

# Ornate Box Turtle (*Terrapene ornata*) Species Guidance

Family: Emydidae – the pond turtles and box turtles

**State Status:** [Endangered](#) (1982)

**State Rank:** [S1](#)

**Federal Status:** [none](#)

**Global Rank:** [G5T5](#)

**Wildlife Action Plan  
Mean Risk Score:** [3.6](#)

**Wildlife Action Plan Area  
Importance Score:** [2](#)



Counties with documented locations of ornate box turtles in Wisconsin. Source: Natural Heritage Inventory Database, February 2013.



Photo by A.B. Sheldon

## Species Information

**General Description:** The ornate box turtle is a small terrestrial turtle with a carapace (upper shell) that measures up to 15.4 cm (6.1 in) long and averages 10.0-12.5 cm (4-5 in; Conant and Collins 1998). The domed carapace is flattened on top with little or no mid-dorsal keel. The carapace is dark brown or black with conspicuous yellow lines that radiate from the center of each costal scute (one of the bony plates that makes up the turtle's shell) and form dashes on the central scutes that give the carapace a hand-painted look (Vogt 1981). A discontinuous, yellow mid-dorsal stripe is often present (Redder et al. 2006). The ornate's hinged plastron (lower shell) begins to function around the age of five. The plastron is brown with yellow lines that radiate on each scute. Adult males typically have a solid-colored head that can vary from a slate-blue to dark green or gold, and bright red eyes and jaws that are often yellow, or tinged with orange-red (Vogt 1981). The foreleg scales are bright red, yellow, or orange. Males have a concave plastron and are equipped with a long, sharply curved first claw on their hind feet. Females have lighter tan or faded yellow spots on a light brown head, brown or yellow eyes, and jaws lined with pale yellow. Juveniles have a dark brown carapace with a distinct yellow vertebral stripe and yellow scute spots instead of lines. Their plastron is yellow with a dark brown central spot (Vogt 1981). Newly hatched young possess a carapace that is nearly flat and circular, and retain their egg tooth up to 30 days (Legler 1960). Individuals may vary in these characteristics, and some may differ slightly from this general description.

**Similar Species:** The ornate is the only native box turtle species in Wisconsin and is distinguished from other box turtles by the brown plastron with yellow lines that radiate on each scute. The Blanding's turtle (*Emydoidea blandingii*) is a similar species that may be confused with the ornate box turtle. Both have moderately high, domed carapaces and a hinged plastron, but Blanding's turtles are medium-sized turtles with adult carapace lengths twice that of ornate turtles. Blanding's turtle coloration of the carapace is usually black-speckled with yellow, rather than lined with yellow. Blanding's turtles can be easily identified by the bright yellow underside of the neck.

**Associated Species:** Predators of ornate box turtle eggs include various raptors, fox, coyotes (*Canis latrans*), ravens (*Corvus corax*), crows (*Corvus brachyrhynchos*), opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), skunks, and snakes (Vogt 1981, Ernst and Lovich 2009). Other species in Wisconsin associated with the box turtle are gophersnakes (*Pituophis catenifer*), prairie ring-necked snakes (*Diadophis punctatus arnyi*), woodland voles (*Microtus pinetorum*), prairie voles (*Microtus ochrogaster*), and Franklin's ground squirrels (*Spermophilus franklinii*)

**State Distribution and Abundance:** This species is limited to the south-central and southwestern part of the state, primarily in areas where broad, deep sand deposits have settled out within the original Wisconsin River floodplain. Distribution information for this species may not reflect its full extent in Wisconsin because many areas of the state have not been thoroughly surveyed.

**Global Distribution and Abundance:** The ornate box turtle is a grasslands/plains species found throughout Texas, Oklahoma, Kansas, Nebraska and parts of Missouri, Illinois, Indiana, Arkansas, Louisiana, Colorado, New Mexico, Arizona and Wyoming



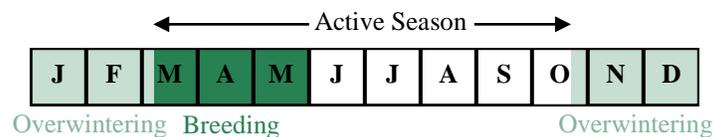
Global range map for the Ornate Box Turtle. (NatureServe 2013)

(Ernst and Lovich 2009). The species occurs locally in Wisconsin along the Wisconsin River floodplain counties and in Iowa along the Mississippi River (Vogt 1981, Doroff and Keith 1990). An intergradation area with the desert box turtle zone exists in western Texas and southeastern New Mexico (Redder et al. 2006).

**Diet:** Box turtles are omnivorous and eat a variety of foods in their dry prairie habitat. The diet is predominantly (> 90%) insect-based (including beetles, grasshoppers, and caterpillars), but also includes carrion, berries, prickly pear cactus, spiderwort, ground cherries, mushrooms, grass, and other succulent vegetation (Vogt 1981, Christoffel et al. 2002, Ernst and Lovich 2009). The ornate efficiently metabolizes liquid from the plant and animal material it eats and therefore does not often drink water (Ernst and Lovich 2009).

**Reproductive Cycle:** Females and males reach sexual maturity at 10-11 and seven years, respectively, and averages for the species vary from seven to 12 years (Blair 1976, Doroff and Keith 1990, Belzer and Steisslinger 1999). Primary breeding season is late April through May (R. Hay per. comm.), and mating opportunities consist of chance visual encounters as turtles move around their home ranges (Belzer and Steisslinger 1999). In May through June gravid females dig small holes in soft, well-drained soil, deposit three to four eggs, and then abandon nests to let eggs incubate (Packard et al. 1985, Packard and Packard 1986, Doroff and Keith 1990, Belzer and Steisslinger 1999). Turtles generally return to the same area to breed and nest each year (Doroff and Keith 1991, Curtin 1997). Incubation periods in Wisconsin range from 79-87 days and are strongly negatively correlated with temperature (i.e., the colder the temperature, the longer the incubation period; Vogt 1981, Temple 1987, Doroff and Keith 1990, Redder 2006). The ornate box turtles' egg shells do not provide protection from desiccation; greater exposure to moisture will increase average mass of hatchlings, increase incubation period by an average of three days, and is vital to modulating physiology of developing young (Packard et al. 1985). Eggs need to be  $\geq 22.5^\circ\text{C}$  to develop, and exhibit temperature-dependent sex determination (Ewert and Nelson 1991). Temperatures from  $22.5^\circ\text{C}$  to  $25.0^\circ\text{C}$  typically produce 100% males, whereas those between  $26.0^\circ\text{C}$  and  $29.0^\circ\text{C}$  typically produce a mix of males and females and temperatures  $\geq 29.0^\circ\text{C}$  will produce 100% females (Bull 1980, Packard et al. 1985, Packard and Packard 1986, Ewert and Nelson 1991). Nest success rates average 69%, and hatchlings emerge in the fall or may overwinter if the nest is deep (Doroff and Keith 1990, Unknown 2002).

**Ecology:** Long term studies have shown that ornate box turtles generally live at least 26 years under natural conditions, and up to age 37 (Blair 1976, Metcalf and Metcalf 1985, Gibbons 1987, Christiansen et al. 2004). Estimated survival rates and adult annual recruitment are 0.82 and 1.02, respectively (Doroff and Keith 1991, Converse and Savidge 2003, Bowen et al. 2004) and Blair (1976) reported a complete population turnover every 32 years. In Wisconsin, ornate box turtles are active from at least mid-April through early September (a five-month activity period; Doroff and Keith 1990, Ellner and Karasov 1993). Home ranges of both adults and juveniles, regardless of sex, overlap and range from 0.5-143.5 acres (0.2-58.1 ha; Doroff and Keith 1990). Box turtles' homing nature leads them to seek out their native home range when moved (Blair 1976, Metcalf and Metcalf 1978, Metcalf and Metcalf 1985, Gibbons 1987, Belzer and Steisslinger 1999, Christiansen et al. 2004). Most ornate box turtle activity consists of basking, foraging, and resting, and length of these activities is affected by environmental temperature (Ernst and Lovich 2009). Ellner and Karasov (1993) reported that box turtle body temperature averages  $21.4^\circ\text{C}$  during basking and  $27.8^\circ\text{C}$  during thermal burrowing, and found that > 90% of all turtle activity occurs when ground temperature is  $20\text{-}28^\circ\text{C}$ . Foraging ceases during the warmest portions of the days when turtles seek shelter in shady areas. Turtles dig shallow depressions known as "forms" in soft soil or litter, and partially or totally bury themselves to thermoregulate (Converse and Savidge 2003). During extreme heat, turtles have been found in shallow areas of lakes or buried in mud (Clarke 1950, Unknown 2002).



Overwintering sites include upland and sand prairies, sand dunes, blackberry thickets, and shrubs that are open and lack shade (Doroff and Keith 1990, Unknown 2002, Bernstein and Black 2005). Box turtles overwinter by burrowing roughly 77 cm deep into well drained soils (range 0.5-1.8 m; Doroff and Keith 1990). Turtles will burrow deeper to achieve higher temperatures when temperatures decrease (Legler 1960, as reviewed by Grobman 1990). Bernstein and Black (2005) reported that ornate box turtles are able to survive exposure to freezing temperatures up to 54 days, but Converse et al. (2005) reported that minimum winter temperature is negatively related to survival rates because turtles respond to cold temperatures by increasing their metabolic rates and burning lipid reserves. Some individuals use burrows excavated by other turtles (Metcalf and Metcalf 1970) or by small mammals (Ernst and Lovich 2009), and turtles have been known to return to the same burrows for overwintering year after year (as reviewed by Redder et al. 2006).

**Natural Community Associations** ([WDNR 2005](#), [WDNR 2009](#)):

*Significant:* [cedar glade](#), [central sands pine-oak forest](#), [dry prairie](#), [oak opening](#), [oak woodland](#), [sand prairie](#), [southern dry forest](#), [southern dry-mesic forest](#)

*Moderate:* dry-mesic prairie, southern mesic forest

*Minimal:* none

**Habitat:** Ornate box turtles in Wisconsin are associated with dry and dry-mesic prairies, sand prairies, oak savannas and open to semi-open woodlands and may choose southern and western exposures where temperatures are higher and soils are drier. Sandy soils facilitate burrowing and provide microhabitat for nesting and overwintering, which often occur in the same burrows (Doroff and Keith 1990). Ornate box turtles are incapable of ascending slopes  $\geq 50^\circ$  and can only travel at 50% of normal speed on slopes  $\geq 35^\circ$ , suggesting that ideal habitat includes areas that are relatively flat with gently sloping hills (Claussen et al. 2002). Ornate box turtles inhabit oak savannas and edges of oak woods in the summer and use the soft soil or litter to thermoregulate (Converse and Savidge 2003). Areas largely composed of rock or pebble substrates are generally avoided (as reviewed by Redder et al. 2006). Grassland and prairie habitats with some access to small ponds and streams are typically used for feeding (Blair 1976, Clarke 1950, as reviewed by Redder et al. 2006).



Ornate box turtle habitat in Sauk County, Wisconsin. Rori Paloski, Wisconsin DNR

**Threats:** The ornate box turtle, guarded only by its shell, is an easy target for pet suppliers and casual collectors, both of which have taken their toll on populations (Belzer and Steisslinger 1999). Adult survivor rates are vital to the success of a population, and the loss of one adult turtle in a population may lead to that population's disappearance over time (Doroff and Keith 1990, Bowen et al. 2004). Roads and developments that fragment habitat lead to deaths by automobiles, habitat alteration, increased disturbance, increased predation, and losses to pet collection (Blair 1976, Doroff and Keith 1990, Gibbs and Shriver, 2002, as reviewed by Redder et al. 2006). Stanley (1987) found that predation pressure is inversely related to the distance between a turtle's nest and an ecological edge; the nest closer to the edge experienced higher predation rates. Conversion of the Great Plains from grasslands to farms and ranches remains an ongoing threat to box turtles (Redder et al. 2006). Agriculture and pine plantations appear to limit ornate box turtles' occurrence (Vogt 1981, Christoffel et al. 2002).

**Climate Change Impacts:** Turtles are at risk of detrimental climate-change impacts due to projected extreme variations in temperature (WICCI 2011). Models of a related species (the three-toed box turtle; *Terrapene carolina triunguis*) show reduced fecundity and growth rates based on simulated climates in 2100 (McCallum et al. 2009). Curtin (1998) reported that the initial environment experienced by ornate box turtles plays an important role in determining thermal preference for the life of that animal. Extreme weather variations may cause problems in ideal habitat selection by ornate box turtle populations. Changes in temperature may also result in single-sex cohorts (see "Reproductive Cycle" section) that can threaten population viability (Dodd 2001, Redder et al. 2006). Warmer temperatures could result in higher metabolic rates in overwintering turtles which, in turn, could deplete lipid reserves to unrecoverable levels and increase mortality rates in adults (Legler 1971, Converse et al. 2005). More frequent and extreme droughts may also affect nesting (Redder et al. 2006). The [Wisconsin Initiative on Climate Change Impacts \(WICCI\)](#) is currently assessing potential climate change impacts on Wisconsin's wildlife.

**Survey Guidelines:** Persons handling ornate box turtles must possess a valid [Endangered and Threatened Species Permit](#). If surveys are being conducted for regulatory purposes, survey protocols and surveyor qualifications must first be approved by the Endangered Resources Review Program (see *Contact Information*). Hand capture through systematic visual encounter surveys (e.g., transects) is the most common and simple to method to survey. Surveys should be conducted from late May to early July during cooler mornings when turtles are most active (Converse and Savidge 2003, Bowen et al. 2004). Drift fences that use funnel traps and pitfall traps have

also been proven to be somewhat effective (Unknown 2002, Converse and Savidge 2003, Converse et al. 2005). It is very important to note that no survey method is considered 100% effective for determining presence/absence of this species.

An individual may also participate in the Wisconsin turtle conservation program by reporting road mortalities. Information found at: <http://dnr.wi.gov>, keyword “turtle conservation”>

Summarize results, including survey dates, times, weather conditions, number of detections, detection locations, and behavioral data and submit via the WDNR online report: <http://dnr.wi.gov>, keyword "rare animal field report form">

## Management Guidelines

*The following guidelines describe actions that will help maintain or enhance habitat for the species. These actions are not mandatory unless required by a permit, authorization or approval.*

This section provides guidance for maintaining, restoring and enhancing habitat for the ornate box turtle. The habitat management goal for this species is long-term preservation of open-canopy uplands with sparse vegetation, sandy soils, and limited access to water sources. Nearby thermal cover (e.g., shrubs, bushes, logs, water bodies) is also beneficial.

Kuo and Janzen (2004) reported that a population size of 700 individuals is necessary to maintain 90% of the population’s allelic diversity over 200 years. Active management should focus on increasing adult survival rates and measures should be taken to increase recruitment into adult populations, increase protections or transplant individuals (Kuo and Janzen 2004). Management should focus on preserving patches  $\geq 250$  acres to minimize disturbance and habitat fragmentation.

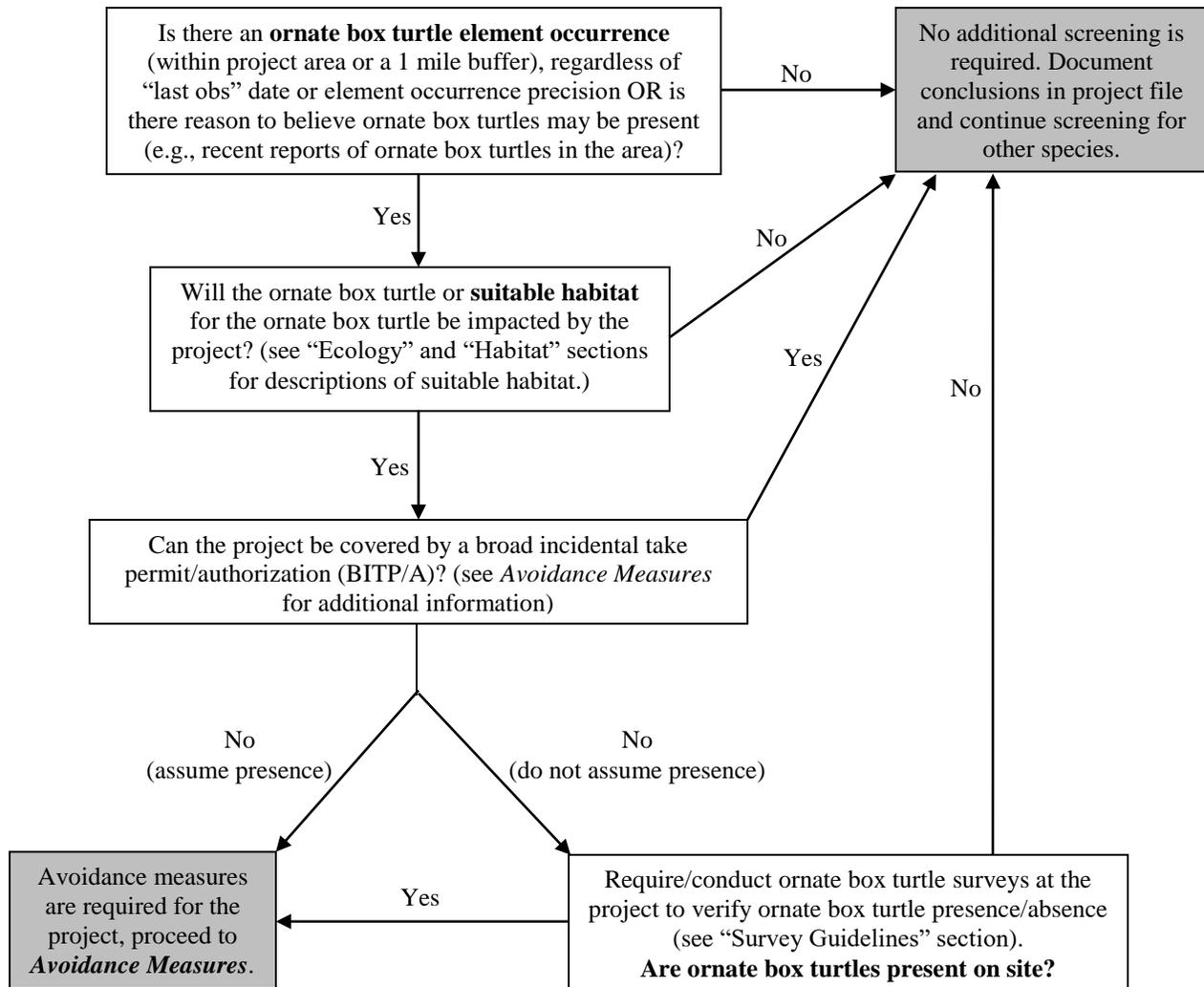
**Upland Habitat:** A light but consistent (e.g., once per year) management protocol, and curtailment of incompatible human activities can keep upland habitat in a high-quality state for the ornate box turtle. Activities that temporarily or permanently destroy habitat, or that affect the structural complexity of upland habitat, can have detrimental effects on the ornate box turtle. The long-term upland habitat management goal is to maintain open-canopy uplands with sparse vegetation, sandy soils, and limited access to water sources. This goal is accomplished by mowing, burning, cutting, and/or herbiciding to prevent woody vegetation encroachment (brush and trees). Grazing is a technique that should not be used because cattle are a threat to the survival of ornate box turtles (Redder et al. 2006). Availability and arrangement of thermal cover (e.g., shrubs, bushes, logs, water bodies) throughout the habitat is linked to population success, and these areas should be close to sandy areas (Converse and Savidge 2003). Management should allow for scattered small trees and brush close to sandy areas. Management is permitted according to the [Grassland and Savanna Protocols](#) (WDNR 2011).

Plastic netting without independent movement of strands can easily entrap amphibians, reptiles, and other wildlife moving through the area, leading to dehydration, desiccation, and eventually mortality (Kapfer and Paloski 2011). Netting that contains biodegradable thread with the “leno” or “gauze” weave (contains strands that are able to move independently) has the least impact on wildlife. If erosion matting (also known as an erosion control blanket, erosion mat or erosion mesh netting) is used, the following matting (or something similar) should be used: North American Green S75BN, S150BN, SC150BN or C125BN.

## Screening Procedures

The following procedures must be followed by DNR staff reviewing proposed projects for potential impacts to the species.

Follow the “Conducting Endangered Resources Reviews: A Step-by-Step Guide for Wisconsin DNR Staff” document (summarized below) to determine if ornate box turtles will be impacted by a project (WDNR 2012):



## Avoidance Measures

The following measures are specific actions typically required by DNR to avoid take (mortality) of state endangered or threatened species per Wisconsin’s Endangered Species Law (s. 29.604, Wis. Stats.). These guidelines are typically not mandatory for non-listed species (e.g., special concern species) unless required by a permit, authorization or approval.

According to Wisconsin’s Endangered Species Law (s. 29.604, Wis. Stats.), it is illegal to take, transport, possess, process, or sell any wild animal on the Wisconsin Endangered and Threatened Species List (ch. NR 27, Wis. Admin. Code). Take of an animal is defined as shooting, shooting at, pursuing, hunting, catching or killing.

If *Screening Procedures* above indicate that avoidance measures are required for a project, follow the measures below. If you have not yet read through *Screening Procedures*, please review them first to determine if avoidance measures are necessary for the project.

1. The simplest and preferred method to avoid take of ornate box turtles is to avoid directly impacting individuals, known ornate box turtle locations, or areas of suitable habitat (described above in the “Ecology” and “Habitat” sections and in *Screening Procedures*).

2. If suitable habitat cannot be avoided, the following time of year restrictions can be used to avoid take:
  - For above-ground activities that do not disturb the soil (e.g., tree cutting), conduct work during the species' inactive period (typically November 16 – March 4).
3. If impacts cannot be avoided but the No/Low Impact Broad Incidental Take Permit/Authorization (BITP/A; <http://dnr.wi.gov/topic/ERReview/ITNoLowImpact.html>) can be followed, the project is covered for any unintentional take that may occur.
4. If impacts cannot be avoided during restoration or management activities, but the Grassland and Savanna Protocols can be followed (<http://dnr.wi.gov/topic/erreview/documents/gspornateboxturtle.pdf>), the project is covered for any unintentional take that may occur.
5. If ornate box turtle impacts cannot be avoided and the No/Low Impact BITP/A or Grassland and Savanna Protocols cannot be followed, please contact the Natural Heritage Conservation Incidental Take Coordinator (see *Contact Information*) to discuss possible project-specific avoidance measures. If take cannot be avoided, an [Incidental Take Permit or Authorization](#) is necessary.

## Additional Information

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### Linked Websites

- Incidental Take Permit and Authorization: <<http://dnr.wi.gov>, key word "incidental take overview">
- Natural Communities of Wisconsin: <<http://dnr.wi.gov>, key word "natural communities">
- Rare Animal Field Report Form: <<http://dnr.wi.gov>, key word "rare animal field report form">
- Wisconsin Endangered and Threatened Species: <<http://dnr.wi.gov>, key word "endangered resources">
- Wisconsin Endangered and Threatened Species Permit: <<http://dnr.wi.gov>, key word "endangered species permit">
- Wisconsin Initiative on Climate Change Impacts: <<http://www.wicci.wisc.edu/>>
- Wisconsin Natural Heritage Working List: <<http://dnr.wi.gov>, key word "Natural Heritage Working List">
- Wisconsin Turtle Conservation Program: <<http://dnr.wi.gov>, key word "turtle conservation">
- Wisconsin's Wildlife Action Plan: <<http://dnr.wi.gov>, key word "Wildlife Action Plan">

### Funding

- USFWS State Wildlife Grants Program: <<http://wsfrprograms.fws.gov/subpages/grantprograms/swg/swg.htm>>
- Sadie Nolan Amphibian and Reptile Education and Conservation Memorial Fund
- Wisconsin Natural Heritage Conservation Fund

### Contact Information (Wisconsin DNR Species Expert for ornate box turtles)

- Refer to the Reptiles contact on the [Rare Species and Natural Community Expert List](#)

### Contact Information

- *Endangered Resources Review Program*: WI Department of Natural Resources, Bureau of Natural Heritage Conservation ([DNRRERReview@wisconsin.gov](mailto:DNRRERReview@wisconsin.gov))
- *Incidental Take Coordinator*: [Rori Paloski](#), WI Department of Natural Resources, Bureau of Natural Heritage Conservation (608-264-6040, [rori.paloski@wi.gov](mailto:rori.paloski@wi.gov))

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