

Richard P. Vlosky¹, Todd Shupe, Qinglin Wu

Perceptions & use of termite resistant treated wood products. Part I: The perspective of homeowners in Formosan subterranean termite infected States

Percepcija i uporaba drvnih proizvoda zaštićenih od termita. Dio I: Stajališta vlasnika kuća u državama zaraženim podzemnim termitima iz porodice *Coptotermes*

Original scientific paper · Izvorni znanstveni rad

Received – prispjelo: 19. 3. 2009.

Accepted – prihvaćeno: 16. 7. 2009.

UDK: 630*841; 630*845.3

ABSTRACT • *Formosan subterranean termites (Coptotermes formosanus Shiraki), is estimated to cause hundreds of millions of dollars in losses annually in North America. Unlike most subterranean species, Formosan termites often build nests (cartons) in living trees and wooden buildings, and even penetrate plaster, plastic, asphalt, mortar, creosote, concrete, and rubber to reach wood. The study addresses issues that U.S. home owners consider in evaluating whether to buy or build homes that are built with termite resistant building materials. The sample frame for this study consisted of a random sample of 5.000 home owners in the region where Formosan subterranean termites are a current or potential problem. When examined by state, 50 percent of respondents in Hawaii said termites have damaged the home they currently live in followed by respondents from Louisiana and California. On average, respondents indicated that preservative pressure treated wood and regular fumigation as being most effective in protecting a house against termites and only 8 percent of respondents said they would not pay a premium for a guaranteed termite-free new home.*

Key words: termites, United States, wood products, home owners, loss

SAŽETAK • *Utvrđeno je da podzemni termiti (Coptotermes formosanus Shiraki) u Sjevernoj Americi svake godine prouzroče stotine milijuna dolara štete. Za razliku od drugih vrsta podzemnih termita, termiti iz porodice Coptotermes često grade gnijezda u živim stablima i drvenim građevinama, a mogu prodrijeti kroz žbuku, plastiku, asfalt, kreozot, beton ili gumu da bi doprli do drva. U studiji se analiziraju stavke koje vlasnici kuća u Sjedinjenim Američkim Državama uzimaju u obzir pri odluci o kupnji ili gradnji kuće od drvnog materijala zaštićenoga od termita. Uzorak za istraživanje dobiven je slučajnim odabirom 5 000 vlasnika kuća u regiji u kojoj su navedeni termiti ak-*

¹ Authors are professors at Louisiana Forest Products Development Center, School of Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, Louisiana.

¹ Autori su profesori u Centru za razvoj šumskih proizvoda, Školi za obnovljive prirodne resurse i Poljoprivrednom centru Sveučilišta u Louisiana, Baton Rouge, Louisiana.

tualni ili potencijalni problem. Analiza studije pokazala je da 50 % ispitanika u državi Hawaii potvrđuje oštećenost kuća u kojima trenutačno žive s termitima, a slijede ih ispitanici iz država Louisiane i Californije. U prosjeku, odgovori ispitanika upućuju na to da su impregnacija i fumigacija drva najučinkovitiji načini zaštite od termita. Samo 8 % ispitanika odgovorilo je da ne bi platilo dodatnu premiju za kuću potpuno zaštićenu od napada termita.

Cljučne riječi: termiti, Sjedinjene Američke Države, drvni proizvodi, vlasnici kuća, šteta

1 INTRODUCTION

1. UVOD

The Formosan subterranean termite, *Coptotermes formosanus* Shiraki, are found throughout the tropical and temperate regions of the world, but they are more prevalent in tropical and subtropical areas (USDA Forest Service 2001). The genus *Coptotermes* contains the largest number of termite pests (28 species) among the >2,500 termite species worldwide, and the Formosan subterranean termite, *Coptotermes formosanus*, is the most widely distributed and most economically important (Su and Scheffrahn 2005). This destructive species was apparently transported to Japan prior to the 1600s and to Hawaii in the late 1800s (Su and Tamashiro 1987). By the 1950s, it was reported in South Africa and Sri Lanka. During the 1960s it was found in Texas, Louisiana, and South Carolina (Su and Scheffrahn 2005). In the United States, the highest hazard areas are in the southeastern states and California. Subsequent colonies were found in New Orleans and Lake Charles, LA, in 1966. Today, *C. formosanus* has rapidly expanded its geographic domain throughout the southern United States and Hawaii. They have been reported in all southern states from Texas to Florida and north to North Carolina (USDA ARS 2008). At least one colony has been found in California (Shupe and Dunn 2000). Their distribution will probably continue to be restricted to southern areas because their eggs will not hatch below about 20° C (68° F) (Protective Packaging, Ltd. 2007).

The degree of damage to homes and forests caused by Formosan termites has been significantly deepened due to the rapid increase of the termite colonies and its absolute population. While native subterranean termite colonies support an average of 300,000 workers, Formosan colonies can average millions of workers, and Formosan queens can produce 1,000 eggs a day (Termite Institute 2008). The New Orleans (Louisiana) Mosquito and Termite Control Board reported that a colony of Formosan termites could consume 0,014 m³ of wood per month. They are able to hollow out walls of new buildings in three months. As of the first of 2005, the invasive Formosan subterranean termites are found in about one-half of the Parishes (counties) of Louisiana. The termites have also been found throughout the southeastern United State and southern California (Ring 2005). Devastation caused by this insect throughout North America has been estimated to be hundreds of millions of dollars yearly (Potter 1997). It is estimated to cost consumers in New Orleans alone over 300 \$ USD million annually (Lax and Osbrink 2003).

Conventional treatments for termite prevention include the use of chemically treated soil barriers, spot

treatments with aerosols, liquids or dust targeting infested sites, and wood preservatives or termiticides. However, the ability of Formosan termites to make nests above ground in trees or homes through interior tunnels in wood makes prevention and control of termites very difficult, and conventional treatments even ineffective, because the structural wood is vulnerable once termites gain entry. Facing these problems, the Louisiana Legislature enacted Act 486, Senate Bill No. 373 (1999) which notes that the construction lumber and sheathing materials (plywood and oriented strandboard) should be treated to be termite-resistant. The ultimate solution to termites is to make wood inedible or to stop using wood or wood products in construction.

Treated lumber can be considered a mature product. This claim can largely be supported by the competitive markets for treated lumber. In the U.S. treated lumber competes against internally (one preservative versus another) and against non-wood alternatives such as steel, plastic, and concrete, depending on in service requirements. Treated wood has been the subject of a great deal of media coverage in recent years. The coverage has been largely negative and has resulted in increased concern and distrust of the wood preservation industry by the general public.

Sinclair and Smith (1990) found that the retail customer of treated lumber products is not fully informed about the proper use, handling and disposal of these products. In spite of the negative publicity surrounding treated wood Vlosky and Shupe (2002) found that homeowners have a generally positive opinion of the safety and performance of preservative-treated wood. A large majority of respondents indicated a positive overall perception of treated wood in that they were willing to use the product inside or near their home. The major reasons for those unwilling to use treated wood were due to perceived livability and health concerns.

The study we conducted addresses issues that U.S. home owners consider in evaluating whether to buy or build homes that are built with termite resistant building materials. By understanding the current perceptions and attitudes on these issues from this group, companies involved in the wood preservation industry will be better positioned to gauge potential participation in this arena. For example, builders may develop market initiatives if it is found that there is a desire from homeowners to have options in structural panels that are termite resistant. Additionally, treaters and chemical manufacturers can benefit from this study by better understanding market conditions which, in turn, can help them to develop effective market and product development strategies.



Figure 1 States infested with Formosan subterranean termites (Ring, 2005)
Slika 1. Države sa zarazom podzemnim termitima (Ring, 2005)

The objective of the study was to identify the factors that affect potential usage of termite resistant structural panels and other treated wood products in the region of the United States that is impacted by the Formosan subterranean termite. We examined the perspectives of home owners to better understand: 1) Basic understanding of the treated wood market space; 2) Incentives for usage; 3) Barriers and concerns that may preclude usage; 4) Willingness-to-pay for termite resistant wood products and; 5) Identify market potential for termite resistant structural panels and other treated wood products.

2 MATERIALS AND METHODS
2. MATERIJALI I METODE

Mailed questionnaires were used to conduct the study. This method is a cost-effective means of data collection and affords a high degree of anonymity. Mail surveys are also less limited by rigid time constraints that can impede the effectiveness of other survey methods. Sampling, survey procedures, follow-up efforts and data analysis were conducted in accordance with well-documented and verified mail survey techniques. The following sections elaborate on these procedures.

Based on the literature, past research, and an iterative process with study clients, a list of topics and questions were generated. The survey was reviewed and revised by the researchers and study clients. In addition, a pre-test sample was conducted with 30 homeowners randomly selected from the sample pool to check for readability and clarity. An iterative process resulted in the final questionnaire. Survey recipients were provided with the following definition of Treated Wood: “Wood in which preservatives have been added to improve resistance to termites and decay.”

The sample frame for the study consisted of a random sample of 5.000 home owners in the study region. The study region included states where Formosan sub-

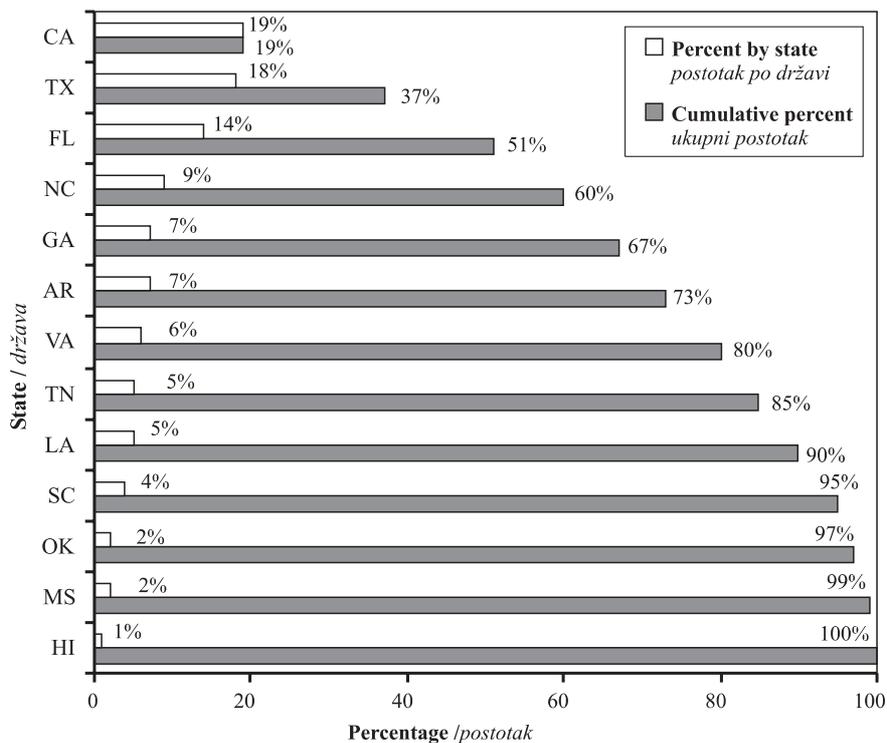
terranean termites exist (Ring 2005) (Figure 1) as well as selected states on the periphery. The mailing list was purchased from Best Mailing Lists, Inc., a national list provider. All survey recipients were identified by name.

Questionnaire quantitative data was coded and entered into the Statistical Package for the Social Sciences (SPSS) for analysis and interpretation. Data entry was closely supervised to ensure accuracy. Descriptive and frequency statistics were generated for the quantitative data; qualitative information from open-ended questions was analyzed to discern common themes or concepts.

3 RESULTS AND DISCUSSION
3. REZULTATI I DISKUSIJA

After accounting for undeliverable surveys and recipient requests to be removed from the mailing list, the adjusted response rate was 10 percent (438 respondents). Over two-thirds of respondents are in 5 of the 13 states included in the homeowner study (Figure 2). California led with 19 percent of respondents, followed by Texas (18 percent) and Florida (14 percent). Thirty-seven percent of respondents plan to buy a new home in the next year and they lived an average of 12 years in the home they currently own.

- Twenty-nine percent of respondents are female.
- The ages of respondents ranged from 21 to 85 with a mean of 47
- Twelve percent of respondents are high school graduates; 30 percent have some college; 33 percent have a college degree and; 25 percent have an advanced degree
- Eighty-six percent of respondents are white, 4 percent are African-American, 4 percent are Asian, 2 percent are Hispanic, 1 percent is Native American, and 2 percent are Other
- Average income is 98.150 \$ USD.



CA – California, TX – Texas, FL – Florida, NC – North Carolina, GA – Georgia, AR – Arkansas, VA – Virginia, TN – Tennessee, LA – Louisiana, SC – South Carolina, OK – Oklahoma, MS – Mississippi, HI – Hawaii

Figure 2 Respondents by state (n = 438)

Slika 2. Postotak ispitanika po državama (n = 438)

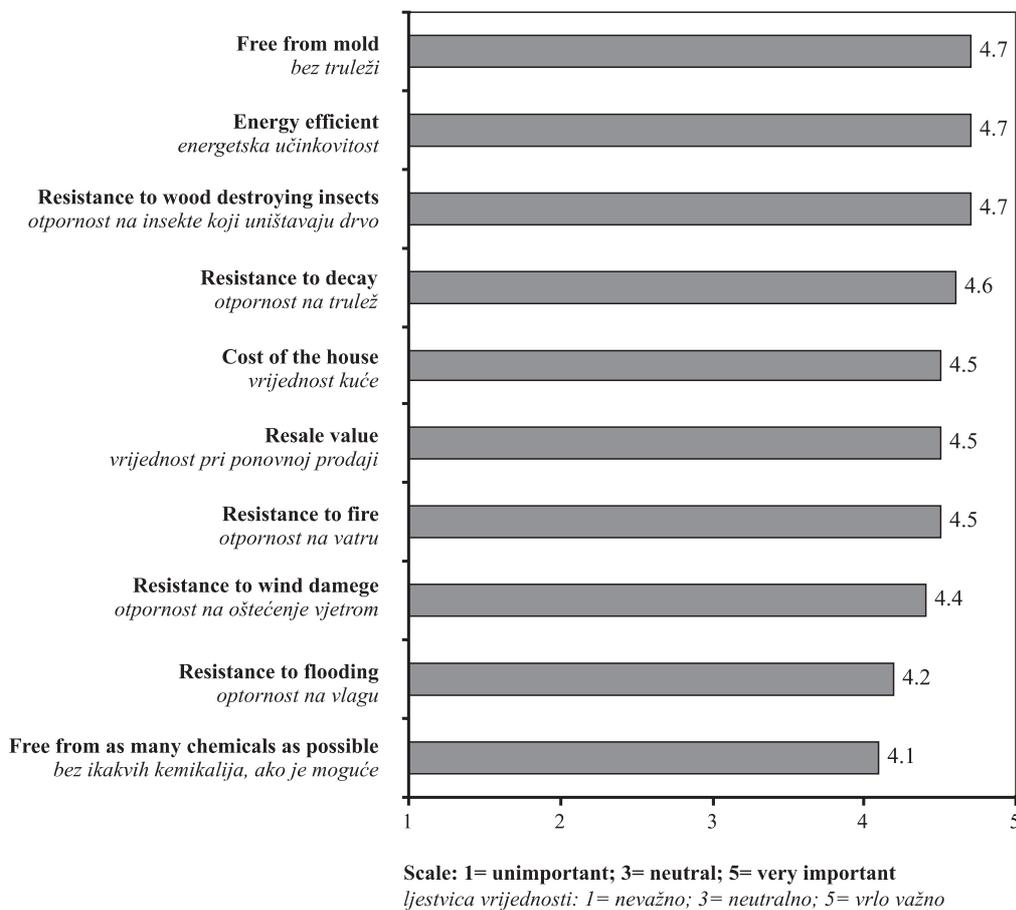


Figure 3 Importance of construction criteria (n = 438)

Slika 3. Važnost konstrukcijskih kriterija (n = 438)

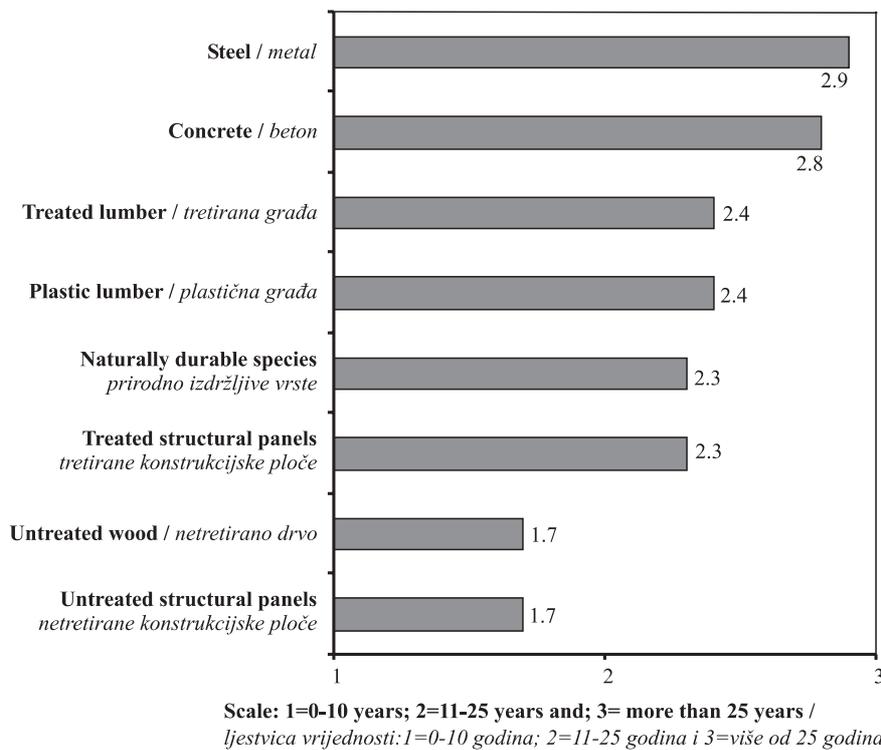


Figure 4 Perceived durability of building materials (n = 438)

Slika 4. Trajnost gradbenih materijala prema mišljenju ispitanika (n = 438)

3.1 Building materials and construction

3.1. Gradbeni materijal i gradnja

Respondents were asked to indicate the importance of the different construction criteria they use when buying or building a new house. A scale of 1=very unimportant to 3=neutral to 5=very important was used. Figure 3 shows the rank of these criteria by mean importance. Of note to the treating industry is that the highest ranked criterion is treated-wood-related, to be free from mold. Additional points to note are that resistance to wood destroying insects was ranked 3rd and resistance to decay was ranked 4th.

Durability is an important concern for homeowners. We asked about the perception that respondents have about the number of years different competing materials would last in unexposed structural home applications (Figure 4). The choices were on a scale of: 1=0-10 Years; 2=11-25 Years and; 3=More than 25 years. Steel (2,9) were ranked as having the greatest longevity. Treated lumber was ranked third (2,4) and treated structural panels was ranked 6th.

3.2 Treated wood products

3.2. Zaštićeni drvni proizvodi

With regard to treated wood, we first asked if respondents would be willing to live in a house partly fabricated with treated wood. Ninety-three percent said yes. For the 7 percent that said no, concerns about chemicals in treated wood products were cited as their major concern. We followed up with a question asking about respondents' overall perception of treated wood (Figure 5). Only 3 percent of respondents had an extremely negative perception while 32 percent had an extremely positive perception of treated wood. Then, we

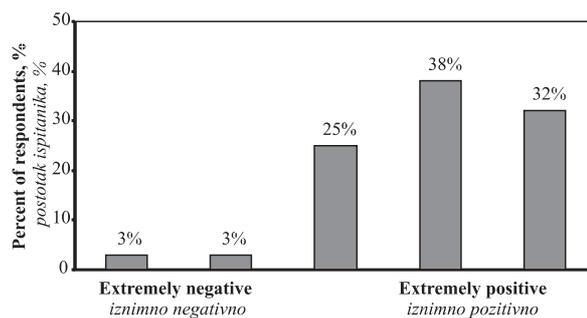


Figure 5 Overall perception of treated wood (n = 436)

Slika 5. Opća percepcija zaštićenog drva (n = 436)

wanted to see if respondents were familiar with various chemicals and compounds used in wood preservation. Respondents were most familiar with creosote (64 percent of respondents) and chromated copper arsenate (CCA) (37 percent) (Figure 6).

Respondents were asked if they used or specified treated wood products for applications in their homes (Figure 7). Landscaping timbers were most cited by 58 percent of respondents. Decks and outside stairs followed with 53 percent. From an expanded list of products, respondents were asked to identify applications where they believed that treated wood is appropriate independent of whether they had used these products in their own homes (Figure 8). Treating landscape timbers and decking/outdoor stairs topped the list with at 87 percent closely followed by fence posts/rails with 86 percent of respondents.

As indicated previously, treated wood safety is an issue for consumers. Using a 5-point scale, we asked respondents to indicate their level of agreement or disagreement with statements regarding treated wood application safety. The results in Table 1 are ranked with the

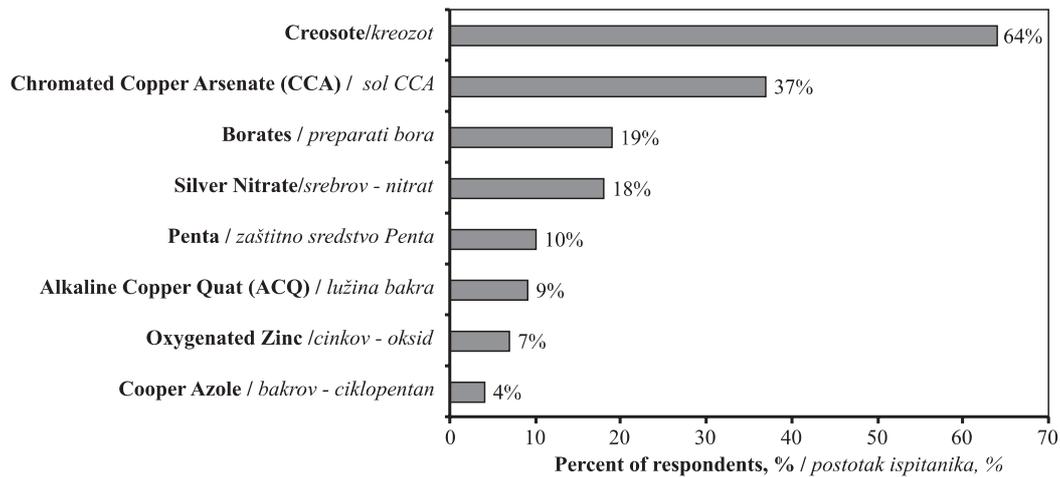


Figure 6 Familiarity with wood treating chemicals ($n = 438$) (multiple responses possible)
Slika 6. Obaviještenost o kemikalijama za zaštitu drva ($n = 438$) (moguće je više odgovora)

strongest level of agreement (somewhat agree + strongly agree) at the top. Overall, respondents are in agreement that treated wood is safe if handled and disposed of properly. Sixty-two percent of respondents agreed that treated wood is safe for human contact in outdoor applications but only 34 percent agreed that treated wood was safe to residents for indoor structural applications. Overall, when taking into account the neutral responses, respondents have a favorable view of treated wood safety for most applications posed to them.

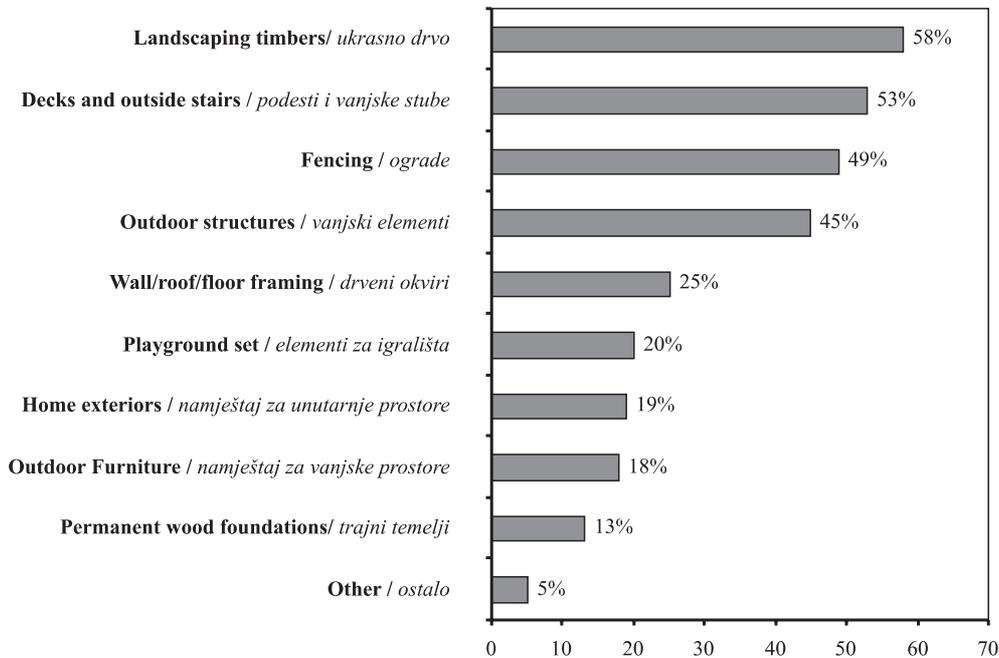
Respondents were asked if they thought that some types of treated wood are safer than others. Twenty-three percent of respondents said yes but 65 percent were not sure. This clearly indicates the need to educate homeowners regarding different preservative treatments and as-

sociated applications. For those respondents that said yes, we asked what they thought makes one kind of treated wood safer than another. The most cited response was “chemicals used”. Forty-six percent of respondents said that they would like more information on proper use, handling and disposal of treated wood. This presents another opportunity for treated wood manufacturers and preservative providers to educate builders and architects on the benefits of using treated wood.

3.3 Termites

3.3. Termiti

Thirty percent of respondents said termites have damaged the home they currently live in. Of these, 21 percent said they knew what types of termites these

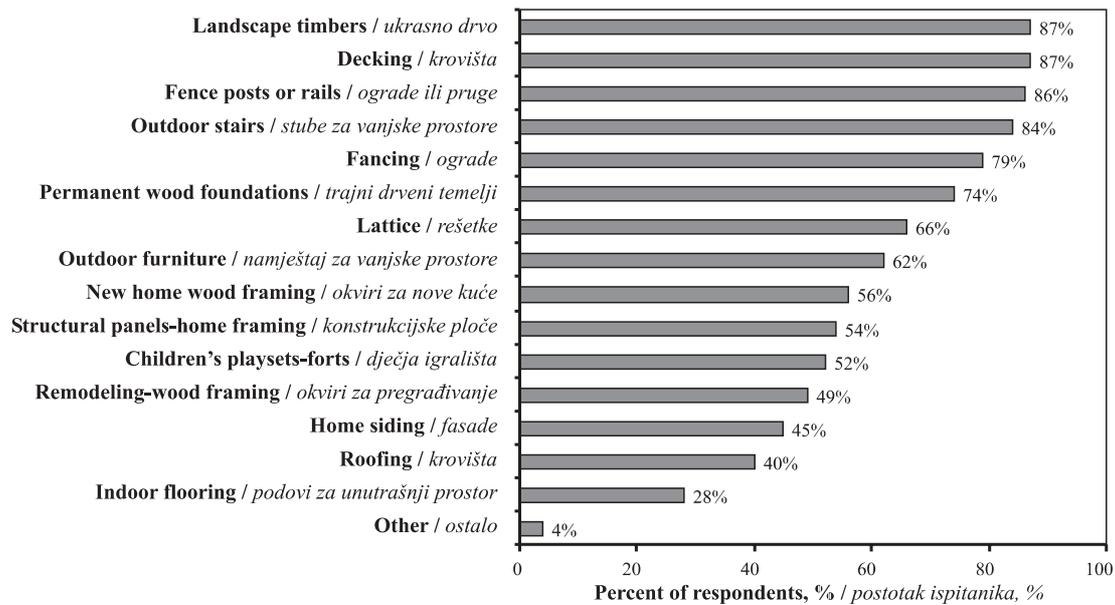


Other / Ostalo

Barns / staje; Boat dock / dok; Bottom plate on addition / osim na dnu; Bulkhead / pregrada; Cabinet base / podloga; Deer stands / nastambe za divljač; Detached shop / samostojeće trgovine; Dog house / kućica za pse; Farm buildings / objekti na farmama; Garage interior / interijer u garažama; Garden / vrt; Greenhouse / staklenik; Outdoor storage buildings / vanjski skladišni prostori; Planter boxes / posude za cvijeće; Retaining well / bunar; Structural applications / konstrukcijska primjena; Subfloor / međupod; Veranda / veranda

Figure 7 Treated wood applications used by respondents ($n = 422$) (multiple responses possible)

Slika 7. Zaštićeno drvo prema uporabi u ispitanika ($n = 422$) (moguće je više odgovora)



Other/ ostalo

Any wood near or at the ground level / bilo koje drvo u blizini zemlje ili na zemlji; Any wood product outdoor / bilo koji proizvod za vanjski prostor; Anything where the wood is exposed or available to above or below ground termites / sva mjesta gdje je drvo iznad zemlje ili u zemlji izloženo ili može biti izloženo djelovanju termita

Figure 8 Treated wood applications deemed appropriate by respondents ($n = 437$) (multiple responses possible)

Slika 8. Primjena zaštićenog drva koju ispitanici smatraju primjerenom ($n = 437$) (moguće je više odgovora)

were. Most cited were subterranean termites (12 respondents) and dry wood termites (5 respondents). When examined by state, 50 percent of respondents in Hawaii said termites have damaged the home they currently live in (Figure 9). Hawaii was followed by Louisiana and California (43 percent of respondents said it was a problem in each state). Tennessee was represen-

ted by the smallest percent of respondents (8 percent). Previously, we talked about building materials in the context of durability. In this section we asked respondents specifically about the efficacy of different building and construction materials protection against termites in general. Using a 3-point scale of protection against termites (1=does not protect at all; 2=protects

Table 1 Treated wood safety for selected applications ($n = 438$)

Tablica 1. Sigurnost zaštićenog drva za određenu primjenu ($n = 438$)

	Strongly Disagree <i>Uopće se ne slažem</i>	Somewhat Disagree <i>Uglavnom se ne slažem</i>	Neutral <i>Neutralno</i>	Somewhat Agree <i>Uglavnom se slažem</i>	Strongly Agree <i>U potpunosti se slažem</i>
entirely safe with proper use, handling and disposal <i>potpuno sigurno za odgovarajuću uporabu, rukovanje i odlaganje</i>	2%	9%	19%	38%	32%
safe for outdoor human contact applications <i>sigurno za vanjsku primjenu i kontakt s ljudima</i>	6%	10%	23%	34%	28%
is an acceptable material to use for new home construction framing <i>prihvatljiv materijal za konstrukcije novih kuća</i>	6%	4%	33%	30%	29%
safe to builders <i>sigurno za graditelje</i>	6%	11%	25%	36%	22%
safe to be near pets or farm animals <i>sigurno za kućne ljubimce i životinje na farmi</i>	9%	14%	28%	31%	18%
safe to children for outdoor play equipment <i>sigurno za djecu na dječjim igralištima</i>	13%	14%	25%	29%	19%
safe to residents for indoor structural applications <i>sigurno za stanovnike pri unutarnjoj strukturnoj primjeni</i>	11%	15%	30%	17%	17%
does not emit odors <i>ne ispušta mirise</i>	11%	22%	41%	19%	8%

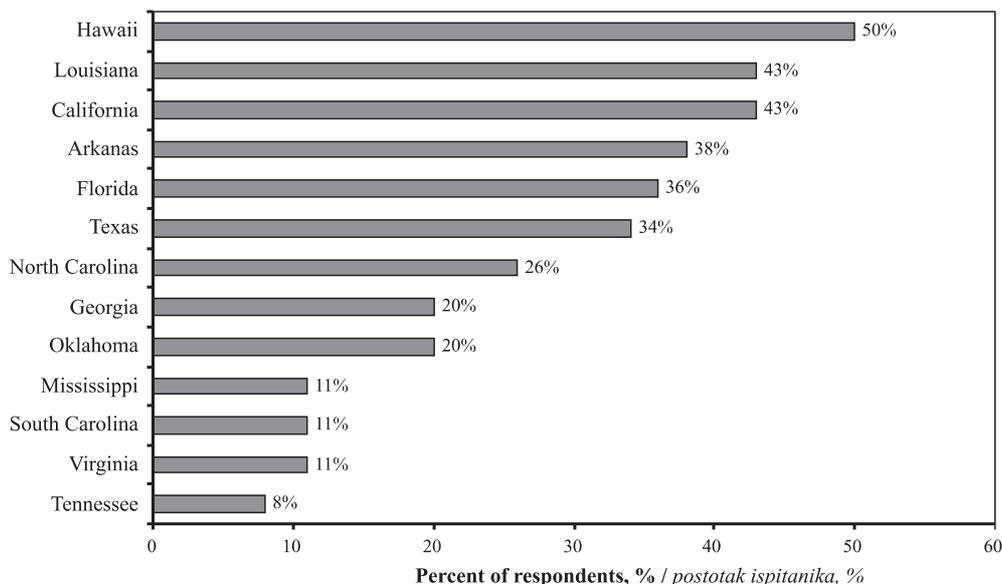


Figure 9 Termite damage encountered by state (n = 438)

Slika 9. Zastupljenost šteta prouzročenih termitima analizirana prema državama (n = 438)

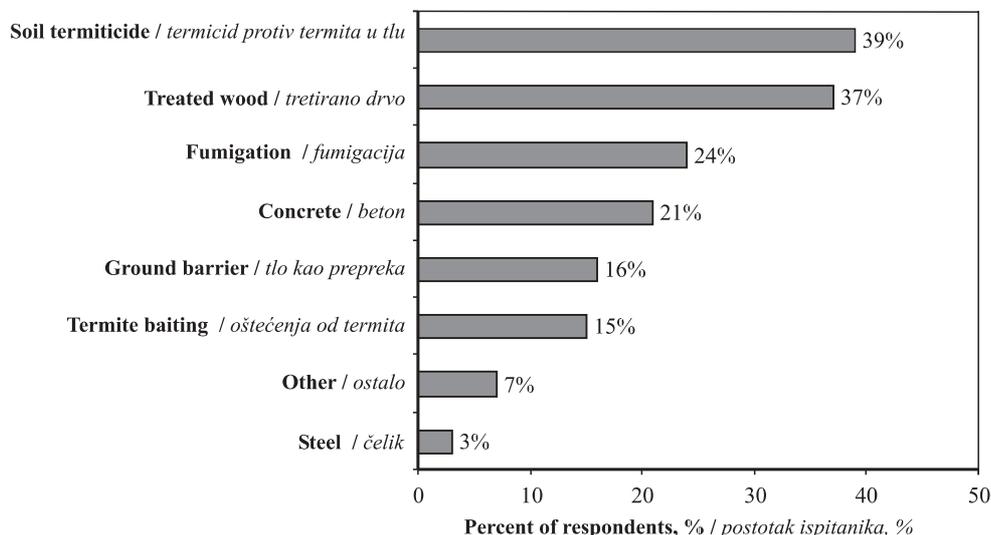


Figure 10 Actions taken to prevent termite attack (n = 411) (multiple responses possible)

Slika 10. Način prevencije napada termita (n = 411) (moguće je više odgovora)

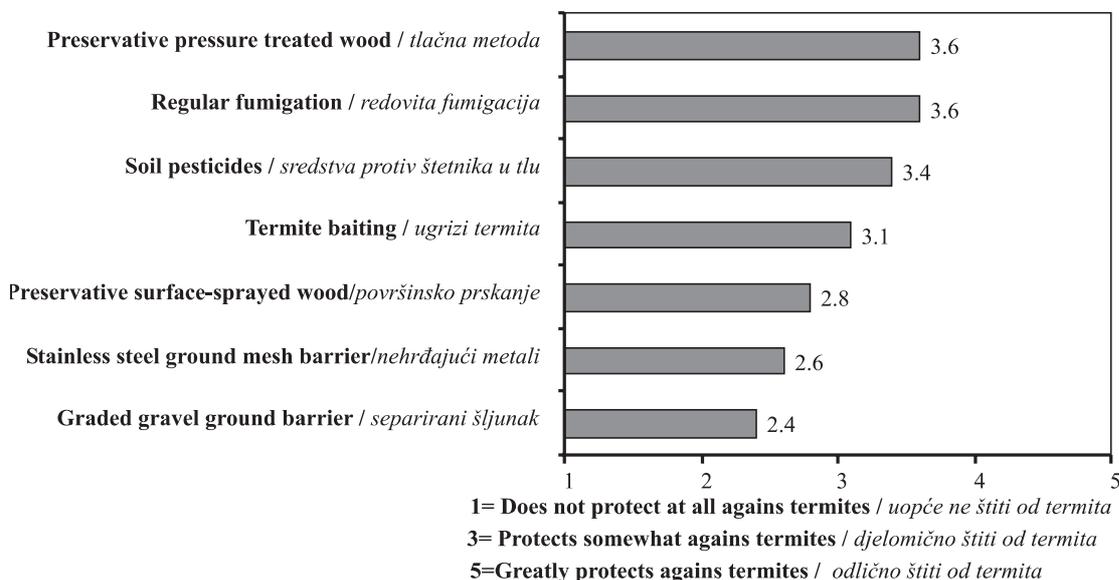


Figure 11 Effectiveness of activities and treatments for termite protection (n = 437)

Slika 11. Učinkovitost prevencije i zaštite drva od napada termita (n = 437)

Table 2 Respondent customer willingness to pay a premium for a termite-free new home ($n = 426$)

Tablica 2. Odgovori o premiji koju su kupci spremni platiti za zaštitu od termita pri kupnji novog stambenog prostora ($n = 426$)

	For a 10-year termite free home i would pay						
	Za kuću 10 godina sigurnu od termita platiti bih						
Percent premium postotna premija	0%	2.5%	5.0%	7.5%	10.0%	12.5%	More than / više od 12.5%
House cost, USD cijena kuće, USD	80.000 \$	82.000 \$	84.000 \$	86.000 \$	88.000 \$	90.000 \$	More than / više od 90.000 \$
Percent of respondents postotak ispitanika	8%	27%	31%	14%	10%	5%	6%

Table 3 Mean annual number of applications and costs for termite applications (multiple responses possible)

Tablica 3. Srednji godišnji broj provedenih zaštita od termita i godišnji trošak tih zaštita (moguće je više odgovora)

Application/Activity Zaštita /aktivnost	Number of respondents Broj ispitanika	Number of applications annually (mean) Broj provedenih zaštita (srednji)	Mean annual cost (USD) Srednji godišnji trošak (USD)
Fumigation / cijanizacija	58	1.5	319
Termite baiting / uništenje termita	49	2.2	275
Home perimeter treatment zaštita vanjskog ruba kuće	92	2.0	219
Soil Termiticide zaštita tla termicidima	102	1.6	205

somewhat; 3=significantly protects), steel and concrete were ranked highest (2,9 and 2,8/3,0, respectively). Plastic lumber was third (2,5/3,0) followed by treated wood (2,4 / 3,0).

Seventy-five percent of respondents have taken some type of action to prevent attack by the termites in homes they own. Figure 10 shows the actions that respondents have taken. The use of soil termiticides was the most cited (39 percent of respondents) closely followed by the use of treated wood (37 percent of respondents). On average, respondents indicated that preservative pressure treated wood and regular fumigation as being most effective in protecting a house against termites (3,6 on a 5-point scale of protection effectiveness) (Figure 11).

In order to develop a perspective on the cost premium the homeowner market places on termite prevention, we asked respondents how much of a premium they thought their customers would pay for an assured termite-free new home for 10 years over a home that does not carry this guarantee. For this exercise, a house was hypothetically priced at 80.000 \$ USD (Table 2). Only 8 percent of respondents said they would not pay any premium for a termite-free house. Fifty-eight percent of respondents said they would pay a premium between 2,5 percent-5,0 percent and 35 percent said they would pay a premium of 7,5 percent or more.

Respondents were asked the number of termite preventative applications they use on their homes annually as well as the annual cost for these applications. As seen in Table 3, on average, 58 respondents pay 319 \$ USD annually for fumigation, 49 respondents pay 275 \$

annually for termite baiting, 92 pay 219 \$ USD/yr. for home perimeter treatment and 102 pay an average of 205 \$ USD/yr. for application of soil termiticides.

4 CONCLUSION 4. ZAKLJUČAK

In this study we examined a number of homeowner perceptions, concerns and behaviors regarding termites and the potential for using treated wood to keep termites at bay. The particularly insidious Subterranean Formosan Termite (SFT) is currently a significant problem for homeowners in the Southern United States and is a potential issue for those residing in other U.S. geographic areas in the future.

Termites are a major problem for respondents. Ninety-two percent said they would pay a premium for a new home that had a 10-year termite-free guarantee. In addition, many respondents are paying between 205 \$USD and 319 \$USD annually for termite prevention. This is big business.

An understanding of termite, building material durability, and treated wood issues from the point-of-view of homeowners in locations most prone to termites, and the SFT in particular, can homeowners themselves to better understand the breadth of the issue and to provide potential solutions. In addition, a myriad of corporate sectors can benefit from this information. These include exterminators, termite prevention material manufacturers, and closer to home, treated wood chemical preservative manufacturers and treaters. In this article, and the subsequent Part II of the study that

examines the same issues from the perspective of U.S. home builders and architects in SFT infested areas, we provide unbiased and useful information that can be use in marketing, corporate strategic planning, and public policy decision making.

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Corresponding address:

Professor RICHARD VLOSKY, Ph.D. FIWSc

Louisiana Forest Products Development Center
LSU AgCenter
Baton Rouge, Louisiana 70803 USA
e-mail: vlosky@lsu.edu