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Tree Hazard Control on Recreation Sites . . .

estimating local budgets

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ABSTRACT: Tree hazard control efforts on recreation sites are subject to budget and administrative restrictions. To make the most effective use of available control funds, priorities should be assigned to various classes of tree defects and a budget set up. With the method provided, local priorities are based on cost effectiveness. Some guidelines and a worksheet for planning a local budget are suggested.

RETRIEVAL TERMS: accident costs; hazard control costs; forest safety; recreation budget; accident prevention; hazard control priorities; tree defect.

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Removal of trees or limbs that pose a safety hazard in campgrounds and picnic areas is a costly process. Nevertheless, the need for such "tree hazard control" is increasing because of mounting use of forest recreation areas. Foresters who must cope with this problem need answers to two kinds of budget questions: When the standard of control is limited by a fixed budget, how can we spend the money most effectively? Or, when management policy specifies certain standards, how do we estimate costs of meeting these standards?

If you have such a problem, this note can help you work up the answers. It suggests a procedure for assigning local control priorities--based on analysis of cost-effectiveness--to classes of tree defects.

An earlier study on forest recreation sites in California[1] suggested that highest priorities be given to reduction of limb defects in oaks and removal of trees with bole defects in other hardwoods and in conifers. But these statewide priorities are not necessarily best in local situations. And they may not be especially helpful in preparing your local budgets. To help you set local priorities, we suggest the following guidelines and worksheet for estimating effectiveness of control by class of defect and by site.

Defects are considered in four classes: root, butt, bole, and limb. These classes also apply to "failures"--a term used to refer to a tree or part of a tree which represented a hazard both because it fell during a season when the site was often occupied and because it was large enough to require clean-up even though not involved in an accident.

The relative effectiveness of control (E) for each class of defect for any given area may be defined by the relationship

$$E = \frac{L}{C}$$

in which:

L = annual property losses resulting from past failures plus losses prevented by removal of defects, and

C = inspection and removal costs for control of hazard.

Three types of information are necessary before this equation can be applied to a specific area:

[1]Paine, Lee A. *Effective tree hazard control on forested recreation sites...losses and protection costs evaluated.* U.S. Forest Serv. Res. Note PSW-157, 8 pp., illus. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 1967.

ESTIMATING EFFECTIVENESS OF HAZARD CONTROL

BY CLASS OF DEFECT--BUDGET REQUIREMENTS

	Class of defect or failure			
	Bole	Butt	Limb	Root
r = Average property loss per failure 1/	$ 386	$ 264	$ 31	$ 263
s = Annual number of in-season failures of each class on area	2	1	2	5
t = Annual number of potential in-season failures prevented by control	2	2	40 (trees)	0
L = POTENTIAL ANNUAL LOSS FROM EACH TYPE OF DEFECT = r (s + t)	$1,544	$ 792	$ 1,302	$ 1,315
u = Average inspection costs per tree for each class of defect	$0.10	$0.15	$0.10	$1.50
v = Total number of trees to be inspected on area	1,000	1,000	1,000	1,000
w = Annual inspection costs = u × v	$ 100	$ 150	$ 100	$ 1,500
x = Cost per defective tree for removal of defect 1/	$ 200	$ 200	$ 50	$ 200
y = Annual removal costs = x(s + t)	$ 800	$ 600	$ 2,100	$ 1,000
C = TOTAL ANNUAL CONTROL COST = w + y	$ 900	$ 750	$ 2,200	$ 2,500
E = EFFECTIVENESS OF CONTROL FOR EACH CLASS OF DEFECT = L/C	1.7	1.1	0.6	0.5
E' = EFFECTIVENESS OF CONTROL FOR SITE = $\frac{\Sigma L}{\Sigma C}$ 2/	0.8			

1/ Figures shown for (r) and (x) apply to conifers and hardwoods other than oak; see sample worksheet (page 5) for values applicable specifically to oak, pine, or fir. Also see Paine, op. cit., for derivation of property loss and inspection cost values.

2/ Σ = summation of.

(s) annual number of in-season failures of each class on the area,

(t) annual number of in-season failures prevented by control; i.e., number of trees from which defects were removed, and

(v) total number of trees to be inspected on the area.

To minimize yearly variations, annual failures (s + t) should represent average values for recent years, excluding unique occurrences such as large-scale blowdown. Situations which are unpredictable on a local basis can be covered in area or statewide budgets.

For convenience of agencies or units participating in the California tree failure report program, a local summary of in-season failures may be requested from this Station. The worksheet (page 5) may be copied to provide a convenient form for determination of budget figures and effectiveness of control, by defect class and by site.

Use of the worksheet is illustrated by example on page 2. In this case we have assumed a mixed conifer population (v) of 1,000 trees subject to inspection, with actual failures (s) = 2, 1, 2, and 5, and controlled failures (t) = 2, 2, 40, and 0. After entering these figures, the appropriate property loss (r) and removal cost (x) factors are selected from the worksheet on page 5. The remaining values are then easily determined as indicated.

The highest value of E(1.7) indicates that reduction of hazardous bole defect will be most effective, with butt, limb, and root defect control next in order.

In the illustration, the losses from bole and butt defect exceed the costs of control (E > 1). And, because of the high number of trees with potential limb failures, limb defect control has become more effective in this situation than root defect control.

A budget of $6,350(ΣC) would presumably cover complete control. If your control budget were limited to $1,600, however, the values of E indicate that the funds should be used primarily to control bole and butt defect.

If your inspection cycle is 2 years or more, the in-season failures (s) should include the number of in-season failures occurring within the entire cycle. You can then read "annual" as "periodic" values.

Priority for control of any given site can be set according to the relative effectiveness of site control (E'). To permit comparison of sites, effectiveness of control must be based on actual costs of control without regard to the sources of funds. When it comes to budgeting funds, local timber sales and other control or improvement programs may provide part of the working capital. For sites with no history of failures or previous removals, priority should depend on occupancy during the use season.

Area priorities may need to be established for the purpose of allotting funds within a region. For each defect class, separately, the area value

$$E'' = \frac{\Sigma L(\text{all sites})}{\Sigma C(\text{all sites})}.$$

After you have defined, within budget restrictions, which classes of defect can be effectively controlled, sites or areas can be worked in order of decreasing values of E' or E".

Inspection and removal costs developed from local experience may be substituted for those given in the worksheet. The same thing holds for average losses if local values differ significantly from statewide averages.

Rating priorities by this method assumes that efficiency of detection is reasonably comparable for each class of defect. We have no measure of detection efficiency available as yet, but relative difficulty of detection is reflected in the inspection times (and inspection costs) assigned to each class of defect.

The rating procedure depends on local records of tree failures and controlled hazards. Some administrative units now keep such records as a matter of course; others would have to initiate them for the first time. But having a sound basis for setting control budgets and directing control emphasis should far outweigh the nuisance of keeping records, especially for areas with heavy recreational use.

Budgets are often too small to allow detailed examination of every tree, even if present methods for detection and evaluation of hazard were not so time-consuming. With limited budgets and in the absence of specified goals, priority rating places greater emphasis on locally important classes of defect and results in more effective use of available money. Furthermore, since realistic administrative policy will never be set at complete elimination of hazard, a required level of control will be obtained more easily by determining which targets provide the greatest opportunity for control.

The Author

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WORKSHEET FOR ESTIMATING EFFECTIVENESS OF HAZARD CONTROL

BY CLASS OF DEFECT--BUDGET REQUIREMENTS

District ____________________ Site name ____________________

	Class of defect or failure			
	Bole	Butt	Limb	Root
r = Average property loss per failure[1]	$____	$____	$____	$____
s = Annual number of in-season failures of each class on area	____	____	____	____
t = Annual number of potential in-season failures prevented by control	____[2]	____	____(trees)	____[3]
L = POTENTIAL ANNUAL LOSS FROM EACH TYPE OF DEFECT = r (s + t)	$____	$____	$____	$____
u = Average inspection costs per tree for each class of defect	$0.10	$0.15	$0.10	$1.50
v = Total number of trees to be inspected on area	____	____	____	____
w = Annual inspection costs = u × v	$____	$____	$____	$____
x = Cost per defective tree for removal of defect[1]	$____	$____	$____	$____
y = Annual removal costs = x(s + t)	$____	$____	$____	$____
C = TOTAL ANNUAL CONTROL COST = w + y	$____	$____	$____	$____
E = EFFECTIVENESS OF CONTROL FOR EACH CLASS OF DEFECT = L/C	____	____	____	____
E' = EFFECTIVENESS OF CONTROL FOR SITE = $\frac{\Sigma L}{\Sigma C}$[4]	________			

1/ Select values for (r) and (x) from following table:

	Bole	Butt	Limb	Root
	- - - - - - (dollars) - - - -			
(r) Conifers and "other hardwoods"	386	264	31	263
Pine	461	44	15	284
Fir	584	267	20	494
Oak	3	0	214	45
(x) Conifers and "other hardwoods"	200	200	50	200
Oak	175	175	75	175

2/ Include removed snags as prevented bole failures.

3/ Include removed "leaners" or unstable trees as prevented root failures.

4/ Summarize only for classes of defect which will be controlled.