# *Economic Impacts of the Red Imported Fire Ant in Texas: The Search for Economically Feasible Solutions*

## *FINAL REPORT, 1997-1999*

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***Source and Amount of Funding***: *Texas Imported Fire Ant Research and Management Plan. Total funding $100,000.*

***Time Period***: *September 1997 - August 1999.*

***Abstract***: *The economic damages associated with the Red Imported Fire Ant's presence in selected economic activities in Texas were evaluated in this project. Red Imported Fire Ant's economic damages analyzed included damages to: electrical and communication equipment in selected sectors (churches, hospitals, airports, prisons, and electric, telephone and cable companies); economically significant wildlife species (white-tailed deer and northern bobwhite quail); major agricultural crops (soybeans, corn, grain sorghum, potatoes, grapefruit, oranges, and cotton); and cattle production. The aggregate damage of the Red Imported Fire Ant on the economic activities analyzed in this project was estimated at $484.5 million per year.*

***Introduction and Background***: *The Red Imported Fire Ant, Solenopsis invicta Buren, hereafter referred to as RIFA, is believed to have been introduced into the United States in Mobile, Alabama, between 1930 and 1940 from South America. Since that time RIFA has spread throughout the Southeast, infesting Alabama, Texas, Louisiana, Mississippi, Arkansas, Georgia, Florida, and North and South Carolina. Currently, RIFA continues to move into surrounding states at a steady rate (Vinson).*

*RIFA was first observed in Texas in 1953 (Culpepper). In 1989, it was estimated that RIFA's range in Texas reached approximately 198,983 sq. km., representing 29 percent of the state (Cockendolpher and Phillips). Current available information indicates that RIFA's range approaches 40 percent of the state (Vinson).*

*RIFA, unlike many other insect pests, has impacts on both urban and agricultural areas. In particular, RIFA impacts include: human medical problems due to stings; livestock and wildlife production problems due to stings; crop production problems due to feeding on crop seeds, foraging on crop plants, and interference with harvesting practices; and structural damage problems of building infrastructure and electrical components, which affect urban and rural populations and have negative impacts on recreation and tourism activities.*

*Several studies have documented RIFA's impacts on crop production. Glancey, Coley, and Killebrew reported a 63.4 percent loss in corn yield potential due to RIFA feeding on corn plants. Lofgren and Adams reported a loss of approximately 14.5 percent of soybean yields due to RIFA infestations. Adams, using as a case study a farm in Marion County, Florida, estimated a 50 percent loss in eggplant production income due to RIFA. Smittle, et al. reported results of RIFA feeding on young citrus trees in controlled experiments and estimated damages to be $750 per hectare.*

*A study by Brinkley estimated RIFA's annual damages (medical, agricultural, wildlife, electrical and golf courses) in Texas to be $52.8 million dollars per year. Using this damage estimate, Ervin et al. performed a benefit-cost analysis for controlling RIFA in Texas and found RIFA to be a significant economic damaging pest in the state. Recent information indicates that RIFA's damages have significantly increased over time. In particular, the estimated urban cost in Texas, including: control of RIFA, structural repairs, human medical expenses, and others is estimated to be $93.2 million dollars annually (Frisbie). Also, a recent cattle producers survey in Texas found that the state's beef cattle industry alone losses $67 million dollars annually (Barr and Drees). Using these two later impacts, a conservative estimate of the annual economic losses due to RIFA in the Texas economy, using input-output multipliers, is estimated at $300 million dollars (Frisbie).*

*Given the economic significance of the impacts of RIFA in the state economy, it is imperative to develop economically viable products and procedures to reduce RIFA populations to a level that eliminates this insect as a serious economic pest. Currently, there are several chemicals and strategies which are labeled for use in RIFA control. However, concerns with respect to both the environmental implications of their use and the effectiveness of their use, in terms of RIFA control, given the geographical spread and distribution of RIFA, highlight the need to analyze and evaluate the economic viability of currently available and alternative approaches for RIFA control.*

*In particular, several on-going research projects at Texas Tech University have focused on the development of new products and procedures to control RIFA. These include: an electric protection device; biological control formulations; and innovative approaches to protect both, wildlife and livestock production in the early stages of growth. The overall objective of this project was to analyze and evaluate economically feasible solutions to RIFA infestations in Texas. Specific objectives were: (1) to identify and estimate economic costs attributed to RIFA's presence in Texas, with focus being*

*placed on RIFA's damages to electrical and communication equipment, economically significant wildlife species, major agricultural crops, and cattle production; (2) to evaluate the economic significance of current RIFA control approaches versus alternative approaches being developed; and (3) to evaluate the economic feasibility of these approaches in terms of the establishment of RIFA control optimal decision rules.*

***Methods and Procedures**: Using three surveys (two elicited under this project and one previously elicited), chemical industry primary sources of information, census data, and other state (TAES, TAEX) and national levels of primary and secondary sources of information, estimates of the annual damages caused by RIFA in selected economic activities were estimated. Also, current versus alternative RIFA control approaches were partially evaluated. That is, because RIFA control alternatives are still being developed, their control effectiveness as well as costs were not readily available and thus, their associated costs of control were not determined. These factors would need to be addressed before the final objective is fully achieved.*

***Results and Conclusions**: The specific economic costs attributed to RIFA's presence in Texas derived under the four components of this project were as follows. A point estimate of the spatial economic impacts of RIFA on the cattle industry was estimated at $254.8 million per year. However, because of the high variability of RIFA damages on the cattle industry across the state, a 95 percent confidence interval of the damage was constructed. Calculation of this confidence interval reveled a lower-bound level of damage of $27.9 million per year, and an upper-bound level of damage of $572.9 million per year on the state's cattle industry.*

*Estimates of the economic cost of RIFA on electrical and communication equipment of the seven sectors analyzed were as follows: electric companies, $ 130.8 million per year; telephone companies, $15.7 million per year; churches, $6.1 million per year; hospitals, $0.5 million per year; airports, $0.4 million per year; cable companies, $0.3 million per year; and prisons, $0.06 million per year. Thus, the total damage of RIFA on electrical and communication equipment of the seven sectors analyzed was estimated at $153.9 million per year.*

*Estimates of the economic cost of RIFA on the six major agricultural crops analyzed were as follows: grain sorghum, $35.6 million per year; soybeans, $5.4 million per year; corn, $4.7 million per year; grapefruit, $1.0 million per year; potatoes, $0.5 million per year; and oranges, $0.25 million per year. Also, an economic benefit of RIFA on cotton production of approximately $1.0 million per year was estimated. Thus, the total net damage of RIFA on the seven major agricultural crops analyzed was estimated at $46.5 million per year.*

*Estimates of the economic cost of RIFA on economically significant wildlife species, specifically white-tailed deer and northern bobwhite quail, were difficult to derive*

*because of the level of uncertainty associated with both, population levels and mortality rates associated with the presence of RIFA. However, under most likely scenarios for population levels and mortality rates due to the presence of RIFA, a total damage of $29.3 million per year was estimated. Of this level of damage, $18.3 million per year and $11 million per year were the levels of damages to northern bobwhite quail and white-tailed deer populations, respectively. Alternative scenarios for white-tailed deer and northern bobwhite quail population levels and mortality rates associated with the presence of RIFA were constructed. Thus, given the results depicted above, the aggregate damage of RIFA on all the economic activities analyzed in this project was estimated at $484.5 million per year.*

*It is anticipated that information from this project will help enhance extension and regulatory decision making with respect to the formulation of an effective and economically viable RIFA control management plan in the state. Also, it is anticipated that information from this project will contribute towards the establishment of research priorities in the development of promising and innovative RIFA control devises or strategies. The spatial depiction of RIFA damages to cattle, major agricultural crops, and electric and communication equipment should prove useful in these efforts.*

***Publications and Presentations:*** *Overall, seven tangible outputs have resulted from this project. These include: one M.S. Thesis in Agricultural and Applied Economics, one refereed journal article currently in press, one peer reviewed professional presentation whose abstract is currently in press, and four peer reviewed technical publications. It is anticipated, that additional professional presentations and/or journal articles will result from this project. The chronological order of the outputs from this project is:*

*Teal, Steve, Eduardo Segarra, Kirstie Moates, Charles Barr, and Bart Drees. "Spatial Economic Impacts of the Red Imported Fire Ant on the Texas Cattle Industry." Technical Research Report No. T-1-484, 38 pgs. College of Agricultural Sciences and Natural Resources, Texas Tech University, September 1998.*

*Teal, Steve, Eduardo Segarra, Charles Barr, and Bart Drees. Impacts of the Red Imported Fire Ant on the Texas Cattle Industry. 1999. Abstract in Journal of Agricultural and Applied Economics, in press. Selected for presentation at the Meetings of the Southern Agricultural Economics Association, January 30 - February 3, 1999, Memphis, Tennessee.*

*Teal, Steve, Eduardo Segarra, Charles Barr, and Bart Drees, 1999. The Cost of Red Imported Fire Ant Infestation: The Case of the Texas Cattle Industry. Texas Journal of Agricultural and Natural Resources, in press.*

*Polk, Wade. "Selected Economic Impacts of the Red Imported Fire Ant in Texas." M.S. Thesis, Department of Agricultural and Applied Economics, Texas Tech University, 196 pgs., August 1999.*

*Polk, Wade, Steve Teal, and Eduardo Segarra. "Economic Impacts of The Red Imported Fire Ant on White-Tailed Deer and Northern Bobwhite Quail in Texas." Technical Research Report No. T-1-506, 32 pgs. College of Agricultural Sciences and Natural Resources, Texas Tech University, August 1999.*

*Polk, Wade, Steve Teal, and Eduardo Segarra. "Spatial Economic Impacts of the Red Imported Fire Ant on Major Agricultural Crops in Texas." Technical Research Report No. T-1-507, 67 pgs. College of Agricultural Sciences and Natural Resources, Texas Tech University, August 1999.*

*Teal, Steve, Eduardo Segarra, and Wade Polk. "Spatial Economic Impacts of the Red Imported Fire Ant on Electrical and Communication Equipment in Texas." Technical Research Report No. T-1-508, 88 pgs. College of Agricultural Sciences and Natural Resources, Texas Tech University, August 1999.*

## *References*

*Adams, C.T. 1983. Destruction of Eggplants in Marion County, Florida by Red Imported Fire Ants. Florida Entomologist, 66: 518-520.*

*Barr, C.L., and B. M. Drees. 1995. Texas Cattle Producers Survey: Impact of Red Imported Fire Ants on the Texas Cattle Industry. Proceedings of the Fifth International Pest Ant Symposia and the 1995 Annual Imported Fire Ant Conference, pg. 138-145, San Antonio, Texas, May.*

*Brinkley, C.K. 1989. Economic Impact of the Red Imported Fire Ant, Solenopsis invicta (Buren), in Texas. Unpublished M.S. Thesis, Department of Agricultural Economics, Texas Tech University, Lubbock, Texas, August.*

*Cockendolpher, J.C., and S. A. Phillips, Jr. 1989. Rate of Spread of the Red Imported Fire Ant, Solenopsis invicta (Hymenoptera: Formicidae), in Texas. Southwestern Naturalist.*

*Culpepper, G.H. 1953. Status of the Imported Fire Ant in the Southern States in July 1953. Entomol. Plant Quar. USDA, Bur. Entomol. Plant Quar. E-867, 8 pgs.*

*Ervin, R.T., C.K. Brinkley, D.E. Ethridge, E. Segarra, P. Zhang, and H.G. Thorvilson. 1990. Economic Impact of Red Imported Fire Ant with Uncertainty Considerations. Working Paper, Department of Agricultural Economics, Texas Tech University, Lubbock, Texas, March.*

*Frisbie, R. 1997. Texas Imported Fire Ant Control Management Plan Summary. World Wide Web posting at: http://fireant.tamu.edu/summary.htm., August.*

*Glancey, B.M., J.D. Coley, and F. Killebrew. 1979. Damage to Corn by the Red Imported Fire Ant. Journal of the Georgia Entomological Society, 14: 198-201.*

*Lofgren, C.S., and C.T. Adams. 1981. Reduced Yield of Soybeans in Fields Infested with Red Imported Fire Ants, Solenopsis invicta Buren. Florida Entomologist, 64: 199-202.*

*Smittle, B.J., C.T. Adams, W.A. Banks, and C.S. Lofgren. 1988. Red Imported Fire Ants: Feeding on Radiolabeled Citrus Trees. Journal of Economic Entomology, 81: 1019-1021.*

*Vinson, S.B. 1997. Invasion of the Red Imported Fire Ant (Hymenoptera: Formicidae): Spread, Biology, and Impact. American Entomologist, 43: 23-39.*