Animal-Vehicle Collision Mitigation in Texas, USA

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A familiar experience...



(Source: http://www.youtube.com/watch?v=zYxbqQoyPXw)

In the United States:

- <u>2001 estimate</u>: 1.5 million deer-vehicle collisions
 - >29,000 human injuries
 - >200 human fatalities
 - 1.3 million deer fatalities
 - >\$1 billion-worth property damage



• <u>2009 estimate</u>: 2.4 million deer-vehicle collisions

- Deaths due to animal-vehicle collisions increasing:
 - 1994: 131 people died
 - 2008: 210 people died



- Top 5 states with <u>most deaths</u> in animal vehicle collisions (2004-2008):
 - 1. Texas, 88 deaths
 - 2. Wisconsin, 62 deaths
 - 3. Ohio, 51 deaths
 - 4 & 5. Pennsylvania and Michigan, 46 deaths each

- SH-130 in Texas:
- Opened October 2012
- The fastest toll road in the U.S., 85mph (140 km/h)
- south of Austin
- feral hog collisions on this new highway





- SUV after hitting hogs (March 2013)



- To effectively manage animal-vehicle collisions:
 - •Knowledge on spatial distribution
 - •Knowledge on severity of collisions
- Statistical models can identify
 - •High-risk accident roads
 - •Features associated with severe crashes

This study

- Objective of this study:
 - Develop logistic regression models to predict the severity of animal-vehicle collisions in Texas based on:
 - Month and time of day
 - Outdoor light condition
 - Rural vs. urban setting
 - Domestic vs. wild animal
 - Vehicle type & traffic
 - Road width, road type
 - Driver age



 Data was obtained from Crash Records Information System (CRIS) of Texas.

Crashes during 2007-09





Data: 2007-2009 average/yr. (Vehicle Type)



Data: 2007-2009 average/yr. (Month)



Overall: October: 1433 crashes November: 1739 crashes December: 1196 crashes

•<u>Most</u> October & November (all severity levels)

<u>Least (varied per severity level)</u>
 July (prop.damage only)
 January (severe injury or death)

Data: 2007-2009 average/yr. (Hour)



Hour

Data: 2007-2009

Outdoor light condition:

(overall)

- 7108 crashes dark, not lighted
- 3115 crashes daylight

Animal Type:

(overall)

- 7007 crashes wild
 - white-tailed deer
 -feral hogs
- 4136 crashes domestic
 - free range livestock
 - pets



(Elgin, TX, September 2013)



(Austin, TX, October 2013)

Logistic Regression Model

$$P(y_i \mid x_i') = \frac{1}{1 + e^{-x_i'\beta}}$$

 $0 \le P(x_i) \le 1$



- β parameters need to be estimated.
 - Maximum Likelihood technique
 - Use a statistical computer package: SAS

Developed Models

- Model 1: P(serious injury or death | x)
- Model 2: P(moderate or minor injury | x)
- Model 3: P(property damage only | x)

Results

Logistic Regression Model for the Probability of *Property Damage Only*

Variable	Parameter Estimate	St. Dev.	P-value
Constant	1.37	0.038	< 0.01
Indicator: Motorcycle	-4.04	0.17	< 0.01
Indicator: Sedan4D	-0.115	0.042	< 0.01
Indicator: SUV	-0.241	0.051	< 0.01
Indicator: October	0.205	0.059	< 0.01
Indicator: November	0.421	0.058	< 0.01
Indicator: December	0.199	0.065	< 0.01
Indicator: 12am	-0.390	0.080	< 0.01
Indicator: 1am	-0.213	0.089	< 0.01
Indicator: 2am	-0.431	0.091	< 0.01
Indicator: Wild	0.374	0.039	< 0.01
Indicator: Daylight	-0.249	0.046	< 0.01

Conclusion

- Need to identify high-risk areas for mitigation
- The models can help understand scenarios that are potentially dangerous
 - Identify the vulnerable time and location
 - Prioritize locations
 - Identify appropriate mitigation technologies
 - Perform cost-benefit analysis
 - Recommend investment options



Thank You!