An Economic Impact of Imported Fire Ants in the United States of America

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Executive Summary

The Imported Fire Ant (IFA) has become a major economic pest to vital sectors of the United States economy. In order to estimate the economic impact of this pest on infested states within the United States and Puerto Pico and potential damage fire ants would cause to Hawaii (if the island became infested), a study was conducted to estimate the annual economic impact of fire ants. This report is based upon the 2000 Texas Economic Impact Study. However, several adjustments were made to represent other states and their differences in numbers of sector entities, climatic conditions, fire ant infestation intensity, etc. Economic impact can be defined as a positive or negative (benefit or cost) change in the economy due to an activity or industry.

A comprehensive empirical study of fire ants on the Texas economy was used as a basis to estimate damages. Multipliers were used to estimate the impact that fire ants have on each state by using modified and proportional known damages in Texas. Adjustments were made for each state based upon land use intensiveness patterns, climatic differences, fire ant invasions and populations, urban landscape with regard to shade and canopy covering, and other factors such as location with respect to where fire ants originated in the southern United States. Using these adjustments, it was found that the annual economic impact would be $5,651,859,165 in the United States and Puerto Rico using data collected in 1999. If this estimate is updated to 2006 based upon the U.S. Labor of Statistics Consumer Price Index (CPI) and Producer Price Index (PPI), the estimate would be $6,323,404,458. The detailed estimates by states and sectors are given in the Appendix. These results can be used to assess damages and estimate the potential costs and benefits of any implemented control and management programs. The two states with the greatest economic impact were Florida and Texas with annual damages of $1.3 billion ($1.6 billion)[1] and $1.2 billion ($1.4 billion)[1] respectively. The types of damages which were the greatest were residential households with over $3.5 billion (almost $5 billion),[1] electric & communication around $600 million (almost $800 million),[1] and agriculture just under $500 million (over $500 million).[1]

[1] The numbers listed in parentheses reflect the inflation adjustment from 1999 to 2006

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Introduction

This report presents the estimates of the potential economic impact caused by imported fire ants, *Solenopsis invicta, Solenopsis richteri*, and their hybrid, in all states that reported fire ants in the continental United States including Puerto Rico and the potential damages if fire ants invaded Hawaii.

This report includes a summary of the estimated fire ant impact for Puerto Rico and the states that are infested and an estimation of potential damages for Hawaii. Estimations include the following sectors: airports, cemeteries, churches, cities, commercial businesses, golf courses, institutions, multi-family households, residential households, schools, electric & communication, and agriculture. Agriculture includes farms, nurseries, sod producers, fruit, vegetable and nut producers, field crops, animal production, pastureland, cropland, hay production, and farmsteads.

Imported Fire Ant History

Originally from tropical South America, the imported fire ant gained entry to the United States through the port of Mobile, Alabama in the early 1900's on cargo ships. It immediately began to thrive, and colonies spread quickly. In 1942 Ed Wilson, a 13 year-old boy, came across a mound in the empty lot next to his home. He continued to study the ants while attending college.[2] While he continued his observation, the ants continued to spread throughout the southern United States. By 1975 the imported fire ant had colonized over 128 million acres of the United States, and today there are more than 321 million acres of fire ant infested land in the United States.

The most common species of imported fire ants is *Solenopsis invicta*, which is also the most aggressive. The four different castes of imported fire ants that live in a colony are winged males, winged females, workers, and queens, as well as the immature stages (eggs, larvae, and pupae). The North American imported fire ant forms colonies with multiple queens (*polygyne).*

Imported fire ant infestations were first documented in Texas in 1953, and in 2000 over 56 million Texas acres were infested with fire ants. To control the spread of fire ants, the Texas Department of Agriculture initiated a county quarantine program in 1958 when it quarantined the states' six most eastern counties. However, the fire ant quarantine failed to stop the westward and northward spread. Today 159 of Texas's 254 counties are under quarantine.

In 1997, in order to both control the spread and to document the severity of the fire ant infestation, the Texas Legislature funded a 6-year imported fire ant initiative at an annual funding rate of $2.5 million. Similar efforts have been initiated in some other states.

[2] http://ant.edb.miyakyo-u.ac.jp/Harvard/ANT_MCZ.html#red

Purpose

The purpose of this report is to show an estimate of the economic impact caused by the imported fire ants in all states who reported fire ants in the continental United States and Puerto Rico, along with the potential damages if fire ants invaded Hawaii.

Objectives

(1) Identify items considered expenses or costs associated with imported fire ants.

(2) Identify those items that have value or benefits associated with the control and management of imported fire ants.

(3) Discover the various ways and areas where imported fire ants affect the nation's economy.

(4) Estimate the overall economic impacts associated with imported fire ants across the nation to serve as a benchmark to evaluate the effectiveness of possible control and management programs implemented by fire ant authorities in infested areas.

Research Methodology

Procedure

A 2000 comprehensive field survey study of fire ants on the Texas economy was used to estimate the damages that fire ants cause throughout the United States. This model was modified and used to estimate the economic impact in other infested states in the United States and Puerto Rico.

Data Collection and Sampling for Texas Study

The primary data used in the Texas study were gathered through five different sector surveys. Four of these, single-family households, golf courses, schools, and cities sector data were collected for the urban study in 1998. The fifth survey, the agricultural sector was conducted in 2000 to obtain fire ant expenses for the calendar year 1999. This study has been followed up with an Agriculture and Rural Survey for selected areas of Texas in 2005.

The Texas Urban Study

The data collection phase included costs and benefits associated with the calendar year 1998. The costs, practices, and benefits were collected for single family homes, schools, cities, and golf courses. The primary data were collected using carefully structured questionnaires and then used for a representative sampling scheme to insure unbiased estimates for each stated variable.

Trained personnel from TASS (Texas Agricultural Statistical Service) helped conduct the sampling and performed the personal interviews to obtain household survey responses. The single-family households were stratified by metroplex by using the TASS geographical area frame sampling scheme.

Questionnaires were administered by mail for schools, cities, and golf courses with phone call follow-ups. All five metro cities (Houston, Dallas, Fort Worth, San Antonio, and Austin) were surveyed.

Sample size was determined by using scientific statistical procedure as follows:

$$n = \frac{z^2 \sigma^2}{e^2}$$

When n = sample size
z = number of standard deviations from the population mean
σ = the population standard deviation
e = the accepted error or desired level of precision

It was decided that an "*e*" of plus or minus 10 percent for the estimated value (sample mean) for fire ant-related expenditures was acceptable, and thus a sample size sufficient to assume that the estimated sample mean was within 10 percent of the population mean was specified. The *z* value was based upon a 10 percent level of precision as well. An estimate for σ was approximated by use of the range test. This technique was also used to estimate the survey sample size for golf courses and schools.

The types of data collected for each of the four sectors in the urban study included: (1) characteristics of each entity, (2) defining the fire ant problem, (3) identifying types of expenditures for control and management, (4) maintenance expenditures and investments, (5) medical expenditures, (6) damage to electrical type equipment, and (7) general information on the sector.

The Texas Agricultural Study

The agriculture survey reports costs and benefits for the 1999 calendar year. The primary objective of the sample design was to obtain a representative sample of Texas agriculture producers. The TASS area frame sampling procedure provides accurate regional estimates on acreage, yields, numbers of producers, and input use. TASS administered the required personal interviews as an addendum to their 1999 Fall Agriculture Survey.

Secondary data were used to augment the survey data. Secondary data sources used consisted of the United States Census of Agriculture and other data annually compiled by TASS. TASS also provided expansion factors for aggregating the survey data into damage estimates for each of the fifteen Texas agricultural statistics districts, in addition to a statewide total.

The types of data collected from each agricultural producer included: (1) irrigated and non-irrigated acres of cropland, (2) crop losses related to fire ants, (3) livestock losses related to fire ants, (4) equipment repair costs due to fire ants, (5) equipment replacement cost due to fire ants, (6) fire ant damages to the farmstead, (7) fire ant related medical expenditures, (8) fire ant veterinary expenditures, (9) cost of fire ant control materials, (10) special equipment purchased to apply fire ant control materials, and (11) the agricultural benefits (if any) of fire ants infestations.

National Study

Nearly all demographic data were generated from the United States Agricultural Census, the National Census, and specific demographic associations that may keep record of such businesses in a particular state or across the country.

Texas data were used as the base model and were compared and adjusted to all of the other states on an individual basis. Individual states' data for the number (or population) of farms, golf courses, schools, businesses, etc. were taken from various secondary statistical data sources such as Census of Agriculture, Census of Population, sales marketing and management data, etc. The data measured the impacts by the sectors and the assumption was made that they were either similar or different compared to the way Texas was structured. Using this procedure, the data compared the effected area of each state and multiplied it by the expenditures per entity for Texas. Then those numbers were adjusted with the change column (modified by climate, location, crops grown, etc.) thus giving estimated expenditures to each state. The agriculture change is a ratio of intensive agriculture to non-intensive agriculture for each state. (Sum of cropland and hay acreage / pastureland, cropland, and hay acreage) That number was divided by Texas's ratio. This would give an adjustment for each state for agriculture. The electric & communication sector was generated by the population ratio (potential electric using customers) of each state multiplied by the expenditure of Texas (thus giving it a per capita basis). All other change ratios are based on relative size and comparisons of each sector in relation to Texas. Some considerations were given for climatic differences such as temperature, growing season, etc.

State Estimations of Fire Ant Damages

In the tables below are the estimations of fire ant damages for each state in the infested areas. Florida has the highest estimated damage with $1,333,773,358, and New Mexico has the least amount of damage with $1,742,875. Puerto Rico is slightly understated because full information was not available for all sectors. This estimation does not include Hawaii because it is not yet infested with fire ants. These estimations include the following sectors: airports, cemeteries, churches, cities, commercial businesses, golf courses, institutions, multi-family households, residential households, schools, electric & communication, and agriculture. Agriculture includes farms, nurseries, sod producers, fruit, vegetable and nut producers, field crops, animal production, pastureland, cropland, and hay production. A breakdown of the economic impact for each state can be found in the Appendix that follows. It should be noted that these estimates reflect 2003 data and the ants are expanding each year to new uninfected areas.

Table 1.1 Economic Impact of Fire Ants by State

State	Total for each state
Alabama	$257,770,890
Arkansas	$128,325,920
California	$844,913,484
Florida	$1,333,773,358
Georgia	$565,626,807
Louisiana	$307,706,245
Mississippi	$236,239,704
New Mexico	$1,742,875
North Carolina	$194,270,988
Oklahoma	$26,004,008
Puerto Rico	$229,036,602
South Carolina	$220,430,214
Tennessee	$101,801,876
Texas	$1,204,216,194
Nation's Total	$5,651,859,165

Current Findings

Damage

Fire ants interrupt and diminish the ability of society to participate in outdoor work, leisure, and family and community type activities. These costs and benefits are not easily quantified and thus were not enumerated in these tables. Damages also occur to equipment, facilities, plants, animals, and human beings.

The following Table 2.1 shows the damages attributed to fire ants for each sector for the nation as a whole.

Table 2.1 Economic Impact by Sector

Sector	Economic Impact
Agriculture	$428,286,974
Airports	$84,346,455
Cemeteries	$98,721,385
Churches	$42,394,283
Cities	$6,969,202
Commercial Businesses	$90,598,908
Golf Courses	$318,604,130
Institutions	$6,035,784
Multi-Family Households	$33,437,968
Nurseries	$45,435,710
Residential Households	$3,674,675,482
Schools	$130,188,066
Sod Producers	$54,514,446
Electric & Communications	$637,650,370
TOTAL	$5,651,859,165

The top five expenses or costs by sector are listed below.

Table 2.2 Top Five Expenses (Costs associated with damages and applications.)

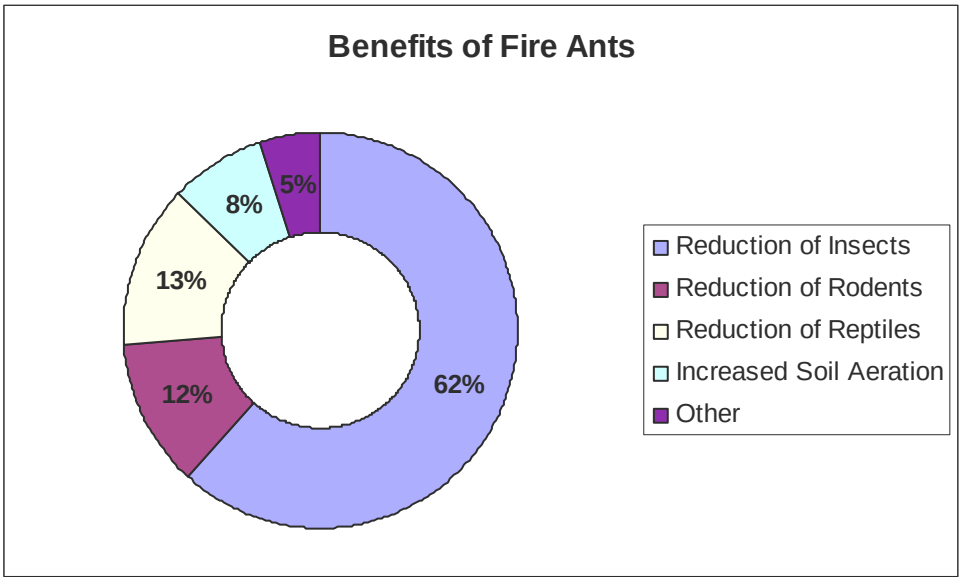
Top Five Expenses	
Sector	Expenses
Residential Households	$3,674,675,482
Electric & Communications	$637,650,370
Agriculture	$428,286,974
Golf Courses	$318,604,130
Schools	$130,188,066

Increasing Threat

The dispersal of fire ants across the United States has been slow but steady, and they spread at a rate of 10 to 20 miles per year.[3] Fire ants are believed to have flourished in the United States because they have essentially no or few natural enemies. At this time, more than 321 million acres in 13 states and Puerto Rico are infested with fire ants.

Benefits

When most people think of fire ants, they instinctively think of the damages they cause. However, fire ants do create some benefits. Fire ants can have some beneficial effects to some crops such as soybeans, sugarcane, pecan orchards, and cotton due to their predation on pests attacking these crops. Fire ants aerate and break up the soil allowing more water and nutrients to become available to the roots. These insects are also notorious for being very aggressive towards insects and pests.



In a recent 2005 Texas study, 15.9 percent of those surveyed reported some benefits from fire ants. Out of those 15.9 percent, 62 percent of respondents reported a reduction of harmful insects, 12 percent observed a reduction in rodent populations, 13 percent reported a reduction in reptile populations, 8 percent noticed an increase in soil aeration, and 5 percent reported other effects such as a decrease in rabbit populations. Reoccurring comments about decreases in ticks, red bugs, quail, and rabbits were common.

Most people would not identify decreases in quail and rabbits as a benefit, however, in the 2005 Texas survey; a few people explicitly stated that the reduction of these animals was a benefit.

[3] http://uts.cc.utexas.edu/~gilbert/research/fireants/faqans.html

Conclusion

For this nation-wide report, the Texas comprehensive study (1998 and 1999 surveys) was used as a basis to estimate the impact that imported fire ants have on all infested states in the continental United States and Puerto Rico along with the potential damages (if fire ants invade Hawaii). As can be seen by the estimates above and the detailed effects reported in the Appendix, fire ants cause significant impacts in all states they infest. They will most likely continue to cause damage in the states in which they spread unless control and management measures are implemented. From the Texas study as a model or basis for the national study and the analyses performed, the annual impact for the nation's economy would be $5.6 billion. If this was updated for 2006 using the CPI and PPI, the impact on the nation's economy would amount to $6.3 billion. The results reported in this report can be used to assess damages and estimate the potential costs and benefits of any applied control and management programs.

Detailed estimates by sector and state are reported in the Appendix pp. 14-26.

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Appendix

State Statistics

These estimates are as of 2000. The estimates were found by using a previous study done on the impact of the red imported fire ant on Texas and other states to estimate the impact that fire ants have on all infested states in the continental United States and Puerto Rico along with the potential damages if fire ants invade Hawaii.

Alabama

Table 3.1 Alabama Fire Ant Impact

Sector	Impact
Agriculture	$42,464,043
Airports	$5,659,882
Cemeteries	$5,785,677
Churches	$3,325,287
Cities	$417,663
Commercial Businesses	$1,929,889
Golf Courses	$23,848,417
Institutions	$43,659
Multi-Family Households	$1,240,624
Nurseries	$2,380,299
Residential Households	$124,805,489
Schools	$2,989,575
Sod Producers	$7,885,738
Electric & Communications	$34,994,647
TOTAL	$257,770,890

Arkansas

Table 3.2 Arkansas Fire Ant Impact

Sector	Impact
Agriculture	$10,328,665
Airports	$1,723,648
Cemeteries	$2,359,808
Churches	$1,216,163
Cities	$263,261
Commercial Businesses	$1,032,987
Golf Courses	$6,297,054
Institutions	$202,881
Multi-Family Households	$351,838
Nurseries	$554,236
Residential Households	$65,831,147
Schools	$2,620,637
Sod Producers	$600,002
Electric & Communications	$34,943,593
TOTAL	$128,325,920

California

Table 3.3 California Fire Ant Impact

Sector	Impact
Agriculture	$81,575,732
Airports	$7,469,142
Cemeteries	$1,948,854
Churches	$2,806,741
Cities	$857,543
Commercial Businesses	$7,733,746
Golf Courses	$29,542,561
Institutions	$1,678,350
Multi-Family Households	$4,580,545
Nurseries	$3,999,253
Residential Households	$598,384,226
Schools	$13,963,470
Sod Producers	$2,228,578
Electric & Communications	$88,144,742
TOTAL	$844,913,484

Florida

Table 3.4 Florida Fire Ant Impact

Sector	Impact
Agriculture	$24,739,378
Airports	$13,406,153
Cemeteries	$4,973,814
Churches	$7,154,866
Cities	$1,426,276
Commercial Businesses	$13,804,969
Golf Courses	$92,781,060
Institutions	$2,874,267
Multi-Family Households	$8,764,624
Nurseries	$14,273,044
Residential Households	$1,004,023,330
Schools	$17,170,891
Sod Producers	$6,171,447
Electric & Communications	$122,209,241
TOTAL	$1,333,773,358

Georgia

Table 3.5 Georgia Fire Ant Impact

Sector	Impact
Agriculture	$49,081,081
Airports	$5,822,484
Cemeteries	$5,777,021
Churches	$3,913,945
Cities	$873,094
Commercial Businesses	$6,512,428
Golf Courses	$34,499,816
Institutions	$717,624
Multi-Family Households	$2,905,053
Nurseries	$3,372,090
Residential Households	$358,867,394
Schools	$17,623,411
Sod Producers	$6,171,447
Electric & Communications	$69,489,918
TOTAL	$565,626,807

Louisiana

Table 3.6 Louisiana Fire Ant Impact

Sector	Impact
Agriculture	$31,295,444
Airports	$4,069,725
Cemeteries	$2,080,190
Churches	$4,064,582
Cities	$502,085
Commercial Businesses	$3,276,025
Golf Courses	$11,455,279
Institutions	$82,587
Multi-Family Households	$1,440,069
Nurseries	$2,222,779
Residential Households	$202,932,844
Schools	$7,369,609
Sod Producers (in acres)	$1,971,434
Electric & Communications	$34,943,593
TOTAL	$307,706,245

Mississippi

Table 3.7 Mississippi Fire Ant Impact

Sector	Impact
Agriculture	$38,593,209
Airports	$4,404,879
Cemeteries	$2,656,373
Churches	$3,715,447
Cities	$363,234
Commercial Businesses	$1,965,092
Golf Courses	$12,728,088
Institutions	$118,224
Multi-Family Households	$645,745
Nurseries	$1,481,853
Residential Households	$136,898,526
Schools	$5,862,867
Sod Producers	$4,628,585
Electric & Communications	$22,177,583
TOTAL	$236,239,704

New Mexico

Table 3.8 New Mexico Fire Ant Impact

Sector	Impact
Agriculture	$35,768
Airports	$47,879
Cemeteries	$8,473
Churches	$10,932
Cities	$2,222
Commercial Businesses	$15,222
Golf Courses	$66,990
Institutions	$3,031
Multi-Family Households	$3,897
Nurseries	$5,834
Residential Households	$1,291,686
Schools	$54,700
Sod Producers	$0
Electric & Communications	$196,241
TOTAL	$1,742,875

North Carolina

Table 3.9 North Carolina Fire Ant Impact

Sector	Impact
Agriculture	$1,622,069
Airports	$3,557,640
Cemeteries	$1,674,174
Churches	$2,050,709
Cities	$539,852
Commercial Businesses	$1,980,040
Golf Courses	$21,503,769
Institutions	$55,646
Multi-Family Households	$1,346,759
Nurseries	$4,789,769
Residential Households	$115,645,846
Schools	$3,403,861
Sod Producers	$3,000,009
Electric & Communications	$33,100,846
TOTAL	$194,270,988

Oklahoma

Table 3.10 Oklahoma Fire Ant Impact

Sector	Impact
Agriculture	$5,263,309
Airports	$813,945
Cemeteries	$347,404
Churches	$237,767
Cities	$106,637
Commercial Businesses	$177,437
Golf Courses	$1,138,829
Institutions	$43,105
Multi-Family Households	$52,537
Nurseries	$58,341
Residential Households	$14,068,220
Schools	$949,794
Sod Producers	$600,002
Electric & Communications	$2,146,681
TOTAL	$26,004,008

Puerto Rico

Puerto Rico's total is slightly understated because full information was not available for all sectors. We used initial data relative to that of Florida's for commercial businesses and nurseries.

Table 3.11 Puerto Rico Fire Ant Impact

Sector	Impact
Agriculture	$24,702,703
Airports	$1,436,374
Cemeteries	$347,404
Churches	$61,491
Cities	$14,440
Commercial Businesses	$3,529,520
Golf Courses	$1,071,839
Institutions	$3,253
Multi-Family Households	$1,035,878
Nurseries	$2,432,806
Residential Households	$179,410,283
Schools	$10,447,739
Sod Producers	$4,542,871
Electric & Communications	
TOTAL	$229,036,602

South Carolina

Table 3.12 South Carolina Fire Ant Impact

Sector	Impact
Agriculture	$25,513,542
Airports	$7,373,384
Cemeteries	$2,170,225
Churches	$3,307,595
Cities	$204,388
Commercial Businesses	$1,765,449
Golf Courses	$28,336,742
Institutions	$45,615
Multi-Family Households	$1,097,978
Nurseries	$3,593,785
Residential Households	$110,161,540
Schools	$3,722,973
Sod Producers	$1,971,434
Electric & Communications	$31,165,562
TOTAL	$220,430,214

Tennessee

Table 3.13 Tennessee Fire Ant Impact

Sector	Impact
Agriculture	$2,500,000
Airports	$1,940,531
Cemeteries	$4,669,562
Churches	$1,073,430
Cities	$271,037
Commercial Businesses	$977,734
Golf Courses	$8,038,792
Institutions	$36,750
Multi-Family Households	$793,726
Nurseries	$746,761
Residential Households	$59,989,282
Schools	$1,755,116
Sod Producers	$1,371,433
Electric & Communications	$17,637,723
TOTAL	$101,801,876

Texas

Table 3.14 Texas Fire Ant Impact

Sector	Impact
Agriculture	$90,572,032
Airports	$26,620,789
Cemeteries	$63,922,406
Churches	$9,455,328
Cities	$1,127,469
Commercial Businesses	$45,898,370
Golf Courses	$47,294,894
Institutions	$130,793
Multi-Family Households	$9,178,695
Nurseries	$5,524,861
Residential Households	$702,365,668
Schools	$42,253,421
Sod Producers	$13,371,468
Electric & Communications	$146,500,000
TOTAL	$1,204,216,194

Hawaii

Hawaii is not infested with fire ants as of this time. There are estimates of the impact that fire ants would have on the state, should they become infested. The estimated impact on resort and tourist areas is not included in this total.

Table 3.15 Estimated Impact on Hawaii

Sector	Estimated Impact
Agriculture	$1,693,148
Airports	$1,436,374
Cemeteries	$288,091
Churches	$114,784
Cities	$322,134
Commercial Businesses	$2,206,327
Golf Courses	$6,297,054
Institutions	$7,246
Multi-Family Households	$730,852
Nurseries	$122,515
Residential Households	$54,710,121
Schools	$1,382,423
Sod Producers	$1,542,862
Electric & Communications	$9,663,574
TOTAL	$80,517,504