serve as important breeding grounds for frogs, toads, and salamanders, and you can even get a wood duck or two if they are large enough. Wildlife biologists can be particularly helpful with designing and placing woodland ponds.

Soft Edge

One final consideration is the development of soft edge. If you are interested in quail and have some quail habitat adjacent to the woodland, you can feather the edge by removing 75 percent of the canopy for 50 feet from the edge, removing 50 percent for the next 50 feet, and removing 25 percent for the next 50 feet and allowing the woodland to regenerate naturally. This creates an environment with varying amounts of sunlight hitting the forest floor, and many briars and bushes will grow and provide a transition zone for wildlife.

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Figure 4. Snags can be created using individual tree injection, hack and squirt, or girdling.



Photo courtesy: Jeff Stringer

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