



CARB Agreement 16MLD011

Survey of Small Off-Road Engines (SORE) Operating within California:
Results from Surveys with Four Statewide Populations

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Protection Agency

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ABSTRACT

Measures to reduce emissions from Small Off-Road Engine (SORE) equipment will play an important role in the California Air Resources Board's (CARB) goal of achieving emission reductions within the State of California. Given that existing state mandates require emissions reductions, it is necessary to establish a baseline estimate of the contribution from different types of equipment, including SORE equipment, to the statewide total. There are no recent estimates of the size of the population of this equipment. To determine the contribution of such equipment to emissions, information must be collected to estimate the size of the population of this equipment as well as different factors that might affect the emissions contribution of each piece.

In order to establish an estimate of the population size of such equipment within the state, staff at CARB and the contracted agency conducted three separate studies to obtain as full coverage of the population as possible: of households, of businesses (which refers throughout this report to all businesses in California except providers of lawn and garden services), and of providers of lawn and garden services (referred to as "vendors" throughout this report) in the state.

To estimate the population of equipment owned by households in the state, the contractor completed telephone surveys with 1,152 households throughout the state of California to determine the number of pieces of lawn and garden and other outdoor equipment that typically belong to the SORE category. Random Digit Dial (RDD) procedures (including both cellular and landline telephones) were used to create a list from which to sample potential respondents. The data obtained through the survey were then extrapolated to the full population of households within the state in order to obtain an equipment population estimate. Using this approach, it was determined that there are approximately 26,431,509 pieces of outdoor lawn and garden and other power equipment, including 10,902,041 pieces of gasoline powered equipment, owned by households in the state of California.

To estimate the population of equipment kept/stored at businesses in the state, SSRC interviewers completed 1,350 telephone surveys with businesses throughout the state, using a list of businesses created by a trusted vendor of such samples. Similarly to the household survey, the data obtained through the survey were scaled up to the full population of businesses in the state to obtain an equipment population estimate. Using this approach, it was determined that there are 2,070,685 pieces of outdoor lawn and garden and other power equipment, including 1,172,680 pieces of gasoline powered equipment, kept or stored at businesses in California.

Creating an estimate of the equipment operated by vendors of landscaping services throughout the state required splitting this population into two groups: those providers with valid licenses to operate throughout the state and those without. SSRC interviewers completed telephone and in-person surveys with 471 licensed and 158 unlicensed providers of lawn/garden services in California. A more focused list similar to the one utilized for the business survey was used to reach licensed vendors, while SSRC research team created a list of unlicensed vendors from online advertisements. The data obtained through the survey were extrapolated to the full vendor population separately, with Economic Census data used to estimate the size of the licensed vendor population and an internal estimate based on survey data used for the unlicensed vendor population. Using this approach, it was determined that there are 566,448 pieces of lawn and garden and other outdoor power equipment used by licensed

vendors operating throughout the state, including 523,744 fueled by gasoline, and 237,260 pieces used by unlicensed vendors, an estimated 215,131 of which are powered by gasoline.

EXECUTIVE SUMMARY

BACKGROUND

California is a national leader in the effort to reduce air pollution and greenhouse gas (GHG) emissions to combat climate change. Bills and executive orders at the state level establish GHG reduction targets for 2020, 2030, and 2050. Although automobiles and stationary producers, such as power plants and factories, are emissions sources more often considered by the general public, Small Off-Road Engine (SORE) equipment, including lawn and garden and other outdoor power equipment, are major contributors as well. Despite their smaller size, SORE emit far more than automobile engines, and while automobile emissions continue to decline, SORE emissions remain level. The study described in this report was carried out to create a comprehensive updated estimate of the size of the SORE population in the state and collect information on the power type, usage pattern, age, and retention time of this equipment. The results of this study can also help to quantify potential emissions offset by the usage of battery powered equipment.

METHODS

HOUSEHOLD SURVEY

The contractor conducted a telephone survey with 1,152 households throughout the state of California, inquiring about the pieces of SORE equipment, including lawn and garden and other outdoor power equipment, owned by each household. The survey instrument was developed in collaboration with staff from the California Air Resources Board's Monitoring and Laboratory Division (who also solicited input from stakeholders) and pilot tested on a small number of households prior to full scale implementation. In addition to collecting information on the pieces of SORE equipment owned by households, where possible, data were collected on the power type, usage pattern, age, and retention time of this equipment.

To ensure adequate coverage of the population of households in the state, the study employed a dual landline and cellular Random Digit Dial (RDD) telephone methodology. Marketing Systems Group (MSG), a leading vendor of RDD samples, provided the SSRC with the lists of telephone numbers created using RDD procedures. Eventually, 101,540 calls were made to complete surveys with 1,152 households. Individuals within each household self-reported on the items of interest, with varying success in terms of certainty and nonresponse. These values were then extrapolated to the full population of households, in order to obtain an estimate of the number of pieces of equipment throughout the state.

BUSINESS SURVEY

The SSRC conducted telephone interviews with 1,350 representatives from businesses operating in California (which refers to all businesses except providers of lawn and garden services for the remainder of this report). The survey instrument used for the business survey was loosely based upon the version

used for the household survey; however, slight modifications were made to account for the fact that businesses may have greater quantities of SORE equipment than households would. Staff from the SSRC and the California Air Resources Board's Monitoring and Laboratory Division worked together with input from outside stakeholders to integrate these changes, which were then pilot tested on a small number of businesses prior to full scale implementation. In addition to collecting information on the pieces of SORE equipment owned by businesses, where possible, data were collected on the power type, usage pattern, age, and retention time of this equipment.

In order to obtain a representative sample of the businesses throughout the state, SSRC obtained a randomly selected list of known businesses operating within California from Scientific Telephone Samples (STS), a reputable, California-based vendor of such lists. In total, 58,938 calls were made to complete surveys with 1,350 businesses. A representative from each business self-reported on the items of interest, with variable success in terms of certainty and nonresponse. These values were then extrapolated to the full population of businesses, in order to obtain an estimate of the number of pieces of equipment throughout the state.

VENDOR SURVEY

The SSRC completed surveys with 629 providers of landscaping and lawn/garden services (also referred to as "vendors" throughout this report) operating in California, with 471 completed with licensed and 158 with unlicensed vendors. Researchers modified the instrument used for the business survey to make it appropriate for lawn/garden care providers and gain more focused information on the services they provided and the clients they serve.

Two distinct sampling strategies were implemented in an attempt to cover the populations of both licensed and unlicensed vendors exhaustively. In order to obtain a representative sample of the licensed vendors throughout the state, SSRC obtained a randomly selected list of known lawn/garden care providers (from Standard Industrial Classification codes in the 078 group) operating within California from STS. The SSRC mainly recruited unlicensed vendors by scanning online classified advertisements from the Farm and Garden section of the website Craigslist. Contact information from these vendors was then loaded into the system to allow interviewers to reach them by telephone. Interviewers made 56,801 call attempts to complete the 624 surveys conducted by phone. Interviewers completed additional surveys in-person at three lawn/garden equipment retail locations. Vendors provided information on the equipment they owned as well as other general business information.

For licensed vendors, this information was then extrapolated to the full population of licensed vendors within the state, as estimated using Economic Census data. For unlicensed vendors, SSRC and CARB staff used known population values as well as survey data collected from this study to create an unlicensed vendor population estimate, since one did not exist already. Researchers then extrapolated the survey values for unlicensed vendors to this population.

RESULTS

HOUSEHOLD SURVEY

Interviewers at the SSRC completed 1,152 surveys with participants across California. The survey sample largely resembled the geographic distribution of the statewide population. There were two areas where the sample was not on par with the actual population: property type (single family homes were overrepresented) and household size (single person households were underrepresented).

Almost three-quarters of interviewed respondents lived in a residence with a landscaped area that required maintenance. Nearly half of these households cared for the landscaped area of their homes themselves, about a third hired someone else, and about one in five did a combination of the two. Of the participants that hired someone to care for the landscaped area of their homes, over half reported that this maintenance occurred four times a month.

Almost half of all the residents surveyed reported owning some type of power lawn or garden equipment. Pieces of lawn and garden equipment owned by those surveyed included 311 chainsaws, 418 lawn mowers, 399 leaf blowers/vacuums, 440 string trimmers/weedwackers, and 139 other pieces of lawn and garden equipment. Additional data were collected and presented on the power type, frequency and duration of use, age, and planned retention of this equipment.

Nearly 40 percent of households had some other type of outdoor power equipment, including 305 compressors, 164 generators, 15 go carts, 221 pressure washers, 167 pumps, 5 snow blowers, 33 utility/golf carts, and 106 welders. The same follow up information was collected for each of these equipment types as well.

Additional inquiry on the maintenance of this equipment showed that about two-fifths of residents had maintenance performed on their equipment, done in over two-thirds of these cases by someone within the household only. In two-fifths of cases where any maintenance was performed, this work was only done when the device stopped working or broke. Fewer than one in ten households had future plans to purchase equipment, with a lawn mower being the most common planned purchase. Electric purchases were planned in 46.1% of these cases.

There were 1,224 gas cans represented in the households surveyed, with 84.3% of these made of plastic and the remainder of metal. The most common gas can size was 5-gallon. Nearly two-thirds of gas cans were filled less than four times a year. Modifications to gas cans were uncommon, and the most common modification was to replace the spout of the can.

Using the aforementioned survey and population data, and accounting for discrepancies between the survey sample and population, it was estimated that there are 26,431,509 pieces of lawn and garden and other outdoor power equipment in households throughout the state, including 10,902,041 fueled by gasoline.

BUSINESS SURVEY

SSRC researchers administered telephone surveys to 1,350 representatives from businesses throughout California. The survey sample closely reflected the state population in most ways, but adjustments were

made to match the survey sample to the population in two places where they diverged: industry and number of employees.

Less than half of businesses in the study sample possessed a landscaped area requiring maintenance. Of these, three quarters hired someone to take care of the area. For more than two-thirds of these businesses service was performed on the landscaped area of their businesses at least once a week but less than daily.

About 15 percent of all businesses surveyed had some type of power lawn or garden equipment. Pieces of lawn and garden equipment kept or stored at the businesses contained in the study sample included 135 chainsaws, 91 lawn mowers, 240 leaf blowers/vacuums, 168 string trimmers/weedwackers, and 28 other pieces of lawn and garden equipment. As with the household survey, data were collected and presented on the power type, frequency and length of use, age, and planned retention time of this equipment.

More than a quarter of businesses had some other type of outdoor power equipment, including 237 compressors, 175 generators, 23 go carts, 206 pressure washers, 108 pumps, 3 snow blowers, 84 utility/golf carts, 162 welders and 3 other pieces of outdoor equipment. The same follow up information was collected for each of these equipment types as well.

Further items regarding the maintenance of this equipment indicated that nearly half of businesses with such equipment regularly did maintenance or had maintenance done. For these businesses, more than half of the maintenance was done by the respondent or someone else at the businesses. Less than two percent of businesses had future plans to purchase equipment, about two-thirds of which would be replacement equipment. Similarly, two out of three of these pieces of equipment would be gasoline powered.

Six hundred sixty-four gas cans were kept/stored at the businesses surveyed, with three quarters of these being plastic. As in households, the most common gas can size was 5-gallon. The greatest proportion of gas cans were refilled at least one a month but less than weekly.

Combining the aforementioned survey and population data, and taking into account discrepancies between the survey sample and population, it was estimated that there are 2,070,685 pieces of lawn and garden and other outdoor power equipment at businesses throughout the state, including 1,172,680 fueled by gasoline.

VENDOR SURVEY

Interviewers at the SSRC completed telephone and in-person surveys with 471 licensed and 158 unlicensed providers of lawn/garden services in California. Weighting adjustments were made to match the survey sample to the population with regard to number of employees. Two-thirds of licensed vendors and nearly 90 percent of unlicensed ones had fewer than five people working for the business.

Almost all vendors of both types were single service locations rather than part of a related group. About half of vendors provided services only in Southern California. Less than half of licensed vendors provided only residential services, while more than two-thirds of unlicensed vendors did. The median number of clients served within the last year was higher among licensed than unlicensed vendors. Correspondingly,

licensed vendors provided services to their clients less often, on average, than unlicensed vendors did, but the length of service each time was higher among licensed providers.

The vast majority of vendors surveyed had some type of power lawn or garden equipment. Pieces of lawn and garden equipment used by licensed vendors included 1,815 chainsaws, 1,029 lawn mowers, 1,576 leaf blowers/vacuums, 1,436 string trimmers/weedwackers, 995 hedge trimmers, 149 riding mowers, and 128 other pieces of lawn and garden equipment. Unlicensed vendors had a total of 305 chainsaws, 214 lawn mowers, 282 leaf blowers/vacuums, 292 string trimmers/weedwackers, 221 hedge trimmers, 13 riding mowers, and 16 other pieces of lawn and garden equipment. Similar to the household and business survey components, interviewers collected information on the power type, frequency and length of use, age, and planned retention of this equipment.

Nearly half of licensed vendors and about a third of unlicensed vendors had one of the eight types of the other outdoor power equipment covered by the study. For licensed vendors these included 142 compressors, 97 generators, nine go carts, 151 pressure washers, 62 pumps, 31 snow blowers, 49 utility/golf carts, 73 welders, and 35 other pieces of outdoor equipment. Unlicensed Vendors had 36 compressors, 14 generators, 38 pressure washers, eight pumps, two utility/golf carts, 11 welders, and five other pieces of outdoor equipment. Interviewers collected the same follow up information for each of these equipment types also.

Further items regarding the maintenance of this equipment showed that the vast majority of both types of vendors had this work done, with a dealer/small engine shop usually providing these services for licensed vendors. For unlicensed vendors, the greatest proportion did this work themselves. Nearly half of unlicensed and a third of licensed providers had plans to purchase equipment in the next year. An overwhelming majority of this equipment would be gasoline powered, with better performance as the main reason for these purchases (rather than electric). More than three quarters of licensed and more than half of unlicensed vendors had never had the engines replaced on any of their equipment. In cases where engines were indeed replaced, it was typically for a small percentage of equipment.

Nearly all gas cans used by vendors were plastic, but licensed vendors had more metal cans on average. The most common gas can size for licensed vendors was five gallon, while for unlicensed it was between 2.5 and 4.0 gallons. Licensed vendors reported owning slightly newer gas cans and refilling them more often. Small proportions of both types of vendors had made modifications to their cans.

Combining the aforementioned survey and population data, and taking into account discrepancies between the survey sample and population, it was estimated that there are 566,448 pieces of lawn and garden and other outdoor power equipment used by licensed vendors operating throughout the state, including 523,744 fueled by gasoline. Using the population estimate created by SSRC and CARB staff and the survey data, it can be calculated that unlicensed vendors operate 237,260 pieces of lawn and garden and other outdoor power equipment. Of these pieces of equipment, 215,131 are estimated to be powered by gasoline.

CONCLUSIONS

Combining the estimates from the household, business, and licensed and unlicensed vendor components, we can obtain a presumed overall population estimate of lawn and garden and other

outdoor equipment in California. The combined survey data yield and estimate of 3,386,750 chainsaws, 4,120,867 lawn mowers, 4,231,843 leaf blowers/vacuums, 4,580,020 string trimmers/weedwackers, 105,959 hedge trimmers, 11,567 riding lawn mowers, 1,424,341 other pieces of lawn and garden equipment, 3,337,843 compressors, 1,858,418 generators, 192,065 go carts, 2,398,713 pressure washers, 1,835,205 pumps, 62,419 snow blowers, 461,631 utility/golf carts, 1,287,840 welders, and 10,421 other pieces of outdoor power used by licensed vendors throughout the state, for a total of 29,305,902 pieces of lawn and garden and other outdoor power equipment. Of these pieces of equipment, 12,813,596 are estimated to be powered by gasoline.