USDA Natural Resources Conservation Service

Ecological site F152BY004TX
Clayey Flat

Last updated: 9/22/2023
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 152B–Western Gulf Coast Flatwoods

Major Land Resource Area (MLRA) 152B, Western Gulf Coast Flatwoods, is in eastern Texas and western Louisiana. Locally termed the Flatwoods, the area is dominated by coniferous forest covering 5,681 square miles (14,714 square kilometers). The region is a hugely diverse transition zone between the northern and eastern mixed forests and southern and western coastal prairies and grasslands.

Classification relationships

Major Land Resource Area (MLRA) (USDA-Natural Resources Conservation Service, 2006)

Ecological site concept

The Clayey Flat ecological site has very deep, somewhat poorly to poorly drained soils influenced by the shrink-swell properties of the clay content. The soils of this site are vertisols, meaning the soils move with moisture content. Their flat landform and shrink-swell clay properties couple to form their plant community.

Associated sites

F152BY003TX	**Sloping Clayey Upland** Soils have steeper slopes.
F152BY005TX	**Seasonally Wet Loamy Upland** Soils have a loamy surface and are on a higher landscape position.
F152BY006TX	**Well Drained Loamy Upland** Soils are loamy and well drained.
F152BY007TX	**Poorly Drained Loamy Upland** Soils have a loamy surface.
F152BY013TX	**Poorly Drained Loamy Bottomland** Soils are loamy, on a lower landform, and flood for extended periods.
F152BY014TX	**Poorly Drained Clayey Bottomland** Soils are on a lower landform and flood for extended periods.

Similar sites

F152BY003TX	**Sloping Clayey Upland** Soils have steeper slopes.
F152BY007TX	**Poorly Drained Loamy Upland** Soils have a loamy surface.
F152BY014TX	**Poorly Drained Clayey Bottomland** Soils are on a lower landform and flood for extended periods.
F152BY005TX	**Seasonally Wet Loamy Upland** Soils have a loamy surface and are on a higher landscape position.

Table 1. Dominant plant species

Tree	(1) *Quercus michauxii* (2) *Quercus phellos*
Shrub	(1) *Sabal minor*
Herbaceous	(1) *Chasmanthium sessiliflorum*

Physiographic features

The ecological site includes areas on flats on uplands. Slope ranges from 0 to 3 percent. Elevation ranges from 15 to 100 feet. The water table fluctuates throughout the year. From December to April, the depth to the top of the water table will be 6 to 27 inches. The water table will deepen during the warmer months of the year.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flat > Gilgai
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	5–30 m
Slope	0–3%
Water table depth	15–69 cm
Aspect	Aspect is not a significant factor

Climatic features

The Western Gulf Coast Flatwoods (MLRA 152B) is within the humid subtropical climate zone. The region boasts one of the highest rainfall averages in the southern United States, over 60 inches (152 centimeters) annually. This is

due to the gulf currents that carry humid air to the region, where it condenses and precipitates. Rainfall averages are fairly consistent month by month, ranging from the lowest of 3.5 inches (8.9 centimeters) in March and the highest of 5.6 inches (14.3 centimeters) in June.

The area is prone to severe thunderstorms and tornadoes when the proper conditions exist, generally in the springtime. Sometimes excessive rainfall occurs, leading to flooding. Hurricanes also strike the region, generally in late summer or early fall. These extreme weather events can be quite destructive, toppling trees, and serves to naturally reset the vegetation to primary succession. The higher humidity of the region amplifies the feeling of heat during the summer. Prolonged droughts and snowfall events are rare.

Table 3. Representative climatic features

Frost-free period (characteristic range)	222-238 days
Freeze-free period (characteristic range)	264-276 days
Precipitation total (characteristic range)	1,499-1,600 mm
Frost-free period (actual range)	219-239 days
Freeze-free period (actual range)	254-343 days
Precipitation total (actual range)	1,397-1,626 mm
Frost-free period (average)	228 days
Freeze-free period (average)	282 days
Precipitation total (average)	1,549 mm

Climate stations used

- (1) LUMBERTON [USC00415435], Silsbee, TX
- (2) DE QUINCY [USC00162361], Dequincy, LA
- (3) WILDWOOD [USC00419754], Kountze, TX
- (4) ELIZABETH [USC00162800], Oakdale, LA
- (5) CLEVELAND [USC00411810], Cleveland, TX
- (6) ORANGE 9 N [USC00416680], Orange, TX
- (7) OBERLIN FIRE TWR [USC00166938], Oberlin, LA
- (8) LIBERTY [USC00415196], Liberty, TX

Influencing water features

The clayey soils are somewhat poorly to poorly drained and do not pond water or flood, but have a water table from 6 to 27 inches during from December to April. Most soils within the Clayey Flats are hydric, but wetland site status will have to be determined on a site-by-site basis using field plant, soil, and water observations.

Wetland description

The Bevil soils associated with this site are hydric. The Vamont soils are non-hydric. The sites that are non-hydric may have small areas of hydric soils. These hydric soils typically are located in the gilgai microdepressions or in low areas that stay wet for long periods. Onsite investigation is necessary to determine exact local conditions.

Soil features

The soils of this site consist of very deep, poorly drained soils formed in clayey fluviomarine deposits. The soils typically have clay-textured horizons through the entire profile. Soils within this ecological site include Bevil and Vamont, which are Chromic Dystraquerts, Oxyaquic Dystruderts respectively. Bevil and Vamont belong to the vertisol order because of their vertic properties. This refers to the lower, subsurface profiles, having shrink-swell properties. The soil shrinks and swells depending on moisture content and leaves large cracks on the surface when dry.

Table 4. Representative soil features

Parent material	(1) Fluviomarine deposits–igneous, metamorphic and sedimentary rock
Surface texture	(1) Clay (2) Silty clay
Family particle size	(1) Fine
Drainage class	Somewhat poorly drained to poorly drained
Permeability class	Very slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	17.78–22.86 cm
Calcium carbonate equivalent (0-152.4cm)	0–2%
Electrical conductivity (0-152.4cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0–4
Soil reaction (1:1 water) (0-152.4cm)	3.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ecological site description (ESD), including the state-and-transition model (STM), was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals, and ecological processes are described to inform land management decisions.

Introduction – In southeastern Texas and southwestern Louisiana the transition from coastal grasslands to the large expanse of coniferous forest has been deemed the “Flatwoods”. As the name suggests, the region is relatively flat and, with many transitional areas, highly diverse in flora and fauna. Historically, the area was covered by pines with mixed hardwoods, sparse shrubs, and a diverse understory of grasses and forbs. Fire and drainage patterns play a significant role in shaping the plant communities and their development. Fire suppression, drainage alterations, and land conversion have reduced the amount of historical communities in existence today.

Background – Prior to settlement by the Europeans, the reference state for the Sandy Terraces were Swamp Chestnut/Willow Oak Forests. Remnants of this presumed historic plant community still exist where natural conditions are intact. Evidence of the reference state is found in accounts of early historic explorers to the area, historic forest and biological survey teams, as well as recent ecological studies in the last 30 years. The age of this community varies, and has a diverse flora.

Settlement Management – As human settlement increased throughout the area, so did the increase in logging and grazing by domestic livestock. The logging became so extensive that by the 1930’s most of the region had been cut-over. Replanting trees to historic communities was not common and early foresters began planting loblolly pine (*Pinus taeda*) for its quick growth. As more people colonized they began suppressing fire, which allowed dense thickets of shrubs to replace the herbaceous understory.

Current Management and State – Today much of the historic forest is gone, replaced by pine plantations, crops, and pastures. The areas that were not converted have been fire-suppressed so long that loblolly pine and fire

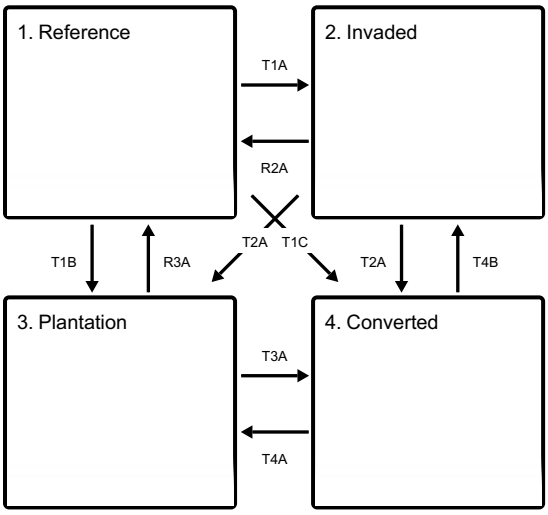
intolerant hardwoods populate the overstory structure. Currently, federally-managed properties are the best place to view the remnant sites (National Park Service, U.S. Fish and Wildlife Service, etc.). Some private individuals have begun restoring communities through selective tree planting and retention of communities that remain. Other restoration efforts include mimicking natural-disturbance regimes through gap-phase regeneration on plantation sites.

Fire Regimes – Fire was a natural and important disturbance throughout the region. Fire occurred naturally from lightning strikes, by Native Americans for game movement, and eventually early European settlers. Fires throughout the Flatwoods occurred at two different times. Early in the year, they would occur during late winter and early spring, removing senescent vegetation, recycling nutrients and minerals, and spurring new plant growth. Late summer and early fall fires occurred as well, but with a different community effect. Summer fires burned hotter and with more intensity, greatly suppressing the shrub canopy layer. The summer fires also shifted the ecological site transitional state by decreasing grass densities and increasing forb densities. The topography, fuel loads, and other conditions caused patchy burns throughout the region resulting in mosaic patterns of plant communities and a heterogeneous landscape.

Disturbance Regimes – Extreme weather events occur occasionally throughout the region. Tornados uproot trees and open canopies in the spring months. In the late summer and early fall, hurricanes or tropical depressions can make landfall, dumping excessive amounts of rain and toppling trees with high winds. Another cause of large canopy openings is the effects of the southern pine beetle (Dendroctonus frontalis). Starting in the late 1950's, beetle outbreaks have occurred every 6 to 9 years (although a major attack has not occurred in some time); usually when the trees are stressed due to multiple environmental factors.

State and transition model

Ecosystem states



T1A - Absence of disturbance, introduction of Chinese tallow and/or other non-native species, and natural regeneration over time

T1B - Native vegetation has been cleared and replaced with desirable timber species

T1C - Native vegetation has been cleared and replaced with improved forage species or annual crops

R2A - Mechanical and chemical control of Chinese tallow, coupled with period fire every 10-20 years

T2A - Merchantable timber is harvested by clearcut and vegetation is replaced with monoculture of desirable timber species.

T2A - Vegetation has been cleared and replaced with improved forage species or annual crops

R3A - Selective harvest combined with reintroduction of native species and periodic fire every 10-20 years

T3A - Native vegetation has been harvested and replaced with improved forage species or annual crops

T4B - Lack of natural/anthropogenic disturbance and natural regeneration over time

T4A - Planting monoculture of desirable timber species

State 1 submodel, plant communities

1.1. Swamp Chestnut/Willow Oak Forest

State 2 submodel, plant communities

2.1. Exotic Thicket

State 3 submodel, plant communities

3.1. Pine/Hardwood Plantation

State 4 submodel, plant communities

4.1. Planted Pasture and Row Crop

State 1
Reference

The Clayey Flat ecological site is a Swamp Chestnut/Willow Oak Forest. The nature of the clayey soils and flat surface greatly increase the available water to the plants. The clayey soils have shrink-swell properties and can cause crooked trunks in the overstory trees. The soils shift through wetting and drying, causing the trees to readjust as they grow towards the sunlight. Clay soils accumulate nutrients more readily which allows the biomass on the sites to be high. The high quality of the soils create a moderate to heavy overstory from 75 to 95 percent. Basal areas are high from 85 to over 105 square feet per acre. Wetness is more of a disturbance factor than fire. Fire frequencies are low and probably occurred every 10 to 20 years.

Dominant plant species

- swamp chestnut oak (*Quercus michauxii*), tree
- willow oak (*Quercus phellos*), tree

Community 1.1
Swamp Chestnut/Willow Oak Forest

Figure 8. Swamp Chestnut/Willow Oak Forest of the Clayey Flat on the Bevil series. Photo by Tyson Hart, USDA-NRCS-2015.

The overstory canopy consists of several hardwoods species. Swamp chestnut oak (Quercus michaeux) is frequently dominant and willow oak (*Quercus phellos*) is highly prevalent. Loblolly pine (*Pinus taeda*), water oak (*Quercus nigra*), and cherrybark oak (*Quercus pagoda*) are often found associated on the site. Dense cover of dwarf palmetto (*Sabal minor*) is an indicator of the Clayey Flats. Other species found in midstory are arrowwood (*Viburnum dentatum*), green ash (*Fraxinus pennsylvanica*), and sweetgum (*Liquidambar styraciflua*). The herbaceous understory varies depending on overstory and midstory densities. Longleaf woodoats (*Chasmanthium sessiliflorum*) and broadleaf uniola (*Chasmanthium latifolium*) are especially common because of their high tolerance to shady conditions.

State 2
Invaded

Chinese tallow (*Triadica sebifera*) is an undesired, invasive species brought to the United States in 1776 (Randall and Marinelli, 1996). Rapid expansion along the gulf coastal states has allowed the species to invade many ecosystems and consequently reduce diversity. Tallow trees are known to cause gastrointestinal upset, contact dermatitis, and toxicity in livestock and humans. Mechanical and chemicals options exist as a means to control the trees.

Dominant plant species

- Chinese tallow (*Triadica sebifera*), tree

Community 2.1
Exotic Thicket

Chinese tallow invade the ecological site via natural movement and flooding events as nearby waterways transport seeds. Once settled, the seeds produce saplings viable to reproduce seeds in as little as three years. The rapid establishment immediately blocks sunlight to understory species and reduces diversity. Unabated growth quickly allows the saplings to grow into the overstory, thus changing the ecological state entirely. Reductions in size and number of all vegetative species are seen in all canopy tiers.

State 3
Plantation

The Plantation State is a result of conversion activities. The landowner has maximized silviculture production by planting a monoculture of pine or hardwood species.

Dominant plant species

- loblolly pine (*Pinus taeda*), tree
- slash pine (*Pinus elliottii*), tree

Community 3.1
Pine/Hardwood Plantation

In the immediate years following the initial plantation tree planting, the understory community will resemble the reference state (State 1). During this early growth period, the landowner will typically remove unwanted hardwoods and herbaceous plants to reduce competition with the planted pine trees. As the overstory canopy closes, less understory management is required due to sunlight restrictions to the ground layer.

State 4
Converted

The converted state is a result of conversion activities. The landowner has maximized agriculture production by planting a monoculture of introduced grass species or agricultural row crops.

Community 4.1
Planted Pasture and Row Crop

Typical introduced pasture grass species include bahiagrass (*Paspalum notatum*) and different varieties of bermudagrass (*Cynodon dactylon*). The grasses are grown for livestock production through direct grazing or baling hay for later use. Agricultural row crops are grown for food and fiber production. Many farmers use herbicides to reduce unwanted plant competition, which yields a plant community unrepresentative of the reference (State 1) or subsequent vegetative states.

Transition T1A
State 1 to 2

The transition from State 1 to State 2 is a result of occupancy by Chinese tallow or other noxious weeds. Invasion can be enhanced by clearing of the overstory. Invasive plants outcompete, and eventually choke out, all other native species.

Transition T1B
State 1 to 3

The transition is due to the land manager maximizing silviculture potential. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to a monoculture of pine or hardwood trees.

Transition T1C
State 1 to 4

The transition is due to the land manager maximizing agricultural production. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to either an improved grass or row crops.

Restoration pathway R2A
State 2 to 1

The driver for restoration is control of Chinese tallow. Although an option, mechanical removal of the trees is difficult because they readily regrow from roots and seeds. Several chemical methods are available including glyphosate for cut-stump treatments, triclopyr for cut-stump and foliar treatments, imazamox for broad spectrum application, and imazapyr as a foliar spray. Many aquatic herbicides have water use restrictions and can potentially kill hardwoods, so labels and restrictions should be read carefully prior to application.

Transition T2A
State 2 to 3

The transition is due to the land manager maximizing silviculture potential. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to a monoculture of pine or hardwood trees.

Transition T2A
State 2 to 4

The transition is due to the land manager maximizing agricultural production. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to either an improved grass or row crops.

Restoration pathway R3A
State 3 to 1

When restoring a plantation, the land manager can either clearcut the timber and begin as in the previous example. Otherwise, gap-phase regeneration is possible through selective timber harvests. This involves replanting the desired overstory species in small openings within the current structure of the woodland. The benefit is a slow progression of restoration instead of starting from primary succession.

Transition T3A
State 3 to 4

The transition is due to the land manager maximizing agricultural production. Merchantable timber is harvested by clearcut, the site prepared and planted to either an improved grass or row crops.

Transition T4B
State 4 to 2

This community transition is caused by neglecting crop or pasture. Without continuation of agricultural management, noxious weeds can invade ground layer and eventually develop into a thicket, shading out desired plants.

Transition T4A
State 4 to 3

The transition is due to the land manager maximizing silviculture production. The site prepared and planted to pine or hardwood trees.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
loblolly pine	PITA	*Pinus taeda*	Native	–	–	–	–
swamp chestnut oak	QUMI	*Quercus michauxii*	Native	–	–	–	–
water oak	QUNI	*Quercus nigra*	Native	–	–	–	–
cherrybark oak	QUPA5	*Quercus pagoda*	Native	–	–	–	–
willow oak	QUPH	*Quercus phellos*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
sedge	CAREX	*Carex*	Native	–	–
Indian woodoats	CHLA5	*Chasmanthium latifolium*	Native	–	–
longleaf woodoats	CHSE2	*Chasmanthium sessiliflorum*	Native	–	–
needleleaf rosette grass	DIAC	*Dichanthelium aciculare*	Native	–	–
panicgrass	PANIC	*Panicum*	Native	–	–
Forb/Herb					
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	–	–
lizard's tail	SACE	*Saururus cernuus*	Native	–	–
Shrub/Subshrub					
southern arrowwood	VIDE	*Viburnum dentatum*	Native	–	–
yaupon	ILVO	*Ilex vomitoria*	Native	–	–
dwarf palmetto	SAMI8	*Sabal minor*	Native	–	–
American beautyberry	CAAM2	*Callicarpa americana*	Native	–	–
Tree					
red maple	ACRU	*Acer rubrum*	Native	–	–
common hackberry	CEOC	*Celtis occidentalis*	Native	–	–
green ash	FRPE	*Fraxinus pennsylvanica*	Native	–	–
sweetgum	LIST2	*Liquidambar styraciflua*	Native	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	–
Vine/Liana					
Alabama supplejack	BESC	*Berchemia scandens*	Native	–	–
peppervine	NEAR5	*Nekemias arborea*	Native	–	–

Wood products

These soils occur in the Woodland Suitability Group 2s8 Sticky. These clayey soils have a high potential for both pine and hardwood management. The 50-year site index for loblolly pine ranges from 85 to 95 feet (approximately 57 to 64 feet on a 25-year curve). For bottomland oaks it averages 80 feet. The yield from an unmanaged, natural stand of loblolly pine, over a 50-year period, is approximately 330 board feet (Doyle Rule), 2.64 tons, or 90 cubic feet per acre per year. Management can substantially increase this yield. Access and equipment operability on these soils is poor during wet periods. Harvesting and other operations may need to be suspended during such periods when rutting can be severe. Wetness and low strength will also cause moderate problems on these soils for log landings and roads. Site preparation during wet periods and tree planting operations will have moderate problems due to the sticky nature of these soils. Site preparation operations should be limited to the dry months and planting should be planned for the drier part of the planting season. Slow drainage may cause moderate pine seedling survival problems. The use of herbicides for site preparation should take into consideration the slow drainage on these soils. Applications should not be made during wet periods.

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Contributors

Tyson Hart

Approval

Bryan Christensen, 9/22/2023

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/04/2024

Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
