



Evaluation of Fire Hazard Inspection Procedures in Butte County, California

WILLIAM S. FOLKMAN

Residents in brush-covered foothill areas are responsible for a disproportionately high number of uncontrolled fires in Butte County. This is a condition common to similar areas throughout California, but the problem, of course, is not confined to California.¹ The problem is expected to increase as the residential use of such areas increases.

Research in human motivation has repeatedly demonstrated that personal contact is the most effective means of influencing human behavior. Such contacts with local residents, through fire hazard inspections by State Division of Forestry personnel, have had considerable success in holding the line with the fire problem created by residential use of foothill areas. Unfortunately, although this type of personal contact is effective, it is also expensive and time consuming. The question is, can the effects be achieved more efficiently? Are there procedures by which the values of personal contact can be preserved or extended while at the same time the costs in energy, time, and money are reduced?

A number of possibilities suggest themselves. Maybe the effect of a

ABSTRACT: To assess effectiveness of fire hazard inspection procedures in securing compliance with fire safety requirements, effects of different types and combinations of contacts and timing were determined, and the production capacity of inspectors measured. It was demonstrated that fire law inspection is as much fire prevention education and engineering as it is law enforcement. The public was found to be uninformed about fire laws but was very receptive to an inspection program.

RETRIEVAL TERMS: Fire prevention; fire hazard inspection; fire law violation; California; Butte County; fire prevention education; forest fire prevention; forest fire risk. Line Project: 2105.

personal contact holds over from one season to the next so that contacts every second (or perhaps third) year would be nearly as effective as an annual visit in securing compliance with fire regulations. Or, perhaps a letter reminding a homeowner what he must do to prepare for the coming season could be substituted in alternate years. To what extent could a follow-up letter pointing out fire regulation violations take the place of an actual follow-up inspection? It would also be interesting to know the extent to which the conspicuous activity of reconnaissance surveillance would substitute for personal visits to each household. What would be the effect if surveillance were coupled with visits to a sample of the households? Are there residential areas where one method would provide adequate control but other areas where more intensive efforts might be required?

The study reported here answers some of these questions and establishes a framework from which some of the other questions might be investigated in subsequent seasons.

¹See, for example, Earl H. Brown, *Preliminary report covering prevention-detection of the protection survey of southwest Oregon fire district*, Oregon State Board of Forestry, February, 1963. p. 8.

PROCEDURE

Five areas in Butte County under the protection jurisdiction of the California Division of Forestry were selected for study purposes. All areas were in the general vicinity of Oroville:

1.--A relatively new, middle income residential area. Streets wind about through the foothills, and there is still considerable open space covered with brush and grass.

2.--A low-income area on relatively flat land. Streets are laid out in a geometric pattern. Houses are quite old, many deteriorated. The lots are frequently grown up with tangled masses of vegetation and cluttered with debris.

3.--A lower-middle income area, also situated on relatively flat land with a geometric street pattern. Many of the houses are of recent construction, and the area generally has a tidy appearance. The area is adjacent to, and partially interspersed with, open grass-covered fields.

4.--Mainly a relatively high income area with structures closely clustered about a small lake. This is near the upper limits of the foothill area, and pine has largely replaced the brush cover. Most structures are cabins for summer or vacation use; many owners are not permanent residents of the county, but some maintain year-round residence. The remainder of the residences are located along the adjacent mountain roads. The occupants are mostly of low to middle income and are permanent residents.

5.--A foothill location overlooking Oroville. It contains some of the most expensive homes in the area, but also one of the lowest income sections. Considerable native vegetation has been retained, and the surrounding area is brush covered.

The areas were selected to represent different types of situations with high but varying numbers of fire starts attributed to residents of the areas. Each area was divided into two parts essentially equal in such characteristics as number of households, socio-economic level, cover, and terrain. On May 5, a letter was sent to each residence in one of the paired parts of each of the five designated areas.² The letter was designed to make the residents aware of the approaching fire season and recommend suggested preventive measures they should take about their homesites to prepare for the hazardous season. Thus, half of the residents received the pre-season letter and half did not. A control segment was designated in each half of the five areas. About 2 weeks after the letters were mailed, a crew of five trained inspectors began an initial inspection of all residences within the study areas except for those in the control areas, which were left undisturbed until the final checkup.

Inspections were performed in a standard way, and notification of any violations found was left with an adult member of the household. If no one was home the notice was left at the residence. In addition, within a day or two following the inspection, letters were sent to half of the residences found to be in violation of fire safety requirements. These letters reminded the family of the violations found, emphasized the legal responsibility for taking corrective measures, and requested compliance. About 10 days later half of the homesteads found to be in violation were re-examined for compliance.

²Copies of the letter and other communications are available from Director, Pacific Southwest Forest and Range Experiment Station, U.S. Forest Service, P.O. Box 245, Berkeley, Calif. 94701

Residences found still in violation during this follow-up inspection were checked for a final time, as were all those who received no follow-up inspection. During this final inspection period, residences in the control segments were also inspected.

Differences in the violation rate between those who received the advance letter and those who did not provided a measure of the effectiveness of such letters. Comparison between the rates of violation observed in the initial inspection and those found in the later inspection of the controls gave an indication of the extent of voluntary or spontaneous compliance during the course of the study. The effects of various combinations of follow-up letters and inspections also were compared. Time schedule for the study was as follows:

May 5, 1966...letter to residents in half of study areas.

May 16 - May 28...initial inspection, all areas except control segments.

Inspection plus 1-2 days...follow-up letter to half of violators.

Inspection plus 10 days...follow-up inspection of half of violators.

June 6-30...final inspection and inspection of control segments.

Initial plans anticipated a study population of 1,100 residences. With follow-up inspections, the total number of inspections was expected to approximate 1,270. Actually, 1,053 properties were located in the study areas, and 1,764 inspections were completed (fig. 1). Careful records were kept of each inspection, including the date, time required for inspection, number and type of violation, and the nature of the follow-up action.

RESULTS

All areas responded very well to the inspections and the inspectors. Few people contacted, however, were aware of the State laws regarding requirements for hazard reductions. In fact, during the initial inspections, 63 percent of the properties were found to be in violation of the law in one or more ways. The percent of properties in violation varied considerably among the five study areas, from a high of 70 percent in area No. 4 to a low of 53 percent in area No. 3. Areas No. 1 and No. 2 both had 68 percent of their properties in violation, while area No. 5 had a relatively low 56 percent in violation. In spite of the high number of violations, or perhaps even because of it, most people felt that the inspection program was very worthwhile and that more of this sort of thing should be done. Very few negative attitudes were observed.

TYPES OF VIOLATIONS

The inspectors were instructed to check particularly for violations of Public Resources Code Section 4291, reduction of fire hazards around buildings; PRC 4423, written permit required for burning; and PRC 4446, incinerator standards. If other violations were observed, they were to be noted, but the main emphasis was to be on violations of these three code sections.

Violation of the clearance requirements (PRC 4291) was the most frequent infraction. Of the 1,152 separate violations recorded in the initial inspection, more than three-fourths (79 percent) were for this section. An inadequate, or lacking, incinerator accounted for 17 percent of the violations. Failure to have a burning permit was responsible for 3.5 percent of the violations. A

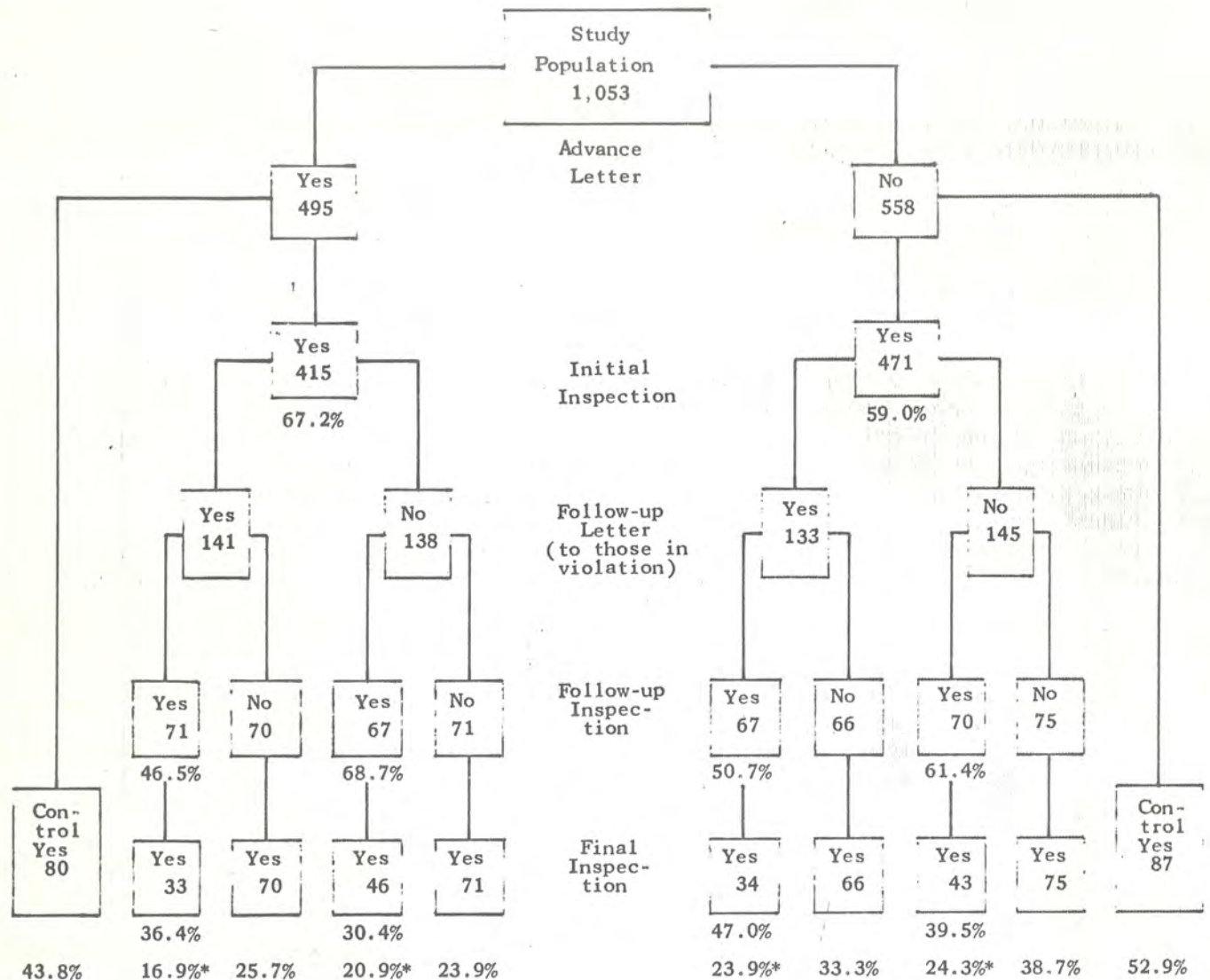


Figure 1.--Summary of study plan and results. Figures in the blocks represent the number of properties involved in that particular treatment. Percentage figures below the blocks show the proportion of violations existing at that stage of the study procedure. Asterisks show percent of original number of violators who received follow-up inspection.

negligible number of violations of other code sections were recorded.

Violations of clearance requirements accounted for nearly all (96 percent) of the infractions noted in the summer home area (area No. 4). In area No. 3, a flat land area, on the other hand, over one-third of the violations were for failure to have a burning permit or adequate incinerator. The situation in area No. 2, another area out of the foothills, was similar--

with 31 percent of the violations for these causes. In areas No. 1 and No. 5, 73 percent and 82 percent, respectively, of the violations were for clearance violations.

The 1,152 separate violations amount to an average of 1.3 violations for each of the 886 properties inspected. (Inadequate clearance around each structure is counted as a separate violation.) Considering only those properties on which

violations were observed, this amounts to 2.1 violations per property.

TYPE OF PROPERTY INSPECTED

Rural dwellings were the principal type of property inspected. The distribution was:

	<u>Percent</u>
Rural dwelling	83.8
Mountain cabin	9.5
Ranch-farm	4.7
Other structure	1.9
Resort	.1

EFFECT OF ADVANCE LETTER

The pre-inspection letters made the point that removal of fire hazards would not only satisfy the State laws but at the same time protect homeowners, their families, and their neighbors. But the advance letters had no observable immediate effect upon compliance.

Those who received letters had a higher rate of noncompliance than those who received no notification (67 percent in contrast to 59 percent). Difficulties in executing the study plan were undoubtedly responsible for the differences. It was not possible to choose properties at random in each area for variable treatment without a large and uncontrollable amount of influence on adjacent properties being submitted to different treatment. Consequently, the areas were divided into contiguous segments to minimize this "slop-over" effect. It is apparent, however, that these segments were not initially homogenous and consequently produced more variability than did the induced variable.

At the end of the study, however, when the areas left as controls were inspected, we found that among those in these areas who had received the initial letter, the properties in violation had dropped from 67 percent

to 44 percent. Figures for the control groups that had not received such a letter showed only a comparatively slight drop, from 59 percent to 53 percent. The advance letters may have contributed to some of the difference.

EFFECT OF FOLLOW-UP LETTERS

Half of those found to be in violation at the time of the initial inspection were sent a personal letter from the State Forest Ranger in addition to the notice left by the inspector at the time of the inspection. These letters appeared to have a significant impact. In the one instance, 54 percent of those in violation at the time of the initial inspection were found to have removed the hazards by the time the follow-up inspection was made. In the other, the reduction was 50 percent. In contrast only 31 to 39 percent of the violators who received only the inspector's notice corrected the situation on their property. A new fire prevention inspection report form (LE 38) developed by the Sacramento office was not available for use in time for the study. The blue-line notice left by the inspectors probably did not have the same impact as would the more official "Notice of Violation" provided by the property owner's copy of the new report form. The effect of the State Forest Ranger's letter would, no doubt, have been much less had this form been used.

The inspectors were often quite frankly told by the property owners who received only the inspector's notice that they had not bothered to take any corrective action because they had expected no follow-up. The re-inspection caught them by surprise. At this point in the study the people contacted appeared to become convinced that the agency was in earnest and the word spread throughout the areas involved.

EFFECT OF FOLLOW-UP

The final inspection revealed that of those who had received both a follow-up letter and a follow-up inspection, only 20 percent had still failed to comply. Comparable figures for those who had not received a letter but had received an inspection were 23 percent; follow-up letter but no follow-up inspection, 29 percent; and neither follow-up letter nor inspection, 32 percent.

If we disregard for the moment the effects of the follow-up letter, those who received the follow-up inspection averaged 21 percent in violation, in contrast with 30 percent for those who received no follow-up inspection.

By the time of the final inspection much of the differential effect of the follow-up letter had dissipated. The figures for those who had, and those who had not, received a letter was 25 percent and 27 percent in violation.

COMPLIANCE AT END OF STUDY

At the beginning of the study, out of 886 properties (of the original 1,053, 185 were reserved as controls) 557, or 63 percent, were in violation of the California Public Resources Code concerning fire hazards. At the end, 145 properties remained in violation. This represents about one-fourth of those initially in violation, or 16 percent of the 886 properties inspected. Of these remaining violators, about a third had made some efforts to reduce their hazards.

After the official end of the study, the inspectors continued to work with those in violation, in addition to extending their inspections to other areas. Continuing their educative approach, they were able to secure compliance in nearly all cases. The 12 remaining cases were referred to the District Attorney. A letter from him brought rapid

compliance. At the end of the season, only one case remained on which court action might be taken. This individual, however, was not from within the original study areas.

EDUCATIONAL PROCEDURES USED

Personal contacts have been demonstrated repeatedly to be the most effective method of getting prevention measures accepted. Fire hazard inspection of properties provides a good opportunity to make such a personal contact. In nearly three out of five instances (59 percent) the inspectors were able to have a discussion with an adult member of the family. The following tabulation indicates the proportion of cases in which various educational methods or materials were used. Often, two or more materials were used together.

<u>Educational method or material</u>	<u>Percent of cases reported</u>
Discussion	59
Literature	47
Letter	31
Notice only	2
None reported	16

There was considerable variation among the five study areas. Discussion was possible during nearly three-fourths (73 percent) of the inspections made in area No. 2. In contrast, little more than two in five inspections in area No. 4 resulted in a personal contact. This area is the one with a high proportion of summer or vacation homes. The proportion contacted would have been considerably lower if the inspectors had not made special efforts to inspect in that area on Saturdays when some of the absentee owners were visiting their property. Area No. 5 also had a low proportion of contacts permitting discussion--55 percent. The inspectors were able to make personal contact in 64 and 63 percent of the cases, respectively, in areas No. 1 and No. 3.

Tuesday proved to be the most favorable day for finding people at home. The inspectors were able to discuss the hazard problem during 70 percent of the inspections made on that day. Saturday was the worst day. Only 44 percent of the inspections made on Saturday permitted discussion with the residents. But only 6 percent of the inspections were made on Saturday, and most of these were in area No. 4. Only two inspections were made on Sunday. The number of inspections per day was quite consistent for the week days with the exception of Tuesday. This day averaged little better than half the number of inspections of the other week days. This suggests that discussion significantly increases the length of time required per inspection.

Of 621 notices given in the course of making the 1,764 inspections, most (82 percent) were left at the residence. The inspectors were able to place only 13 percent of the notices in the hands of an adult member of the household. In 4 percent of the cases it was necessary to mail the notice to the responsible party. In two cases, notices were both mailed and placed.

There is a marked contrast in the proportion of personal contacts made with the general population in the study and with those whose property was found to be in violation. Problem cases appear much more prevalent among families who are all away during the day, or who are absentee owners, and thus unavailable for personal contact. Nearly 60 percent of the general population were personally contacted during the course of the inspections, but only 13 percent of the violators were similarly contacted.

INSPECTIONS PER INSPECTOR

The number of inspections conducted by each inspector varied considerably (table 1). Inspector number 4 was on other duty during part of the study period. Some of the variation among

the other inspectors may be due to differences in the ease with which areas assigned could be inspected. However, this would tend to be equalized during the course of the study. Most of the variation must be attributed to the work characteristics of the individual inspectors.

Table 1.--Number of inspections performed in each inspection area

Inspection area	Inspector					Total
	1	2	3	4	5	
No. 1	153	120	104	79	106	562
No. 2	29	43	54	6	44	176
No. 3	101	81	56	17	78	333
No. 4	83	80	65	0	101	329
No. 5	71	71	76	60	86	364
Total	437	395	355	162	415	1,764

TIME PER INSPECTION

The way the data were recorded does not permit a precise report of average time per inspection. In addition, no time was recorded for one fourth of the inspections; these were left out of the computations of averages. But the average time is probably somewhere between 15 and 20 minutes per inspection. Follow-up and final inspections on the average took 2 to 3 minutes less time per inspection than did the initial inspections.

The inspectors reported some feeling of pressure in completing all of the inspections within the time limits permitted by the circumstances under which the study was conducted. They, and some of the reviewers of the study, have felt that allowing more time per inspection would have improved the effectiveness of the contacts made.

The average time per inspection reported by the different inspectors varied from 8 minutes to 20 minutes per inspection. The two inspectors with the lowest average time per interview were also the ones who account for the large number of failures

to report time. It is possible that they were most apt to neglect to record the time used on the longer inspections, which would account for the difference. All inspectors worked in each study area, so differences in the physical inspection situation should have been essentially evened out.

The distribution of amount of time required per inspection is probably the most valid way of viewing this dimension (table 2).

Table 2.--Percentage distribution of inspections, by time required for inspection and by type of inspection

Time (minutes)	First inspection	Second inspection	Third inspection	Control	Total
	Percent				
< 10	13.8	17.3	16.4	14.9	15.2
10-14	37.3	50.2	49.1	46.8	43.0
15-29	41.8	28.8	31.8	29.8	35.8
30-44	5.8	3.0	.9	3.6	4.4
45-59	.9	.2	.9	2.8	.9
> 59	.4	.5	.9	2.1	.7
Total	100.0	100.0	100.0	100.0	100.0

NUMBER OF INSPECTIONS PER DAY

The average time per inspection reported in the previous section makes no allowance for the time lost in locating a property, travel, office work, and so forth. For administrative purposes, a more meaningful figure would be the average number of inspections completed per day. For all types of inspections this amounted to 12.5 inspections per day. (The inspectors averaged 1.4 hours overtime per day during this period. For an 8-hour day, the average number of inspections per day would be 10.6.)

Although follow-up and final inspections required less time per inspection, the number of individual inspections per day was much less than for initial inspections. Such

inspections were quite widely distributed and considerable time was used up in getting from one location to the next. The average number of inspections per day was 10.9 for second inspections, and 7.0 for third inspections, in contrast to 17.7 for initial inspections.

Variance among inspectors was not large. The lowest averaged 11.6 inspections per day, and the highest averaged 14.1.

Better than one-third of the inspectors' time each day was taken up with office work--checking property ownerships, preparing reports, typing letters or notices, critiques of inspection problems, and so forth. In an operational situation a considerable proportion of this work might have been more efficiently handled by clerical personnel, leaving the inspector free for more time in the field conducting inspections.

In the field, the inspectors used a locally devised report form. This form, containing the same information as that on the fire prevention inspection report (Form LE 38), utilized both sides of a 5-x 8-inch file card. The workers found the cards more convenient to use under field conditions than the less substantial paper forms with their attendant pressure-sensitive copies. The cards had the added advantage of providing a permanent, portable file of properties inspected. The inspectors carried these files with them in the field, where they were found to be most useful in follow-up work. The files are anticipated to have even more utility in succeeding seasons. The inspectors were unanimous in their feelings that the advantages of the card system far outweighed the disadvantages of the additional office work involved in transcribing the data from the cards to the report forms.

DISCUSSION

This study demonstrates the effects of various types of fire hazard inspection procedures. It is evident that each measure had a positive effect upon reducing the fire hazard in rural properties. It is not anticipated that an operational program could afford to carry out as intensive a program as was here done experimentally. The results, however, have already proven of value to administrators in planning an inspection program for the State.

A follow-up study is planned for next season. It will be conducted in the same areas covered in this study, and basically the same procedures will be followed. In the study reported here, many people anticipated no follow-through on the initial contacts made. It will be interesting to observe the effect of the previous season's experience on their behavior next year. We anticipate a much higher rate of compliance following the initial contact than was obtained with this study.

The physical characteristics of the area, the nature of the development of the area, and the characteristics of the people living there--all were observed to have a considerable effect on the number of violations encountered, the ease or difficulty of achieving compliance, and the cooperativeness of the residents.

In most instances, a heavy stand of dry, annual grasses constituted the hazard responsible for clearance violations detected in this study. The physical effort to remove this fuel would have been much less had it been

done earlier in the season before the grass had become rank and the soil had become dry and hard. Furthermore, the judicious use of pre-emergent sprays and soil sterilants would reduce these difficulties. These training and educative matters will be incorporated in future plans. They do not apply, of course, in areas where the vegetative cover is an evergreen type, such as pine. Here, needle-fall is more or less continuous throughout the fire season and several cleanups during the season may be necessary.

The inspectors were well received by the property owners. But those contacted were quite uninformed regarding the provisions of the Public Resources Code. They were appreciative of having the hazards on their property brought to their attention.

The inspectors were instructed that they were to regard their role at this stage as an essentially educative one. It is quite apparent that a high level of compliance can be achieved without resorting to coercive action.

The study attracted considerable attention in the neighborhoods within which it was conducted. As a consequence we were not successful in confining the effects of the experimental variables to the areas within which they were applied. However, the only significant effect would be in raising the general level of compliance. This would reduce the variability between experimental areas and thus partially mask the effects of various treatments. The differences in results reported here, therefore, should be interpreted as minimal. If complete isolation had been possible, the differences would have undoubtedly been more dramatic.

This study was fortunate in the high caliber of the people responsible for its execution in the field. The inspectors were well chosen and had been given a week of special training in preparation for their assignment. Their conscientious and enthusiastic coopera-

tion was responsible in large measure for the success of the study. It was evident from the study that the careful selection and training of such workers would be equally essential in an operational fire hazard inspection program.

*The Author*_____

WILLIAM S. FOLKMAN is responsible for studies of the sociological problems in the prevention of man-caused forest fires. He joined the Pacific Southwest Station staff in 1962. He holds a bachelor's degree in agriculture from Utah State Agricultural College, a master's degree in sociology from the University of Utah, and a doctorate in rural sociology from Cornell University.