

## **Faculty Paper Series**

Faculty Paper 00-6

February 2000

### **The Economic Impact of the Red Imported Fire Ant on the Metroplexes of Texas**

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**Abstract:** This research estimates the annual economic impact of the fire ant on key urban sectors in Texas. A study was conducted in 1998-1999 in the 5 metroplexes of Austin, Dallas, Fort Worth, San Antonio and Houston to estimate the costs of controlling and managing fire ants (Lard, et al). This study found that the annual expenditure for fire ant control and management by selected sectors in these metroplexes totaled more than \$581 million. The total annual expense by sector amounted to \$526 million for households, \$29 million for golf courses, \$25 million for schools, and \$0.6 million for cities. These annual cost figures do not include all urban costs or costs borne by electrical utility companies, communication firms and cable companies. These results can be used to assess damages and estimate the potential costs and benefits of control and management programs, such as the community-based effort underway as part of the Texas Fire Ant Initiative.

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# **The Economic Impact of the Red Imported Fire Ant on the Metroplexes of Texas**

**By Victoria Salin, Curtis F. Lard, and Charles Hall<sup>1</sup>**

## **Introduction**

The Texas Fire Ant Initiative was launched in 1997 to investigate the effects of the red imported fire ant on the state, and to discover appropriate and cost-effective management programs that may alleviate continued damage from this pest in the future. The on-going program is a multi-disciplinary effort, involving both the rural and urban sectors of the State. This paper presents some of the results from the economic component of the Initiative's first phase. It is based on original survey research and focuses on cost estimates obtained from the survey of urban sectors. In addition to presenting the cost estimates, the effort at valuation of non-monetary damages is also discussed.

The specific objectives of the economics component of the Texas Fire Ant Initiative include:

1. To identify items which are considered expenditures or costs and those items which have value or benefits (if any) associated with the control and management of fire ants.
2. To estimate the cost of various control and management measures used by selected sectors of the urban areas.

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<sup>1</sup> The research team was chaired by Curtis F. Lard, Professor, and Charles R. Hall, Associate Professor, faculty members in the Department of Agricultural Economics at Texas A&M University. Other individuals on the team included Victoria Salin, Assistant Professor of Agricultural Economics, Brad Vinson, Professor of Entomology, and Kristi Hobbs Cleere and Stephanie Purswell, research assistants in the Department of Agricultural Economics.

The research project was a cooperative effort by Texas A&M University, the Texas Agricultural Experiment Station, the Texas Agricultural Extension Service and the Texas Department of Agriculture (TDA). The main source of funding was the TDA through the Texas Imported Fire Ant Research and Management Project (<http://fireant.tamu.edu>). The Texas Agricultural Statistical Service (TASS) assisted through a subcontract in the collection of data from the single-family households.

3. To discover the various ways and areas where the fire ant affects the urban space.
4. To estimate various expenditures associated with the fire ant damages.
5. To estimate the overall economic impacts associated with fire ants in the selected metroplexes to serve as a benchmark to evaluate possible control and management programs implemented by the Texas Fire Ant Initiative.

A literature study was made to ascertain what other research was done in Texas or other states on the economic impact of fire ants. To our knowledge, no other economic research had been done on fire ants that used primary data. However, the University of Arkansas (Jones and Thompson) and the University of Georgia (Diffie and Sheppard) did limited economic impact studies.

The remainder of this paper is organized as follows: (1) description of data collection and analytical methods; (2) summary of survey findings for each urban sector (households, golf courses, schools, and cities); (3) description of contingent valuation efforts and outcomes; and (4) conclusions.

#### Data Collection Methods

The data collection phase of the study was completed in 1998 and 1999 and uncovered costs and benefits associated with the calendar year 1998. The costs, practices and benefits data were collected for single-family detached homes, schools (public and private schools, including elementary schools, high schools and higher education institutions), cities, and golf courses in the major metroplexes of Texas: Austin, Dallas, Fort Worth, Houston, and San Antonio.

The principal types of data needed for this study were primary data. These data were collected from households, schools, cities and golf courses by using carefully structured questionnaires and a random sampling scheme. Questionnaires were administered by mail to schools, cities, and golf courses, with phone call follow-ups. The household survey responses were obtained by telephone interviews conducted by trained personnel from the Texas Agricultural Statistical Service (TASS).

The research team determined that multiple choice, discussion and fill-in-the-blank questions would provide the desired results in terms of answers as well as responding to the study. This type of questionnaire permitted an easy tabulation of data using the SPSS<sup>®</sup> Analysis System.

Secondary data sources used included the Census of Population, Census of Agriculture and the Sales Marketing and Management Survey. These were used in obtaining the weights for the multiplication or expansion factors for the household part of the study. Texas Education Agency data were used for the school expansion factors. The directory of Texas Golf Courses was used to obtain the expansion factors for the golf course sector.

### Sampling Process

The main goal of the sample design for each sector was to obtain a representative sample of the households, schools, and golf courses. All five metro cities were surveyed to obtain city data.

The single-family households (detached homes) were stratified by metroplex and the sampling scheme was based upon the National Agricultural Statistical Service's area frame sampling. Texas Agricultural Statistical Service (TASS) conducted the sampling and the personal interviews. These area frames were modified with the 1997 Census of Agriculture which indicated non-agricultural areas, primarily residences. These adjustments were necessary because the Area Frame Sample for TASS was designed to obtain data about acreage, yields, numbers, etc. of agricultural products and inputs.

A complete list of frames was used for schools and golf courses in the metroplexes. Sample size was determined by using the usual scientific statistical procedure as follows:

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

when  $n$  = sample size

$z$  = number of standard deviations from the population mean

$S$  = the population standard deviation

$e$  = the accepted error or desired level of precision

In this study it was decided that an “ $e$ ” of plus or minus 10 percent for the estimated value (sample mean) for fire ant expenditures was acceptable. Also, it was decided that 90 percent of

the study's observations should fall within the plus or minus 10 percent of the population mean, our  $z$  value was based upon this as well. The  $\sigma$  was approximated by use of range tests. The requirements were used to guide the survey of households, schools and golf courses.

The types of data collected for each sector 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) damages to electrical type equipment and (7) general information on the sector. The complete text of the questionnaires is available from the authors upon request.

#### Summary of Fire Ant Expenditures for the Metroplexes

The primary objective of this study was to estimate the economic impacts of fire ant on the metroplexes where people live, work and recreate. The overall cost to these metroplexes for fire ant damages and control was over \$581 million for 1998. The expenditures by sector are reported in Table 1. The greatest cost was to the household sector with \$526 million in damages and control. The per household average annual expenditure was \$150.79. The golf course expenditure was \$29.49 million or \$63,495 per golf course. The expenditures for the school sector were \$25.44 million at \$4,954 per school and for cities were \$612,453.

If the costs and damages to all residential households, businesses, churches, institutions, cemeteries, airports and others affected by fire ants were added to this total the aggregate annual costs would be much greater.

**Table 1. Total Fire Ant Control and Damage Expenditures in Texas Metroplexes by Selected Sector for 1998.**

<u>Sector</u>	<u>Total Expenditures</u>
Households	\$525,882,656
Golf Courses	\$ 29,487,659
Schools	\$ 25,441,524
Cities	\$ 612,453
<b>Total</b>	<b>\$581,424,292</b>

**Table 2. Total Expenditures for Fire Ants by Metro Area by Sector for 1998.**

Sector	Metro Area					Total
	Austin	Dallas	Ft. Worth	Houston	San Antonio	
Households	\$45,783,120	\$99,346,358	\$72,065,323	\$111,055,396	\$197,632,458	\$525,882,656
Golf Courses	\$14,185,158	\$10,009,844	\$1,177,055	\$3,537,610	\$577,992	\$29,487,659
Schools	\$1,014,431	\$11,933,903	\$1,311,722	\$7,271,224	\$3,910,193	\$25,441,524
Cities	\$51,559	\$194,523	\$326,754	\$28,860	\$10,716	\$612,453
<b>Total</b>	\$61,034,309	\$121,484,628	\$74,880,905	\$121,893,090	\$202,131,359	
				<b>Total</b>		<b>\$581,424,292</b>

**Table 3. Total Expenditures by Type of Expense by Metro Area for 1998.**

Expense Category	Metro Area					Total
	Austin	Dallas	Ft. Worth	Houston	San Antonio	
Treatment	\$22,960,163	\$98,240,765	\$37,571,769	\$73,560,495	\$69,218,857	\$301,552,049
Repair	\$2,828,744	\$8,133,426	\$34,028,954	\$10,087,244	\$25,548,194	\$80,626,562
Replacement	\$32,028,966	\$11,177,899	\$1,000,952	\$1,583,623	\$106,288,348	\$152,079,788
Medical	\$3,216,437	\$3,932,538	\$2,279,230	\$36,661,728	\$1,075,960	\$47,165,893
<b>Total</b>	\$61,034,309	\$121,484,628	\$74,880,905	\$121,893,090	\$202,131,359	
				<b>Total</b>		<b>\$581,424,292</b>

## Results for Households

Fire ant related expenditures on treatment, repair, replacement, and medical costs over the 5 large metroplexes in Texas were \$150.79 per household, leading to total metroplex expenditures of \$525.88 million. Clearly, fire ants have a considerable impact on these metroplex households. Treatment costs, which include pesticides, baits, and other control measures for the metroplexes are \$279.63 million, making up a significant portion of the expenditures. Repair costs account for \$72.77 million and replacement costs are \$126.43 million for the five-metroplex household totals. Total annual metroplex expenditures for medical care costs are \$47.05 million. For a comparison between per household figures and per metroplex figures see table 4.

In the metroplexes surveyed, most households own the property where they reside. The average lot size was about .6916 acres.<sup>2</sup> Of that area, most was comprised of a grass lawn (61.33%). A portion of the lot was designated for swimming pool area (16.8%), landscape area (20.98%), and hardscape area (17.61%). A smaller portion of the average lot was made up of garden area (11.19%). Most homes surveyed are less than 20 years old and are bordered by neighbor's homesites, streets and alleyways.

Most of the households (58.91%) reported that fire ants are "somewhat of a problem" around their residence. Some (31.28%) households report fire ants as "not a problem" and 9.77% of households report fire ants as a "serious problem." The responses have shown that fire ants are a seasonal problem occurring between April and September in an average year. About 67% of households said they have 5 or fewer mounds in their yard.

On average, the family male adult (70.30%) and family female adult (32.02%) are responsible for the control of fire ants. Fewer households (2.56%) use pest control operators.<sup>3</sup>

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<sup>2</sup> The average lot size was slightly inflated due to the San Antonio average of 1.12 acres, which seems high relative to the other metroplex averages: .556 acres for Austin, .3776 acres for Dallas, .3096 acres for Fort Worth, and .4544 acres for Houston.

<sup>3</sup> Respondents indicated more than one person responsible for labor in the household, so the percentages shown indicate the share of the sample using that resource and the total is greater than 100%.



Problem areas for households in the surveyed metroplexes were landscape areas, hardscape areas, yard areas, and gardens. Even though fire ants are a problem for households, most (73.2%) responded that fire ants do not restrict members of their households from doing activities in their yards or gardens. Of those who confirmed that fire ants restrict activities, they noted gardening, swimming, sunbathing, landscaping, picnicking and children playing in the yard as the activities that they had curtailed because of fire ants.

#### Results for Golf Courses

Fire ants have made a large economic impact on the golf courses of the five large metroplexes of Texas. The fire ant expenditures on treatment, repair, replacement, and medical costs over the five large metroplexes in Texas was \$64,494.90 per golf course. When looking at each of the four above expenditure categories for the golf courses relating to fire ants, replacement cost was the most significant of the metroplexes total expenditure. Replacement expenditure was \$25.24 million. A considerable proportion was for the replacement of costly irrigation systems due to fire ant habitation in the system. Treatment costs, which included mostly insecticide baits followed by individual mound treatment performed by the golf course management, had an expenditure across the metroplexes of \$3.10 million. Repair costs account for both electrical equipment and physical damage to the different areas of the course, and was \$1.15 million. Annual metroplex expenditures for medical care costs were \$3,610.13. For a comparison between per golf course expenditure figures and per metroplex expenditure figures see Table 5.

Of the metroplexes surveyed, most of the golf courses were 18-hole public golf courses with an average age of 34.56 years. With this average age, it can be concluded the fire ant activity was somewhat limited because fire ants thrive on newly established areas. The average size of the golf courses was 164.14 grass acres. Clubhouses had an average size of 17,789.08 square feet. The number of acres around the course constituting the hardscape portion of the golf course was 44.18. Swimming pool area was 106,677.2 square feet on average.



Most of the golf courses (72%) defined fire ants on the golf course as “somewhat of a problem.” Only 7% of the sample said fire ants were not a problem. Furthermore, 21% reported that fire ants were indeed a serious problem for the golf course. The golf courses reported that the most fire ant activity leading to problems on the course occurred from April to September. This response showed that fire ants were a seasonal problem from the rainy season of the year to the hot and dry portion of the Texas weather. Across the metroplexes, 74% responded heavy fire ant activity from April to June. Similarly, 71%<sup>4</sup> reported fire ant activity from July to September.

Since the five large metros in Texas confirmed that fire ants were a problem on golf courses, it was important to consider who was having to provide labor time due to fire ant habitation on and around the golf course. The internal golf course maintenance provided most of the labor for controlling fire ants, instead of contacting outside sources for control. The four areas constituting most of the damage were landscape areas (51%), fairways (48%), tees (48%), and electrical equipment (59%). The internal personnel for the golf course maintenance provided the labor to repair and treat the damaged areas caused by fire ants.

As noted earlier the problem areas on and around the golf course were electrical equipment (59%), landscape areas (51%), fairways (48%), tees (48%), and roughs (42%). Electrical equipment was a very serious concern for the golf courses in these metroplexes due to fire ant activity in the irrigation systems. Even though fire ants were somewhat of a problem for the golf courses, most (78%) responded that fire ants did not restrict individuals from participating in activities on or around the golf course. Of those who responded, 22% noted that fire ants restricted and limited the golfers and landscape personnel from doing their daily activities.

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<sup>4</sup> Respondents indicated more than one time of year for problems with fire ants, so the percentages shown indicate the share of the sample using that resource and the total is greater than 100%.

**Table 5. Comparison of Metroplex and Per Golf Course Expenditure.**

Per Golf Course Expenditure in the Five Large Metros of Texas						
Expenditure	Austin	Dallas	Fort Worth	Houston	San Antonio	Weighted Average
Repair	\$2,111.22	\$2,329.66	\$1,019.28	\$2,524.00	\$4,390.60	\$3,746.07
Treatment	\$5,565.08	\$5,830.36	\$1,800.27	\$12,272.51	\$3,620.27	\$6,533.17
Replacement	\$151,499.10	\$93,981.25	\$11,355.56	\$11,997.14	\$12.50	\$53,208.05
Medical	\$10.00	0	\$18.83	\$6.43	\$4.29	\$7.62
Per Golf Course	\$159,185.40	\$102,141.26	\$14,193.94	\$26,800.08	\$8,027.66	
Total per Golf Course						\$63,494.90

Expenditure	Austin	Dallas	Fort Worth	Houston	San Antonio	Summation of Expenditure
Repair	\$187,898.76	\$228,306.56	\$84,600.58	\$333,167.39	\$316,123.22	\$1,150,096.51
Control	\$495,291.96	\$571,374.90	\$148,380.78	\$1,619,971.17	\$260,659.77	\$3,095,678.58
Replacement	\$13,501,077.50	\$9,210,162.50	\$942,511.11	\$1,583,622.86	\$900.00	\$25,238,273.97
Medical	\$890.00	0	\$1,562.99	\$848.57	\$308.57	\$3,610.13
Total	\$14,185,158.22	\$10,009,843.95	\$1,177,055.46	\$3,537,609.99	\$577,991.56	
				<b>Total</b>		<b>\$29,487,659.19</b>

## Results for Schools

The schools sector accounts for more than \$25.4 million in economic impact of fire ants in Texas metro areas. Average expenditure per school responding to the survey was \$4,954. The leading share of school expenditure (71%) was treatment measures, both by hired professional service companies and by school staff. The Dallas schools responding to the survey reported expenditures that averaged two and even three times larger than schools in the other metro areas.

A total of 52 schools responded to the survey, more than one-half of which were post-secondary schools. The respondents included 4-year colleges and universities (39%), 2-year colleges (16%), public school systems (33%), and a few private schools (5%). Another 7% of the respondents were institutions not fitting any of these categories, including a seminary. The grounds at the schools were extensive, averaging 110.9 acres. The school grounds included 5.69 athletic fields on average, which covered 23.1 acres on average.

Fire ants were considered “somewhat of a problem” for 66% of the educational institutions that responded. Nineteen percent of respondents characterized the fire ant problem as “serious,” and 15% said fire ants are “not a problem.” Problems occurred most often in July-September (72%) and April-June (63%).

School grounds and landscapes were the most common areas in which fire ants presented problems, with 69% and 63% of schools reporting these problem areas, respectively. Playgrounds and athletic fields were considered problem areas by fewer than one-half of the respondents.

Almost three-fourths of the respondents indicated that fire ants did not restrict activities at the educational institution. Among those reporting that activities were curtailed, children playing outside was most frequently restricted. Children’s play was restricted at 18% of the schools. This is a relatively small percentage of the total number of schools responding, but it accounts for nearly one-half of the elementary/secondary school systems in the sample.

**Table 6. Summary of fire-ant related expenditures by schools and metroplex, 1998.****Per School Expenditures**

	<b>Austin</b>	<b>Dallas</b>	<b>Fort Worth</b>	<b>Houston</b>	<b>San Antonio</b>	<b>Total</b>
Treatment	\$1,980	\$5,519	\$985	\$3,597	\$3,038	\$3,532
Repair	\$350	\$3,453	\$1,123	\$333	\$418	\$1,326
Replacement	\$0	\$264	\$0	\$0	\$5	\$75
Medical	\$126	\$5	\$71	\$0	\$0	\$22
Total per school	\$2,456	\$9,240	\$2,179	\$3,930	\$3,461	
	<b>Total per School</b>					<b>\$4,954</b>

**Per Metro Expenditures in Schools**

	<b>Austin</b>	<b>Dallas</b>	<b>Fort Worth</b>	<b>Houston</b>	<b>San Antonio</b>	<b>Total</b>
Treatment	\$817,740	\$7,278,189	\$592,884	\$6,803,224	\$2,892,886	\$18,384,923
Repair	\$144,550	\$4,319,525	\$676,247	\$468,000	\$1,012,885	\$6,621,207
Replacement	\$0	\$330,503	\$0	\$0	\$4,423	\$334,925
Medical	\$52,141	\$5,686	\$42,642	\$0	\$0	\$100,469
Total per Metro	\$1,014,431	\$11,933,903	\$1,311,772	\$7,271,224	\$3,910,193	
	<b>Total</b>					<b>\$25,441,524</b>

## **Results for Cities**

On average, the cities managed approximately 225 individual sites (including parks, buildings, airports, cemeteries, etc.), comprising a total of 20,771 acres. The types of properties maintained by the cities and their respective acreage includes 7,704 acres of parks, 2,987 acres of grounds, 576 acres of athletic fields, 605 acres of recreational areas, 392 acres of swimming complexes, and 8,507 miscellaneous acres of office and other building areas.

Virtually all (97%) of Texas metroplex cities reported problems with fire ants, with 44 percent stating fire ants as “somewhat of a problem” and 38 percent viewing fire ants as a “serious problem”. However, the problems associated with fire ants were seasonal with 56 percent of the respondents indicating problems during the months of April to September. The specific areas in which respondents indicated damages took place included lawns/landscapes, parks, roadways, athletic fields and swimming complexes. This was expected a priori due to the significant portion of “grass areas” in these respective areas. However, 41 percent of the respondents also indicated problems occurring with electrical equipment, preserves, and sewage plants.

Costs for repairing areas damaged by fire ants averaged \$901 per city and totaled \$11,370 for the entire metroplex areas. These repairs were made by city maintenance staff, parks departments, aviation employees, and private contractors. Outdoor lighting fixtures and city parks were by far the most often repaired areas, however lawn areas and airport areas were the most expensive areas to repair (\$5,267 and \$2,579 respectively).

Persons performing the various treatments of fire ant infested areas included city staff, licensed applicators, contractors, parks departments, and aviation employees. There were various types of fire ant treatments made by respondents, including the use of insecticide mound treatments, insecticide baits, biological controls, mechanical disturbance, and other specialized remedies. The areas receiving the greatest number of treatments were lawns/landscapes, parks, athletic fields, and cemeteries, with a total of 1,020 hours being expended on fire ant treatment activities during the course of an “average” year. The total costs of performing these treatment activities averaged \$19,889 per city, totaling to \$226,740 for the entire metroplex areas.

**Table 7. Summary of fire ant-related expenditures by city and by metroplex, 1998.**

<b>Total Per City Expenditures</b>						
Type of cost	Austin	Dallas	Fort Worth	Houston	San Antonio	Weighted Average
Repair Damage	\$1,400.00	\$0	\$1,700.00	\$1,000.00	\$0	<b>\$901.32</b>
Treatment	\$9,625.50	\$500.00	\$59,886.00	\$25.00	\$6,000.00	<b>\$19,889.43</b>
Control	\$11,312.41	\$54,825.00	\$4,488.33	\$11,050.00	\$1,600.00	<b>\$18,642.71</b>
Medical	\$15.00	\$0	\$5,000.00	\$0	\$0	<b>\$1,462.91</b>
Replacement	\$2,100.00	\$4,250.00	\$17,550.00	\$0	\$0	<b>\$6,492.54</b>
Electrical Repair	\$3,450.00	\$10,650.00	\$9,500.00	\$1,800.00	\$0	<b>\$6,238.95</b>
Total per City	\$27,902.91	\$70,225.00	\$98,124.33	\$13,875.00	\$7,600.00	
				<b>Total per City</b>		<b>\$53,627.85</b>
<b>Total per Metro Expenditures</b>						
Type of cost	Austin	Dallas	Fort Worth	Houston	San Antonio	Total Expenditures
Repair Damage	\$3,629.05	\$0	\$5,661.00	\$2,080.00	\$0	<b>\$11,370.05</b>
Treatment	\$17,422.16	\$1,385.00	\$199,420.38	\$52.00	\$8,460.00	<b>\$226,739.54</b>
Control	\$20,475.46	\$151,865.25	\$14,946.14	\$22,984.00	\$2,256.00	<b>\$212,526.85</b>
Medical	\$27.15	\$0	\$16,650.00	\$0	\$0	<b>\$16,677.15</b>
Replacement	\$3,801.00	\$11,772.50	\$58,441.50	\$0	\$0	<b>\$74,015.00</b>
Electrical Repair	\$6,244.50	\$29,500.50	\$31,635.00	\$3,744.00	\$0	<b>\$71,124.00</b>
Total per Metro	\$51,599.32	\$194,523.25	\$326,754.02	\$28,860.00	\$10,716.00	
				<b>Total</b>		<b>\$612,452.59</b>

### Contingent Valuation

The economic impact of fire ants in terms of expenditures for control, repairs and replacement of damaged items can be measured fairly easily through survey research such as that reported in this paper. But it is possible that these observable expenditures are merely the “tip of the iceberg,” in that effective control of fire ants could provide significant non-monetary benefits.

The surveys of the four urban sectors included questions that were designed to elicit information about the non-monetary effects of fire ants. First, respondents were asked to assign a value to



the activities that had been curtailed as a result of the presence of fire ants in their environment. The question in the household survey instrument was:

Of the activities that you have curtailed in #16, how much is it worth to you and/or your family members, EACH YEAR, to not do the activity? (Activities and ranges for dollar values are listed).

Two questions covered the importance of fire ant management.

Is it important to you to control fire ants? (Yes/No)

If it is important to you, then how much would you be willing to spend EACH YEAR to control fire ants? (Ranges for dollar values are listed).

Similar questions were included in the survey instruments administered to officials representing golf courses, schools, and cities. The responses to these questions are outlined below, for each sector. An interesting finding is that household and golf course respondents sectors stated that they were willing to pay *less* than the total average expenditures reported in the responses to the direct questions about expenditures. Respondents to the cities and schools surveys evidently had difficulty in responding to these questions, so the findings from these sectors should be approached with caution.

It should be noted that there may be interdependence among the various activities curtailed. Thus the values provided should be interpreted accordingly. It is important to not combine valuation of activities with the willingness to spend for control.

### *Households*

Those who responded that they indeed had to stop or limit some activities because of fire ants gave some insight into how much each activity was worth in dollar terms. Of those who responded, picnicking was “worth” to them the most (\$60.92 on average), and gardening (\$23.11) and sunbathing (\$42.70) had significant value as well. Respondents indicated that swimming, landscaping, and children playing were worth \$1.89, \$6.33, and \$5.32 respectively.

Thus, we see that fire ants cause households to limit or stop doing some activities and the value of those activities was around \$140.27 for all activities curtailed, per household reporting.

Texas metro area residents stated they were willing to spend, on average, \$89.47 each year to control fire ants. This is below the \$150.79 average per household expenditure reported for control measures and cost of repair and replacement of damaged items.

Given the expenses for households to treat fire ants at their homesite, it was not surprising that 88% of the households in the metroplexes surveyed responded that it was important to control fire ants.

### *Golf Courses*

Those who responded that fire ants curtailed activities estimated how much the activity was worth in dollar terms. Of those who responded, golfing activity was “worth” the most (\$181.52) followed by landscape personnel activities (\$103.82), clubhouse activities (\$85.25), swimming (\$46.37), and other activities not specified (\$38.64).

Controlling fire ants was important for golf courses (98%). Golf courses in the Texas metroplexes reported they would be willing to spend \$1,925 a year to control fire ants. This was substantially lower than the amount they were actually spending (\$63,495) on average each year for fire ant control.

### *Schools*

The average value of curtailed activities reported by the schools was \$44.16. It should be noted that reporting the value of the curtailed activities was difficult for these respondents. Sixty percent did not respond to the question, and among those who responded, values were evenly scattered across the categories. The range of \$101-200 was reported most often as the value of being able to have the activities without any disruption, but only 5 respondents reported this figure. Ninety percent of the responding schools indicated that it is important to the institution to control fire ants. Willingness to pay to control fire ants ranged widely, from less than \$500

(20%), to more than \$3001 (20%). On average, schools in the metroplexes were willing to spend around \$1,500 to control fire ants. This stated willingness to pay was below the \$4,954 average per-school expenditure.

### *Cities*

Only 34 percent of the cities indicated that fire ants restricted the city or its citizens from conducting outdoor activities. The majority of respondents indicated that even though fire ants were a problem, outdoor activity prevailed. Of those activities that were limited or curtailed, maintenance activities were the most common (11% of the cases), with 8 percent also indicating activity associated with wildlife productivity, game preserves, and even burial services.

An interesting follow-up question asked of respondents was how much would it be worth to the city to not have these activities disrupted by fire ants in any way. While responses to this question were too sparse to report any meaningful results, subsequent non-response inquiry revealed that uninterrupted or curtailed activities would indeed be worth paying for, but assessing an actual dollar amount proved to be too cumbersome for the respondents. Nevertheless, the majority (68%) of responding cities indicated that controlling fire ants was important to the city and its citizens.

### *Conclusions*

The survey findings reported in this paper indicate the economic significance of the red imported fire ant as a pest in Texas metropolitan areas. Annual expenditure for control of fire ants, and for repair or replacement of damaged items, exceeded \$581 million in 1998, based on studies of metropolitan households, golf courses, schools, and cities. The initial assessment of economic impact serves as a baseline for evaluation of the benefits of new control and management programs, such as the community-based effort underway as part of the Texas Imported Fire Ant Research and Management Project. The work demonstrates the importance of sound economic input into inter-disciplinary research and extension programs.

In addition to the direct economic costs uncovered by the questions about expenditures, respondents to these surveys provided input into non-monetary benefits of effective control of the fire ant. While this survey was not primarily a contingent valuation study, the responses to questions on (1) the value of specific activities that have been curtailed because of fire ants, and (2) willingness to pay for control, are interesting and are an important part of a complete economic impact assessment. Households indicated dollar values for curtailed outdoor activities of \$140, nearly as high as their actual average expenditures for control and repair (\$150). Willingness to pay for effective control averaged \$89, substantially below actual household expenditures. The contingent valuation results are puzzling and the conclusions should not be over-stated given the stated difficulty of several respondents in answering these questions.

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