



Alternatives for Green Ash In North Dakota Conservation Plantings

Green ash (*Fraxinus pennsylvanica*) is a deciduous tree species that is resilient to the diverse and challenging climatic conditions of North Dakota. It is a medium/tall, single stemmed tree, native to North Dakota in riparian areas and wooded draws. Green ash is widely adapted to various soil and climatic conditions, relatively fast growing, structurally strong and readily available from nurseries. Due to its broad adaptability, it has been extensively used in conservation and landscape plantings in North Dakota, often as a single or predominant species. Tree plantings with single or limited species are more vulnerable to devastation from pests and diseases than those with numerous species, compromising the intended function of a planting as trees die. Widespread use of a species within a geographical area also makes trees more susceptible to destruction from pests.

Emerald ash borer (*Agrilus planipennis*)(EAB) is a wood-boring insect that attacks species of ash, including green ash. It feeds on the inner bark, blocking water movement, which kills the tree. As green ash has been extensively planted in the Northern Great Plains, including North Dakota, infestation of EAB would destroy or jeopardize the function of a vast number of tree plantings. Currently, EAB has been found in only a few North Dakota locations, but extensive presence in surrounding States means widespread risk is imminent. There are several proactive options to consider when planning future tree plantings. Planting a

diversity of species is one of the best ways to greatly reduce the vulnerability to EAB or other pests and diseases, even if green ash is part of the planting. If green ash is included, avoid planting in multiple rows so that large sections will not be lost if EAB invades it. Alternating tree species within the row is another option. Strongly consider alternative species for green ash. Substitute with numerous species; avoid substituting with single species.



Following are suggested alternative species for green ash in conservation plantings such as windbreaks and shelterbelts. In this publication, the alternative species are listed for each Conservation Tree and Shrub Group (CTSG) where green ash is adapted in North Dakota. The goal was to select species similar in growth habit, structure, and conservation function to green ash trees. Conifer species have not been included as alternative species in this publication unless the number of adapted species is limited for a specific CTSG. Information from the ND NRCS Field Office Technical Guide was used as a reference when selecting and grouping species. Only species approved for Conservation programs have been included in the lists.

CTSG 1 Soils are deep, well drained to somewhat poorly drained and receive beneficial moisture from favorable landscape positions, flooding, runoff from adjacent land, or they have a beneficial seasonally high water-table during the spring. Soils are generally fine sandy loam to silty clay loam. **LISTED SPECIES ARE SUGGESTED GREEN ASH ALTERNATIVES FOR PLANTING IN CTSG 1**

* 1K and 1KK- restricted by calcium carbonates

**1S-restricted by sand content

✓ additional CTSGs where species can be planted

Species	Characteristics	1K*	1KK*	1S**
apricot (Manchurian)	<i>small tree, fast growing, reddish-brown bark, flowers white-pink, small yellow fruit for preserves, yellow-orange fall color, spreading growth form, serious decline in vigor by 10 yrs old</i>			✓
black walnut <i>MLRA 56 Only</i>	<i>should be planted where protected by other trees in windbreak, sensitive to high pH, marginally winter hardy in ND</i>	✓	✓	✓
boxelder	<i>relatively fast growing, short lived, highly sensitive to phenoxy herbicide, moderately drought tolerant, multi-stemmed crooked trunk is common, some shade tolerance, weak, brittle wood</i>	✓	✓	✓
cherry (black)	<i>small tree. more adapted in Eastern ND, fast growing, white flowers in May, very small astringent edible fruit, shade intolerant, thin bark, leaves toxic to livestock</i>	✓		✓
crabapple (Manchurian)	<i>densely branched, oval/round tree form, cold hardy, very early white blooms and leafing, very small fruit, shape and fruit have wildlife benefits, 'Midwest' cultivar adapted to North Dakota</i>	✓		✓
crabapple (Siberian)	<i>small flowering tree, edible fruit larger than Manchurian, white flower, prefers heavy loam soils, prefers slightly acidic soils, full sun, hardest of crabapples</i>	✓		✓
cottonwood (Eastern)	<i>large, fast growing, loams to sands are most favorable soils, female trees bear cottony seed</i>	✓		✓
hackberry (common)	<i>gray, stucco-like bark, somewhat tolerant to alkaline soils, moderately drought tolerant, performs well on a variety of soils, high cold tolerance, nipple gall and witches broom reduce aesthetic quality</i>	✓		✓
hawthorn (Arnold)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, earlier ripening fruit than other listed hawthorns</i>	✓		✓
hawthorn (downy)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, largest leaves and fruits of listed hawthorns</i>			
hawthorn (fireberry)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, smallest height, leaves and fruit of hawthorns listed</i>			
linden (American) (basswood) <i>MLRA 55A, 58B, 56, 102A only</i>	<i>native east of Missouri River in ND, aromatic flowers, intermediate tolerance to flooding, not drought resistant, flood plain tree, grows well on deep, fertile, well-drained loam and clay soils, pyramidal to round shaped tree</i>			✓
oak (bur)	<i>large, long-lived, tap rooted, smaller in drier sites, irregularly lobed leaves, acorn fruit</i>	✓		✓
Ohio buckeye <i>MLRA 55A, 58B, 56, 102A only</i>	<i>medium sized tree with oval to rounded crown, palmate compound leaves, large candle like flowers, large nutlike ball-shaped fruit with prickly husk and "buckeye" markings</i>			✓
pear (Ussurian)	<i>white, early flowers, semi glossy leaves, dense upright form becoming rounded, small hard edible fruit, does not tolerate saline soils</i>			✓

CTSG 2 Soils are deep, somewhat poorly drained, and excessively wet or ponded during the spring or overflow periods. They also include drained phases of poorly drained soils. Wetness limits the selection of species suitable for planting on these soils and may reduce the growth rate. (Due to limited species on 2KK soils, conifers may be considered). LISTED SPECIES ARE SUGGESTED GREEN ASH ALTERNATIVES FOR PLANTING IN CTSG 2

* 2K and 2KK are restricted by calcium carbonate

✓ additional CTSGs where species can be planted

Species	Characteristics	2K*	2KK*
apricot (Manchurian)	<i>small tree, fast-growing, reddish-brown bark, flowers white-pink, small yellow fruit for preserves, yellow-orange fall color, spreading growth form, serious decline in vigor in 10 yrs or less</i>		
aspen (quaking) Only 2KK soils in MLRA 55A, 55B, 56, 102 (other deciduous species are adapted in CTSG 2 and CTSG 2K)	<i>multi-stemmed, rapidly colonizes and regenerates by suckering, white to olive green bark, cottony seed, prefers sands to loam but tolerates variable soil conditions, needs moist sites or high water-table to thrive</i>		✓
boxelder	<i>relatively fast growing, short lived, highly sensitive to phenoxy herbicide, moderately drought tolerant, multi-stemmed crooked trunk is common, some shade tolerance, weak, brittle wood</i>	✓	✓
cedar (Eastern red) Only 2KK soils (deciduous species are adapted in CTSG 2 and CTSG 2K)	<i>small/medium size, various forms, prickly leaf surface, drought tolerant but prefers moist soil, tolerates shade only when young, cedar-apple rust host, more tolerant of shade, may be invasive</i>		✓
cherry (black)	<i>small tree. more adapted in eastern ND, fast growing, white flowers in May, very small astringent edible fruit, not shade tolerant, thin bark, leaves toxic to livestock</i>	✓	
cottonwood (eastern)	<i>large, fast growing, loams to sands are most favorable soils, female trees bear cottony seed</i>	✓	
hackberry	<i>gray, stucco-like bark, somewhat tolerant to alkaline soils, moderately drought tolerant, performs well on a variety of soils, high cold tolerance, nipple gall and witches broom reduce aesthetic quality</i>	✓	
juniper (Rocky Mountain) Only 2KK soils (deciduous species are adapted in CTSG 2 and CTSG 2K)	<i>small /medium conifer tree, dense pyramidal crown, native to western ND, wide variety of forms, full sun, very stress tolerant, cover and food for wildlife, less susceptible to cedar-apple rust, slower growing, better for less humid western ND, may be invasive</i>		✓
linden (American) (basswood) Only MLRA 55A, 55B, 56, 102A	<i>native east of Missouri River in ND, aromatic flowers, intermediate tolerance to flooding, not drought resistant, a flood plain tree, grows well on deep, fertile, well-drained loam and clay soils</i>		
spruce (Colorado blue) Only 2KK soils in MLRA 55A, 55B, 56, 102A (deciduous species are adapted in CTSG-2 and CTSG 2K and other MLRAs)	<i>broad and dense pyramidal shape with stiff branches horizontal to ground, performs best on moist, well-drained loams, does not tolerate flooding or shade, most drought tolerant of spruces</i>		✓

CTSG 3 Soils are deep, well-drained with loamy and silt loam textures and high available water capacity

Species	Characteristics
apricot (Manchurian)	<i>small tree, fast growing, reddish-brown bark, flowers white-pink, small yellow fruit for preserves, yellow-orange fall color, spreading growth form, serious decline in vigor in 10 yrs or less</i>
black walnut MLRA 56 only	<i>should be planted where protected by other trees in windbreak, sensitive to high pH, marginally winter hardy in ND</i>
boxelder	<i>relatively fast growing, short lived, highly sensitive to phenoxy herbicide, moderately drought tolerant, multi-stemmed crooked trunk is common, some shade tolerance, weak, brittle wood</i>
cherry (black)	<i>small tree. more adapted in Eastern ND, fast growing, white flowers in May, very small astringent edible fruit, shade intolerant, thin bark, leaves toxic to livestock</i>
crabapple (Manchurian)	<i>densely branched, oval/round tree form, cold hardy, very early white blooms and leafing, very small fruit, shape and fruit have wildlife benefits, 'Midwest' cultivar adapted to North Dakota</i>
crabapple (Siberian)	<i>small flowering tree, edible fruit larger than Manchurian, white flower, prefers heavy loam soils, prefers slightly acidic soils, full sun, hardiest of crabapples</i>
hackberry	<i>gray, stucco-like bark, somewhat tolerant to alkaline soils, moderately drought tolerant, performs well on a variety of soils, high cold tolerance, nipple gall and witches broom reduce aesthetic quality</i>
hawthorn (Arnold)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, prefers full sun, earlier ripening fruit than other listed hawthorns</i>
hawthorn (downy)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, largest of listed hawthorns</i>
hawthorn (fireberry)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, smallest of listed hawthorns</i>
linden (American) (basswood) MLRA 55A, 55B, 56, 102A only	<i>native east of Missouri River in ND, aromatic flowers, intermediate tolerance to flooding, not drought resistant, flood plain tree, grows well on deep, fertile, well-drained loam and clay soils, pyramidal to round shaped tree</i>
oak (bur)	<i>large, long-lived, tap rooted, smaller in drier sites, irregularly lobed leaves, acorn fruit</i>
Ohio buckeye MLRA 55A, 55B, 56, 102 A only	<i>medium sized tree with oval to rounded crown, palmate compound leaves, large candle like flowers, large nutlike ball-shaped fruit with prickly husk and "buckeye" markings</i>
pear (Ussurian)	<i>white, early flowers, semi glossy leaves, dense upright form becoming rounded, small hard edible fruit, does not tolerate saline soils</i>

CTSG 4, 4C, 4CK Soils are moderately deep and deep, have loamy surface textures with clayey subsoils, have slow or very slow permeability and occur on uplands.

Species	Characteristics
apricot (Manchurian)	<i>small tree, fast-growing, reddish-brown bark, flowers white-pink, small yellow fruit for preserves, yellow-orange fall color, spreading growth form, serious decline in vigor in 10 yrs or less</i>
boxelder MLRA 55A, 55B, 56, 102A only	<i>relatively fast growing, short lived, highly sensitive to phenoxy herbicide, moderately drought tolerant, multi-stemmed crooked trunk is common, some shade tolerance, weak, brittle wood</i>
cherry (black) MLRA 55A, 55B, 56, 102A only	<i>small tree. more adapted in Eastern ND, fast growing, white flowers in May, very small astringent edible fruit, shade intolerant, thin bark, leaves toxic to livestock</i>
cottonwood (Eastern) MLRA 55A, 55B, 56, 102A only	<i>large, fast growing, loams to sands are most favorable soils, female trees bear cottony seed</i>
crabapple (Manchurian)	<i>densely branched, oval/round tree form, cold hardy, very early white blooms and leafing, very small fruit, shape and fruit have wildlife benefits, 'Midwest' cultivar adapted to North Dakota</i>
crabapple (Siberian)	<i>small flowering tree, edible fruit larger than Manchurian, white flower, prefers heavy loam soils, prefers slightly acidic soils, full sun, hardiest of crabapples</i>
hackberry	<i>gray, stucco-like bark, somewhat tolerant to alkaline soils, moderately drought tolerant, performs well on a variety of soils, high cold tolerance, nipple gall and witches broom reduce aesthetic quality</i>
hawthorn (Arnold)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red fruit, large thorns on stems, wildlife food and habitat, prefers full sun, earlier ripening fruit than other listed hawthorns</i>
hawthorn (downy)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, largest of listed hawthorns</i>
hawthorn (fireberry)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, smallest of listed hawthorns</i>
oak (bur)	<i>large, long-lived, tap rooted, smaller in drier sites, irregularly lobed leaves, acorn fruit</i>
Ohio buckeye MLRA 55A, 55B, 56, 102A only	<i>medium sized tree with oval to rounded crown, palmate compound leaves, large candle like flowers, large nutlike ball-shaped fruit with prickly husk and "buckeye" markings</i>

CTSG 5, 5K Soils are deep, with loamy, fine sandy loam, and sandy loam texture (uplands, fans, terraces)

Species	Characteristics
apricot (Manchurian)	<i>small tree, fast-growing, reddish-brown bark, flowers white-pink, small yellow fruit for preserves, yellow-orange fall color, spreading growth form, serious decline in vigor in 10 yrs or less</i>
crabapple (Manchurian)	<i>densely branched, oval/round tree form, cold hardy, very early white blooms and leafing, very small fruit, shape and fruit have wildlife benefits, 'Midwest' cultivar adapted to North Dakota</i>
crabapple (Siberian)	<i>small flowering tree, edible fruit larger than Manchurian, white flower, prefers heavy loam soils, prefers slightly acidic soils, full sun, hardiest of crabapples</i>
hackberry MLRA 55A, 55B, 56, 102A only	<i>gray, stucco-like bark, somewhat tolerant to alkaline soils, moderately drought tolerant, performs well on a variety of soils, high cold tolerance, nipple gall and witches broom reduce aesthetic quality</i>
hawthorn (Arnold)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red fruit, large thorns on stems, wildlife food and habitat, prefers full sun, earlier ripening fruit than other listed hawthorns</i>
hawthorn (downy)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, largest of listed hawthorns</i>
hawthorn (fireberry)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, smallest of listed hawthorns</i>
oak (bur)	<i>large, long-lived, tap rooted, smaller in drier sites, irregularly lobed leaves, acorn fruit</i>
pear (Ussurian)	<i>white, early flowers, semi glossy leaves, dense upright form becoming rounded, small hard edible fruit, does not tolerate saline soils</i>

CTSG 6D, 6DK, 6G, 6GK Soils well-drained, mostly loamy textures, and moderately deep over sand, gravel, bedrock and other layers that can severely restrict root growth, low or moderate available water capacity. *(Due to limited suitable species, conifers may be considered)*

Species	Characteristics
cedar (Eastern red) MLRA 53A,53B, 54, 58C, 60B, 63A only (deciduous species are adapted in MLRA 55A, 55B, 56, 102A)	<i>small to medium size, various forms, prickly leaf surface, drought tolerant but prefers moist soil, tolerates shade only when young, cedar-apple rust host, more tolerant of shade, better performance in eastern ND, may be invasive</i>
crabapple (Manchurian) MLRA 55A, 55B, 56, 102A only	<i>densely branched, oval/round tree form, cold hardy, very early white blooms and leafing, very small fruit, shape and fruit have wildlife benefits, 'Midwest' cultivar adapted to North Dakota</i>
crabapple (Siberian) MLRA 55A, 55B, 56, 102A only	<i>small flowering tree, edible fruit larger than Manchurian, white flower, prefers heavy loam soils, prefers slightly acidic soils, full sun, hardiest of crabapples</i>
elm (Siberian)	<i>fast-growing, brittle wood, susceptible to insects, disease, and herbicides. produces many viable seeds that easily spread</i>
hawthorn (Arnold)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red fruit, large thorns on stems, wildlife food and habitat, prefers full sun, earlier ripening fruit than other listed hawthorns</i>
hawthorn (fireberry)	<i>predominately multi-stemmed tree/shrub, broadly rounded, low branched with side spreading branches, white flowers, red edible mealy fruit, stems have large thorns, wildlife food and habitat, smallest of listed hawthorns</i>
juniper (Rocky Mountain) MLRA 53A,53B, 54, 58C, 60B, 63A only (deciduous species are adapted in MLRA 55A, 55B, 56, 102A)	<i>small to medium tree, dense pyramidal crown, native to western ND, wide variety of forms, full sun, very stress tolerant, cover and food for wildlife, less susceptible to cedar-apple rust, slower growing, better for less humid western ND, may be invasive</i>
pine (ponderosa) MLRA 53A,53B, 54, 58C, 60B, 63A only (deciduous species are adapted in MLRA 55A, 55B, 56, 102A)	<i>large conifer native to southwest ND, grows best on deep, well-drained loam soil, but will tolerate sandy soils, will tolerate saline and alkaline soils, drought tolerant, does not tolerate flooding or poorly drained soils</i>
pine (Scotch) MLRA 53A,53B, 54, 58C, 60B, 63A only (deciduous species are adapted in MLRA 55A, 55B, 56, 102A)	<i>medium to large conifer, orange-brown peeling bark, prefers moist, well drained soils, but will tolerate drier sites, does not tolerate flooding, susceptible to pine wilt disease when 10 yrs or older</i>
Russian olive MLRA 53A,53B, 54, 58C, 60B, 63A only (other deciduous species are adapted in MLRA 55A, 55B, 56, 102A)	<i>small tree/large shrub, will tolerate saline/alkaline soils, drought resistant, may be invasive in unmanaged areas, thorny, silvery leaves that are retained late into fall</i>

CTSG 8K Soils are calcareous at or near the surface. They do not receive beneficial moisture from run-on, flooding, or seasonal high water-tables. *(Due to limited suitable species, conifers may be considered)*

Species	Characteristics
cedar (Eastern red)	<i>small to medium size, various forms, prickly leaf surface, drought tolerant but prefers moist soil, tolerates shade only when young, cedar-apple cedar rust host, more tolerant of shade, better performance in eastern ND, may be invasive</i>
elm (Siberian)	<i>fast-growing, brittle wood, susceptible to insects, disease, and herbicide injury, produces many viable seeds that easily spread</i>
juniper (Rocky Mountain)	<i>small to medium conifer tree, dense pyramidal crown, native to western ND, wide variety of forms, full sun, very stress tolerant, cover and food for wildlife, less susceptible to cedar-apple rust, slower growing, better for less humid western ND, may be invasive</i>
pine (ponderosa)	<i>large conifer native to southwest ND, grows best on deep, well-drained loam soils, but will tolerate sandy soils, tolerates saline and alkaline soils, tolerates drought, does not tolerate flooding or poorly drained soils</i>
Russian olive	<i>small tree/large shrub, tolerates saline/alkaline soils, drought resistant, may be invasive in unmanaged areas, thorny, silvery leaves that are retained late into fall</i>

CTSG 9, 9N Soils are affected by salinity and/or sodicity. *(Due to limited suitable species, conifers may be considered)*

Species	Characteristics
cedar (Eastern red)	<i>small to medium size, various forms, prickly leaf surface, drought tolerant but prefers moist soil, tolerates shade only when young, cedar-apple rust host, more tolerant of shade, better performance in eastern ND, may be invasive</i>
elm (Siberian)	<i>fast-growing, brittle wood, susceptible to insects, disease, and herbicides. produces many viable seeds that easily spread</i>
juniper (Rocky Mountain)	<i>small to medium conifer tree, dense pyramidal crown, native to western ND, variety of forms, full sun, very stress tolerant, cover and food for wildlife, less susceptible to cedar-apple rust, slower growing, better for less humid western ND, may be invasive</i>
Russian olive	<i>small tree/large shrub, tolerates saline/alkaline soils, drought resistant, may be invasive in unmanaged areas, thorny, silvery leaves that are retained late into fall</i>

USDA is an equal opportunity provider, employer, and lender.