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County Transportation Officials' Perceptions of Timber Transportation Economic Importance, Infrastructure Impact, and Weight Limits in Georgia, USA

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Abstract

Log truck gross vehicle weight (GVW) limits in the US state of Georgia are among the lowest of any timber-producing state in the US and are far below GVW limits in countries such as Australia, Canada, Finland, and Sweden. In the state of Georgia, log trucks travel on county and state roads between harvest sites and forest industry mills. Most county roads were not constructed to support heavy trucks and so log trucks may damage these roads, even at the low GVW limits allowed in Georgia. Local governments sometimes enact timber harvesting ordinances to constrain timber transportation and often oppose efforts to increase GVW limits. The purpose of this study was to document local transportation officials' perceptions of timber harvesting and transportation and to measure their support or opposition to alternative log truck weights and configurations. A telephone survey of county transportation superintendents or their equivalent was conducted in Georgia during the summer of 2020. Forty-three county officials responded to the survey, yielding a response rate of 43%. Ninety-eight percent of respondents reported that timber harvesting was important to their local economy, and 86% agreed that local governments were cooperative with log truck owners. County officials were concerned about damage from overweight log trucks and mud on public roads. The average preferred GVW and tandem axle weight limits were approximately 10% lower than the existing limits. County officials opposed six- and seven-axle 45,359 kg (100,000 lbs) GVW configurations but did support allowing log trucks to operate on interstate highways at current state weight limits. Findings suggest that logging businesses and mills should focus on improving compliance with weight laws, improving the condition of log trucks, and maintaining or improving relationships with the public and local government officials.

Keywords: log trucks, US South, forest operations

1. Introduction

The US state of Georgia leads the nation with approximately 50 million tonnes of timber harvested annually (USDA Forest Service 2019). Georgia's forestry and forest products industry contribute $36.5 billion (USD) to the state economy and supports over 140,000 jobs and $8.6 billion in wages per year (Georgia Tech 2020).

Georgia counties have a complex relationship with timber harvesting and transportation. More than 60% of Georgia counties have been classified as at least somewhat dependent on forestry for employment and wages (Riall 2011). On the other hand, Georgia counties incur costs associated with timber harvesting. For example, log trucks[1] cause wear on county roads because most of these roads were not designed to accommodate heavy trucks. There are 201,986 km (125,508 mi) of public roads in Georgia (GDOT 2019). State roads, including interstate and US highways, account for 14% of the kilometers of roads and accommodate 58% of vehicle kilometers traveled. County roads account for

[1] Log truck, log tractor-trailer and log semitrailer are used interchangeably

Table 1 Gross vehicle weight (GVW), single axle, and tandem axle weight limits and number of axles required for maximum GVW in the major timber producing states and regions in the US. Weight limits are inclusive of any permits or tolerances available for trucks hauling timber. Temporary provisions are not included. Values are based on the author's reading of state statues, confirmed by secondary sources and were current as of fall 2021 (e.g., FHWA 2017, Conrad 2020)

US State	GVW limit, kg	Number of axles for maximum GVW	Single axle limit, kg	Tandem axle limit, kg
US Interstate highways	36,287	5	9072	15,422
US South				
Alabama[a]	39,916	5	9979	16,964
Arkansas	38,555	5	9072	16,556
Florida	39,916	5	9979	19,958
Georgia – state highways	38,102	5	10,954	21,909
Georgia – county roads[b]	25,401	5	10,954	21,909
Louisiana	41,731	5	Unlimited[c]	Unlimited[c]
Mississippi	38,102	5	9979	16,964
North Carolina	40,823	5	9979	19,051
South Carolina	38,225	5	10,433	18,779
Virginia	40,823	5	10,886	18,144
US Northeast				
Maine	45,359	6	10,977	19,958
New Hampshire	47,151	6	11,177	17,962
Vermont	44,906	6	11,177	17,962
US Lake States				
Michigan	74,389	11	8165	12,973
Minnesota[d]	44,906	6	10,977	17,350
Wisconsin	44,452	6	8165	15,422
US West				
Idaho	47,854	8	9072	15,422
Oregon	47,854	8	9072	15,422
Washington	47,854	8	9072	15,422

[a] Alabama allows 6-axle tractor-trailers with GVW of 41,277 kg; however, this configuration is not used because there is little or no payload advantage compared to 5-axle tractor-trailers with 39,916 kg GVW

[b] Trucks may operate at state highway weigh limits when traveling from a state highway to a pickup or delivery location on a county road

[c] Log tractor-trailers are not cited for axle weight violations as long as they are in compliance with GVW regulations

[d] GVW limit is reduced to 40,823 kg when ground is not frozen

69% of road kilometers and 27% of vehicle kilometers traveled. The remainder of the roads are owned by cities or other agencies. A typical timber delivery in Georgia begins on a county road adjacent to a harvest site. The log truck travels an average of 3.7 km (2.3 mi) on county roads with the remaining distance traveled on state roads (Conrad 2020).

Counties in Georgia and elsewhere have attempted to regulate timber harvesting through local ordinances (Jackson et al. 1993, Mortimer et al. 2005, Prisley et al. 2006, Forman-Cook et al. 2015). In the past, Georgia counties have required logging businesses to obtain permits and post bonds prior to harvesting timber (Jackson et al. 1993). Georgia has 159 counties, and individual logging businesses may harvest timber in 20 or more counties over the course of a year. Complying with differing regulations in each county can complicate timber harvesting efforts. Since 2016, state law has limited counties ability to regulate timber harvesting. Counties may require a harvest notification, but not a permit, and may require a bond of up to $5000 that applies to all harvests conducted by a company in that county (Georgia Code § 12-6-24 2016).

The forest products industry relies on thousands of log trucks to deliver timber from harvest sites to

mills. Timber transportation has been identified as the greatest challenge facing logging businesses. Rising insurance premiums, difficulties recruiting and retaining qualified drivers, low payloads, and long haul distances are among the challenges facing timber transportation in the eastern US, including the state of Georgia (Koirala et al. 2017a and b, Conrad 2018, Conrad et al. 2018).

Georgia has among the lowest gross vehicle weight (GVW) limits for log trucks in the US (Table 1). Heavy trucks are limited to 25,401 kg (56,000 lbs) GVW on county roads unless making a pickup or delivery because these roads were not designed to support heavy truck traffic. On state roads, log trucks are allowed up to 38,102 kg (84,000 lbs) GVW, including tolerances. Hereafter, all weight limits reported are inclusive of tolerances. Many southern states allow GVW between 39,916–41,731 kg (88,000–92,000 lbs) on five-axle tractor-trailers (FHWA 2017, Conrad 2020). States in the US Northeast, Midwest, and West allow approximately 45,359 kg (100,000 lbs) GVW on 6–8 axles. The state of Michigan allows 74,389 kg (164,000 lbs) GVW on eleven axles. Most Canadian provinces allow 63,500 kg (139,994 lbs) (Woodroofe et al. 2010) and Finland and Sweden allow more than 74,000 kg (163,142 lbs) (Väätäinen et al. 2020).

Increasing GVW limits for log trucks would reduce transportation costs, fuel consumption, and emissions. Raising weight limits reduces transportation costs because the costs of owning and operating each truck are spread over more tonnes of payload (Brown and Ghaffariyan 2016, Korpinen et al. 2019, Brown 2021, Väätäinen et al. 2021). US and international research has found that raising GVW limits reduces fuel consumption and greenhouse gas emissions (Tunnell and Brewster 2005, FHWA 2015, Sinnett 2016, Palander 2017, Asmoarp et al. 2018, Väätäinen et al. 2020, Väätäinen et al. 2021).

Opponents of heavier trucks often raise objections regarding safety and infrastructure impacts. Pavement damage is primarily a function of axle weight. Pavement damage increases geometrically with axle weight (Cambridge Systematics 2006, Adams et al. 2009). It is possible to increase GVW limits for trucks and reduce pavement damage as long as axles are added to trucks (Adams et al. 2009, Carson 2011, USDOT 2012a). On the other hand, bridge damage is most sensitive to GVW, and so increasing GVW will increase stress on bridges (Cambridge Systematics 2006, Adams et al. 2009, Carson 2011, FHWA 2015).

The relationship between GVW limits and crash risk is unclear. Some studies suggest that increasing GVW limits increases crash risk per kilometer traveled (Adams et al. 2009, Carson 2011). Other studies suggest there is insufficient evidence to draw conclusions because of a lack of data regarding truck weight at time of crash (FHWA 2015, Peterman 2017). Some studies suggest that higher GVW limits are associated with reduced crash risk because of reductions in heavy truck traffic (Transportation Research Board 1990, Wilbur Smith Associates 2004, Adams et al. 2009, Carson 2011).

Several US states have updated their GVW limits during the past 20 years. North Carolina and Virginia increased their GVW limit for five-axle log trucks to 40,823 kg (90,000 lbs) in 2012 and 2015, respectively (North Carolina Session Law 2012-78 2012, Virginia House Bill 2072 2015). Minnesota and Wisconsin have allowed six-axle log trucks with GVW of 44,452 kg (98,000 lbs) and 44,906 kg (99,000 lbs), respectively, since the mid-2000s (Wisconsin Act 167 2005, Minnesota HF 3486 2008). Internationally, Canada has gradually increased GVW limits since the 1960s (Woodrooffe et al. 2010) and Finland and Sweden have agressively increased GVW limits since 2010 (Väätäinen et al. 2020, Väätäinen et al. 2021).

Increasing Georgia's GVW limit for log trucks would require legislation be passed by both houses of the state legislature and be signed into law by the governor. Legislation was introduced in 2011 and 2015 that would have raised the GVW limit to approximately 39,916 kg (Georgia Senate Bill 2011, Georgia House Bill 411 2015) but neither bill passed. Weight limit increases have been opposed by local governments, advocacy organizations such as AAA, and many voters according to some polls (Hart 2011, AAA 2016). The Association of County Commissioners of Georgia (ACCG) has opposed weight limit increases (ACCG 2015). The perceptions of local governments and the citizens they represent can play a major role in the success or failure of log truck weight reform. Therefore, it is important to understand how local government officials perceive timber transportation and its impact on local infrastructure.

Increasing Georgia's GVW limit would reduce timber transportation costs and make the state's forest products industry more competitive in a global marketplace. This may benefit Georgia counties in the long term if the change resulted in maintaining or expanding timber harvesting and forest products manufacturing. On the other hand, any changes to GVW limits would also impact Georgia's county road system. Therefore, the objectives of this study were to document local county road officials' perceptions of:

⇒ the importance of timber harvesting and transportation to local economies
⇒ timber harvesting and transportation impacts on local infrastructure
⇒ current weight limits for log trucks
⇒ alternative log truck GVW limits and configurations.

2. Materials and Methods

A telephone survey of Georgia county road officials was conducted during the summer of 2020. A telephone survey was selected because of restrictions on in-person interviews associated with COVID-19 during summer of 2020. Previous research suggests that data quality is similar in face-to-face interviews and telephone interviews (Block and Erskine 2012). Telephone surveys were chosen over mail surveys because of the ability to explain questions that may have been unfamiliar to respondents, build rapport with respondents, and increase the response rate (Marando and Boss 1975, Novick 2008, Block and Erskine 2012, Jones et al. 2013).

The survey population included roads/transportation superintendents or their equivalent in timber-producing counties. Georgia has 159 counties, some of which are in urban areas and therefore have limited exposure to timber harvesting and transportation. Only counties in the top two-thirds in annual timber harvest volume (USDA Forest Service 2019) or with at least one medium or large mill (Southern Group of State Foresters et al. 2020) were included. There were 110 Georgia counties that met one or both of these criteria. Contact information for the roads/transportation superintendent or equivalent was collected from county and state websites. Contact information was unavailable in 10 Georgia counties, meaning 100 counties were included in the study. Each county was assigned a random number, the list was sorted by the random number, and calls were made in ascending order.

The survey was designed to be completed in approximately 10–15 minutes. The questionnaire included eighteen questions, including open-ended, closed-ended, and five-point Likert scale questions. Questions focused on the following topics: the county's relationship with timber harvesting and transportation businesses; perceptions of safety, pavement damage, and bridge damage from timber transportation; current weight limits for log trucks; and support or opposition to alternative weight limits and configurations. Questions were reviewed by individuals knowledgeable of the subject matter prior to the initiation of the survey. Survey protocols were approved by the University of Georgia Institutional Review Board (ID: PROJECT00002460) prior to implementation.

Participants were asked about their support for or opposition to the following weight limits and configurations: five axles, 39,916 kg (88,000 lbs); six axles, 41,277 kg (91,000 lbs); six axles, 45,359 kg (100,000 lbs); and seven axles, 45,359 kg (100,000 lbs) GVW. These alternatives were evaluated because they were legal in at least one US state at the time of the study, their braking and maneuverability were similar to existing trucks (Cambridge Systematics Inc. 2006, Adams et al. 2009, Lascurain et al. 2013, FHWA 2015), and these configurations would accommodate the timber hauled within the state of Georgia. The five-axle, 39,916 kg configuration would include a three-axle tractor (i.e., one steering axle and one tandem drive axle) and a tandem axle trailer. This configuration is similar to the trucks that operate in Georgia's neighboring states (Table 1). The six-axle, 41,277 kg configuration would include a three-axle tractor and a tridem axle trailer (alternatively, a tridem drive axle could be placed on the tractor). This configuration is similar to the trucks that operate in the US state of Minnesota outside of frozen ground conditions. The six-axle 45,359 kg configuration is identical to the six axle 41,277 kg configuration except that additional GVW would be allowed. This configuration is similar to trucks operating in the US Northeast and Lake States. The seven-axle 45,359 kg configuration would include a four-axle tractor (i.e., one steering axle and a tridem drive axle) and a tridem axle trailer. This configuration is comparable to one of several configurations transporting timber in the US West (Mason et al. 2008), and similar configurations have been evaluated in previous studies (Cambridge Systematics 2006, Adams et al. 2009).

Mean responses to Likert scale questions were tested to determine whether the mean response was significantly different from neutral ($\bar{x}$=3.0). If a 95% confidence interval did not overlap with the neutral response, then the response was considered significantly different from neutral. Responses to Likert scale questions were compared using t-tests when two responses were compared. Three or more means were compared using analysis of variance and the Tukey *HSD* test. Data analysis was conducted using Microsoft Excel and JMP 14.3.0 (2018). All statistical tests were conducted at α=0.05.

3. Results

Officials from 43 counties completed an interview, yielding a response rate of 43%. Responding counties accounted for approximately 32% of timber harvest

volume in 2019 (USDA Forest Service 2019). The other 57% could not be reached by telephone or declined to participate. This response rate is comparable to the response rates achieved in telephone surveys of family forest landowners (Schubert and Mayer 2012), county commissioners (Marando and Boss 1975), and better than that achieved in a survey of logging business owners (McKee et al. 2012).

3.1 Perceptions of Timber Harvesting and Transportation

County officials recognized the importance of timber harvesting to the local economy (Table 2). Seventy-five percent of respondents stated that local governments understood timber harvesting businesses and 86% stated that local governments in their area were cooperative with log truck owners.

While county officials recognized the importance of timber harvesting and transportation, they were concerned about overloaded log trucks and their impact on local infrastructure (Table 2). Sixty-one percent of respondents perceived that log trucks were commonly overloaded and 76% perceived that overloaded log trucks had damaged local infrastructure. A greater percentage of respondents reported damage from overloaded log trucks than perceived that log trucks were commonly overloaded, suggesting that some officials believed that most log truck owners obeyed weight laws, but a minority of overloaded trucks damaged infrastructure. An approximately equal percentage of respondents agreed and disagreed with the notion that log truck owners do their best to protect local infrastructure.

Table 2 County officials' agreement or disagreement with eight statements regarding timber harvesting and transportation and the impact on the local economy and infrastructure. Percentages in rows may not sum to 100% because of rounding

Statement	Strongly disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly agree (5)	Mean
Timber harvesting is important to the local economy	0%	2%	0%	28%	70%	4.65*^{A}
Local government officials understand timber harvesting business	2%	7%	16%	56%	19%	3.81*^{BC}
Local governments in my area are cooperative with log truck owners	0%	0%	14%	60%	26%	4.12*^{AB}
Log trucks are commonly overloaded	3%	8%	30%	38%	23%	3.70*^{BCD}
Overloaded log trucks have damaged local infrastructure in my area	2%	7%	15%	39%	37%	3.99*^{B}
Log truck owners do their best to protect local infrastructure during timber transportation	9%	28%	23%	35%	5%	2.98^{E}
The public in my area supports timber harvesting businesses	5%	9%	35%	49%	2%	3.35*^{CDE}
The public in my area supports log trucking businesses	16%	7%	33%	40%	5%	3.09^{DE}

* Mean response is significantly different from the neutral response ($\bar{x}$=3.0) at α=0.05
^{A,B,C,D,E} Means connected by the same letter are not significantly different at α=0.05

Table 3 Perceived importance of factors relating to timber harvesting and transportation among Georgia county officials. Percentages in rows may not sum to 100% because of rounding

Variable	Not important (1)	Of little importance (2)	Moderately important (3)	Important (4)	Very important (5)	Mean response
Mud on the road from log trucks during wet weather	0%	0%	14%	17%	69%	4.50^{A}
Pavement damage caused by log trucks	2%	0%	5%	27%	66%	4.49^{A}
Bridge damage caused by log trucks	5%	9%	21%	23%	42%	3.89^{AB}
Water quality impacts from timber harvesting	14%	7%	36%	17%	26%	3.33^{BC}
Automobile crashes involving log trucks	14%	21%	21%	12%	33%	3.28^{BC}
Visual impacts of timber harvesting	7%	24%	26%	21%	21%	3.26^{BC}
Traffic congestion caused by log trucks	14%	21%	43%	19%	2%	2.76^{C}

^{A,B,C} Means connected by the same letter are not significantly different at α=0.05

County officials were most concerned about mud on the road, pavement damage, and bridge damage associated with log truck traffic in their county (Table 3). Respondents were less concerned about issues such as water quality, log truck crashes, aesthetics, and traffic congestion.

3.2 Perceptions of Weight Regulations, Safety, and Infrastructure Impact

A plurality (48%) of county officials perceived that the GVW limit of 38,102 kg was about right on a five-point Likert scale. However, 45% of respondents stated that GVW limits were slightly or far too high compared to only 7% that reported GVW limits were slightly or far too low. Consequently, the mean response was significantly different from neutral (p<0.01). When asked an open-ended question about their preferred GVW limit, the average response was 34,512 kg (76,086 lbs) (Fig. 1). The average preferred weight limit was 3590 kg (7914 lbs) lower than the current limit (p<0.01).

The majority (59%) of county officials perceived that the tandem axle weight limit of 21,909 kg (48,300 lbs) was about right on a five-point Likert scale. Far more respondents perceived that the tandem axle weight limit was either slightly or far too high (32%) than perceived that it was slightly or far too low (10%). As a result, the mean response was significantly different from neutral (p=0.02). When asked an open-ended question about their preferred tandem axle weight limit for log trucks, the average response was 20,197 kg (44,526 lbs) (Fig. 1). The average preferred tandem axle weight limit was 1712 kg (3774 lbs) lower than the current limit (p=0.05).

A plurality (46%) of county officials perceived that log trucks were slightly less or much less safe than other heavy trucks (Table 4). Only 14% perceived that log trucks were safer than other heavy trucks. The mean response was significantly lower than equally safe (p<0.01).

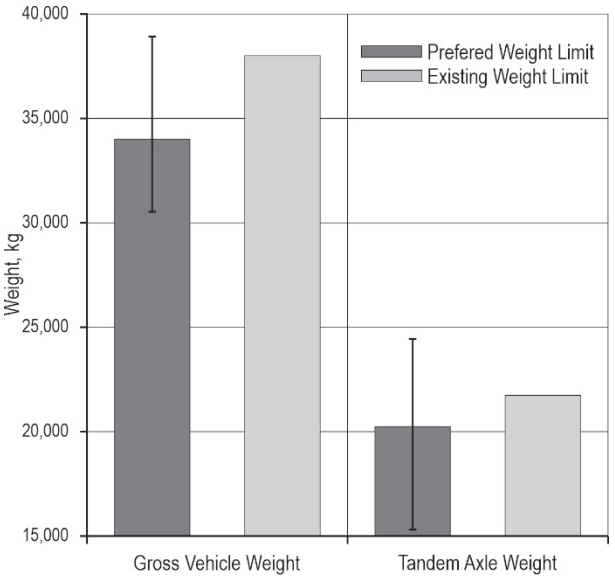

Fig. 1 Preferred and existing gross vehicle weight and tandem axle weight limits. Error bars represent ±1 standard deviation from the mean

Sixty percent of county officials perceived that log trucks cause slightly more or much more pavement damage than other heavy trucks and the mean response was significantly higher than the neutral response (p<0.01) (Table 4). On the other hand, the majority (63%) of county officials perceived that log trucks cause the same amount of bridge damage as other heavy trucks and the mean response was not different from the neutral response (p=0.07).

3.3 Support for Alternative Truck Weights and Configurations

A majority of county officials opposed the six- and seven-axle, 45,359 kg configurations (Table 5). A majority of county officials were neutral or supported the five-axle, 39,916 kg and six-axle, 41,277 kg configurations. The five-axle, 39,916 kg configuration was the only configuration with a mean response that was not significantly lower than the neutral response.

Table 4 Georgia county officials' perceptions of safety, pavement damage, and bridge damage caused by existing log truck configurations relative to other heavy trucks

	Response					Mean
Variable	Much less (1)	Slightly less (2)	Equal (3)	Slightly more (4)	Much more (5)	response
Safety	16%	30%	40%	14%	0%	2.51*
Pavement damage	2%	7%	31%	36%	24%	3.71*
Bridge damage	0%	10%	63%	27%	0%	3.17

* Indicates the mean response was statistically significantly different from 3.0 at α=0.05

Table 5 County officials' support or opposition to four alternative log truck weights and configurations and the application of state weight limits on interstate highways. Percentages in rows may not sum to 100% because of rounding

Alternative	Strongly oppose (1)	Mildly oppose (2)	Neither (3)	Mildly support (4)	Strongly support (5)	Mean
Five-axles, 39,916 kg (88,000 lbs) GVW	17%	20%	34%	24%	5%	2.80[A]
Six-axles, 41,277 kg (91,000 lbs) GVW	30%	15%	28%	25%	2%	2.52[*AB]
Six-axles, 45,359 kg (100,000 lbs) GVW	50%	28%	10%	2%	10%	1.94[*B]
Seven-axles, 45,359 kg (100,000 lbs) GVW	47%	18%	21%	12%	2%	2.04[*B]
Apply state weight limits to interstate highways	2%	5%	14%	26%	52%	4.21[*C]

* Mean response is significantly different from the neutral response ($\bar{x}=3.0$) at $\alpha=0.05$
[A,B,C] Means connected by the same letter are not significantly different at $\alpha=0.05$.

Table 6 County officials' perceptions of safety of four alternative log truck configurations relative to existing log trucks. Percentages in rows may not sum to 100% because of rounding

Alternative	Much less safe (1)	Slightly less safe (2)	Equally safe (3)	Slightly safer (4)	Much safer (5)	Mean
Five-axles, 39,916 kg (88,000 lbs) GVW	5%	27%	44%	20%	5%	2.93[A]
Six-axles, 41,277 kg (91,000 lbs) GVW	15%	20%	43%	23%	0%	2.73[A]
Six-axles, 45,359 kg (100,000 lbs) GVW	27%	22%	34%	12%	5%	2.46[*A]
Seven-axles, 45,359 kg (100,000 lbs) GVW	34%	17%	22%	15%	12%	2.54[*A]

* Mean response is significantly different from the neutral response ($\bar{x}=3.0$) at $\alpha=0.05$
[A] Means connected by the same letter are not significantly different at $\alpha=0.05$.

A plurality (44% and 43%, respectively) of county officials perceived that the five-axle 39,916 kg and six-axle 41,277 kg configurations were equally safe as the existing log trucks (Table 6). The mean response was not significantly different from the equally safe response for either configuration ($p>0.05$). In contrast, 49% and 51% of county officials perceived that the six- and seven-axle, 45,359 kg configurations, were slightly or much less safe and the mean responses were significantly lower than the equally safe response ($p<0.05$).

Seventy-eight percent of respondents supported applying state weight limits to interstate highways so that log trucks could bypass cities and rural communities (Table 5). Only 7% of respondents opposed this proposal. In the US, states set weight limits on state roads and US highways, whereas federal law governs truck weights on interstate highways, and federal weight limits are substantially lower than state weight limits (Table 1).

4. Discussion

Results of the study provide a valuable perspective on timber harvesting and transportation in the leading timber producing state in the US. Given the sample size and response rate, these findings should be considered representative of local government officials in Georgia. Additional research is necessary in other states and other US regions to determine whether Georgia local government officials' perceptions of timber harvesting and transportation are consistent with their counterparts in other states and regions.

Timber harvesting and transportation businesses should be somewhat concerned about their image. An approximately equal percentage of respondents agreed and disagreed with the notion that log truck owners do their best to protect local infrastructure (Table 2). Approximately half of county officials perceived that the public supported timber harvesting and transportation companies. Previous studies in the US Northeast found that loggers perceived disrespect from members of the public and even received personal taunts in some cases (Egan and Taggart 2004, Egan 2009, Egan 2011).

While most forestland is privately owned in Georgia and most timber harvesting occurs on private land (USDA Forest Service 2021), members of the public as well as state and local governments can restrict timber harvesting and transportation. There are approximately 215,000 family forest owners (USDA Forest Service

2021) and approximately 2000 logging workers in Georgia (BLS 2021) out of a total state population of 10.6 million people (US Census Bureau 2019). While forest industry is a major employer in the state (Georgia Tech 2020), most Georgians neither own forestland nor are employed in forest industry. The majority of Georgia residents without a direct connection to timber harvesting can pressure state and local governments to restrict timber harvesting and transportation. In Georgia, local governments have restricted timber harvesting through local ordinances requiring permits and bonds (Jackson et al. 1993), although this practice has been limited by state law in recent years (Georgia Code § 12-6-24 2016). The state has much more leeway in governing timber harvesting. Therefore, improving the image of timber harvesting and transportation should be a priority.

Logging businesses and the forest products industry should be concerned about the perception that log trucks are less safe than other heavy trucks. Nearly all timber is transported by log trucks and timber transportation is recognized as a major challenge (Koirala et al. 2017a and b, Conrad 2018, Conrad et al. 2018). While timber transportation is demonstrably safer than it was decades ago (Greene et al. 2007, Mason et al. 2008), recent research demonstrates there is still room for improvement (Cole et al. 2019, Conrad 2019, Conrad 2021). Specifically, log trucks are older and in worse mechanical condition than other heavy trucks. Log trucks are more likely to experience tire and brake failure than other heavy trucks, issues that should be addressed by log truck owners. Michigan has demonstrated that log trucks can operate more safely than other heavy trucks (Green et al. 2005).

County officials were most concerned about mud on the road, pavement damage, and bridge damage from log trucks (Table 3). These priorities appear reasonable. The county officials interviewed are responsible for maintaining and repairing the county road system. Therefore, issues such as mud on the road and pavement damage are within their immediate purview. Automobile crashes involving log trucks have declined in Georgia in recent years and are most likely to occur in urban areas rather than on county roads (Conrad 2019). Likewise, best management practices implementation rates are high and water quality is protected during timber harvesting (Cristan et al. 2016, Conrad et al. 2018, Georgia Forestry Commission 2019). Traffic congestion on county roads is generally minimal because most kilometers are traveled on state roads (GDOT 2019).

It is unsurprising that county officials preferred lower weight limits. County roads were not built to accommodate heavy truck traffic. The GVW limit for these roads is 25,401 kg unless making a pickup or delivery. These roads only experience log truck traffic when there is an active timber harvest adjacent to one of these roads. Nonetheless, county roads are a vital link between harvest sites and the state roads that accommodate most log truck traffic (Conrad 2020).

Respondents preferred a reduction of approximately 10% in both GVW and tandem axle weight limits. The preferred tandem axle weight limit is surprisingly high. While Georgia's GVW limit for log trucks is lower than that of other states, its tandem axle weight limit is much higher (FHWA 2017, Lancaster 2017, Conrad 2020, Table 1). The tandem axle weight limit preferred by county officials, 20,197 kg, would remain among the highest in the region. In contrast, the preferred GVW limit would be, by far, the lowest in the region. These preferences are even more perplexing given that pavement damage is much more sensitive to axle weight than GVW (Adams et al. 2009, Carson 2011, USDOT 2012b). Perhaps these results indicate that county officials are not familiar with the specific relationships between truck weight and pavement damage. It is also possible that county officials were anchored to current weight limits (Furnham and Boo 2011). This would explain why officials preferred similar percentage reductions in GVW and tandem axle weight limits even though Georgia's tandem axle weight limit was higher than in other states and axle weight is most responsible for pavement damage.

County officials' opposition to heavier truck weights and the perception that heavier log trucks will be less safe than the existing trucks are impediments to increasing log truck weight limits. Previous research found that rates of fatal log truck crashes were higher in the US South, where log trucks are limited to 38,102–41,731 kg GVW on five-axle log trucks, than in the US Northeast, Midwest, and West, where 6–8-axle log trucks are allowed GVW of approximately 45,359 kg (Cole 2018, Table 1). The relationship between GVW limits and crash risk of heavy trucks is open to interpretation, but research results do not support county officials perceptions of the alternative weights and configurations (Transportation Research Board 1990, Wilbur Smith Associates 2004, Adams et al. 2009, Carson 2011, FHWA 2015, Peterman 2017).

County officials' support for allowing state-legal loaded log trucks to operate on interstate highways is consistent with previous research. In Maine, public officials favored exempting the Maine Turnpike from federal weight laws and allowing state-legal heavy trucks to operate on interstate highways instead of traveling through local communities on state roads

(Wilbur Smith Associates 2004). Interstate highways are the safest roadways in the US (FHWA 2020). In some areas, 40% or more loads of timber could utilize interstate highways for a portion of their journey from harvest sites to mills, with significant safety and efficiency benefits (Conrad 2020). It is important to note that, while the weight limits on interstate highways are governed by the federal government, interstate highways are owned by the state in which they are located.

5. Conclusions

This study offers unique insight into the perceptions of county officials regarding timber harvesting and transportation. County officials recognized the importance of timber harvesting to their communities. They perceived that local governments were cooperative with log truck owners. These officials did not consider themselves adversaries of logging businesses or log truck owners. However, they did have operational concerns such as log trucks tracking mud onto county roads and overweight log trucks damaging local infrastructure. These officials did not favor heavier trucks but did support allowing existing log trucks to operate at state-legal weights on interstate highways.

Logging business owners, log truck owners, and forest industry should cultivate relationships with local government officials, especially those managing local roads. Logging business owners, log truck owners, and forest industry should increase compliance efforts, especially regarding overweight log trucks, which was a concern among county officials. Log truck owners should work to improve the age and condition of log trucks to minimize crash risk and improve their public image. Finally, education and outreach will be necessary to build support for, or at least reduce opposition to, alternative log truck weight limits and configurations.

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