

# Michigan White-tailed Deer Stand Specific Habitat Management Guidelines

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## Guidelines for Key Stand-Specific Management

Achieving objectives for shelter and food for obligate, conditional and resident deer range, requires management of key forest cover type. Forest tree species composition and structure can be manipulated to meet desired future stand condition goals. The key forest cover types identified in this phase require the appropriate forest management methods be used to achieve the desired future stand conditions. The cumulative stand specific recommendations aggregate to address the different landscape goals and objectives identified for obligate (DWC), conditional and resident deer range.

Hemlock and cedar are the most critical deer winter habitat components due to their ability to intercept snow and provide food in the form of litter fall and browse. Hemlock and cedar represent preferred winter food and may be difficult to recruit due to deer browsing on regeneration. Deferring harvest of these species is the preferred management recommendation to ensure sustainability of deer winter shelter. If harvest of these species is necessary due to desired objectives or due to requirements of applicable laws such as the Commercial Forest Act (CFA), a “shelterwood” with reserves” harvest system is suggested as an alternative to optimize shelter retention for wintering deer. Shelterwood with reserves is a silvicultural system implemented to retain higher tree canopy closure following stand treatment and to leave the residual trees for an extended period. Removing the short-lived species and leaving cedar and hemlock can enhance the sheltering capability of the stands and allow less intensive harvesting.

Forest openings, upland brush and oak stands inside and adjacent to DWC’s and winter shelter on conditional range provide nutritious food during the critical early spring period when deer break-out of their winter confines. Upland openings are also important during fall as deer store fat reserves prior to entering their winter shelter areas. Acorns are an exceptionally important fall food due to their high nutritional content of carbohydrates, fats and proteins.

### Each Key Habitat Group Description Includes the Following:

**Overview** - A brief summary of the land cover types.

**Importance as Deer Habitat** – Discussion of how the habitat condition is used by deer.

**Wildlife Species** – The number and species that use this habitat to meet their life requirements.

**Featured Species** – Those species selected by Wildlife Division as indicators of specific habitat conditions, species of interest, game species and species of concern.

**Community Occurrence** – Ecological classification system to use when assessing the site potential and successional pathways for habitat treatments

**Forest Cover Types Included in Key Forest Cover Type** – Commonly used forestry related terms for describing different stand conditions.

**Risks** – Identifies risks associated with maintaining the key forest cover types.

**Recommended strategies to increase shelter** – Identify forest practices that result in increased shelter value for wildlife species. Shelter values may vary by season.

**Recommended strategies to increase food** – Identify forest practices that result in increased food value for wildlife species. Food requirements may vary by season.

**Stand Management Strategies** – Identifies broad, general strategies for producing the desired future stand conditions for deer and other wildlife species using the key habitat to meet their life requirements.

### Hemlock: Hemlock and Northern Hardwood with Hemlock Dominant



Hemlock has declined dramatically from the conditions that early surveyors reported in the 1850s. The decline approaches 97% based on circa 1800 reports. Hemlock was originally dominant on 13% of the landscape of Michigan and it was co-dominant in 85% of the northern hardwood forests. Currently hemlock stands represent less than 1% of Michigan's forests. Hemlock has declined due to timber harvest methods, deer browsing, land-use changes and the rather specific life history requirements of the species. Hemlock reproduction is readily consumed by deer and browsing is an obstacle to recruitment in some areas. The almost complete removal of hemlock seed trees indicates planting may be required to restore hemlock as a component in northern hardwood stands

#### Importance for deer habitat:

Hemlock provides the best snow interception of all conifer species and along with cedar represent the primary shelter species for deer. Hemlock stands that provide functional shelter for deer have basal areas greater than 100 sq. ft. / acre and are greater than 30 feet in height. These stand conditions reduce snow depths under the canopy and result in increased mobility and reduced energy costs to access food and avoid predators. These stands also reduce the effects of wind and low temperatures and provide a surprisingly large amount of food in the form of litter fall, including hemlock and cedar fronds, hardwood stems and lichens.

Hemlock stands are not used as heavily during summer as they are during winter. Deer may use ground flora as a food source in hemlock stands, but the heavier hemlock canopy closure reduces the amount of herbaceous vegetation when compared to hardwoods. Hemlock is not browsed heavily in the summer. Deer may use the hemlock as shade during the warmest parts of the summer.

Hemlock management strategies center on retention of this species in the stand because deer browsing makes it difficult to regenerate, and removing the trees can permanently eliminate the shelter value and eliminate them from the site. These stands are relatively young and should be able to sustain periods of deferred harvest until regeneration and recruitment conditions improve. Beyond the deer benefits, retaining these trees has the added value of preserving seed trees for future reforestation and

maintaining stand diversity to enhance biological diversity and provide habitat for many conifer associated species.

When considering a thinning treatment pay close attention to the crowns of the hardwood stems. Large hardwood stems will often have their branches interwoven with the hemlock branches and removal of these hardwood stems during a thinning can cause significant structural damage to the residual hemlocks resulting in compromised shelter value.

#### Wildlife Species:

Approximately 70 wildlife species use hemlock to meet a portion of their life history requirements. The number of wildlife species using the sapling and mature developmental stages are more than double the number of species using the pole developmental stage. The decline in upland conifer habitat, including the decline in hemlock, has reduced the number of conifer associated wildlife species.

#### Featured Species:

- Blackburnian Warbler
- Snowshoe Hare
- American Marten
- Gray Jay
- Pileated Woodpecker
- Eastern Fox Snake
- White-tailed Deer
- Moose
- Northern Goshawk

#### Community Occurrences:

- Mesic, mesic northern forest and wet-mesic

#### Forest cover types included in key forest cover type:

- Hemlock, Upland conifer, mixed upland conifers, mixed upland forest

#### Risks:

Winter deer browsing is a significant factor when attempting to regenerate and recruit hemlock seedling past browsing by deer. It is logical to attempt regeneration of hemlock and cedar in obligate deer summer range as deer are not present, or present in very low numbers, during the winter.

The risk from woolly adelgid is a concern due to its presence in the Lower Peninsula (LP). With a warming climate, woolly adelgid may extend its range into the UP and NLP. Global climate change and the resulting warmer environments have the potential to limit our ability to manage hemlock in the future and emphasizes maintaining existing hemlock trees and stands.

#### Recommended strategies to increase shelter:

- Harvest hardwood trees heavier around perimeter of hemlock clumps.
- Harvest during snow free periods to encourage scarification
- Leave conifer seed trees and heavier basal area than normal.

#### Recommended strategies to increase food:

- Harvest hardwood trees leaving hemlock.

### Stand Management Strategies:

#### *Recommended Strategy 1:*

Defer timber harvest in these stands when located in conditional and obligate deer winter range due to the risk of deer browsing the regeneration. This is the simplest method to maintain the current shelter value.

#### *Alternative Strategy 2:*

If harvest must occur, retain hemlock and cedar. Maintain sufficient basal area in the residual stand to minimize windfall of remaining hemlock. Experiment with different hemlock harvest methods in obligate deer summer range.

#### *Alternative Strategy 3:*

Harvest using shelterwood with reserves method, leave 70% canopy closure with retention heavy to hemlock in DWCs and conditional range. Without future regeneration and recruitment of hemlock this method may have limited repeatability.

### Northern Hardwood Dominant and Mixed Conifer/Hardwood: Hemlock a Minority



Northern hardwoods currently occupy approximately 2.5 million acres in Michigan. This represents about a 34% decline since the original land survey. The major acreage decline is due to the conversion of northern hardwoods to agriculture. At the time of the original survey, about 85% of the northern hardwoods had hemlock as a dominant or co-dominant tree species. On state forest land, northern hardwood is the second most abundant forest type representing about 13% of the total. Approximately 40%, 34% and 26% of the northern hardwoods are in the NLP, western UP and eastern UP, respectively.

#### *Importance for deer habitat:*

Northern hardwood stands where hemlock is a minority component, serve primarily as a food source for wintering deer although patches in the stand heavier to conifers may provide shelter during mild winters. Sugar maple typically makes up most of these stands but can be mixed with white ash, yellow birch, basswood, red oak, black cherry and shelter species including hemlock, white spruce, balsam fir and white pine. Often these stands become more mixed with shelter species as the stand transitions from the upland to the lowland. The mixed portions become important travel corridors for foraging on regenerating hardwood stems and moving between functional shelter areas. The recommended



strategies center on providing food for deer the year they are harvested and in subsequent years from regenerating stems. These strategies may increase the conifer component, if canopy gaps are greater than single tree selection, especially in transition areas.

Leaves on regenerating hardwood stems are readily consumed by deer in the summer. Stands cut to a lower residual basal area represents fair to good summer range habitat due to the increased presence of herbaceous vegetation resulting from the increased light levels.

When considering a thinning treatment pay close attention to the crowns of the hardwood stems. Large hardwood stems will often have their branches interwoven with the hemlock branches and removal of these hardwood stems during a thinning can cause significant structural damage to the residual hemlocks resulting in a compromise to the shelter value.

#### Wildlife Species:

About 115 species use northern hardwoods to meet some of their life requirements. Most species are found using the saw-log and uneven aged classes. Historically, northern hardwoods stands were much more diverse with composition oftentimes including black cherry, hemlock, oak, ash, basswood, spruce-fir and beech.

#### Featured Species:

- Black bear
- Northern goshawk
- Pileated woodpecker
- Red-shouldered Hawk
- Wild turkey
- White-tailed deer
- Wood duck
- American Marten
- Black-throated blue warbler

#### Community Occurrence:

- Mesic, Dry Northern Forest

#### Forest cover types included in this key forest cover type:

- Northern hardwood
- Mixed northern hardwoods
- Mixed Upland Forest
- Sugar Maple/Northern Red Oak
- Paper birch      Sugar Maple/Basswood
- Sugar Maple      Red maple (dry sites)
- Northern Hardwood/Hemlock
- Mixed upland deciduous

#### Risks:

The biggest risk is attempting to regenerate hemlock on obligate or conditional deer range and deer browsing the reproduction before it can grow out of the reach of deer. In addition, silvicultural

practices have favored providing the site conditions conducive to growing other, more economically valuable tree species. Scarification and especially hand planting of hemlock, is possible on historic deer winter range and in non-winter range due to the low incidence of hemlock in most northern hardwood and red maple stands.

#### Recommended strategies to Increase Shelter:

- Retain conifer trees, especially cedar and hemlock, to facilitate deer movement and shelter, provide suitable winter cover and ensure they are present on the landscape to enhance biodiversity.
- Increase secondary shelter by one or more of the following:
  - Use shelterwood with reserves silviculture in areas dominated by other conifers and hardwoods but avoid high grading; retain a good distribution of high quality seed trees, increase canopy closure and conifer seedtrees compared to final harvest and increase patch and group selection cuts.
  - Consider planting combinations of white spruce, balsam fir, white pine and possibly hemlock depending on local site conditions.
    - White pine under plantings are the preferred option if deer numbers are low to moderate.
    - White pine planting may require timber harvest planning to schedule timber harvests away from the plantings sites until they are out of reach of deer.

#### Recommended strategies to Increase food:

- Harvest in winter using single tree or group selection leaving felled tops to provide easily accessible winter food.
- Retain cedar and hemlock trees to facilitate feeding opportunities and provide diversity in stand.
- Retain oak trees to provide access to acorns during early and late winter as snow depths allow.
- Select cut to produce small openings for regeneration and multi age management.
- Plant and/or retain mast species. Harvest deciduous species harder within a tree height around clumps of hemlock.
- Feather edges to encourage early succession and shrubby mast species establishment along boundaries.
- Look for opportunities to create, enhance or expand openings and upland brush.

## Cedar: Lowland Conifer with Cedar Dominant



It is estimated that cedar acreage has increased about 8% since circa 1800. Cedar represents about 5.8% (228,000 acres) of state land with the majority in the EUP (45%) and about equal amounts in the WUP (68,000 acres) and NLP (62,000 acres). Most of the cedar in Michigan is pole size and only about 100 years old. Cedar can grow to an age of 400+ years old.

### Importance for deer habitat:

While not as efficient at snow interception as hemlock, cedar provides most of the primary functional shelter for deer in Michigan's UP and NLP. Cedar stands that provide functional shelter usually have a cedar basal area greater than 150 sq. ft./acre, >70% canopy closure and are greater than 35 feet in height. These stand conditions function to reduce snow depths under the canopy and result in decreased energy expenditure and increasing mobility for deer in the form of trail systems to access food and avoid predators. These stands also reduce the effects of wind and low temperatures and provide a surprising amount of food from litter fall, including cedar fronds, hardwood stems and lichen. Cedar is a preferred winter food for deer.

During summer, cedar stands are generally avoided by deer. They may be used to provide shade and some relief from the summer heat for bears and moose. Cedar stands may provide horizontal cover obstruction to avoid predation.

Cedar strategies center on retention of this species in the stand as deer browsing makes it difficult to recruit, and removing the trees can permanently eliminate the shelter value and seed source. Cedar stands currently are relatively young at 100-120 years old and should be able to sustain several periods of deferred harvest until regeneration and recruitment conditions improve. It takes approximately 30 years for cedar to grow out of the reach of deer browsing. Beyond deer benefits, retaining these trees has the added value of preserving seed trees for future regeneration efforts and maintaining stand diversity.

### Wildlife Species

About 50 wildlife species have been documented to use cedar stands to meet some part of their life requirements. Species are spread evenly over the regenerating and pole size classes. The number of species using sawlog size stands is greater than the younger size classes. Due to excessive deer

browsing, there is little regeneration in much of the WUP and NLP. Cedar appears to be increasing in the obligate summer range portions of the EUP. The shelter value of conifers to mitigate winter conditions is important to a variety of permanent resident wildlife species. Increasing summer temperatures results in cedar being used as a refuge by moose and black bear to reduce temperature.

#### Featured Species:

- American Marten
- Blackburnian Warbler
- Black-throated BlueGray Jay
- Moose
- Northern Goshawk
- Pileated Woodpecker
- Snowshoe Hare
- Ruffed Grouse
- Spruce Grouse
- White-tailed Deer
- Bobcat

#### Community occurrence:

- Wet and wet mesic, rich conifer swamp, hardwood-conifer swamp

#### Forest Cover types included in this key forest cover type:

- Cedar and lowland coniferous forest

#### Risks:

High deer numbers in obligate and conditional range results in a low probability of cedar to grow out of the reach of browsing deer over the 30 years it takes to grow out of their reach. .

Conversion to other forest types due to improper harvest techniques is a major concern. Improperly managed cedar stands are often harvested too heavily and result in stand conversion to balsam poplar, tamarack and lowland brush. Climate change and the warmer summer period may have an adverse impact on our ability to grow cedar and argues for maintaining existing cedar. Recommended strategies to increase shelter:

- No harvest of cedar is recommended to maintain the cedar footprint on the landscape. Cedar will live to 400+ years old and current age of most cedar is approximately 120 years old.
- If cutting is necessary, remove other tree species and leave cedar and attempt to leave total conifer canopy of at least 50% on conditional and 70% on obligate deer range.
- If some cedar must be harvested to remove other species, leave >70% cedar canopy closure.

#### Recommended strategies to increase food:

Clearcut or reduce basal area to as low as necessary. Most stands will regenerate to balsam or lowland mixed with a high proportion of tamarack if seed trees are available.

### Stand Management Strategies:

#### *Recommended Strategy:*

Defer timber harvest in these stands in obligate and conditional deer range due to the threat of deer browsing. This is the simplest method to maintain the current shelter value.

#### *Alternative Strategy 2:*

Harvest using shelterwood with reserves leaving at least 50% canopy closure with retention heavy to cedar (Figure 6). Without regeneration and recruitment of cedar this method may have limited repeatability. Emphasize using different harvest techniques in obligate summer range.

#### *Alternative Strategy 3:*

Harvest other species but retain the cedar. Other conifer species may be contributing to functional shelter and their removal may significantly reduce the shelter value depending on the arrangement and extent of the cedar retention.

### Lowland Conifer: Cedar Minority Mixed with Black Spruce, Tamarack, Balsam Poplar, Red Maple



Mixed conifer swamps have declined approximately 80% since circa 1800. This decline is attributed to the swamps being drained for agriculture, and timber harvesting resulting in the conversion of lowland forested stands into lowland shrub type habitat.

#### *Importance for deer habitat:*

Lowland conifer stands used by deer that are not predominately cedar are typically comprised of combinations of white spruce, black spruce, balsam fir, cedar, hemlock and deciduous trees including balsam poplar and red maple. These stands often provide patches of functional winter shelter in mature, high basal area cedar and/or hemlock stocked patches within the mixed species stand. Even non-functional stands (short tree heights and poor canopy closure) can provide valuable travel corridors between functional shelter and food stands. Similar to hemlock and cedar stands, they provide food in the form of litter fall including hemlock and cedar fronds, hardwood stems and lichens. In addition, the scattered canopy gaps can provide valuable browse such as red maple and red osier dogwood. One concern in these stands is that some timber harvest methods result in conversion from mixed lowland

conifer to balsam poplar or tamarack which provides no shelter or food value for wintering deer. The recommended management strategies reflect that concern.

These stands are used to provide shade during the warmest parts of summer. Some wet-mesic sites may be suitable for opening creation or enhancement of existing openings.

#### Wildlife Species:

This key habitat condition is used by about 70 wildlife species. The mixed composition of hardwoods and conifers in these types plus the generally uneven-aged nature of these types provides a diverse stand of all ages and in different stages of development. The multi species and varying canopy heights provide a very diverse stand suitable for both conifer and hardwood associated species.

#### Featured Species:

- Black Bear
- Gray Jay
- Pine Marten
- Pileated Woodpecker
- Snowshoe Hare
- Spruce Grouse
- White-tailed Deer
- Ruffed Grouse

#### Community Occurrence:

- wet mesic, rich conifer swamp, hardwood-conifer swamp

#### Forest cover types included in key forest cover type:

- Hemlock, northern white cedar, balsam fir, tamarack black spruce white spruce, balsam, red maple, black ash

#### Risks:

The greater the harvest intensity the more likely the species composition will shift future stand conditions toward hardwoods such as red maple, black ash and balsam poplar. Conifer species will be discriminated against and species composition in the future stand will be less than in the parent stand.

#### Recommended strategies to increase shelter:

- Light harvests with a nearby conifer seed source will encourage conifer species.
- Leave stand alone and allow short lived species to fall out of the stand.
- Remove non-conifers and spruce and fir.

#### Recommended strategies to increase food:

Harvest of all trees of all species will produce hardwoods and tamarack in future stand.

#### Stand Management Strategies

Harvest leaving all cedar/hemlock in patches or clumps with >50% canopy closure. If harvest must occur, use the shelterwood with reserves method favoring conifer leave trees and >50% canopy closure.

#### *Recommended Strategy 1:*

Harvest using shelterwood with reserves leaving 50% canopy closure with retention of larger diameter cedar and hemlock.

#### *Alternative Strategy 2:*

Harvest short-lived species but retain cedar if available using other silvicultural methods. The drawback to this alternative is large areas may convert to balsam poplar or cattails depending on the stand and site conditions unless sufficient overstory canopy is retained to discriminate against balsam poplar. Without adequate overstory stocking, this could result in a short-term and long-term reduction in shelter.

#### *Alternative Strategy 3:*

Mark out heavy patches of cedar or functional shelter patches for retention and then harvest using other silvicultural methods. Like alternate strategy 2, the drawback to this alternative is that large harvest areas may convert to balsam poplar depending on the stand conditions, extent of retention and harvest method. This could result in a short term and long term reduction in shelter.

### White Spruce/Balsam Fir: White Spruce and/or Balsam Fir Dominant



White spruce and balsam fir acreage approximates that present in circa 1800. From 1988 to 2009 the spruce and fir cover types declined 28% on Michigan state forest land. Due to the dramatic decline in mesic conifers, primarily hemlock and white pine, spruce and fir can contribute to increasing the upland conifer component on appropriate sites. It is more cost effective to use appropriate silvicultural practices to encourage natural regeneration of mixed spruce-fir stands. The mixed upland conifer stands can be used to increase secondary shelter in the UP, NLP and SLP to expand or enhance winter shelter conditions and secondarily to improve access to browse and to evade predators. The goal is to maintain or increase spruce/fir on the landscape as an important component of deer winter shelter.

#### *Importance for deer habitat:*

Spruce/fir stands are typically comprised of white spruce and balsam fir dominant stands often in combination with black spruce, white pine, cedar, hemlock and deciduous trees including aspen, birch, balsam poplar and red maple. Spruce/fir stands can occur in both lowland and upland sites. These stands often provide patches of functional winter shelter in mature stands especially when mixed with

cedar and hemlock trees. Even sub-functional stands (tree heights < 30 ft. and canopy closure < 70%) can provide valuable travel corridors between functional shelter and food stands. Like lowland conifer stands, they provide food in the form of litter fall including hemlock and cedar fronds, hardwood stems and lichens. In addition, scattered canopy gaps can provide valuable browse including red maple, aspen, birch and red osier dogwood.

Spruce budworm outbreaks are a concern in these stands as older and denser stands provide the best winter deer shelter, they also are most susceptible during outbreaks. Spruce/fir stands can be managed as even age stands (using clear cuts) or uneven age stands (using partial cuts). Uneven age stands are preferred in obligate winter and conditional deer range. Even age management in deer winter range requires sufficient acreage in the DWC to spread the stand ages so that winter shelter is provided on a sustainable basis. In most DWC's however the amount of spruce/fir acreage is relatively small and therefore the recommended strategy centers on maintaining the stand through uneven age management to maximize winter shelter potential.

Some of the habitat types that spruce-fir stands grow on, have the potential to grow oak and these opportunities should be evaluated and considered when making management decisions. The leaves of regenerating aspen on these sites are oftentimes used heavily by deer. If spruce-fir stands are within or close to a DWC or winter shelter areas on conditional range, consideration should be given to maintaining and enhancing landings as openings or upland brush sites to provide grazing sites during the snow free period.

#### Wildlife Species:

Approximately 80 wildlife species use upland mixed spruce and fir stands to meet their life requirements. The greatest number of species are found in mixed conifer and hardwood stands with a diversity of height and age classes.

#### Featured Species:

- Black Bear
- Blackburnian Warbler
- Elk
- Pileated Woodpecker
- Goshawk
- Gray Jay
- White-tailed Deer
- American Marten

#### Community Occurrence:

Mesic northern forest, dry-mesic northern forest,

#### Forest cover types included in this key forest cover type:

white spruce, balsam fir, upland conifer, mixed upland conifer, upland spruce/fir,

#### Recommended Strategy:

Harvest using shelterwood with reserves leaving ~50% canopy closure (Figure 1).

- Target for harvest over mature balsam fir and white spruce trees.



- Focus retention heavy to hemlock, cedar, black spruce and white pine to increase stand species diversity.
- Retain white spruce and balsam fir less the 4-inch diameter at breast height (DBH) and protect regeneration from damage during harvest.
- See the spruce budworm section for more management considerations especially during periods of outbreaks.

#### Risks:

The greatest risks to maintaining white spruce and balsam fir are inappropriate harvest methods that favor hardwoods over conifers, inappropriate spruce budworm harvest strategies, and potentially climate change. Climate change is predicted to have a negative impact on white spruce and balsam fir. Altered silvicultural methods may be a possibility to encourage spruce-fir despite the warming environment. The appropriate harvest strategies must be used to retain spruce and fir in the future stands. The more intensive the harvest, the greater the conversion from mixed stands to hardwood dominated stands.

#### Spruce Budworm Considerations

The spruce budworm is one of the most destructive native insects in the northern spruce and fir forests of Michigan. Periodic outbreaks of the spruce budworm are a part of the natural cycle of events associated with the maturing of balsam fir every 30-50 years. The last widespread outbreak of the insect in Michigan ended during the 1980s and experts think we may be seeing the beginning of a new epidemic. While balsam fir and white spruce are the most damaged by the budworms, they also feed on black spruce, tamarack, pine and hemlock trees when they are in stands with balsam fir or white spruce. Tree mortality results not just in lost timber value but also can result in reductions of current and future deer winter shelter. As these outbreaks occur there is an interest on the landowner's part to salvage timber value while also preserving deer winter habitat. Below are some recommendations for managing forest lands that may be affected by spruce budworm while also considering deer winter habitat.

#### Information of spruce budworm epidemics to consider:

- Stands with an extensive overstory (> 40% of stand) of white spruce and/or balsam fir that are older than 50 years are most vulnerable. These are typically spruce/fir stands but sometimes lowland conifer stands.
- Stands mixed with a component of balsam fir and white spruce < 40% are less vulnerable
- Younger white spruce and balsam fir in the understory are less vulnerable unless located underneath heavily stocked older infected trees in the overstory.
- Even without management in an infected stand, white spruce and balsam fir tend to regenerate due to the presence of seedlings and canopy gaps provided by the dead and dying overstory trees.

#### Management recommendations:

- Where there is an extensive overstory (>40% of stand) of mature spruce/fir and the overstory is showing signs of infection or has a high probability of infection.

- Harvest the mature balsam fir and white spruce overstory while protecting the understory from further damage.
- Retain hemlock, cedar, black spruce and white pine to increase diversity and decrease vulnerability in the future stand.
- Where spruce/fir is a component <40% of stand.
  - Leaving the stand unmanaged is the simplest option to maintain shelter. Even if the overstory spruce/fir dies the probability is the gaps underneath will regenerate to spruce/fir.
  - Removing mature infected overstory balsam fir and white spruce trees may protect extensive existing understory regeneration in some cases.
  - Harvest of these stands may improve future food conditions as it often encourages hardwood regeneration.

### Red Maple (wet mesic and transitional stands between uplands and lowlands)



Lowland hardwoods, especially red maple stands tend to occupy the transition between upland and lowlands and represents the mesic to wet mesic habitat types. These stand conditions currently serve primarily as a food source for wintering deer, however, they have significant potential for enhancing the conifer component and improving the food–shelter ratio in obligate, conditional and resident deer range. Red maple typically makes up most of these stands but can be mixed with white ash, basswood, black cherry and shelter species including hemlock, white spruce, balsam fir and white pine.

#### Importance for deer habitat:

Often these stands become more mixed with shelter species as the stand transitions from the upland to the lowland. These areas become important travel corridors for deer and serve to disperse deer thereby reducing browse pressure. The recommended strategies center on providing food for deer the year of harvest and in subsequent years from regenerating stems. This forest cover type is generally wide spread in Michigan and represents the best opportunity to expand hemlock, white pine and spruce/fir due to its inherent site conditions. Deer use this cover type during all seasons of the year but especially transition areas lowlands to uplands. Portions of stands heavier to hardwoods receive more use during summer, while areas heavier to conifer generally are used more heavily by deer in winter.

When a white pine seed source is located within these stand retain these as residual stems and consider scarifying a total distance of 3 tree heights downwind to promote longer lived conifer regeneration.

#### Wildlife Species:

About 70 species have been documented using this forest type. This key forest cover type is usually quite diverse and offers many management options for increasing or decreasing the hardwood and conifer tree composition in the future stand. By manipulating stand tree species composition, the stand can be pushed in either direction. Using different silvicultural techniques in the stand can result in a very diverse stand with different aged trees and of different stand compositions.

#### Featured Species:

- Black Bear
- Elk
- Goshawk
- Gray jay
- Snowshoe Hare
- Moose
- Red-shouldered Hawk
- Marten
- Spruce Grouse
- White-tailed Deer

#### Community Occurrence:

- Rich conifer swamp, hardwood-conifer swamp, wet-mesic, mesic

#### Recommended Strategies to Increase Shelter:

- Retain ~50 percent conifer canopy cover with selective cutting or single tree or group selection to encourage multiple canopy layer
- Let the non-target tree species decline and die of old age providing small gaps
- Retain cedar and hemlock trees to increase shelter and facilitate deer dispersal and provide diversity in stand.
- Reduce overstory to 30-50% canopy closure and leaving conifer patches and mature trees to enhance the conifer component in future stands (leaving 20 sq. ft. residual basal area or more conifer recommended as seed source).
- Summer harvest may occur if scarifying for conifer regeneration is the preferred alternative.
- Retain cedar and hemlock trees to facilitate deer dispersal, enhance deer mobility and access to food, and to increase within stand diversity.
- Use seed tree silvicultural method especially for primary cover species but avoid high grading; retain a good distribution of high quality seed trees.
- Plant a combination of conifer species for diversity and incorporating the hemlock or cedar as site conditions allow and/or measures are utilized to protect plantings.
- Avoid cutting near planted or young conifer to discourage browse pressure.

- Plant combinations, or emphasize individual species groups of white spruce, balsam fir, white pine and possibly hemlock depending on local site/soil conditions.
- White pine and hemlock planting may require fencing or other protections to keep deer away from the plantings until they are out of reach

#### Recommended Strategies to Increase Food:

- Retain oak trees to provide access to acorns during late fall and early winter as snow depths allow
- Harvest in winter to provide downed tops for food.
- Enhance or introduce acorns or seedlings for oak regeneration as conditions allow.
- Create small gaps or openings in the canopy to encourage a mixed hardwood/conifer forest condition.
- Feather edges to encourage early successional growth and shrubby mast establishment along boundaries

#### Upland Pine (white, red and jack pine)

There are three primary pine dominated landscapes in Michigan: the mixed red and white pine community, the dry northern forest communities of jack pine and red pine, and the dry-mesic northern forest community containing white pine and oak. White pine communities have declined by about 80% from circa 1800. Conversely, red pine associated communities have increased by 50%, while jack pine has decreased by 20%, over the same time frame. Much of the increase in the red pine is the result of establishment of plantations. Jack pine and red pine represent poor winter shelter and are not managed for deer winter shelter. White pine offers many desirable characteristics for providing deer winter shelter and is the pine species of choice for conifer management emphasis.



#### Importance for deer habitat:

There are areas of conifer dominated habitat that may not include the preferred primary cover species of cedar and hemlock. Secondary shelter consist of white spruce, balsam fir and white pine. These conifers are not as good at intercepting snow but may contribute to functional shelter on conditional and

resident deer range, especially when mixed with primary and secondary cover species. Due to reduced snow depth and duration on conditional range, white pine growing in mixed stands with balsam fir, white spruce and cedar and hemlock represents functional shelter. These tree communities also provide feeding corridors through northern hardwood and aspen stands and shelter during periods of lower snow depth. Many of these species occur as a component of mixed stands in the transitions between upland and lowland.

Management for aspen, upland brush or openings should be emphasized on on dry-mesic northern forest or mesic northern forest communities. These communities have sufficient moisture and nutrients to support early successional habitats.

#### Wildlife Species:

Approximately 80 wildlife species use upland pine habitats. It is important to maintain a variety of developmental stages from young seedling/sapling to old forest conditions to ensure all habitat conditions are represented. Plantations are not well used by wildlife due to the homogeneous species composition and structure. Jack pine should be emphasized on nutrient and moisture poor sites. Red pine management should prioritize natural regeneration methods. White pine should be emphasized due to its snow interception capability for deer shelter, it's rarity on the landscape compared to earlier time periods and it's regeneration capabilities. There is considerable interest and money available in the Great Lakes Region for restoration of white pine habitats.

#### Featured Species:

- Black Bear
- Eastern Fox Snake
- White-tailed Deer
- Kirkland Warbler

#### Community Occurrence:

- Dry northern Forest, Mesic Forest,

#### Forest cover types included in this key forest cover type:

- Eastern white pine
- Eastern white pine/Hemlock
- Jack Pine
- Mixed pines
- White spruce/balsam fir
- Planted Conifer
- Planted Pine
- Natural pine

#### Risks:

Climate change is predicted to have a negative impact on jack pine while red pine and white pine are predicted to respond favorably. From a wildlife perspective, natural regeneration methods are preferred over artificial methods.

#### Recommended Strategies to Increase Shelter:

- Retain appropriate conifer canopy cover with selective cutting of single tree or group selection to encourage multiple canopy layer. Use seed tree silvicultural method for cover species but avoid high grading; retain a good distribution of high quality seed trees.
  - Create patches or group selection of a radius no more than the height of trees in the stand
- Plant a combination of conifer species (emphasizing white pine) for diversity and incorporating hemlock if site conditions allow and/or protective measures are utilized to protect plantings.
- Avoid cutting near planted or young conifer to discourage browsing pressure.

#### Recommended Strategies to Increase Food:

- Harvest in winter to provide downed tops for food.
- Plant acorns or seedlings for oak regeneration as conditions allow.
- Create small openings to encourage a mixed hardwood/conifer habitat type.
- Feather edges to encourage early successional growth and shrubby mast establishment along boundaries.
  - Maintain suitable areas within a ¼ mile of DWCs in grass openings or upland brush for forage during summer, fall and especially spring food.

#### Early Successional Habitat:

##### Aspen, Birch and Mixed Aspen with a Conifer Component



Aspen and white birch, along with openings and upland brush, are considered part of a habitat condition commonly called early successional forest. Many wildlife species are dependent on this poorly stocked, semi-open habitat condition. The early successional seedling/sapling stage, through old forest developmental stages benefit a variety of wildlife species at different developmental stages.

Aspen, balsam poplar and birch acreage has increased significantly since circa 1800 (the original land survey), however, aspen acreage has decreased since 1935 (the first comprehensive USFS survey). Aspen represents more acreage on state forest land than any other forest type. Most of the aspen on

state forest land is on dry-mesic and mesic sites. Aspen represents about 45%, 27% and 14% of state land in the NLP, WUP and EUP, respectively. Aspen and birch generally regenerate best with high amounts of sunlight which stimulates suckering from the root system. Aspen and paper birch are typically managed by using even-aged management (clearcut) with retention of scattered, older trees or patches within the clear cut. White birch may best be regenerated by using the seed tree method of silviculture.

#### *Importance for deer habitat:*

Aspen regeneration serves primarily as a food source for wintering deer and patches of conifers provide shelter and improve mobility of deer during winter. Big tooth aspen, quaking aspen and birch typically makes up most of these stands but they can be mixed with shelter species including hemlock, white spruce, balsam fir and white pine. Often, these stands become more mixed with shelter species as the stand transitions from the upland to the lowland. These heavily mixed stands are important travel corridors for deer to forage on regenerating hardwood stems and enhances movement between shelter areas due to reduced snow depths. The recommended strategies center on providing food for deer in the year of timber harvest and in the subsequent 2-3 years from regenerating stems. The strategies also include increasing the conifer component, especially in transition areas.

White-tailed deer use aspen stands as cover and food throughout the year. Deer consume aspen leaves and herbaceous vegetation during spring, summer and fall. The relatively open aspen stand canopies allow enough sunlight through to the forest floor, allowing herbaceous vegetation and shrubs to grow and be used by deer as food. The annual growth and buds of regenerating aspen serve as a food source for wintering deer. Aspen stands with patches of mature conifers may provide adequate shelter during mild winters, and the patches of conifer reduces the amount of energy necessary for deer to move through the aspen stand.

#### *Wildlife Species:*

Approximately 80 species of wildlife use aspen/birch trees or stands, to meet some portion of their life requirements. Early successional conditions, along with old forest conditions, represent the communities with the greatest number of wildlife species. The semi-open brushy habitat conditions are favored by many species. This habitat condition has declined dramatically since its peak in the 1930s due to the burning of slash from the intensive logging operations.

#### *Featured Species*

- American Woodcock
- Ruffed Grouse
- Beaver
- American Marten
- Golden-winged Warbler
- Snowshoe Hare
- Moose
- White-tailed Deer
- Pileated Woodpecker
- Northern Goshawk

- Black Bear

*Community Occurrence:*

- Mesic northern forest, dry-mesic northern forest and dry northern forest

*Forest cover types included in this key forest cover type:*

- openings, upland brush, aspen, birch

*Risks:*

Encroachment and filling in of open and semi-open areas through natural succession following timber harvest. Harvesting aspen in a timely manner with insufficient removal of the overstory reduces the percentage of aspen in the next stand.

*Recommended Strategies to Increase Shelter:*

- Encourage a mixed conifer - hardwood (aspen) stand condition for diversity.
- Retain conifer and release sub-canopy conifer trees using single tree or group selection
- Retain conifer trees to facilitate horizontal cover and deer movement especially on upland-lowland edges.
- Increase secondary shelter presence where possible using one or more of the following:
- Retain patches that are heavier to conifer as retention especially those with cedar and hemlock present
  - Meander edge to optimize edge-area ratio.
- Protect existing conifer regeneration
- Emphasize aspen management on dry-mesic and mesic sites
- Plant white spruce and balsam fir post-harvest in poorly stocked areas
- In red maple areas of stand refer to the red maple recommendations
- Utilize downed branches to create barriers around regenerating/planted conifer
- Avoid cutting near areas recently planted with conifer to discourage browsing pressure
  - Leave some aspen stands to succeed naturally to later developmental stages where access to the stand is limited.

*Recommended Strategies to Increase Food:*

- Harvest in winter leaving felled tops to provide accessible winter food.
- Consider small cut units (e.g. 20 acres) to spread the harvest over multiple sites and winters.
- Retain cedar and hemlock trees to facilitate mobility between feeding opportunities and provide diversity in the stand.
- Retain oak trees to provide access to acorns during early and late winter as snow depths allow.
- Cut aspen to encourage regeneration as deer utilize leaves for spring forage.
- Retain and release patches of understory mast species (i.e. hazelnut, dogwood, serviceberry, etc.)
- Plant and protect hemlock and cedar for future browse
  - Conversion of other stand types to aspen is probable if >20 sq. ft. of aspen is in the parent stand.



- Consider leaving a 50-foot buffer of mature aspen around openings and upland brush to prevent aspen encroachment, and meet retention guidelines. This practice will provide cavity nesting trees over early successional site conditions.
- Increase secondary shelter presence by retaining patches that are heavier to conifer as retention especially those with cedar and hemlock present.

## Forest Openings and Upland Brush



Forest openings within and adjacent to deer wintering complexes may provide a key early spring food source. Deer leave complexes in the spring and move toward their summer ranges as soon as snow depths moderate. If existing openings are limited and represent less than 1 percent of the complex emphasis should be placed on creating openings within the complexes and near winter concentration areas on conditional range. Examples of openings include utility corridors, timber harvest landings, old logging roads and remnant forest openings. Snow melts early on south facing slopes and these sites often provide the first available succulent and nutritious green vegetation for deer. These south facing slopes represent especially good locations for managing for forest openings. Strategies center on maintaining these openings in cool season plants species that provide early spring nutrition.

### Importance for Deer Habitat:

Emphasize management of forest openings within DWC boundaries and near winter concentration areas on conditional range. Maintain or expand large forest opening complexes due to their rarity. Forest opening and upland brush sites inside and adjacent to DWC's often provide protein-rich food in spring and fall before deer enter or leave the complexes.

Soft mast from raspberries, blackberries, cherries (pin, choke and June), dogwoods, viburnums, elderberries, thimbleberries, and blueberries represent a few, but not all, of the soft mast species that are important food sources for wildlife. Management of openings and upland brush areas help to maintain many of these species due their requirements for sunlight. The more diverse the mast species, the more wildlife species associated with the open areas. Management for diverse species composition and structure maximizes the potential for diverse assemblages of wildlife species.

#### Wildlife Species:

Over 75 wildlife species are documented to use openings and over 100 wildlife species are associated with upland brush areas. The increased number of species are due to the additional shrub structure which promotes shrub associated species. As a group, species using open or semi-open habitat conditions are in decline due to tree species encroaching into the open areas and opening condition becoming fully stocked with trees.

#### Featured Species:

- Black Bear
- Elk
- Wild Turkey
- Bobolink
- Ruffed Grouse
- Bluebird
- Cottontail Rabbit
- Eastern Meadowlark
- White-tailed Deer

#### Community Occurrence:

- Dry northern forest, dry-mesic northern forest, mesic forest

#### Forest Cover types included in this key forest cover type:

- Upland shrub, herbaceous openland, low density trees, barrens

#### Risks:

The greatest risk to openings are tree encroachment into the opening and eventually the open condition is lost to encroaching trees. Efforts should emphasize leaving larger aspen around the perimeter of the opening to discriminate against aspen sprouting. The leave trees can be used by cavity nesting wildlife species.

#### Recommended Strategies:

- Follow opening and upland brush management goals as outlined in the Regional State Forest Management Plans.
- Prioritize large openings and opening complexes for prescribed burning and maintenance
- Manage for compositional and structural diversity of grasses, forbs, shrubs and trees to provide a variety of soft mast, hard mast, conifer and hardwood seeds.
- Maintain existing openings by cutting, mowing or burning to control tree encroachment. Treat every 5 – 10 years depending on encroachment.
- It is usually more cost efficient to create openings as part of an active timber sale, so it should be prescribed in the inventory phase.
- Emphasize cool season grasses and forbs with mixes of warm season native species.
- For maximum spring deer food benefit, consider maintaining forest openings in wildlife clover mixes with annual late summer mowing and regular 3-5 year maintenance. Emphasize south facing slopes for openings and/or managing for early succession growth for spring forage

- Maintain existing old and abandoned agricultural fields.
- Provide a range of size classes in open and shrub condition
- Maintain the open characteristics of early successional forest conditions. Manage in a sustainable manner for areas dominated by grasses, forbs, shrubs/brush within forest dominated landscapes.



### Oak: Pure Stands and Stands with an oak component

There are 11 different oak species native to Michigan. Four oak species are most abundant; northern pin oak, black oak, white oak and red oak. Historically, most of the oak in Michigan occurred in mixed pine – oak forest cover types. Oak was found most frequently on the drier, sandy growing sites and actual oak cover types were only about 70,000 acres at the time of the original land survey. Oak acreage currently represents about 6.2% or 245,000 acres in state ownership. The current acreage and distribution of the oak resources is the result of the unmatched harvest of mixed oak and pine stands and the extensive wildfires around the turn of the century. Those conditions no longer exist and oak acreage is currently declining in the state.

Oaks begin acorn production when about 45 years old and, depending on site conditions, reach maximum production of acorns when about 80 – 100 years old. The healthiest oaks produce the most acorns. Acorn production varies from year to year for individual trees and may range from 20 to 100 pounds of acorns per year.

#### Importance for Deer Habitat:

Oak (red, white and black oak groups), beech, hazelnuts and hickory are the most important fall food sources for many species of wildlife, including deer. Acorns are the most nutritious food naturally available to deer in the fall.

Efforts should focus on providing an adequate and sustainable oak, beech/hazelnut hard mast supply, to enhance physical condition and overwinter survival of deer. Acorns and beech nuts, when they are available, are premier foods as they provide high carbohydrate, fat and protein levels and are stored as fat which is metabolized for energy during winter. During especially

good acorn years deer can access acorns early into winter as snow depths allow. The abundance of the fall acorn crop has been shown to have positive impacts on deer overwinter survival and physical condition and on the beam diameters of deer the year following average or above average crops

Acorns are included in what is termed hard mast. Mast consists of nuts and seeds and represents an exceptionally important food source for wildlife in the fall. Mast production is affected by weather, genetics, insects, disease and the size and age of trees and shrubs. Oaks are disproportionately important due to their wide distribution and abundance. Hickories are scattered and rare in the UP but more common in the NLP. Beech trees are currently being devastated across Michigan by the disease called Beech Bark Disease. Beech nuts due to lower tannin level and white oaks are more palatable than red or black oak acorns. Beech tree nut production begins at about 50 years old and occurs every 2 – 8 years. Red oaks produce acorns at 2 – 5 year intervals when trees are 6 inches DBH. White oaks produce heavy crops at 4 to 10 year intervals and peak crops when the trees are about 20 inches DBH.

#### Wildlife Species:

Approximately 95 wildlife species have been documented to use oak to meet different parts of their life requirements. Acorns are probably the most important fall food utilized by many wildlife species as they build fat reserves for the winter. A variety of oak management techniques should produce abundant oak regeneration and different composition and structural characteristics which are important to different wildlife species.

#### Featured Species:

- Black Bear
- Elk
- Goshawk
- Pileated Woodpecker
- Red-headed Woodpecker
- Ruffed Grouse
- Wild Turkey
- White-tailed Deer

#### Community Occurrence:

- Dry northern forest, dry-mesic northern forest, mesic northern forest, oak-pine barrens, and jack pine barrens.

#### Forest Cover Types Included in this Key Forest Cover Type.

- Oak, mixed upland forest, pine-oak

#### Risks:

Oak wilt is an important pathogen of oak trees and large areas throughout Michigan have been infected with oak wilt. Efforts have been expanding to control the disease and frequently requires the use of a vibratory plow to break the root systems of infected trees so healthy trees are not infected. Oaks are projected to be favored using current global climate change models.

#### Recommended Strategies:

- When single or multiple stem dominant crown class red oaks are located within a red maple stand, conduct a drip line plus 10 feet release (crown release the oaks on all 4 sides providing a hardwood competition free ring 10 feet beyond the oak crown drip line). Retain any conifer within this zone regardless of size.
- For pockets or groups of oak are within the red maple type, thin from below removing intermediate and suppressed crown class oaks. Release the outside edge of the oak pocket or group from competing hardwoods. Retain any conifer adjacent to within the oak pocket regardless of size.
- When single or multiple stem dominant crown class red oaks are located within a hard maple stand, conduct a drip line plus 10 feet release (crown release the oaks on all 4 sides providing a hardwood competition free ring 10 feet beyond the oak crown drip line). Retain any conifer within this zone regardless of size.
- For pockets or groups of oak within the hard maple type, thin from below removing intermediate and suppressed crown class oaks. Release the outside edge of the oak pocket or group from competing hardwoods. Retain any conifer adjacent or within the oak pocket regardless of size.

## APPENDIX

FIGURE 1. SCHEMATIC DEMONSTRATING SHELTERWOOD WITH RESERVES CYCLE

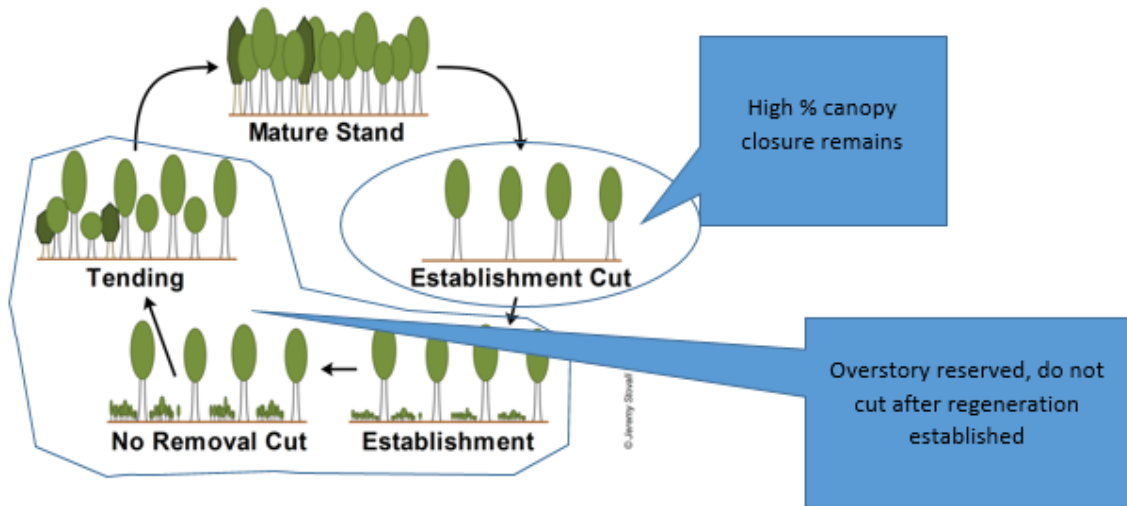


Figure 2. Example of Shelterwood with Reserves Post Harvest Mixed Cedar Stand Condition.



**Habitat strategies by Key Habitat Types:**

[Michigan Wildlife Action Plan \(DNR Website\)](#)