Wood-destroying Beetle Treatment Incidence in Arkansas and Georgia During 1962 and 1967 With Estimated Losses Caused by Beetles for 11 Southern States During 1970

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SUMMARY

Estimates derived from 1962 and 1967 State regulatory records indicate that as many as 53,000 treatments for wood-destroying beetles were performed in **11** Southern States in 1970. Cost of these treatments was probably about $4.9 million. With inflation and the fact that beetles can no longer be treated in combination with termite treatments, 1976 losses were estimated at $12.9 million.

Records in Georgia and Arkansas, States with the most thorough records, showed that percentages of houses with crawl spaces treated were 0.18 percent in Georgia and 0.03 percent in Arkansas. About 9.2 percent of the reported treatments in the two States during 1967 were for beetles and termites treated together and about 78 percent of all beetle treatments were in combination with termite treatments.

That over 99 percent of 673 beetle infestations inspected by Arkansas inspectors during 1962 and 1967 were located in crawl spaces beneath houses suggests that anobiid beetles had caused them. Personal inspection of 31 houses in Arkansas, 77 in Georgia, and 68 in Mississippi indicated that over 99 percent of the confirmed infestations were by the Anobiidae, primarily ***Xyletinus peltatus*** (Harris). Beetle infested houses ranged from 9 to 100+ years old, with an average of 38 years in Georgia and 36 years in Mississippi.

1978

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Introduction

The economic impact of wood-destroying beetle infestations in seasoned wood is not well known. Estimates available are old and tell nothing about how frequently infestations occur or how estimates were derived (Hatfield 1950, Gerberg 1957). The National Pest Control Association also lacks sure figures on beetle-caused losses?

Knowledge of economic impact is more crucial now that chlorinated hydrocarbon insecticides cannot be used inside structures for beetle infestations and beetles cannot be treated in combination with termites. To know whether economic losses by each kind of beetle warrant the expense of developing new controls or registering old measures specifically for them, we need to know where infestations occur, how often they occur, which beetle causes them, and how much damage is caused.

In this study, we recorded available data for 1962 and 1967 from State regulatory offices to learn the numbers, types, and costs of beetle treatments being done. We personally inspected treated houses to determine where infestations were within structures, which beetle was causing them, and if infestations were being accurately diagnosed. Then, by using our sample data on treatment incidence and cost combined with reported numbers of treatments from States requiring them and the 197u housing census data[2] we estimated economic loss caused by beetles in 1970 in **11** Southern States.

Methods

Data gathered from State regulatory agencies

State pest control records are not separated by type of treatment performed; that is, whether the treatment was for termites alone, beetles alone, or termites and beetles in combination. So in 1969 we examined 1962 and 1967 pest control contracts in Arkansas, Georgia, Mississippi, and Tennessee -States with the most data about beetle treatments. We chose every fourth firm from an alphabetical listing from each State. We examined all contracts to determine type of treatment and cost of treatment. In Arkansas, where many treated houses are inspected by the State, we recorded the location of infestations from inspection reports for sampled contracts.

For 1970 we obtained the number of reported termite treatments in Alabama, Arkansas, Geor-

[1]Williams, Lonnie H., and Philip J. Spear, Technical Director, National Pest Control Association. Personal communications dated August 2, 1968, and December 27, 1977, responding to request for information on actual dollar damage of "powderpost beetles."

[2]All data on numbers and characteristics of housing were obtained from the United States Summary U.S.Census of Housing, HC(1) No. 1, Table 5, 1963, and from the United States Summary Detailed Housing Characteristics HC(1)-B1, Table 22, 1972.

gia, Louisiana, Oklahoma, and Tennessee. The number of treatments included those that were for termites and beetles together.

How inspections were made

In Arkansas, we selected for personal inspection every tenth treatment in 1967 of each firm sampled, whether the treatment was for termites, beetles, or both. In Mississippi and Georgia, we narrowed our inspection to every tenth treatment for beetles by each firm because we wanted more data on location of infestation and the diagnoses of infestations. In Arkansas we observed that most beetle infestations occur in older houses, so we asked residents in Georgia and Mississippi to tell the age of their houses. No inspections were made in Tennessee because treatments for beetles alone were not reported before 1972.

How estimates were made

Sample data expansion, composition, and incidence. -To expand our sample data for each sample State each year, we assumed that treatments for beetles alone or beetles treated in combination with termites were the same percentage of reported treatments in the State as they were of total treatments in our sample. We found our data for Mississippi were incomplete for making Statewide expansions and we excluded the State's data when making estimates. Using 1970 housing census data, we determined treatment incidence as a percentage of all houses in Arkansas and Georgia with crawl spaces.

Southwide estimates for beetles and termites treated together. -Because similar percentages of the treatments in Arkansas and Georgia were for beetles and termites treated together, we used the mean percentage for these States during 1967 (9.2 percent) when estimating treatments for 1970 in the 11 States. For the six States with reports of termite treatments, we estimated treatments for beetles and termites together in each State to be 9.2 percent of reported treatments.

For the four States not requiring reports (Florida, North Carolina, South Carolina, Texas) and Mississippi, we first estimated total treatments, assuming they were 2.73 percent of houses; this was the percentage of total houses treated in the six States with reliable records. Then we calculated the number of treatments for beetles and termites together as 9.2 percent of the estimated total treatments.

Southwide estimates for beetles treated alone. -Because the incidence of beetles-alone treatments in Arkansas during 1962 and 1967 differed greatly from that in Georgia, we compared the effect of temperature and relative humidity on equilibrium wood moisture content in all States (Duff and others 1965) (figs. 1 and 2). Assuming similar climatic conditions should result in a similar occurrence of infestations, we estimated beetles-alone treatments for 1970 in each of the seven Coastal States (excluding Texas) to be 0.18 percent of the houses with crawl spaces, the percentage of crawl spaces treated for beetles alone in Georgia during 1967.

Estimates for inland States-Arkansas, Oklahoma, and Tennessee-were made with the percentage for Arkansas during 1967 (0.03 percent). Because of the vast inland area of Texas, the mean 1967 percentage for Arkansas and Georgia (0.1 percent) was used to estimate Texas treatments.

Cost of treatments

We calculated costs for beetle treatments in each State by multiplying the estimated numbers of treatments for beetles and termites together and beetles alone by 1967 mean costs for similar treatments. After reviewing 19 construction cost indexes (Levy 1977) indicating 1967 costs may be increased from 86 to 124 percent by inflation to 1976 dollars, we inflated 1967 costs 100 percent when evaluating the effect of beetle control label cancellations on cost.

Sample State Results and Discussion

Results of State and personal inspections

For 673 of the beetle-infested houses inspected by Arkansas inspectors in 1962 and 1967, 99.9 percent of the infestations occurred in crawl spaces with 97.2 percent confined to that area. About 2.4 percent of the infestations were in outbuildings, but three-fourths of these were in the crawl space as well. Because southern pine timbers are widely used for wood-frame construction in the South (Phelps 1966), the location of infestations strongly suggests buildings were infested by anobiid beetles, beetles usually found in older softwood materials in damp environments (Williams 1973 a, b).

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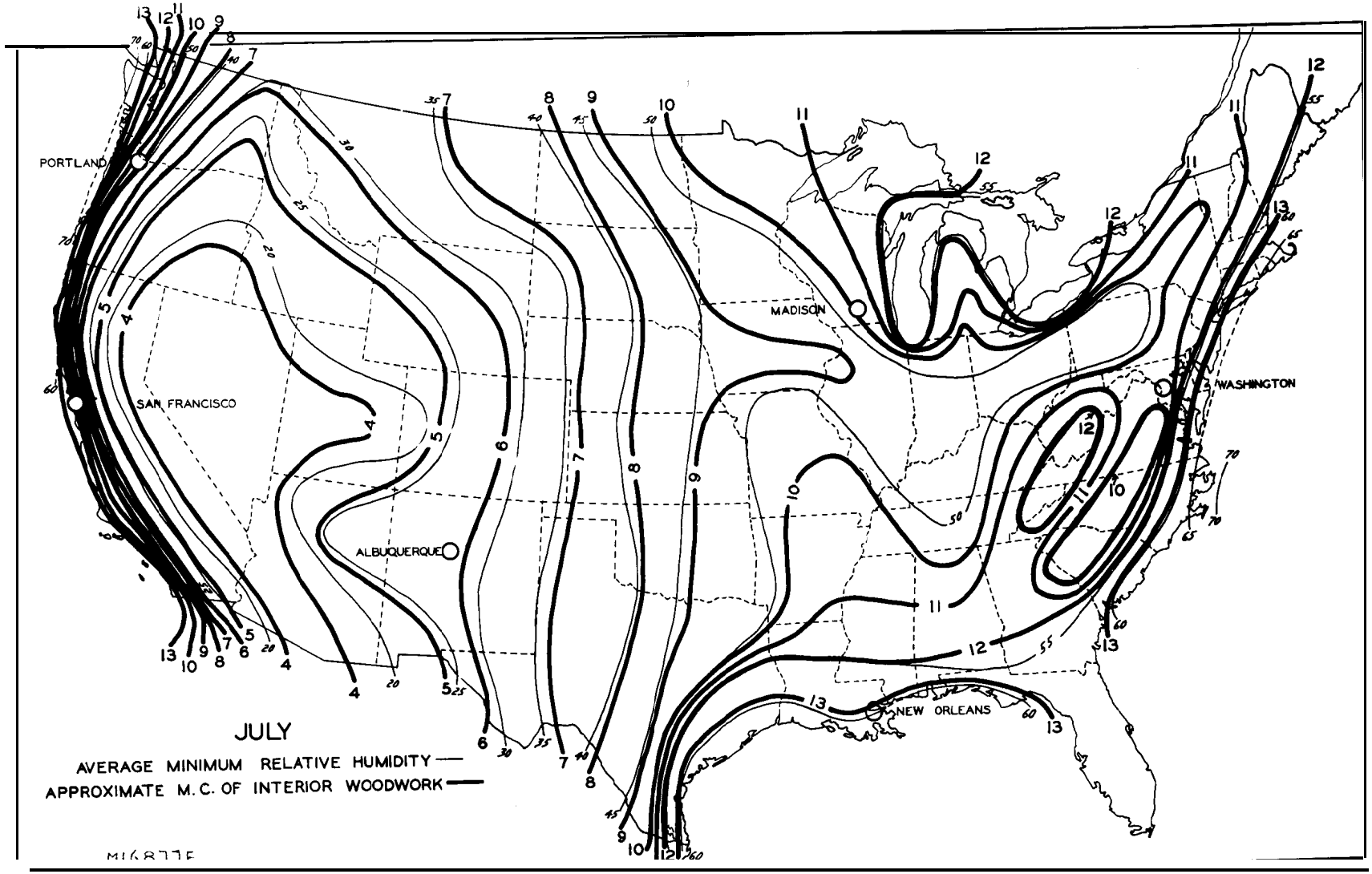

Figure 1.—*Moisture content levels found in indoor wood products in the United States in July.*

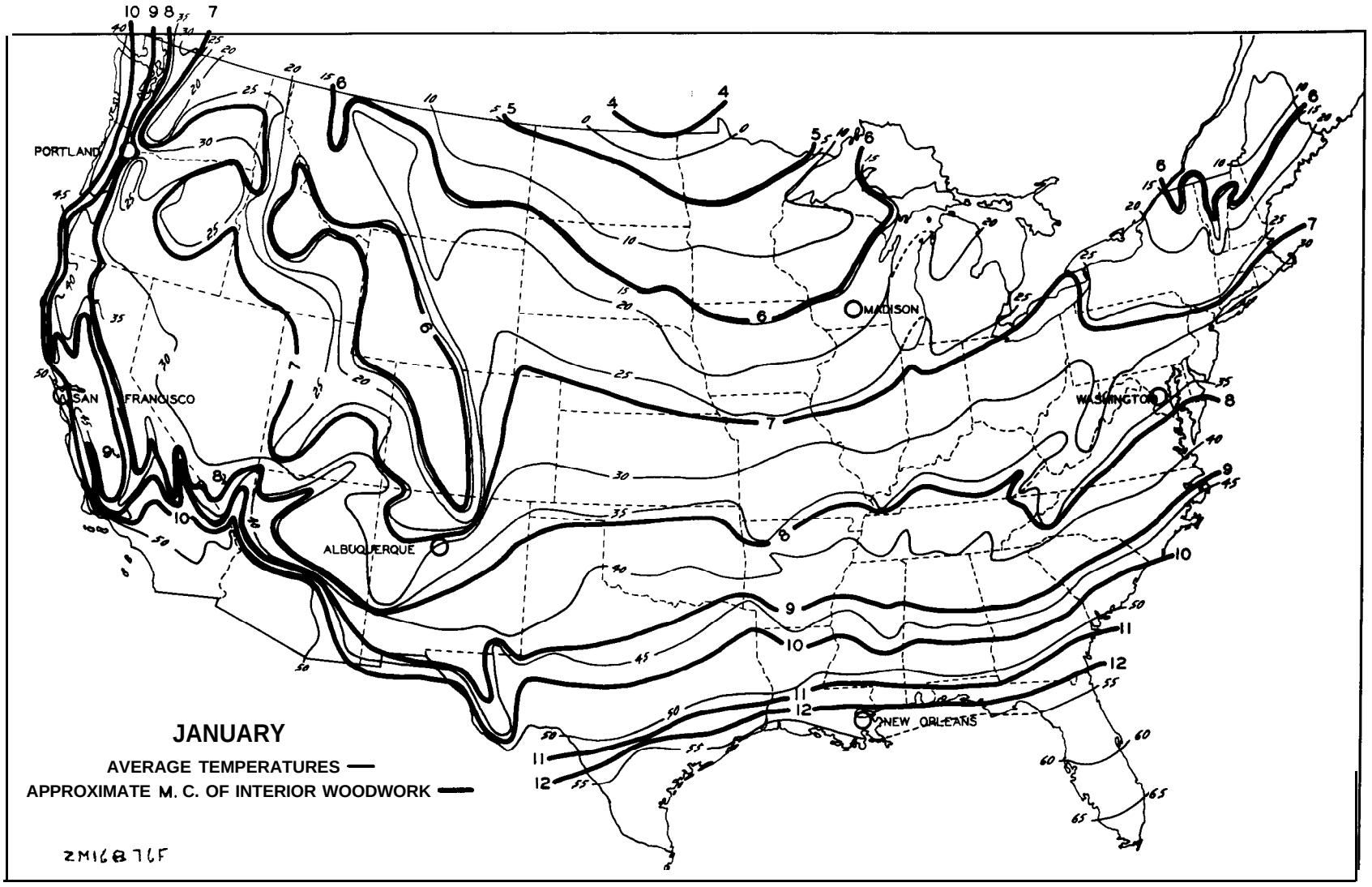

Figure *2.-Moisture content levels found in interior wood products in the United States during January.*

Personal inspection of 31 houses in Arkansas, 77 in Georgia, and 68 in Mississippi revealed that over 99 percent of the confirmed infestations were by the Anobiidae. Although we cannot be sure when identifying species only from damage, most of the damage appeared to be by ***Xyletinus peltutus*** (Harris), the species most common in the Southeast.

Accuracy of diagnoses by pest control personnel was similar in each State with about 20 percent of the infestations treated in combination with termites being incorrectly diagnosed or inappropriate (table 1). Of those considered incorrect in Georgia, 60 percent were pretreatments of new houses with full basements; in our opinion, prevention of beetles is unnecessary in such cases. Of houses treated for beetles alone, 25 percent were considered incorrectly diagnosed in Georgia; none was found incorrect in Arkansas or Mississippi.

Houses with confirmed beetle infestations ranged from 9 to 100+ years old, with an average of 38 years in Georgia and 36 years in Mississippi. Although age was not asked of Arkansas homeowners, observations while verifying data suggested a similar result. Only two houses were less than 10 years old; one g-year-old house had roundheaded borer damage in floor boards and paneling, and another g-year-old house had a few anobiid beetle holes near the crawl-space access door.

Many houses had sections built at different dates, and the seriousness of infestations varied with age of construction. Infestations were less severe in sections constructed before 1940 than they were in newer sections unless the new sections were less than 10 years old. Wood in old houses is from large mature trees with high density and much heartwood, conditions unfavorable to beetles. In general, wood from fast-grown trees with abundant springwood was infested most severely because springwood is the main food source for X. *peltatus* in pines (Williams 1977). Infestations were limited primarily to southern pine wood but other infested woods included blackgum, baldcypress, and yellow-poplar.

Old house borers (*Hylotrupes bajulus* L.) were found in three Georgia houses that were 10, 17, and 20 years old. In this study, we did not find houses infested by old house borer in the other States, thus confirming that this beetle is more common along the Atlantic coast from Florida though Massachusetts (McIntyre and St. George 1976). At other times, old house borer infestations have been observed in Mississippi and Tennessee, but apparently not in Arkansas!

Treatment incidence

The total of treatments for beetles and termites together and beetles alone never exceeded 13 percent of all reported treatments in either Arkansas or Georgia (table 2). The incidence of beetles-alone treatments decreased slightly from 1962 to 1967 in Arkansas but increased over twofold in Georgia. In 1967, Georgia had almost nine times more treatments than Arkansas. While part of this may be attributable to Georgia's greater

[3]Williams, **Lonnie H., and Gerald King, formerly Head, Commercial Pest Control Section, Arkansas State Plant Board, Little Rock, Arkansas. Personal telephone conversation October 1976.**

Table 1.—*Accuracy of pest diagnoses by structural pest control firms in Arkansas, Georgia, and Mississippi.*

State/treatment	*No.* inspected	*No.* correct	No. unconfirmed	Reasons incorrect		Miscellaneous	Percent correctly diagnosed
				Beetles not present	Ambrosia beetle damage		
Arkansas							
Beetles only	5	5	—	—	—		100.0
Beetles + termites	20	17	5	3	1	—	80.9
Termites (pretreated)	7	NA	—	—	—	—	—
Termites (remedial)	37	NA		—	—	—	—
Georgia							
Beetles only	24	18	0	3	2	1	75.0
Beetles + termites	53	41	2	4	—	6[a]	80.3
Mississippi							
Beetles only	13	13	0	—	—	—	100.0
Beetles + termites	55	38	9	3	4	1	82.6

[a]Reported **as pretreatments for combination of termites, beetles, and fungi.**

Table 2.-Composition *and incidence of beetle treatments in Arkansas and Georgia in 1962 and 1967.*

	Arkansas		Georgia	
	1962	1967	1962	1967
	Number			
Total treatments for wood products insects	10,296	13,759	28,793	44,621
Composition				
Beetles + termites	703	1,248	2,782[a]	4,069[b]
Beetles only	172	162	600	1,413
	Percent			
Incidence				
Total treatments				
Beetles + termites	7.05	9.32	9.74	9.44
Beetles only	1.72	1.21	2.10	3.17
Houses with crawl spaces[c]				
Beetles + termites	0.14	0.26	0.34	0.51
Beetles only	0.03	0.03	0.07	0.18

[a] Includes 33.5 percent pretreatments.

[b] Includes 13.8 percent pretreatments.

[c] Percent of number of houses with crawl spaces in 1960 *census* of housing for 1962 and in 1970 census for 1967.

population and the effect of higher per capita income on pest control industry sales, incidence was probably considerably higher in Georgia because it is a Coastal State with a warm, humid climate that favors anobiid beetles. In Georgia, 0.18 percent of the houses with crawl spaces were treated, but in Arkansas only 0.03 percent were treated. Also, Georgia had old house borer infestations and Arkansas did not. In 1967, treatments for beetles and termites together increased 56.3 percent in Arkansas and 68.4 percent in Georgia. For this type treatment, the percentage of crawl-space houses treated in Arkansas was closer to the percentage in Georgia than it was for beetles-alone treatments. The beetles-alone percentage probably more accurately reflects differences in beetle incidence while closeness of Arkansas and Georgia percentages for treatments of beetles and termites together suggests a greater emphasis on the sale of treatments for beetles and termites together by the Arkansas pest control industry.

The overall increase in beetle treatments from 1962 to 1967 was probably not caused by greater beetle incidence but by greater industry awareness of beetles (NPCA 1965, 1972, and Heal 1970) and by the availability of a new inexpensive control method (Spink and others 1966).

Treatment cost (Arkansas and Tennessee)

In 1967, treatments of beetles and termites together cost $207 per treatment compared with $123 for termite treatment alone, so $84 of the $207 can be attributed to beetle treatment. Beetles-alone treatments cost $122 per treatment. About 78 percent of the beetle treatments were performed with termite treatments, and most beetle infestations probably were found during inspections for termites. Treating termites and beetles with the same chemicals could be done with little additional expense for transportation and preparation of materials. The lower overhead expense of treating beetles and termites together permitted lower charges to the homeowner.

Southwide Estimates and Discussion

Table 3 shows the estimated number of beetle treatments during 1970 in 11 Southern States. By basing our estimates on number of crawl spaces and pest control treatment volume in six States, we believe they are reasonably accurate though we recognize beetle or beetle treatment incidence may vary with a State's climate, population, economy, or pest control industry activity. We think beetle control procedures in other States were similar to those of our sample States because: (1) unlike today, the same beetle control measures were available in each State; (2) in several and perhaps most States, the same kind of beetles, anobiids, were usually being controlled; and (3) treatments for beetles and termites together were nearly the same proportion of total treatments for 2 years in two States (Georgia and Arkansas) with great differences in population, climate, and number of pest control firms.

Our estimates of treatment numbers, if in error, are most likely to be high for some Coastal States because the incidence of beetles in Georgia probably equals or exceeds that in other Coastal States except Florida (table 3, figs. 1 and 2). Only North Carolina has more crawl spaces than Georgia, but its climate, except on the coast, is less favorable for anobiids. Florida, however, has nearly as many crawl spaces as Georgia and a more favorable climate for anobiids. Similarly, conditions in Oklahoma, Tennessee, and much of Texas appear less favorable than in our sample States. For example, Texas has over 22 percent of the houses with crawl

Table 3.—*Total number houses, number of crawl-space houses, and estimated number and cost of beetle control treatments in 11 Southern States in 1970.*

State	No. houses	No. crawl-space houses	No. treatments		Treatment cost (1967 dollars)	
			Beetles + termites	Beetles only	Beetles + termites[a]	Beetles only
Alabama	1,114,845	681,538	3,359	1,227	$ 282,156	$ 149,694
Arkansas	672,967	476,900	1,506	192	126,504	23,424
Florida	2,490,838	801,798	6,378	1,443	535,752	176,046
Georgia	1,466,687	802,072	5,022	1,753	421,848	213,866
Louisiana	1,146,105	690,360	2,533	1,243	212,772	151,646
Mississippi	697,271	509,199	1,785	917	149,940	111,874
N. Carolina	1,619,548	918,914	4,147	1,654	348,348	201,788
Oklahoma	937,815	518,282	966	155	81,144	18,910
S. Carolina	804,858	567,859	2,061	1,022	173,124	124,684
Tennessee	1,297,000	598,931	3,586	180	301,224	21,960
Texas	3,809,086	1,907,746	9,754	2,003	819,336	244,366
Total	16,057,020	8,473,599	41,097	11,789	3,452,148	1,438,258

[a]Based on assumption that $84 of the $207 cost of termite and beetle treatment should be attributed to beetle control because cost of a remedial termites only treatment was $123.

spaces in the 11 States, but many may be located in arid West Texas where the dry climate is not favorable to anobiids.

Based on the national distribution of crawl spaces, climatic conditions, and anobiid requirements, we can safely assume that more than half the nation's treatments for anobiids are performed in the 11 States. These States contain about 49 percent of the nation's houses with crawl spaces and have a climate more favorable to anobiids than do most States (figs. 1 and 2). For example, incidence in California, which has over one-fourth of the crawl spaces in the remaining 37 mainland States, is probably much lower than in Arkansas or Georgia. Records of the California Pest. Control Board suggest treatments for beetles made up less than 5 percent of total treatments for wood-destroying insects and decay between January 1962 and June 19654

Treatment costs

We think the $4.9 million is a reasonable estimate of beetle-caused losses in the 11 States during 1970 (table 3). This estimate is only for treatment costs (1967 dollars), including costs of unnecessary treatments incurred by homeowners. Costs of damage repair are not included, but we found repair of anobiid beetle damage was seldom needed. Our estimates do not include losses from uncontrolled infestations, unreported treatments by homeowners, nor an adjustment for inflation between 1967 and 1970, but we believe these costs would be slight.

Current beetle treatment costs have certainly increased greatly. For example, about 70 percent of the $4.9 million estimate was from treatments for beetles and termites together, which would now be beetles-alone treatments at a higher cost. The 1970 estimate represents a loss of at least $12.9 million in 1976 dollars-53,000 treatments x $244, the 1967 cost of a beetles alone treatment inflated 100 percent. Depending upon State regulations and the availability of beetle control chemicals, current losses may be more than $12.9 million because some pest control firms must use expensive tent fumigation while other firms can use water emulsion of lindane or existing stocks of formulations previously labeled for beetle control. However, the incidence of beetle treatments may have declined from lack of an inexpensive, easily sold control measure. For example, Mississippi regulatory records indicate 1,791 beetle treatments were done in 1976 or 911 fewer than estimated for 19705

Assuming we have made reasonably accurate estimates, the market for anobiid beetle control

[4]Structural pest infestation report for the calendar year 1962, 1963, 1964, 1965, and January, February, March, April, May, June, 1966, by county, compiled by the Structural Pest Control Board, Department of Professional and Vocational Standards, State of California.

[5]Williams, Lonnie H., and Robert W. McCarty, Assistant Director, Mississippi State Department of Agriculture and Commerce, Mississippi State University. Personal correspondence enclosing tabulation on activities under the regulations of professional services act., 1976.

does not appear to be a lucrative one that encourages research and development of new chemicals, if used solely for beetle control. Moreover, the incidence of anobiid infestations probably will decline because 1960 and 1970 housing census data suggest that fewer houses are being built with crawl spaces. Also, more existing houses with crawl spaces probably will have central heating and air-conditioning to help lower wood moisture and confine infestations to the crawl space.

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Estimates derived from 1962 and 1967 State regulatory records indicate that treatments for wood-destroying beetles in 11 Southern states in 1970 cost about $4.9 million. Inspections of treated houses revealed that most infestations were in crawl spaces beneath houses and were caused by anobiid beetles.