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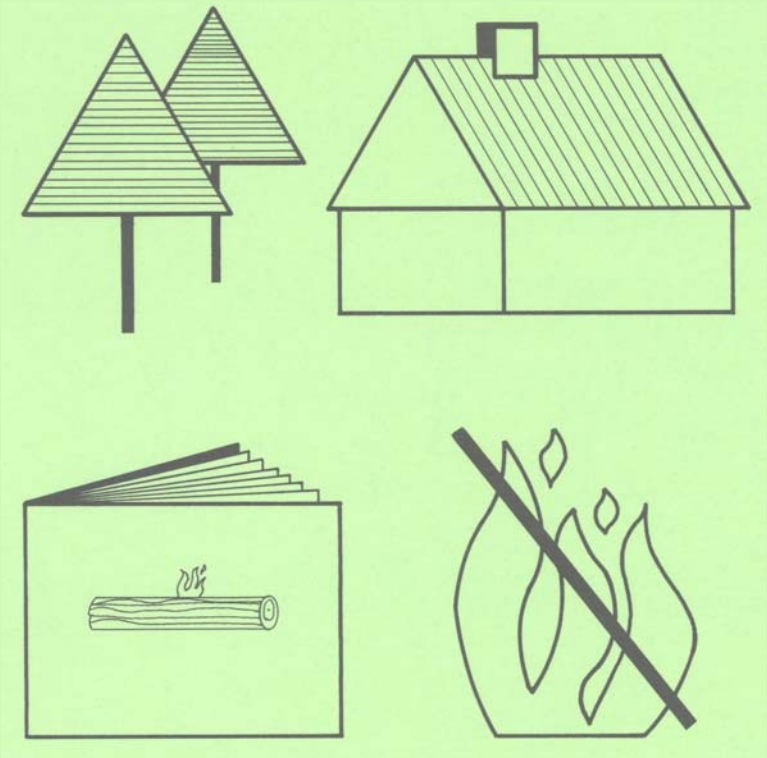

FIRE PREVENTION IN BUTTE COUNTY, CALIFORNIA.. . evaluation of an experimental program

William S. Folkman

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CONTENTS

The Author

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SUMMARY

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Fire protection agencies in California became increasingly concerned in the 1950's that their fire prevention and control efforts were inadequate to keep abreast of a situation that had steadily worsened. This decline had come about because of the increased use of wildlands coupled with rapidly increasing values at risk. The characteristics of topography, climate, fuel accumulation, as well as the human population, combined to give California a fire problem of growing complexity and severity.

Previous efforts at fire prevention had been hampered by limited resources and minimal staffing. It was proposed that the U.S. Forest Service and the California Division of Forestry join forces in an experimental, coordinated fire prevention program to be conducted in an operational situation. The program would be carried out with a sufficient staff of competent fire prevention specialists and adequate support to mount a well-rounded program.

The design of the program was essentially that of a before- and after-study. Butte County, in north-central California, was selected as the locus of the experiment that became known as the *BUCO Project.* An initial survey measured the existing levels of knowledge and attitudes concerning the use and abuse of fire in wildland areas among the resident population of the county. Some difficulty was experienced in assembling the staff of prevention personnel for carrying out the intensive program. Consequently, only during 2 years (1968 and 1969) out of the six did the program approach that planned. The fire prevention program conducted included emphasis on information and education, engineering, and law enforcement. In 1970, a resurvey was conducted from which changes induced by the experimental program might be measured.

A comparison of the data from the two surveys showed little change in the levels of knowledge and attitudes among the resident population from 1964 to 1970 in spite of the diligent efforts of all members of the fire prevention staff. Some differences were observed in areas of the county where special programs, such as intensive hazard reduction programs, were conducted. Fire records do show a drop in fire starts in the county during the period of intensive prevention action–1968 and 1969. Regression analysis of these records and those of adjacent counties was not conclusive in showing this drop to be due to the experimental program, however.

The experiment demonstrated that it is difficult to produce large-scale, rapid changes in autonomous individuals. The initial character of the population involved also affect the outcome. Pre-existent, generally favorable attitudes, for example, may be reinforced, but are not amenable to marked intensification. Results from program activities were most apparent from such specific actions as hazard reduction contacts and direct "Team Teaching" education efforts with children in the schools. The experience was effective in revealing important factors concerning organization and administration of fire prevention personnel, time and cost of specific operations, and similar operational matters.

In the mid-1950's, wildland fire protection agencies in California–primarily the California Division of Forestry and the U.S. Forest Service–became uncomfortably aware that they faced a problem that threatened to overpower their control efforts. Soaring values at risk and ballooning control costs suggested greater concentration on stopping fires before they began.

About 90 percent of all forest fires in areas protected by the State and more than 50 percent of those in areas under U.S. Forest Service protection are man-caused; that is, they result from the ig-norance, carelessness, indifference, or malice of people in their varied uses of the forests. The preven-tion of such fires was seen to involve the modification of the knowledge, attitudes, and behavior patterns of forest users, but the most effective ways of accomplishing this puzzled the protection agencies.

In 1955, a jointly sponsored research contract was awarded to the University of Southern California to make some preliminary studies of the human behavioral aspects of forest fire protection. The recommendations of the report that resulted were later incorporated in a research program assigned to the Pacific Southwest Forest and Range Experiment Station.

This paper evaluates the effectiveness of an experimental, coordinated fire prevention program in Butte County, in north-central California, and reports the findings of what became known as the *BUCO Project.*

BUCO PROJECT

Research Approach

Researchers at the University of Southern California defined 8 criteria they considered *essential* in determining the location of the test community for an experimental fire prevention program. These included: (a) availability of data on the incidence of man-caused forest and wildland fires for a five year period; (b) facilities for ascertaining a risk factor; (c) a representative pattern of fire causation; (d) a cooperative organizational climate; (e) availability for data gathering facilities; (f) a pattern of use including residency, logging, and recreation; (g) cooperative mass communications media; and (h) population stability.

An additional seven criteria were proposed as *desirable:* (a) substantial areas under the jurisdiction of the California Division of Forestry and the U.S. Forest Service; (b) availability of data on risk rating for the previous five-year period; (c) availability of data on the characteristics of the resident population; (d) availability of additional data on the incidence of man-caused forest and wildland fires; (e) availability of data on fire prevention efforts; (f) cooperation of private forest landowners, and (g) availability of information on the violations of fire laws and regulations in previous 5 years.

In consultation with Division of Forestry and Forest Service representatives the University researchers determined that a county, rather than a community–was the unit of study best suited to meet the criteria. The uniformity of county ordinances and relative autonomy of administrative jurisdiction were among the considerations in making this decision. (The boundaries of a Ranger Unit, a basic administrative division of the California Division of Forestry, usually coincide with county boundaries.)

On the basis of the criteria previously outlined, the number of qualifying counties of the State was reduced to 12 and then to five. Butte County was finally selected as the county possessing the greatest number of essential and desirable qualities for such a study *(fig. 1).*

The planning, collection of background data, and establishing of working relations culminated in a survey of the resident population of Butte County in fall 1964. This survey determined the existing level of attitudes and understanding of the local residents per-

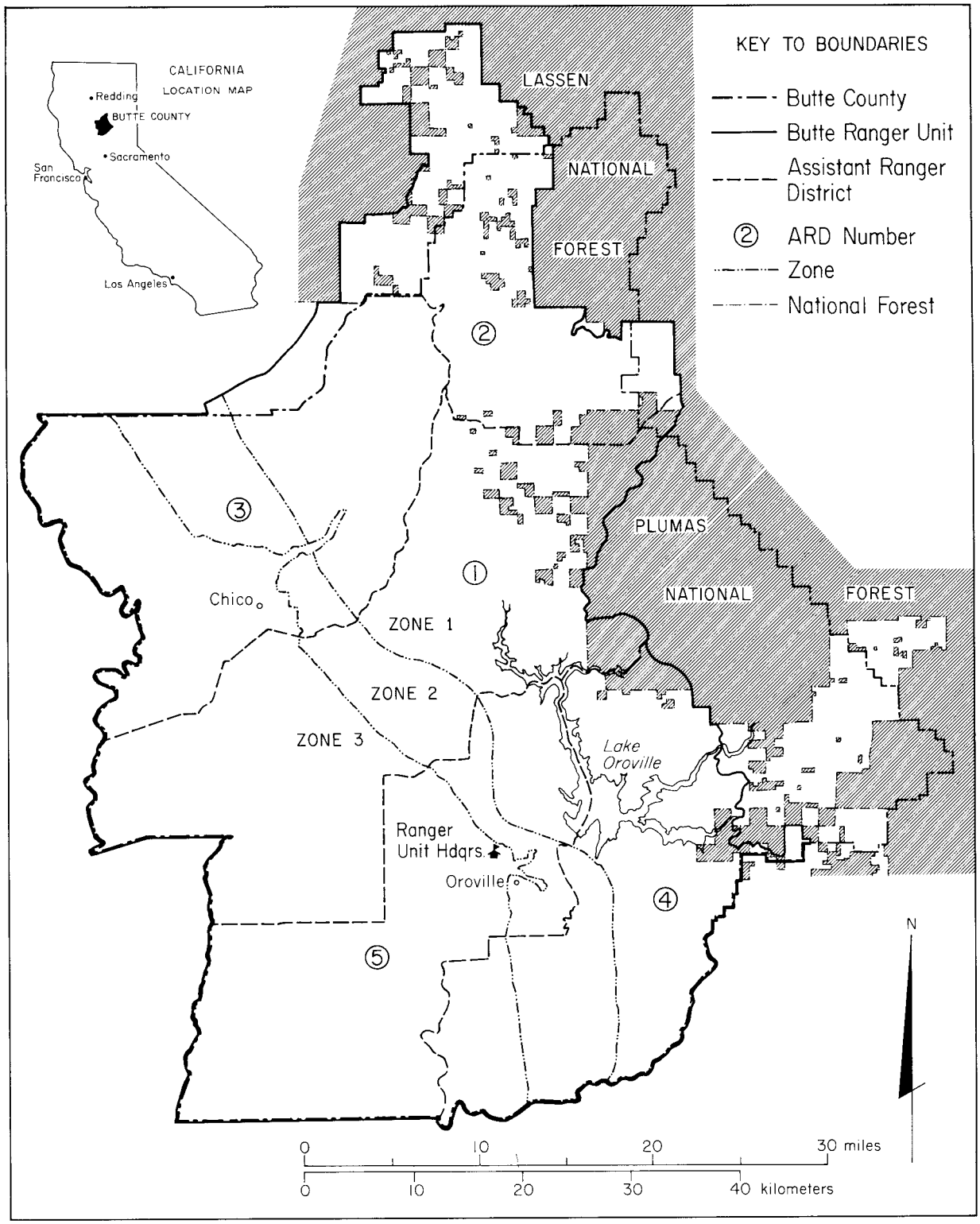

Figure 1—The Butte Ranger Unit, California Division of Forestry, served as the site for an experimental fire prevention program carried out from 1964 to 1970. It is divided into five Assistant Ranger Districts. Zone I lands are forest or watershed lands; Zone II lands are primarily rangelands; and Zone III lands are areas without State or Federal interest in timber, watershed, range, or erosion.

taming to the use of fire and of fire prevention (Folkman 1965). The survey results served as a benchmark from which changes induced by the experimental program would be measured.

Ideally, the classic research approach, with control and test subjects, would have been used. But the University of Southern California scientists concluded that the variance between counties was too great, and the control of extrinsic variables too limited for this approach to be feasible. Consequently an alternative method was selected, i.e., the test-retest procedure, in which one county would be compared with itself at different times.

The reliance on determining the effect of the program by means of measuring changes in levels of attitude and knowledge, rather than using actual changes in fire starts, may require some justification. Feelings and understandings have only a limited relationship to actual behavior, so to use measures of these attributes as *criteria* of program success is not particularly satisfactory. On the other hand, the number of fire starts varies so markedly from season to season as influenced by such uncontrolled, and uncontrollable, factors as variations in rainfall, wind, fuel accumulations, that such variation in numbers of fire starts attributable to the program would most likely be masked by these other, more powerful, influences. The use of indirect criteria, therefore, was considered to be unavoidable.

Implementing the BUCO Project met with initial discouragement. The large-scale funding anticipated by the original planners did not materialize and no additional funds or staffing were immediately forthcoming to carry out the proposed experimental program. It became evident that in an action program, such as this, considerable improvisation and alteration of plans is to be expected.

For some time the action program was limited to such additional emphasis to fire prevention that the existing staff could give as other duties permitted. Research studies concerned with roadside fire prevention signing (Ruckel and Folkman 1965, Folkman 1966a) conducted in the county, experiments involving inspections for fire hazard reduction (Folkman 1967, 1968), and development of conservation/ fire prevention education in public schools (Gladen and Carkin 1970) also provided some inputs to the fire prevention activity in the county.

The California Division of Forestry conducted a workload inventory of the Butte Ranger Unit. This inventory defined the fire prevention job for Butte County and provided the basis for calculating the number of man-hours per year needed to do the fire prevention job. This analysis formed the basis for a budget request to the State Legislature for optimum staffing of the Unit. The request provided for 16 fire prevention positions. (Up to then the Unit had no one assigned full time as a fire prevention officer.) The proposed 16 new positions were considered adequate to handle 75 percent of the workload inventory (Moore 1970). It was estimated that 25 percent of the prevention work was of such a nature that fire control, administrative, and professional (foresters, engineers, etc.) personnel could do it with a minimum of additional training. Under provisions whereby the State reimburses the U.S. Forest Service for protection of private land within National Forest boundaries, it was proposed to finance two fire prevention personnel to work in the units of the Plumas and Lassen National Forests within Butte County boundaries.

Staffing

Project Butte [1] was authorized by the State Legislature for activation during the 1966-67 fiscal year. This provided funding for the 16 fire prevention positions within the Butte Ranger Unit, but not for the two positions for the National Forests. These two positions were never filled. The original intent was that the project would be activated in stages throughout the first 10 months of the fiscal year so as to be fully operational before the 1967 fire season. Because of problems in meeting this timetable, however, Project Butte was not completely staffed before the end of that season. Except for normal vacancies it remained fully staffed through the 1968 and 1969 fire seasons.

Since this staffing was to serve as a pilot model for future normal operations in other ranger units, it was fully integrated into the existing ranger unit organization *(fig. 2).* The Ranger in charge of the Ranger Unit directed the work of two Associate Rangers. Assigned to the Associate Ranger for Fire Prevention were: three Fire Prevention Officers II (one each responsible for information and education, fire prevention engineering, and law enforcement), a stenographer, and a Fire Prevention Officer I, who worked under the Fire Prevention Officer II in charge of law enforcement. The existing structure provided an Associate Ranger for Administration to whom were assigned Assistant Rangers who headed each of the

[1] The field input of the experimental fire prevention staff was given this title by the California Division of Forestry to preserve a distinction from the over-all research study known as the BUCO Project.

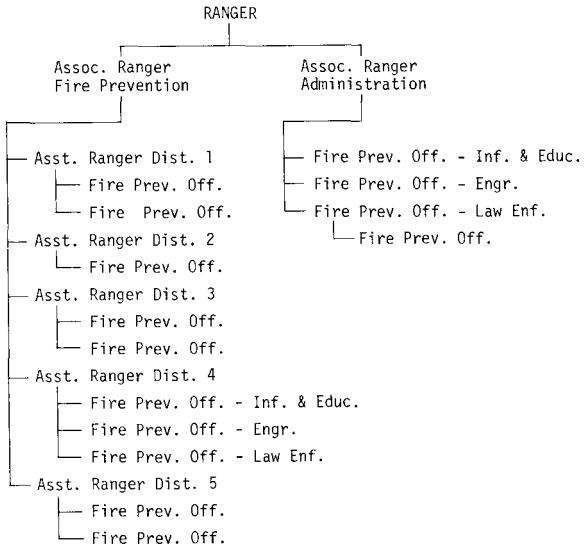

Figure 2—Fire prevention work in the Butte Ranger Unit was carried out by the Associate Ranger and his staff at Unit headquarters and fire prevention officers administratively assigned to each of the five Assistant Ranger Districts.

five Assistant Ranger Districts into which the Unit was divided. Depending on fire prevention work load, from one to three of the other 10 Fire Prevention Officers were added to each of these Assistant Ranger Districts. These fire prevention personnel were originally assigned to geographic subdistricts in which each person was responsible for the full fire preven-tion program.

The original assignment of positions and duties at the headquarters staff level proved effective and no changes in organization at this level were deemed necessary during the course of the project. The organization in the Assistant Ranger Districts, however, was modified after about a year's trial. It was found that functional, rather than geographical assignments provided more flexibility and efficiency–both within and between Districts. Each Fire Prevention Officer was given primary responsibility within a District for one of the three major components of the fire prevention program: information and education, engineering, or law enforcement. Assignment of secondary and tertiary responsibilities allowed any officer to fill in for another when necessary, and all officers were thus kept familiar with the total prevention situation within the Assistant Ranger District to which he was assigned. It was not uncommon for a problem to arise requiring the participation of a number of officers on an inter-District basis. The Associate Ranger for Fire Prevention had authority to withdraw Fire Prevention Officer I's as necessary from Assistant Ranger Districts to handle these emergency situations. Under the reorganization this could be done without leaving major components of the fire prevention program unmanned in any District. This increase in efficiency and promptness in meeting emergencies quite outweighed the advantages of having one individual intimately acquainted with one geographical sub-District.

During fiscal year 1970-71 some of the Project Butte positions were reassigned to other Ranger Units in other parts of the State. By the close of 1970 fire season, when the resurvey of the resident population of the county was made, the Project Butte staff had been gradually reduced to one FPO II and four FPO I's as called for by a new fire protection plan approved by the State Board of Forestry.

FIRE PREVENTION ACTIVITIES

The fire prevention activities in this experimental program consisted of hazard reduction work, information and education, and law enforcement. Statistics reporting numbers of contacts, programs given, or fire prevention supplies distributed are only rough indicators of the magnitude of the program. They, in themselves, convey little of the quality of the activities, the emphasis given, or the effect on the behavior of recipients. The records, however, do show a marked increase in most prevention activities during the experiment. This is particularly true in 1968 and 1969 *(table 1).*

Some increases in certain types of prevention activity would no doubt have occurred regardless of the experimental program (albeit, at the expense of other lower priority activities) because of significant changes taking place in the Butte Ranger Unit that increased fire prevention work load during the time of the study. Although population stability was one of the "essential criteria" used in selecting the area, the construction of the Oroville Dam on the Feather River and associated facilities in Butte County between 1961 and 1968 resulted in a tremendous increase in certain types of hazards and risks. This was particularly true from 1964 through 1966, when construction reached its peak and there was a temporary influx of workers into the area. In addition to this population increase, Butte County also shared in the

Table 1–*Forest fire prevention activities in Butte County, California, 1964-71*[1]

Activity	1964	1965	1966	1967	1968	1969	1970	1971
	Number							
Prevention effort contacts:								
Fire station personnel	7,219	3,140	4,785	11,267	20,861	9,619	14,542	15,428
Patrolmen	3,367	12,985	13,682	21,708	69,003	27,791	12,010	9,844
Assistant rangers	2,877	2,411	2,579	3,973	2,377	2,691	2,488	2,176
Others	905	404	813	5,956	3,294	4,537	4,313	6,289
Total	14,368	18,940	21,859	42,904	95,535	44,638	33,353	33,737
Outlets-contacts--programs:								
Newspapers	20	10	51	330	1,566	1,012	614	653
Radio	2	5	15	28	864	850	364	237
Television	6	2	5	1	793	112	189	170
Theater	18	12	0	6	34	8	0	0
Others	5	7	2	0	0	0	0	0
Total	51	36	73	365	3,257	1,982	1,167	1,060
Schools	2,538	2,179	1,461	1,298	7,356	8,856	6,982	3,556
Service groups	291	202	83	830	782	233	303	272
Women's groups	0	42	350	253	160	376	21	153
Youth groups	180	307	988	1,446	2,057	917	1,271	318
Agricultural groups	75	132	68	100	584	203	141	153
Sportsmen's groups	0	0	0	50	588	738	201	13
Conservation groups	296	0	0	120	223	40	18	3
Others	90	424	135	0	587	464	485	306
Total	932	1,107	1,624	2,799	4,981	2,971	2,440	1,218
Fire prevention materials postings:								
Posters								
By Calif. Div. For.	69,826	31,310	1,348	896	2,005	1,221	907	5,622
By cooperators	1,195	1,320	268	600	2,163	399	557	662
Other materials								
By Calif. Div. For.	22,890	3,650	76,342	30,514	75,699	383,216	25,473	41,903
By cooperators	267,925	442,297	353,822	393,465	422,953	312,155	363	9,036
Roadside signs	23	18	27	22	28	44	47	40
Burning:								
Permits issued	6,731	4,480	4,755	4,367	4,569	6,819	6,731	8,062
Burning sites inspections	2,942	2,111	2,624	1,559	2,571	3,374	2,753	1,350
Existing or potential hazards and risks:								
Mechanical equipment (inspections):								
Agricultural	50	21	79	65	57	13	1	0
Forest products	54	35	299	455	82	70	86	30
Construction	265	982	3,279	346	50	44	48	8
Other industrial	3	2	2	5	32	17	23	10
Total	372	1,040	3,659	871	221	144	158	48

continued

Table 1–*Forest fire prevention activities in Butte County, California, 1964-71* [1]—Continued

Activity	1964	1965	1966	1967	1968	1969	1970	1971
				Number				
Roadside (miles treated):								
State highways	0	0	29	15	104	79	60	25
Country roads	116	60	130	225	50	139	18	18
Cal. Div. For. Admin. Rds.	0	0	40	55	15	30	0	0
Utilities (miles treated):								
Railroads	62	33	54	33	42	59	46	46
Powerlines	0	18	93	227	355	551	331	211
Other	20	20	0	0	0	0	0	0
Dumps (inspections) public, private	31	20	32	28	41	47	44	12
Recreation (inspections):								
Resorts	16	8	6	13	19	6	2	2
Organized camps	5	1	10	7	8	3	10	4
Campgrounds	126	78	218	219	234	119	155	1
Other	0	0	0	17	36	12	24	8
Total	147	87	234	256	297	140	191	15
Forest products (inspections):								
Sawmills	13	10	6	9	11	6	4	8
Other mills	2	0	2	3	1	13	3	0
Operating areas	61	65	60	64	30	21	25	15
Total	76	75	68	76	42	40	32	23
Industrial operations (inspections):								
Agricultural	19	15	19	18	7	2	2	0
Mineral	3	1	2	8	7	7	1	1
Construction	49	18	512	28	54	46	19	2
Other	0	0	0	5	54	10	14	0
Total	71	34	533	59	122	65	36	3
Structures, premises (inspections):								
Mountain cabins	811	296	384	621	547	371	395	287
Ranches, farms	188	45	170	431	416	251	136	23
Rural dwellings	1,186	337	2,048	2,296	2,297	2,644	2,109	600
Other	0	0	31	49	93	91	370	17
Total	2,185	678	2,633	3,397	3,353	3,357	3,010	927

[1] Source: Annual Reports (Form FPE-2) of California Division of Forestry 1964-1971.

general population growth that California was then experiencing. During the decade 1960 to 1970 the population of the county increased 24.3 percent–from 82,030 to 101,969 (U.S. Bureau of the Census 1971). This growth in population was concentrated in the urban areas. The rural population declined 3.9 percent, while the urban population increased 49.3 percent.

Because of these changes, the reported increase in numbers of inspections of industrial operations and of mechanical equipment over the course of the experiment is only partly attributable to the experi-

mental program. Similarly the development of new campgrounds and other recreational facilities about the anticipated lake resulting from the dam construction added further to the workload and precipitated a need for additional inspections in this area.

Hazard Reduction

A legislative change in the State Public Resources Code in 1963 placed greater emphasis on the clearing of inflammable vegetation and other materials from around rural structures. This change was not immediately felt, but by 1966 it was providing impetus for intensified hazard reduction inspections of rural residences and mountain cabins in high-risk areas as part of the experimental program input. The record concerning inspections of structures and premises reflects this emphasis *(table 1).*

In 1966, five selected areas in the county near Oroville, were studied to assess the effectiveness of various fire hazard inspection procedures in securing compliance with fire safety requirements of the revised code. A specially trained crew of inspectors was used. The effects of different types and combinations of contacts and timing in the inspection of rural properties and the time expended were measured. The results suggested that fire law inspection is most effective when the fire prevention education function, rather than law enforcement, is stressed (Folkman 1967).

In 1967 this fire hazard inspection study was repeated in the same areas. In this study the carry-over effect of the inspection procedure was demonstrated (Folkman 1968). The area covered in these two studies continued to receive special attention by fire prevention personnel throughout the course of the project.

Project Butte also included working closely with State and county highway departments, railroad companies, and public utilities to secure their cooperation in reducing fire hazards. Training sessions were held with personnel of these organizations to help them to identify areas needing special attention and to give them instruction in prevention measures. Rights-of-way and facilities were periodically inspected to insure compliance with the Public Resources Code *(table 1).*

Information and Education

Informing and educating the general public by means of newspapers, television, and radio were emphasized during the experimental program. The magnitude of these efforts is suggested by the increased number of contacts with these media reported, especially in 1968 and 1969 *(table 1).* These contacts sought to encourage the mass media to keep the public sensitive to the fire problem and aware of subjects of particular concern at specific times (such as problems with debris burning, children-caused fires, incendiarism, etc.) and to educate them as to sound fire prevention measures appropriate to their use.

In carrying out the assignment, information and education officers encountered difficulty in competing with their own organization's more "news worthy" fire control activities. Their fire prevention effort was further diluted by the necessity for them to report other Division of Forestry activities, such as station or facility construction, truck trail maintenance, personnel assignments, and social events. (Presumably, all of this, by keeping the Division before the public, has a latent if not manifest function of keeping the public fire and fire prevention conscious.)

To get some objective measure of the fire-related content actually appearing in the newspapers, and to determine the changes in amount and emphasis, I did a content analysis of the newspapers serving the county from 1958 through 1968. The newspapers analyzed were the *Chico Enterprise Record, Oroville Mercury Register, Gridley Herald, Feather River Times, Biggs News,* and–for comparative purposes–*Sacramento Bee.* Similar measures of the use of radio and television would have been desired, also, but the logs kept by the stations did not provide the detail (particularly of spot announcements, etc.) which was necessary for such an analysis.

The analysis shows that the number of fire-related items (exclusive of reports of fires) appearing in the local newspapers did increase during the period of the project, especially fire prevention articles and news *(table 2). The Sacramento Bee,* which covers a wider area than the other five newspapers consistently published fewer such articles, and it did not show a consistent increase in number of items over the time period studied. The local papers increased the number of fire warning articles, fire prevention ads, reports of fire arrests, and in reports of other Division of Forestry activities not specifically related to fire prevention.

Five radio stations serve the Butte County area, but their coverage is not confined to it. Their combined daily listening audience is estimated at 250,000 people–two and one-half times the population of Butte County. The number of reported contacts with radio stations ranged from only two in 1964 to 864 in 1968 *(table 1).* The figure 864, by itself, may seem unimpressive, but summarizes the effort to write and tape 38 fire prevention spot announcements–each 15

Table 2–*Average number per year of fire prevention articles and related items appearing in Butte County, California, newspapers*[1] *and in* The Sacramento Bee, *by groups of years, 1958 to 1968*

Article or item	*The Sacramento Bee*			Butte County Newspapers[1]		
	1958-62	1963-66	1967-68	1958-62	1963-66'	1967-68
Fire prevention speech to adults	2.0	0.0	0.0	4.2	0.0	4.5
Fire prevention speech to children	.0	.0	.0	4.2	5.0	7.5
Training program for adults	2.2	.0	.0	1.2	.0	1.5
Training program for children	.0	.0	.0	.0	.0	.5
Fire warnings	11.2	10.0	12.5	33.0	42.5	49.5
Firemen sports teams	2.0	.0	.0	6.0	10.0	5.0
Firemen women's auxiliary	.0	.0	.0	4.4	10.0	11.5
Insurance	1.0	.0	1.5	4.4	7.5	4.5
Insurance ads	.0	.0	.0	9.6	.0	6.5
Fire prevention ads	.0	.0	.0	1.2	5.0	12.0
Fire prevention ads-private sponsored	.0	.0	4.5	2.0	.0	5.5
Fire calls (summary)	.0	.0	.0	.0	.0	1.0
Fire Prevention District Articles (or pictures)	13.8	70.0	29.5	24.6	37.5	59.5
Fire Information reports (statistic on No. of fires, etc.)	23.8	12.5	4.5	45.2	27.5	20.5
Fire Information-human interest-Smokey Bear, etc.	7.8	17.5	15.0	15.8	22.5	13.0
Fire arrests; fire starts-not arson	1.0	2.5	.5	11.2	2.5	26.5
Fire arrests-arson	.0	.0	.0	2.2	.0	.5
Letters to editors	3.6	2.5	.5	4.8	2.5	6.5
Firemen's social events	4.6	12.5	3.5	9.0	17.5	13.0
Fire prevention-human interest	.0	.0	4.0	3.2	2.5	.0
Fire prevention-research article	1.6	.0	1.0	6.0	5.0	.5
Editorials	.0	.0	.0	3.8	.0	2.0
Other	4.6	2.5	4.0	3.6	2.5	1.0
Total	79.2	130.0	77.0	199.6	200.0	252.5

[1] *Chico Enterprise Record, Oroville Mercury Register, Gridley Herald, Feather River Times,* and *Biggs News.*

seconds to one minute in length. All stations transmitted an average of three spots per day during the fire season. It includes the 70 news releases which were provided to the radio stations. (These were generally condensed versions of stories released to the newspapers.) Also included are the 80 tape-recorded "on-the-spot" interviews which were given to the stations' mobile reporters. Generally these were fire activities.

Butte County has one television station. The station claims a viewing audience of about 150,000 people during peak viewing hours. In 1968, the Butte Ranger Unit personnel provided 793 releases to this station. Most were transmitted twice daily–during the 6 p.m. and 11 p.m. news reports. A fire response board was prepared on which was shown the fire activity daily for the area. During the showing of the board, the newscaster would insert a fire prevention message and, possibly, supplement it with a short film clip of a current fire.

During 1968, the Butte Ranger Unit information and education officer appeared 10 times on television. He covered such subjects as children-caused fires, incendiary fires, incinerator standards and use, and fire safety during the deer season.

Children contribute significantly to the fire problem in Butte County. They are responsible for about one-fourth of the forest fires reported. Of the 30,247 children under the age of 18 in Butte County in 1970 (U.S. Bureau of the Census 1971a), 8,818 (29.2 percent) were in the critical ages of 5 to 10, when experimentation with fire is most prevalent (Folkman 1966b). Special efforts were made by Project Butte personnel (Goings 1968) and BUCO Project researchers to develop new methods and materials for effectively teaching fire prevention and conservation of natural resources to children in kindergarten through the third grade. Much of this work was done through California State University, Chico (Gladen and Carkin 1970). A particularly successful system of

"team teaching" was worked out, in which California Division of Forestry employees would divide a class into small groups of children, five to seven per group, and lead them in a discussion of a limited number of prevention ideas. These discussions were limited to 8 to 10 minutes to accommodate the limited attention span of children of this age level. For a grand finale, Smokey would appear briefly before the reassembled class to reinforce what the children had learned and the commitments to fire safety they had made. A significant proportion of the school children were reached in this and other school programs during the 1968 to 1970 period *(table 1).*

The field fire prevention officers developed slide shows and programs using other types of visual aids for appearances before various types of groups of youths and adults. A fire prevention poster and essay contest was developed in cooperation with the Junior Women's Club.

Law Enforcement

One of the main functions performed by those with law enforcement responsibility is to investigate fire cause. A knowledge of fire cause is basic to any planning of fire prevention programs. Affixing cause in forest fire cases is extremely difficult, however. Before the experimental program was started, "known cause" was recorded in less than one-third of the forest fire reports in the Butte Ranger Unit. In 1967, the first year of operation in which specifically trained fire prevention officers were beginning to be available, the percent of known causes was 40 percent. In 1968 the percentage increased to 52 percent, and in 1969 the known causes increased further to 58 percent.

In the enforcement of fire laws, knowing the cause of a fire is only a preliminary to enforcement action. Establishing the identity of the person (or persons) responsible is generally an even more difficult procedure. Proving this identity to the satisfaction of a court of law adds increased complications. When investigation has provided satisfactory answers to these issues, the circumstances of the case are evaluated, taking into consideration all of the legal aspects and Division policy, to determine what enforcement action is applicable.

In the experimental program developed under Project Butte, law enforcement was regarded as complimenting the education and fire engineering components of the program. The objective of the whole program was reduction of man-caused fires. In general, law enforcement was accepted as a last resort measure–applicable in dealing with those relatively rare cases in which education and engineering were ineffective. It was anticipated that the publicizing of court cases would underline the legitimacy of fire regulations and the seriousness of any violation of them. Thus, this would reinforce the educational efforts being undertaken.

Butte Ranger Unit records show these law enforcement activities:

	1967	*1968*	*1969*	*1970*
Activity:				
Number of investigations	325	269	340	346
Misdemeanor cases	17	35	12	13
Felony cases	1	1	1	0
Misdemeanor convictions	15	33	9	13
Felony convictions	1	1	1	0

Throughout the course of the experiment, the knowledge that the county was being used as an experimental area was deliberately kept from the public in order to avoid the effect such knowledge, itself, may have had on their behavior. The final survey revealed that some people were aware of an increased prevention activity in their area, but, they appear to have remained unaware of the experimental program itself.

MEASURING THE RESULTS

Resurvey

The resurvey of the resident population of Butte County followed the same design as that used in the original survey (Folkman 1965). No attempt was made to interview the same people contacted in the first survey. Instead, an entirely new sample was drawn by using the same area sampling procedure. A comparison of social and demographic characteristics of the two samples revealed a reasonably close correspondence between them *(table 3).* Most of the differences reflect changes that took place in the population during the interim period. The 1970 sample does appear somewhat under represented in the "under 25 years of age" category. An over representation of similar magnitude in the "over-65 years of age" group is also apparent. The distribution of the 1970 sample by place of residence reflects the rapid growth of the suburban population in Butte County and the decline in rural population.

Items reflecting exposure to the high fire risk

Table 3–*Comparison of certain social and demographic characteristics of Butte County, California, residents, 1964 and 1970 surveys*

Characteristics	1964 (n = 761)	1970 (n = 663)
	Percent	
Age:		
14-24 years	23.4	17.6
25-34 years	13.8	13.4
35-49 years	25.8	16.7
50-64 years	21.7	26.6
65 years and over	15.2	24.0
Not reported	.1	1.7
Total	100.0	100.0
Sex:		
Male	48.5	44.6
Female	51.5	55.1
Not reported	–	.3
Total	100.0	100.0
Marital status:		
Single	18.5	16.0
Married	68.5	65.1
Widowed, divorced or separated	13.0	18.7
Not reported	–	.2
Total	100.0	100.0
Race:		
White	97.5	96.6
Black	1.3	1.2
Other	1.2	1.1
Not reported	–	1.1
Total	100.0	100.0
Schooling completed:		
0-4 years	3.7	2.6
5-7 years	6.7	6.2
8 years	14.8	14.2
Some high school	25.8	24.6
High school graduate	23.1	25.6
Some college	17.6	19.0
College graduate	4.7	4.0
Post-graduate	3.6	3.0
Not reported	–	.8
Total	100.0	100.0
Occupational status:		
Employed, full time	37.3	32.9
Employed, part time	15.3	15.1
Retired or disabled	13.1	21.3
Housewife	22.2	24.7
Student	11.8	3.8
Not reported	.3	2.0
Other	–	.2
Total	100.0	100.0

Characteristics	1964 (n = 761)	1970 (n = 663)
	Percent	
Family income (dollars):[1]		
Under 1,500	8.0	5.1
1,500-2,999	12.8	13.4
3,000-4,499	13.3	15.7
4,500-5,999	13.1	11.3
6,000-7,999	17.3	13.3
8,000-9,999	10.8	11.9
10,000-14,999	12.9	18.8
15,000-19,999	2.5	5.7
20,000 and more	.9	1.5
Not reported	8.4	3.3
Total	100.0	100.0
Length of residence in neighborhood (years):		
Less than 1	18.4	8.0
1-2	17.5	24.2
3-5	17.6	13.1
6-10	12.2	19.6
10 or more	34.3	35.1
Not reported	–	–
Total	100.0	100.0
Place last lived:		
Elsewhere in Butte County	32.3	40.1
Other county, Northern California	31.0	25.2
Other county, Southern California	12.9	13.1
Other states	14.4	10.7
Always lived here	9.3	10.9
Not reported	.1	–
Total	100.0	100.0
Present residence:		
City	47.8	43.0
Suburb	18.9	33.0
Small town or village	13.3	7.2
Open country, farm	8.9	6.3
Open country, non-farm	6.1	9.4
Not reported	–	1.1
Total	100.0	100.0

[1]Median income in 1964: $5,842; in 1967: $6,420.

forest, or wildland, environment show that most Butte County residents continue to use these areas *(table 4)*. However, the proportion reporting no wildland visits during the preceding year was higher than in the 1964 survey. This may be a reflection of the higher proportion of older people included in the

Table 4–*Comparison of wildland and fire use of Butte County, California, residents, 1964 and 1970 surveys*

Characteristics	1964	1970
	— *Percent* —	
Number of wildland visits:		
None	24.0	31.5
1-2	11.3	13.3
3-5	16.6	13.0
6-10	16.0	9.6
11 or more	32.1	31.4
Don't know	–	–
Not reported	–	1.2
Total	100.0	100.0
Frequency of use of fire in wildlands:		
Not at all	71.2	73.4
1-2	10.9	9.8
3-4	6.8	5.6
5 or more times	12.0	10.9
Don't know	–	–
Not reported	.1	.3
Total	100.0	100.0
Obtained a campfire permit?		
Yes	29.0	18.0
No	70.2	81.4
Don't know	.7	–
Not reported	.1	.6
Total	100.0	100.0
Obtained a burning permit?		
Yes	35.6	41.2
No	63.3	58.2
Don't know	1.1	.3
Not reported	–	.3
Total	100.0	100.0
Ever helped fight a forest fire?		
Yes	30.4	21.4
No	69.3	78.1
Not reported	.3	.5
Total	100.0	100.0

1970 survey–wildland use being closely correlated with age. The proportion reporting over 10 visits remained essentially unchanged from the earlier study. This was also true of the reports of frequency of use of fire in wildland areas. Possession of a *campfire* permit has dropped sharply in the years between the two surveys, while the obtaining of a *burning* permit experienced a slight increase. In summer 1970, the U.S. Forest Service changed its regulations regarding campfire permits, making them no longer required in established campgrounds in the National Forests. This change undoubtedly was responsible for the drop in the possession of campfire permits. The reduction in the proportion reported having helped fight a forest fire at anytime in the past is inexplicable.

Results

Knowledge about fire prevention and fire behavior was measured by the same 20-item multiple choice instrument used in the original survey *(table 5).* Mean scores for the two tests did not differ significantly: 58.1 percent correct in 1964 and 57.6 percent in 1970. However, the average figures mask significant differences in the distribution of scores *(table 6).* There were fewer very low scores (less than 50 percent correct) and more high scores (75 percent or more) in the 1970 survey than in the 1964 survey. It was the distributions within the middle range that resulted in near identical scores.

The California Division of Forestry at the time of the study classified the lands within its area of responsibility into three zones *(fig. 1).* Fire prevention and fire control plans and operations were strongly influenced by this classification. The three zones were: Zone I–lands covered wholly or in part by forests or by trees producing or capable of producing forest products; and lands covered wholly or in part by timber, brush, undergrowth, or grass, whether of commercial value or not, which protect the soil from excessive erosion, retard runoff or water or accelerate water percolation, where such areas are sources of water which is available for irrigation or for domestic or industrial use; Zone II–lands in areas which are principally used or useful for range or forage purposes which are contiguous to the lands in Zone I; Zone III–those valley lands having no State or Federal interest in timber, watershed, range or erosion and are the fire protection responsibility of local agencies.

The State Division of Forestry contracts with counties for Zone III protection where the State is already protecting mountain areas and is established in the fire protection business. Through these contracts, the State does the entire protection job and is reimbursed by the county concerned for the effort expended on non-State interest land.

In 1972, the California Division of Forestry discarded the Zone classification. It no longer distinguishes between the former Zone I and II lands, but refers to them collectively as Clarke-McNary lands. Former Zone III lands are referred to as Contract Lands.

Table 5–*Distribution of responses to items in the Knowledge Test, 1964 and 1970 surveys*

Knowledge Test item	1964 (n = 761)	1970 (n = 663)
	Percent	
Green trees and shrubs of California:		
Are very difficult to burn	19.6	21.9
Will not burn at all	1.6	2.7
Will catch fire and burn very rapidly[1]	43.4	46.6
Will burn only in the hot summer months	27.7	21.1
Do not know	7.7	7.7
	100.0	100.0
If you take extra gasoline for your camp stove, you should carry it in:		
A glass jar or jug	1.6	.8
A safety can[1]	72.2	73.3
A container in which flammable liquids are purchased	21.9	20.9
A plastic container such as is used in the kitchen	1.7	1.8
Do not know	2.6	3.2
	100.0	100.0
The safest method for lighting cigarettes in the forest area is to use:		
Book-type safety matches	19.3	16.7
Strike anywhere, stick-type matches	1.2	1.4
Stick-type safety matches	8.3	9.2
A cigarette lighter[1]	65.4	63.5
Do not know	5.8	9.2
	100.0	100.0
The surest way to put out a campfire assuming all these methods are available, is to:		
Pour water on it	7.1	12.1
Completely cover it with dirt	34.3	29.3
Pour water on it and stir thoroughly[1]	56.6	55.0
Spread out the embers and let it burn itself out	1.2	2.3
Do not know	.8	1.3
	100.0	100.0
If you are negligent with your campfire or warming fire and it escapes to the property of another, whether privately or publicly owned, you are:		
Not liable for damages	.5	.6
Criminally liable, but not civilly liable	4.3	3.0
Civilly liable, but not criminally liable	15.7	19.0
Both criminally and civilly liable[1]	32.2	33.6
Liable, but don't know which	37.6	32.6
Do not know	9.7	11.2
	100.0	100.0
If you drive your car off the road in dry grass areas:		
Exhaust sparks can start a fire	18.3	17.8
Sparks made by contact of metal parts of the car with rocks can set fires	3.7	3.3
Both 1 and 2 are correct[1]	61.8	66.7
Neither 1 or 2 are correct	5.0	2.0
Do not know	11.2	10.2
	100.0	100.0
A sign in a National Forest that reads "Closed Area" means:		
That you may enter, but not smoke in the area	3.3	1.4
You may enter, but not build any campfires in the area	6.4	6.5
You may not enter the area[1]	74.3	80.2
You may not hunt or shoot within the area	5.6	3.3
Do not know	10.4	8.6
	100.0	100.0
Windy weather:		
Tends to put out fires	.3	.5
Affects only poorly built fires	.6	1.3
Makes necessary more precautions with fires[1]	97.1	94.9
Has little or no influence on fires	.4	.6
Do not know	1.6	2.7
	100.0	100.0
Prevention of man-caused forest fires ultimately depends upon:		
More and better trained personnel	6.4	7.4
More and better equipment	4.1	5.4
Public cooperation and recognition of personal responsibility[1]	80.2	74.8
Better techniques of fire fighting with the equipment we have	5.1	5.4
Do not know	4.2	7.0
	100.0	100.0
When you are in a National Forest area in California, the law permits you to:		
Never smoke or build campfires	2.4	1.5
Smoke, but never build campfires	1.8	.9
Smoke and build campfires only in areas so designated, during specified periods[1]	85.4	86.5
Smoke and build campfires only during the wet season	3.3	3.7
Do not know	7.1	7.4
	100.0	100.0

[1]Indicates correct response.

continued

Table 5–*Distribution of responses to items in the Knowledge Test, 1964 and 1970 surveys*–Continued

Knowledge Test item	1964 (n = 761)	1970 (n = 663)
	Percent	
"Humidity" is a measure of:		
Temperature of the air	7.5	7.1
Amount of rainfall that has fallen in last 24 hours	2.9	1.5
Percent of cloudiness during the daylight hours	.9	.8
Amount of moisture in the air[1]	81.2	81.4
Do not know	7.5	9.2
	100.0	100.0
"Watersheds" are:		
Areas where rain falls or snow melts to supply water to springs and creeks[1]	47.1	49.1
Structures over railroads for protection against heavy snow and rain	6.7	5.9
Buildings with gutters that run water to a cistern	3.4	3.4
Lakes and reservoirs which collect the water runoff from forests	20.4	18.6
Do not know	22.4	23.0
	100.0	100.0
The time of day that forest fires typically will spread most rapidly:		
Sundown to midnight	8.8	8.0
Midnight to sunrise	4.3	2.1
10 a.m. to sundown[1]	58.0	58.8
Sunrise to 10 a.m.	4.5	5.7
Do not know	24.4	25.4
	100.0	100.0
A fire is more apt to start where there is:		
Low temperature and low humidity	1.6	1.2
High temperature and low humidity[1]	62.6	63.4
High temperature and high humidity	21.9	22.3
Low temperature and high humidity	3.0	1.4
Do not know	10.9	12.7
	100.0	100.0
A fire in the rotten vegetation found on the forest floor:		
Burns very rapidly–almost like a dry gunpowder train	18.6	17.8
Smolders slowly as in punk or cotton with little or no visible smoke[1]	49.5	42.7
Burns slowly along the top of the ground with easily detected production of smoke	17.1	20.9
Will not burn at all	1.8	1.7
Do not know	13.0	16.9
	100.0	100.0
The chief cause of forest fires in Butte County is:		
Lightning	17.5	16.0
Campfires	5.9	10.3
Children playing with matches	3.0	11.4
Smokers' cigarettes and matches[1]	58.8	45.4
Do not know	14.8	16.9
	100.0	100.0
The term "forest fire" means a fire which is burning out of control on lands covered wholly or in part by:		
Timber only	7.1	3.2
Timber and brush only	22.9	17.8
Timber, brush, and grass only	25.2	23.5
Timber, brush, grass, grain or other flammable vegetation[1]	39.5	50.5
Do not know	5.3	5.0
	100.0	100.0
The people responsible for starting most forest fires are:		
Hunters	12.4	11.4
Hikers	4.5	4.1
Campers	45.5	44.1
Local residents[1]	10.4	14.9
Do not know	27.2	25.5
	100.0	100.0
Of the approximately 3,000 forest fires in California each year, what percent are human caused:		
10 percent	6.2	3.5
50 percent	19.4	17.7
70 percent[1]	26.8	30.4
90 percent	25.3	26.4
Do not know	22.3	22.0
	100.0	100.0
Campfire permits are required for the use of:		
Gasoline or propane type camp stoves	2.2	1.4
Fire grates and charcoal burners	1.2	4.7
Open campfires	28.6	45.3
All of these[1]	58.7	40.6
Do not know	9.3	8.0
	100.0	100.0

[1]Indicates correct response.

Table 6–*Comparison of Knowledge Test scores*[1] *of Butte County, California, residents, 1964 and 1970 surveys*

Knowledge Test Score (percent)	1964	1970
	No. respondents [2]	
Less than 50	257 (224)	162 (195)
50-64	185 (214)	216 (187)
65-74	203 (195)	162 (170)
75 or more	116 (128)	123 (111)
Total	761	663

[1] Mean scores (percent correct): 1964-58.1; 1970-57.6.
[2] Figures in parentheses show expected frequencies. Test of statistical significance yielded $x^2 = 22.11$, df = 3, P <.001.

Table 7–*Comparison of knowledge scores* [1] *of residents of different geographic divisions of Butte County, California, 1970*

Knowledge Scores (percent)	Zone		
	I	II	III
	No. respondents		
Less than 50	22 (21)	29 (33)	111 (108)
50-64	28 (28)	44 (44)	144 (144)
65-74	22 (21)	28 (33)	112 (108)
75 or more	14 (16)	35 (25)	74 (82)
Total	86	136	441

[1] Figures in parentheses represent expected frequencies. Test of statistical significance yielded x2 = 6.49, 6df, .30 < P <.50.

Because of their presumed differential exposure to wildfire risks and to fire prevention efforts, it was expected that residents in the various Zones would differ in their knowledge of fire prevention and fire use. The 1970 survey revealed no significant differences among these residents, however *(table 7).* A similar comparison of residents from the area in which especially intensive fire hazard inspections were conducted (Folkman 1967, 1968) with those residing in Zone III resulted in differences that approached statistical significance *(table 8).* Those from the experimental area tended to have higher scores.

Special tabulations were made, by cause, of the fire statistics for these areas which were subject to the intensive fire hazard inspection procedures *(table 9).* They show a marked drop in the number of fires attributed to debris burning and to children playing with matches. These types of fires were the subjects of special concern in this aspect of the program.

Butte County residents still have a limited awareness of the forest fire incidence in their county. Half of the respondents in 1970 said they did not know the number of fires and nearly all who ventured an estimate fell far short of the actual number *(table 10).* Even so, they were more inclined than those in 1964 to feel that the number was more than usual. Actually, the number in 1970 (214) was near the long-term average for the county, while the number in 1964 (331) represented the highest number in recent years.

The proportion of respondents in the two surveys who were familiar with the nature of fire danger in California (i.e., that it gets progressively higher throughout the season, with periods of extreme danger) was not markedly different, except for the proportions in 1970 who admitted they did not know *(table 10).*

To measure attitudes regarding fire prevention and fire use in wildland areas, respondents were asked to express their agreement or disagreement with 18 statements dealing with these matters. Responses were in terms of a five-place scale ranging from "strongly agree" to "strongly disagree." Fifteen of the statements were identical to those used in the 1964 survey. Items 2, 10, and 18 were found to contribute little to the total statistical variance in the 1964 survey, and new items were substituted for them.

Table 8–*Comparison of knowledge scores of residents of BUCO experimental area* [1] *with Zone III* [2] *residents, Butte County, California, 1970*

Knowledge score (percent)	BUCO experimental area	Zone III
	No. respondents [3]	
Less than 50	4 (10)	111 (105)
50-64	16 (13)	144 (146)
65-74	10 (10)	112 (111)
75 or more	10 (7)	74 (77)
Total	40	441

[1] Area near Oroville, California, where special fire prevention activities were conducted.
[2] Valley lands having no Federal or State interest in timber, watershed, range, or soil erosion.
[3] Figures in parentheses represent expected frequencies. Test of statistical significance yielded $x^2 = 6.64$, 3df, .05 <P <.10.

Table 9–*Fires in BUCO experimental area* [1] *of Butte County, California, by causes, 1964-1972*

Cause	1964	1965	1966	1967	1968	1969	1970	1971	1972
Children/matches	12	7	9	16	12	5	6	4	4
Debris burning	12	13	17	8	3	2	5	5	3
Incendiary	1	1	1	8	2	3	6	1	1
Smoker	8	4	1	8	1	4	5	3	3
Structure	4	7	10	10	8	2	12	3	8
Miscellaneous	5	1	1	6	5	7	5	12	4
Total	42	33	39	56	31	23	39	28	23

[1] Area near Oroville, California, where special fire prevention activities were conducted.

Comparison of the responses to the individual items, common to both surveys, reveals what appears to be a strong decline in attitudes in the interval between the two surveys *(table 11).* The difference represents a shift from a "strongly agree" to merely "agree," or, for those items negatively worded, from "strongly disagree" to "disagree." It should be recognized that attitude items of this type are notoriously unstable in distinguishing between adjacent categories. Consequently, the change in attitude between the two surveys may be more apparent than real. When the two categories in question are combined into one general "agree" response, the difference between the two surveys is no longer statistically significant.

Forty-one percent of the respondents in the 1970 survey felt the California Division of Forestry did an "excellent" fire prevention job, while 53 percent felt that the Division did a "satisfactory" job *(table 12).* The respondents were asked to compare the job the Division had done in the past 3 to 4 years with that done before that time. Their responses seem to demonstrate that these people were aware that there had been changes in the operation of the Division during the test period (although, they were not aware of the experimental program, as such). And 55 percent of them felt that this change had been for the better *(table 12).* Thirty-three percent said the Division had been doing "almost the same." Only a few gave a negative appraisal.

For the most part, these impressions were based on limited or indirect evidence.

Sixty percent of the respondents reported no contact with the State Division of Forestry during the period in question. Of those who reported contact the bulk considered the contact "satisfactory" or "very satisfactory." Most contacts reported were made through the process of obtaining a burning or

Table 10–*Impressions of forest fire incidence by Butte County, California, residents, 1964 and 1970 surveys*

Characteristics	1964	1970
	—*Percent*—	
Estimate of number of forest fires in Butte County during the past year: [1]		
Less than 25	20.9	20.4
25-49	8.1	5.7
50-99	8.1	5.1
100-199	10.7	7.5
200-299	6.6	3.9
300-499	4.3	2.1
500 or more	8.2	4.8
Don't know	33.1	49.1
Not reported	–	1.4
Total	100.0	100.0
Impressions of number of forest fires in the county during the past year:		
More than usual	8.8	21.0
About the same	20.0	47.0
Less than usual	45.6	21.7
Don't know	4.6	10.3
Not reported	–	–
Total	100.0	100.0
Fire danger in California:		
Stays uniformly high throughout the season	10.1	7.1
Gets progressively higher	19.2	22.6
Gets progressively higher, with periods of extreme danger	45.4	42.8
Reaches a peak then tapers off	20.4	13.9
Don't know	4.6	13.3
Not reported	.3	.3
Total	100.0	100.0

[1] Actual number of forest fires in 1964–331; in 1970–214.

Table 11–*Distributions of responses to items in the Attitude Test, 1964 and 1970 surveys*

Attitude Test item	1964 (n = 761)	1970 (n = 663)
	Percent	
1. Fire prevention instruction should be given to each person applying for a campfire permit:		
Strongly agree	60.0	33.3
Agree	35.2	58.8
Undecided	2.5	2.6
Disagree	2.0	5.1
Strongly disagree	.3	.2
Don't know, or no answer	–	–
	100.0	100.0
2. The National Forests belong to the public and people should be free to come and go as they please in them:		
Strongly agree	15.9	
Agree	31.3	
Undecided	9.8	
Disagree	30.5	
Strongly disagree	12.1	
Don't know, or no answer	.4	
	100.0	
Even though in an experienced camper's judgment it is perfectly safe to build a campfire, he nevertheless should be punished if he does so in a prohibited area:[1]		
Strongly agree		18.4
Agree		72.1
Undecided		3.0
Disagree		4.5
Strongly disagree		2.0
Don't know or no answer		–
		100.0
3. People who are careless with fire should be severely punished:		
Strongly agree	40.0	25.9
Agree	46.3	62.1
Undecided	10.2	7.9
Disagree	3.0	3.6
Strongly disagree	.1	.3
Don't know, or no answer	.4	.2
	100.0	100.0
4. Preventing forest fires is none of my concern:		
Strongly agree	2.1	1.3
Agree	3.8	3.9
Undecided	1.4	2.3
Disagree	42.2	62.5
Strongly disagree	50.1	30.0
Don't know, or no answer	.4	–
	100.0	100.0
5. Observing fire prevention rules is more important than obeying traffic regulations:		
Strongly agree	6.2	4.5
Agree	14.8	20.2
Undecided	38.5	33.2
Disagree	34.0	35.6
Strongly disagree	5.2	5.1
Don't know, or no answer	1.3	1.4
	100.0	100.0
6. I should report people who break fire prevention rules in forest or brush areas:		
Strongly agree	29.0	14.9
Agree	59.7	76.0
Undecided	8.7	5.7
Disagree	2.2	2.3
Strongly disagree	.3	.6
Don't know, or no answer	.1	.5
	100.0	100.0
7. "Smokey Bear" does a poor job of alerting the public to fire dangers:		
Strongly agree	2.3	2.0
Agree	4.9	9.8
Undecided	5.3	10.2
Disagree	58.8	61.5
Strongly disagree	28.7	15.6
Don't know, or no answer	–	.9
	100.0	100.0
8. Fire prevention literature is a waste of taxpayers' money:		
Strongly agree	2.5	1.1
Agree	2.0	9.8
Undecided	4.3	5.9
Disagree	61.9	71.5
Strongly disagree	29.2	11.3
Don't know, or no answer	.1	.4
	100.0	100.0
9. More space in school textbooks should be given to fire prevention:		
Strongly agree	17.0	8.1
Agree	48.9	59.7
Undecided	21.2	21.1
Disagree	8.5	8.8
Strongly disagree	.9	–
Don't know, or no answer	3.5	2.3
	100.0	100.0
10. Applicants for campfire permits should be required to pass an examination just as they do for a driver's permit:		
Strongly agree	16.2	
Agree	44.7	
Undecided	13.0	
Disagree	24.0	
Strongly disagree	1.8	
Don't know, or no answer	.3	
	100.0	

continued

Table 11–*Distributions of responses to items in the Attitude Test, 1964 and 1970 surveys*—Continued

Attitude Test item	1964 (n = 761)	1970 (n = 663)
	Percent	
Because things "just happen," there is no point in attempting to prevent fires and other accidents:[1]		
Strongly agree		1.2
Agree		3.0
Undecided		5.4
Disagree		61.2
Strongly disagree		28.8
Don't know, or no answers		.4
		100.0
11. School should not be permitted to use school time for instruction in forest fire prevention:		
Strongly agree	1.6	1.1
Agree	4.7	8.0
Undecided	4.7	4.8
Disagree	64.1	68.2
Strongly disagree	24.4	17.6
Don't know, or no answer	.5	.3
	100.0	100.0
12. Everyone should be required to attend a meeting at least once every three years, where he would get information and instruction on fire prevention:		
Strongly agree	14.4	3.9
Agree	40.2	47.2
Undecided	13.9	13.3
Disagree	27.5	32.4
Strongly disagree	3.7	3.0
Don't know, or no answer	.3	.2
	100.0	100.0
13. I would like to see school children bring home fire prevention literature from school:		
Strongly agree	16.8	8.7
Agree	68.5	76.6
Undecided	7.9	9.8
Disagree	5.4	4.1
Strongly disagree	.4	.2
Don't know, or no answer	–	.6
	100.0	100.0
14. Fire prevention people should establish closer relations with the Boy Scouts and similar organizations:		
Strongly agree	23.8	11.8
Agree	62.6	77.8
Undecided	10.2	7.2
Disagree	2.5	2.6
Strongly disagree	.4	–
Don't know, or no answer	.5	.6
	100.0	100.0

Attitude Test item	1964 (n = 761)	1970 (n = 663)
	Percent	
15. Rangers should have much more important things to do than going around checking on forest visitors:		
Strongly agree	2.5	.8
Agree	8.9	9.2
Undecided	7.6	6.9
Disagree	62.2	72.4
Strongly disagree	18.3	10.3
Don't know, or no answer	.5	.4
	100.0	100.0
16. Fire prevention efforts in forests are money well spent:		
Strongly agree	39.0	19.0
Agree	57.1	75.3
Undecided	2.8	3.3
Disagree	.6	2.0
Strongly disagree	.1	.3
Don't know, or no answer	.4	.1
	100.0	100.0
17. Forest fire danger in this area is highly overrated:		
Strongly agree	2.0	1.3
Agree	5.4	5.6
Undecided	18.4	11.8
Disagree	56.2	68.3
Strongly disagree	16.3	11.9
Don't know, or no answer	1.7	1.1
	100.0	100.0
18. All persons entering a forest area should be required to register:		
Strongly agree	19.6	
Agree	45.0	
Undecided	11.3	
Disagree	21.4	
Strongly disagree	2.4	
Don't know, or no answer	.3	
	100.0	
You don't have to worry about the woods, Mother Nature will always take care of the trees:[1]		
Strongly agree		.8
Agree		5.0
Undecided		1.5
Disagree		60.3
Strongly disagree		32.4
Don't know, or no answer		–
		100.0

[1]In the 1970 survey this item was substituted.

Table 12–*Impressions of the Butte County residents of fire prevention efforts by the California Division of Forestry (CDF) in Butte County, California, 1964 and 1970 surveys*

Characteristics	1964	1970
	—*Percent* —	
The fire prevention job done by the CDF is:		
Excellent	(1)	41.0
Satisfactory		53.4
Poor		2.0
Don't know		3.3
Not reported		.3
Total		100.0
How has the CDF done during the past 3-4 years:		
A much better job	(1)	13.4
A better job		41.7
About the same		32.7
A poorer job		.4
A much poorer job		.3
Don't know		11.5
Not reported		–
Total		100.0
Nature of contact with CDF:		
Obtaining burning or campfire permit	(1)	15.7
Social contact		7.1
Contact at campsite		5.4
Investigation of fire or fire regulation violation		3.8
Seeking advice or information		3.3
Occupation brings into contact		3.0
Routine inspection for fire law compliance		.9
Through schools		.8
Through mass media		.4
Inspection of equipment		.4
Public meeting		.2
Don't know		61.2
Not reported		.6
Total		(2)

[1]Question not asked in 1964 survey.

[2]Does not total 100 percent because multiple responses reported.

Characteristics	1964	1970
	—*Percent* —	
Contacts with CDF:		
Very unsatisfactory	(1)	2.3
Unsatisfactory		.3
Neutral		1.7
Satisfactory		18.7
Very satisfactory		14.8
Mixed, both satisfactory and unsatisfactory		2.4
Don't know		.2
No contact		59.6
Total		100.0
Fire prevention job done by schools is:		
Excellent	19.7	9.4
Satisfactory	42.3	51.7
Poor	13.9	17.2
Don't know	24.1	20.8
Not reported	–	.9
Total	100.0	100.0
How have the schools done during the past 3-4 years:		
A much better job	(1)	6.9
A better job		25.6
About the same		34.5
A poorer job		2.7
A much poorer job		.8
Don't know		29.2
Not reported		.3
Total		100.0
Fire Control Laws in the State are:		
Too strict	.8	.6
Not strict enough	39.8	49.2
About right	53.6	46.1
Don't know	5.8	3.5
Not reported	–	.6
Total	100.0	100.0
Enforcement of such laws is:		
Too strict	.1	.7
Not strict enough	38.2	48.7
About right	54.7	44.5
Don't know	7.0	5.9
Not reported	–	.2
Total	100.0	100.0

campfire permit *(table 12).* The next most frequent type of contact mentioned was as a friend or relative of Division personnel in social relationships. Another frequent mention was contact at campsites. (There is always a certain amount of confusion of government agencies in the public mind. Some of these contacts at campsites may actually have been with U.S. Forest Service personnel rather than representations of the State Division of Forestry. However, Division personnel were involved in inspecting use of recreation facilities about Lake Oroville.)

Over 60 percent of the respondents in both 1964 and 1970 were favorably impressed with the job in fire prevention education for children being done in the schools (*table 12).* The proportion considering the job "excellent" was only half as large in 1970 as it was in the original survey, however. Still, 33 percent felt that the schools had been doing a better job during the past 34 years as compared to earlier. An additional 34 percent felt the schools were doing about the same, while nearly all of the remaining one-third said they did not know.

An increased percentage of the respondents in 1970 survey judged that fire control laws in California were not strict enough and that their enforcement was likewise, not strict enough *(table 12).*

DISCUSSION

A fire prevention program has the obvious goal of reducing the number of undesired, uncontrolled fires in wildland areas. To expect such a program to *eliminate* all these fires would be patently unrealistic. But how many, or what proportion is a reasonable goal? Although not explicitly expressed, expectations from this study were undoubtedly unrealistically high. Fire prevention has been actively promoted in California and nationally for a number of years. The higher the level of fire prevention already achieved, the harder it is to make significant changes. The easy gains have already been made. The analogy might be made to providing potable water in a community which has been accustomed to using polluted water. Dramatic reduction in mortality will result. However, in a community with relatively good public health practices, each new gain in reduction of morbidity and mortality can be achieved only at the expense of increased effort and complex developments.

From previous experience it was considered infeasible to measure the effect of the program solely in terms of changes in absolute or relative numbers of fire starts. Effectiveness was to be determined by using indirect criteria (knowledge and attitudes concerning fire and its use) which were assumed to be related to actual fire associated behavior. There was no implication of a one-to-one relationship between attitude/knowledge levels and fire related behavior. That some relationship might be expected is evidenced by a large body of social science research. However, questions concerning the actual relationship between behavior and knowledge and/or attitude states become academic in this instance, as the before and after surveys reveal very little influence of the program on either knowledge or attitudes.

The failure of the test instruments to detect significant changes resulting from the intensive prevention program mounted in Butte County was disappointing. The program was experimental. Objectively, failure should be as acceptable as success. However, involvement in such an endeavor results in the participants developing vested interests in its success. And that interest is to find *positive* effects and not *negative* effects or no effects at all. The first impulse is to question the validity of the study–did the test instruments really tap the significant dimensions of the situation. If only disproportionately small improvements over existing programs are possible, more high-powered evaluation methods may well be needed to demonstrate effectiveness.

With the 20-item multiple choice instrument used to test knowledge of fire prevention and fire behavior, the mean scores from the before and after surveys did not differ significantly. The distribution of scores, however, was significantly different. The program appears to have been effective in reducing the proportion of respondents receiving very low scores (below 50 percent correct) and increasing the proportion receiving high scores (75 percent or more correct).

If these results do not meet expectations, it should be recognized that the main thrust of the experimental fire prevention program was in operation during two seasons only: 1968 and 1969. Education is a slow, continuous process, and modification of behavior depends on repeated reinforcement. In this educational program, efforts were directed primarily toward changing autonomous individuals, a process less amenable to rapid change than one involving changes in institutions or technology under tight

control. In addition, much of the direct educational effort of the program was aimed at children in the early elementary grades. They were not included in the survey sample. And although the efforts expended might be expected to show up in reduction of children-induced fires, most of the response could be expected to manifest itself much later in the fire-related behavior of the children involved over a period of years.

Another factor to be considered is that the prevention program eventually implemented in Butte County was quite different from the one anticipated in the planning stages. The knowledge items used in the survey had been developed primarily in relation to problems associated with the recreational use of fire in National Forest-type situations. The prevention program that eventually evolved was focused on the main fire problems in State-protected areas, namely, home-centered fire activities such as debris burning, incinerator misuse, and related practices. If this orientation of the program had been anticipated, the test instruments might have more faithfully reflected the thrust of the program.

The experimental program in Butte County was not conducted in a social vacuum. The forces affecting the rest of the nation at that time impinged to some degree at least on the locus for the experiment. The 1960's were disturbed by civil and racial strife, youth revolt, assassinations of popular leaders, a long and controversial war, ecological crises, and other manifestations of social and political unrest. Forces of this magnitude might have accounted for most of the change noted in the responses to attitude items between the two surveys. The pervasive feeling that nothing was "very good" could well produce the shift from the most positive response, "strongly agree" in 1964, to merely "agree" in the 1970 survey. And the shift was probably not related to the experimental program at all.

That the over-all effects of the program were, in fact, positive is attested by the feeling on the part of more than 40 percent of the respondents that the Division of Forestry had done an "excellent" job during the test period, and nearly all rated the Division's job at least "satisfactory." They also recognized changes for the better in recent years. It is important to recognize, also, that despite the extensive efforts of the experimental personnel, contacts with the general public, as perceived by this public, still were limited and indirect in nature.

An examination of the fire records for Butte County showed a marked decline in number of man-caused forest fires in 1968 and 1969 *(fig. 3; table 13).* The departure from the expected was sufficiently great to suggest that, contrary to forecasts, the prevention program may have produced a reduction in fire starts for that period that was perceptible despite the large, and only grossly measurable, effects of various climatological and other variables. To determine if this observed departure from the anticipated was as real as it was apparent a comparison was made with neighboring counties (Nevada, Placer, Shasta, Tehama, and Yuba counties). I assumed that fire starts in Butte County would be linearly related to starts in these neighboring counties. I also assumed that other factors influencing fire starts in these counties would be comparable. Regression equations for fire starts in Butte County in terms of starts in the

Table 13–*Forest fires in Butte Ranger Unit, Zones I and II,*[1] *by cause, 1958-70*

Year	Light-ping	Camp-fire	Smoking	Debris	Incen-diary	Machine	Misc.	Man-caused	Total
1958	18	4	51	27	25	6	43	156	174
1959	9	6	47	17	20	15	67	172	181
1960	72	1	81	24	19	4	42	171	243
1961	7	4	83	28	33	5	63	216	223
1962	4	1	46	21	14	5	53	140	144
1963	3	3	56	25	25	16	31	156	159
1964	3	2	105	48	60	50	66	331	334
1965	15	3	50	35	28	43	56	215	230
1966	9	2	87	40	33	37	80	279	288
1967	10	5	39	28	51	17	51	191	201
1968	1	13	28	30	41	25	45	182	183
1969	63	5	28	17	59	31	39	179	242
1970	14	9	49	28	47	26	55	214	228
Average	17.5	4.5	57.7	28.3	35.0	21.5	53.2	200.1	217.7

[1] Lands consisting of forests or forested watersheds under State protection.

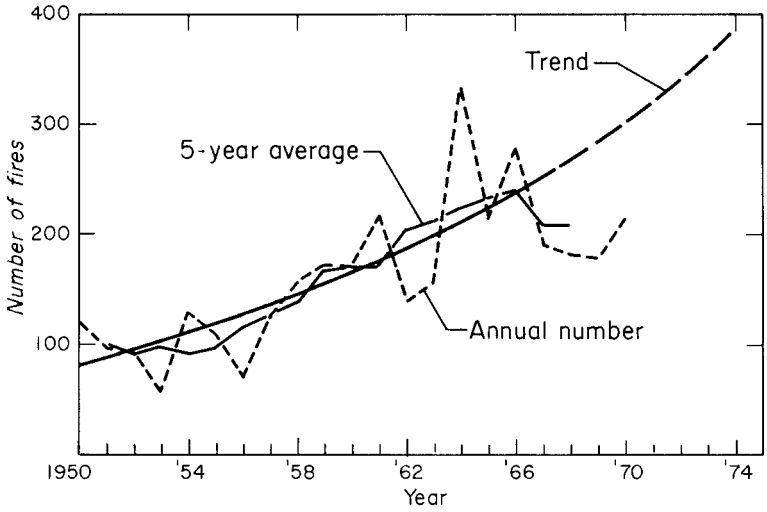

Figure 3–Man-caused forest fires in the Butte Ranger Unit of California fluctuated, by years, in lands classified as Zones I or II --areas of forests or forested watersheds under State protection, 1951-1970 (adopted from Moore 1970).

neighboring counties were derived by using available data for the years 1958 through 1967. These equations were used to predict fire starts in Butte in 1968 and 1969. Whether the change in fire starts in Butte County during the period of intensive fire prevention activity were significant could not be conclusively determined.

The resurvey of levels of knowledge and attitudes in fall 1970 marked the formal ending of the BUCO Project. No new research was planned, but for several years thereafter, the fire situation in Butte County is being monitored to determine if a new plan of fire prevention staffing could maintain the level of control achieved by the larger staff.

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An initial survey in 1964 measured the existing levels of knowledge and attitudes concerning use and abuse of fire in wildland areas among residents of Butte County, California. During the next 6 years, the California Division of Forestry carried out an intensive fire prevention program. A resurvey was conducted in 1970 to find out if any changes in levels of knowledge and attitude resulted. The evaluation showed little change during the interim. The number of fires in the study area dropped during the period of most intensive prevention activity. But the analysis was not conclusive in showing this decline to be due to the fire prevention program rather than to other variables.

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