



LANDSCAPE ARCHITECTURE
PRODUCTION SUPPORT OFFICE – OFFICE OF DESIGN

SAFETY EFFECTS OF REDUCED MOWING

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Executive Summary

Reduced mowing, through less frequent mowing and/or the area mowed, occurs in and beyond the clear zone. To determine if there are any impacts to safety of motorists or those managing roadside vegetation, an exhaustive search of the literature was conducted as well as an examination of crash reports on state roads from 2011 to 2018, the period of greatest reduced mowing activity in Florida.

Decreased Safety

There is limited empirical evidence¹ about the negative impacts of reduced mowing on safety. One report notes that the rate of spread of fire in the regularly mowed grass of the safety strip will be slower than in the taller grass which is only mowed once per year.

There is no evidence that reduced mowing is a safety issue with respect to sight distance or obscured signage. Overgrown roadside vegetation (tree branches, shrubs, and tall grass) has been implicated as a factor in numerous crashes in Great Britain, but the only reduced vegetation management concern was the budget cutbacks with regard to the trimming of tree branches and shrubs. And here in Florida, reduced mowing on state roads has not been implicated in any crash from 2011 to mid-2018 with respect to sight distance or obscured signage.

Finally, the preponderance of empirical evidence does not support the belief that the likelihood of wildlife-vehicle collisions, especially deer-vehicle collisions, is increased in reduced mowing areas because of concomitant increases in the amount palatable native vegetation that attracts wildlife to roadsides.

Increased Safety

Empirical evidence that reduced mowing improves safety was very limited.

Conclusion

Issues raised about the impact of reduced mowing on safety issues, for the most part, are not supported by the empirical evidence.

¹ Empirical evidence – data obtained via experimentation or observation, which is then recorded and analyzed.

Introduction

Reduced mowing occurs in and beyond the clear zone. While there are economic and ecological benefits, impacts on safety need to be elucidated so that FDOT can make informed decisions about implementing this practice. Empirical evidence to support improved or decreased safety claims mentioned in this report is very limited, with conclusions often based on perception, conjecture, and anecdotal evidence. Researchers in Texas even noted that “There has been only limited research conducted on the effects of mowing on sight distance, speeds, and crash reduction....[with] results of those research efforts [providing] little guidance or definitive conclusions as to how a mowing program should be carried out or improved.”²

The most commonly mentioned impacts of reduced mowing on increased or decreased safety are noted in this report, with a summary about the validity of each point based on empirical evidence and if available, crash reports on state roads from 2011 to 2018 (see Appendix for crash report query parameters), the period of greatest reduced mowing activity in Florida.

Improved Safety

- Reduced presence of mowers and string trimmer operators improves safety for motorists and mower/string trimmer operators.
- Taller turf slows errant vehicles making it easier for the driver to regain control while traversing the clear zone.
- Older and taller turf is less attractive to foraging deer than short, tender green growth stimulated by mowing.
- Taller vegetation reduces glare at night from oncoming traffic.
- Reduced mowing can improve roadside aesthetics, which can reduce driver fatigue or increase driver alertness.

Safety to Motorists and Mower/String Trimmer Operators

From 2011 through mid-2018 there were no reported crashes on Florida state roads involving a mower operated on the roadside. The only reported crash was a vehicle that crashed into a bush hog being legally towed by a tractor in the right lane. The bush hog was being towed for refueling; there were no mitigating circumstances (sight distance, obscured view, time of day, rain, DUI, etc.). During that same time period, there was only one report of afform crash involving a person operating a string trimmer. An inmate crew was string trimming/leaf blowing when a driver struck the leaf blower being operated by an inmate. The driver failed to move over for the inmates working on the roadside. There were no mitigating circumstances (sight distance, obscured view, time of day, rain, DUI, etc.).

Reducing the frequency of mowing limits the likelihood of mower-thrown-objects (MTOs) striking a vehicle. And if increasing the mowing height is part of a reduced mowing program, raising the mowing height to 6 inches will reduce MTOs based on research conducted in Texas.^{3,4}

Tall Turf Slows Errant Vehicles

There was only one study that dealt with the effect of turf height on braking and control of errant vehicles.⁵ In that study, the focus was Coefficient of Friction (CF), which is a value that expresses how easily two surfaces slide over each other. Typically, values are between 0 and 1; the closer the value is to 0, the easier the two surfaces slide over each other. For roadside ROWs in general, a high CF between tires and vegetation would reduce the braking distance of an errant vehicle while lower CFs would increase braking distance. Dry, short rye grass reduced braking distance about 6% compared to tall rye grass, and about double that on wet rye grass. *However*, braking distance is only one safety consideration with respect to CFs. The researchers emphasized the importance of the difference between CFs for tire/pavement, tire/shoulder, and tire/vegetation when a vehicle leaves the road. The closer the difference is to 0 between any two CFs the less likely the vehicle is to swerve. They stressed that “Differential friction can either

² Fitzpatrick, Parham, & Brewer, 2002

³ Marshek, DaSilva & Kannapan, 1986

⁴ DaSilva, Marshek, & Kannapan, 1986

⁵ Cenek, Jameison, & McLarin, 2005(Cenek, Jameison, & McLarin, 2005)(Fulbright, 1999)

exacerbate the effects of an emergency manoeuvre (e.g. a locked-wheel skid for example) or precipitate an emergency during an otherwise normal manoeuvre (e.g. unexpected locking of a wheel)."

Older and Taller Turf is Less Attractive to Deer

It's widely reported that deer do not prefer to forage on grasses except when grasses are "...young, green, and succulent" (for example, see Fulbright, 1999), which would occur shortly after mowing as well as during green-up in the spring. Grass digestibility also is an issue, as it has been noted that

"Grasses rarely are a preferred food item of whitetails, except during the early growth stages when the grass shoots are more digestible."⁶

Glare Reduction

Headlight glare is a safety hazard if it causes a motorist to lose sight of the road.⁷ And it's even more of a significant issue in Florida given our number of retirees since those 65 and older have an increased sensitivity to glare.⁸ Interestingly, the effect of headlight glare from high beams can occur when an oncoming vehicle is 3000 ft away.⁹

Headlight glare is affected by median width¹⁰ and "... degree of curvature of horizontal curves".⁷ Vegetation in the median can limit glare, with the greatest apparent effects being for medians up to 50 ft wide.¹⁰ However, it's been noted that vegetation must be dense and continuous to fully eliminate glare, and "less dense planting may tend to result in intermittent flashes...[and] vegetation in the median may introduce irregular, moving shadow patterns on the roadway ahead of the driver."⁹

While there is no documented evidence about glare reduction from tall vegetation resulting from reduced mowing, several states specifically allow for the use of vegetation to reduce headlight glare, for example,

Indiana DOT "Screening for Headlight Glare. Depending upon roadway alignment and the selected type of vegetation, landscaping features may be used to effectively screen headlight glare, for example, in a freeway median."¹¹

Minnesota DOT "Other benefits of using native grasses and wildflowers include...Improved traffic safety, as vegetation screens headlight glare in curved median areas and delineates the roadway for drivers."¹²

Washington (State) DOT "Locate roadside features to screen reflective objects where practical.

- Glare can be blocked with vegetation, glare screens, berms, walls, etc.
- Vegetation in medians can reduce headlight glare.
- Bright lights from land uses, such as adjacent industrial complexes, can be screened by walls or evergreen trees and shrubs."¹³

Improving Roadside Aesthetics Reduces Driver Fatigue / Increases Driver Alertness

There are numerous assertions that improving roadside aesthetics, whether a result of landscape plantings or reduced mowing, improves safety to motorists by either reducing fatigue or increasing alertness. An extensive

⁶ Kroll, 2015(Kroll, 2015)

⁷ Johnson D. T., 2017 (Johnson D. T., 2017)

⁸ Lutkevich, McLean, & Chung, 2012 (Lutkevich, McLean, & Chung, 2012)

⁹ Powers & Solomon, 1965(Powers & Solomon, 1965)

¹⁰ The following criteria should be considered when deciding to choose glare screens: 1. Median width < 20 feet: Glare screen warranted. 2. Median width 20-50 feet: Glare screen may be warranted, need other justification, perhaps a study is needed. 3 Median width > 50 feet, Glare screen typically not warranted. (Johnson D. T., 2017)

¹¹ Indiana Dept. of Transportation, 2018

¹² Johnson A. M., 2008

¹³ WSDOT, Development Division, Design Office, Engineering and Regional Operations, 2017

search of the literature yielded no empirical evidence showing that improved aesthetics resulting from reduced mowing led to a reduction in driver fatigue or improved alertness. There is empirical evidence showing that improving roadside aesthetics can lead to reductions in driver fatigue or improving alertness; however, all of those studies involved trees/shrubs, natural scenery/landscapes (vegetation not always specified), or urban settings.

Decreased Safety

- Reduced mowing leads to tall grass that becomes a fire hazard in the clear zone.
- Reduced mowing can increase occurrence of tall native grasses, especially beyond the clear zone, which can become a fire hazard.
- Reduced mowing at intersections, interchanges, and other restricted view areas can interfere with required sight view distances.
- Reduced mowing can obscure signage.
- Reduced mowing increases occurrence of palatable native vegetation which attracts wildlife to roadsides thereby increasing the likelihood of wildlife-vehicle collisions (WVCs), especially deer-vehicle collisions (DVCs).
- FDOT personnel or contractors may encounter or be bitten by venomous snakes in tall vegetation.

Fire¹⁵

The only roadside safety issue related to reduced mowing and for which there is some evidence is the fire hazard of tall, unmowed grass. In Texas, Hauser and McCully (1993) compiled observations and reports about roadside ROW fires and the flammability of roadside vegetation. They pointed out that from 1988 to 1991 Texas averaged over 3500 ROW fires per year. It was also noted that while "...the rate of spread [of fire in mowed safety strips] will be slower than in the taller unmowed grass, [even] ...safety strips may fuel a fire under dry, windy conditions, and ...if taller grass contains enough moisture, there is a strong possibility it will not ignite." Researchers in Australia¹⁶ recently noted that areas of relatively dense, tall, brown grass were the greatest fire hazard, although their study was not about tall grass resulting from reduced mowing, rather it was focused on determining the fire hazard of roadside grasses.

Sight Distance / Obscured Signs

The only empirical evidence showing that tall vegetation resulting from reduced vegetation management can limit sight distance or obscure signage is from Great Britain; however, it must be noted that reduced mowing was not specifically mentioned and overgrown vegetation in those reports included tree branches and shrubs in addition to tall grass.

"Hidden signs and sight lines contribute to more than 1000 casualties. According to Reported Road Casualties Great Britain: 2015¹⁷, masked signs and overgrown vegetation contributed to more than 1000 casualties including three fatalities."¹⁸

"An AA-Populus Driver Poll of more than 16,000 found that two fifths (40%) of drivers say that speed limit and warning signs being blocked by overgrown foliage on local roads are causing problems. The same survey also found: More than two fifths (42%) say that sight lines at junctions were now a problem because of overgrown shrubs and long grass."¹⁸

¹⁴ Cackowski & Nasar, 2003; Fitzpatrick et al., 2014; Mok, Landphair, & Naderi, 2006; Thiffault & Bergeron, 2003; Van Treese et al., 2017; Wilde, 2009; Zhao & Rong, 2013; Zhao et al., 2015

¹⁵ Wilson (1979), who summarized California roadside fire studies for the 1930s-60s, also noted that in some other states it was estimated that at least half of wildfires started on roadsides.

¹⁶ Zhang & Verma, 2016

¹⁷ Department for Transport, 2016

¹⁸ Automobile Association Developments Limited [GB], 2017

Reduced sight view distance due to tall vegetation. From 2011 to mid-2018, 95 crashes were reported on Florida's state roads that involved reduced sight view distance due to tall vegetation. If any of those crash report narratives included the type of vegetation, it was trees, shrubs or hedges; tall grass or weeds were not mentioned. *NOTE: In 2013, two crashes were reported in which 'trees/crops/bushes' was a contributing factor. Both crashes occurred at intersections and involved bicyclists, and in one case the bicyclist was cited for failing to yield to traffic.*

Signs obscured by tall vegetation. From 2011 to mid-2018, there were only two reported crashes on Florida's state roads that involved signage obscured by tall vegetation. Shrubbery was mentioned in one report; type of vegetation was not noted in the other report. Reduced mowing was not implicated in either case.

Debris/litter obscured by tall, un-mowed vegetation. From 2011 to mid-2018, there were two reported crashes on Florida's state roads in which debris or litter obscured by vegetation (trees/crops/bushes) was a contributing factor. One of those reports noted the type of vegetation – a tree.

Wildlife

Deer. A major concern has been that reduced mowing, as well as Wildflower Areas, would lead to crashes involving deer. The rationale is that reduced mowing increases occurrence of palatable native vegetation (including wildflowers), which attracts wildlife to roadsides thereby increasing the likelihood of wildlife-vehicle collisions (WVCs), especially deer-vehicle collisions (DVCs). The preponderance of empirical evidence does not support that conclusion. DVCs involve many factors (and interactions among those factors), so experimentally determining specific causes for DVCs is very challenging when all factors have to be considered and subsequently accounted for during statistical analyses. Moreover, all factors are not always included in studies, and methods used to measure DVCs often vary among studies, which precludes legitimate comparison of studies and formulating conclusions.

State Road 65 in the Apalachicola National Forest (ANF) in Liberty County not only is widely considered to be the best Wildflower Area in the state, there is also a history of reduced mowing. From 2011 to mid-2018, there have been 11 reported crashes involving deer in the ANF in Liberty County, about 1.5 crashes per year; eight occurred at night, one occurred at dawn, and the other during the day; in no case was obscured vision a factor. In contrast, there were eight reported crashes that involved deer on SR 65 in Liberty County but outside of the ANF, about 1.1 year but over a much smaller segment of road. Of the eight, six occurred at night and the other two during the day. In no case was obscured vision a factor.

Finally, Oetting and Cassel (1971) recorded road kill along a section of North Dakota highway in which the entire ROW was mowed one year and half the ROW was unmowed the following year during that same time period. The first year there were 42 road kills and the second year 37 road kills, but the species composition varied. They concluded that "Changes in the species of composition of wildlife killed...suggests these kills were more a function of movement or population fluctuations than of unmowed vegetation on the right-of-way."

Snakes. An exhaustive literature search and discussions with herpetologist Dr. Kimberly Andrews (personal communication, January 31, 2018)¹⁹ revealed that encountering any snake on a roadside ROW during the day, let alone a venomous one, is a highly unlikely event. She even rarely encounters snakes on roadsides, and she is looking for them. Moreover, Dr. Andrews cited statistics noting that someone on a roadside ROW is more likely to be injured by a car or struck by lightning than being bitten by a venomous snake, and went on to point out that:

- There is no empirical evidence about snakes on roadside ROWs (due to lack of research funding). Insight about snake occurrence on roadsides is based on general snake biology/ecology in edge habitats.
- Most venomous snakes are nocturnal. The two most likely to be seen are the copperhead and cottonmouth (near aquatic areas). November to February is the most likely time to encounter a snake during the day. Coral snakes also may be seen during the day.

¹⁹ I was referred to [Dr. Andrews](#) (Univ. of Georgia; stationed in Brunswick) by Dr. Ken Dodd, Univ. of Florida/IFAS Wildlife Ecologist. Ken's research interests include herpetology and conservation biology, and he was involved in a research study of road kills in Florida: Wildlife Mortality on U.S. Highway 441 across Paynes Prairie, Alachua County, Florida. 2002. Florida Scientist Vol. 66, No. 2 (Spring, 2003), pp. 128-140.

- While snakes are attracted to areas with small mammals, there is no research showing that there is a higher incidence of snakes along roadsides where there may be more small mammal food sources in unmowed areas or areas with native wildflowers and grasses.
- Won't see snakes when the temperature is below 50°F; very little movement at those temperatures.
- Snakes attracted to roadside ROWS tend to get killed off quickly.
- Snakes are very sensitive to vibrations (vehicles, mowers, string trimmers), which they avoid.
- Most snakes attracted to roadsides are cosmopolitan species like rat snakes and corn snakes.

Appendix

Florida State Road Crash Report Query Methods

For Wildlife-Vehicle Collisions (WVCs), crash report spreadsheets were obtained from FIRES (Florida's Integrated Report Exchange System). All other crash report spreadsheets, as well as all but seven reports (obtained from FIRES), were obtained from the FDOT State Safety Office. Reports were requested since the narrative in each report contained details that were not searchable in crash report queries. For example, if a deer was the cause of a crash, the word 'deer' would only appear in the narrative; the searchable part of the report would only be coded to indicate that the crash involved an animal.

Crash report data from FDOT was for 2011 to 2018 since Benjamin Jacobs noted that "...the crashes that we have in the system from 2011 forward are all geolocated (when they have occurred on a public roadway)."

Crash reports relevant to the issues highlighted below were identified based on the narratives in the crash reports.

Wildlife-Vehicle Collisions (WVCs)

Data was requested for SR 65/Liberty County/Apalachicola National Forest, but FIRES provided data for all of SR 65 within Liberty County for 2011 to June 8, 2018.

Crash report query:

- First harmful event Harmful Event of 13, Animal
- Contributing Circumstance: Environment 5, Animal(s) in roadway

Kenneth Borges (FIRES) noted that:

- If crashes were not geo-located, improperly geo-located, not reported, not reported due to statute (pre-2011), or improperly coded they may not appear within this set.
- All 2017 and 2018 data are considered preliminary at this time (June 20, 2018) and will change as new reports are submitted and updated. These results should be viewed as a snapshot of what currently exists in the repository as of today June 8, 2018.

Number of reports received and reviewed: 18

Signs Obscured by Tall Vegetation as a Contributing Factor in Crashes

Crash report query: "Road Contributing Circumstances" of 13(traffic control device inoperative, missing or obscured) and combined it with "Driver Vision Obstruction" of 4(trees/crops/bushes). This reduced the crashes from over 1,000 to just 2 statewide.

Number of reports received and reviewed: 2

Crashes in Which Debris/Litter was Obscured by Tall, Un-Mowed Vegetation as a Contributing Factor in Crashes

Crash report query: "Road Contributing Circumstances" of 12(Debris) and combined it with "Driver Vision Obstruction" of 4(trees/crops/bushes). This reduced the crashes from over 1,000 to just 2 statewide.

Number of reports received and reviewed: 2

Reduced Sight View Distance Due to Tall Vegetation as a Contributing Factor in Crashes

Crash report query: The only way to really search for this was using "Driver Vision Obstruction" of 4(trees/crops/bushes), which resulted in 960 crashes. The 960 was then filtered to eliminate the following crashes:

- Occurred within city limits* (City Limits = Yes), since reduced mowing is more likely to occur in rural areas
*Jacksonville was not excluded since there are some rural roads within "city" limits
- Driver was impaired (Suspected Alcohol Use = Yes; Suspected Drug Use = Yes)

Number of reports received and reviewed: 95

Crashes Involving Mowers or String Operators

Crash report query: Used non motorist "Action Prior to Crash" of 6(in roadway-working, playing), 7(Adjacent to roadway), 9(working in traffic way), which was combined with "Non-Motorist Description" of 6(occupant of a non-motor transportation device). This reduced the crashes from 2,500 to 61 state wide; then included "Non-Motorist Description" of 2(other pedestrian), which increased the amount of crashes.

Number of reports received and reviewed: 218

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