SNAGS, CHAINSAWS AND WILDLIFE: ONE ASPECT OF HABITAT MANAGEMENT

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Abstract. Four important timber producing plant communities of the Northwest (Douglas-fir, true fir, ponderosa pine and mixed conifer) were sampled to determine intensity of snag utilization by wildlife for cavity nesting and piciformes feeding. Samples were analyzed, by habitat types, to determine snag occurrence (on a per acre basis) and species of snag preferred. Utilization relative to five snag characteristics (hardness, height, "dbh", bark and limb conditions) was analyzed. Recommendations are given regarding minimum number of snags to be left in logging operations for each community. Samples were considered too small for statistical analysis.

INTRODUCTION

For several decades it has been State law on private lands, and Federal policy on government lands, that all snags within a logging area shall be dropped. By definition of these laws, a snag is a dead tree or any portion thereof, over 16 inches diameter breast height and twenty feet tall. "Logging area," includes the land within 200 feet, slope distance, from any cut green tree, logging road centerline, or landing.

This policy has led to the destruction of countless thousands of snags used as wildlife nesting and feeding habitat. Besides elimination of snags within the cutting unit itself, forty acres per mile of road construction were cleared of such habitat. The Forest Service began to officially recognize this loss in 1970, when it began to formulate policy allowing recognition and protection of some wildlife snags. A 1971 supplement to the Forest Service Manual for California recommends leaving a minimum of two hard and one soft snag per five acres.

There have been mixed reactions by Forest Service personnel to this change in policy. While some disagree, most recognize the merits of these measures, and many go beyond the basic requirements and attempt to leave all snags which are not safety or fire hazards. Some of those who were aware of the reasons behind the change of policy began to ask some rather embarrassing questions regarding what type of snag should be saved. Should they be fat or skinny, short or tall, with or without limbs, etc. Research or study information was not available to give answers. In order to make practical recommendations based on wildlife needs we decided to gather field data in the summer of 1972.

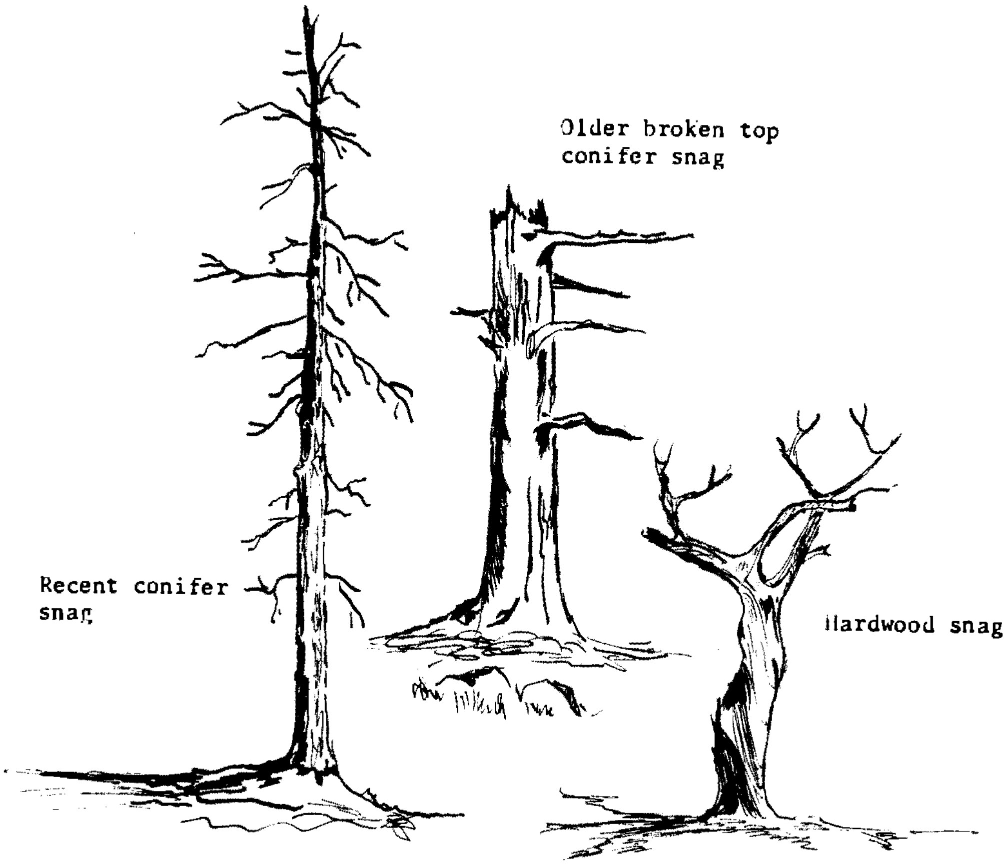


Figure 1. Typical snag form

There are many uses of snags by countless numbers of wildlife (Figure 2). Raptors use them for hunting, feeding, roosting and nesting, they are dwelling places for amphibians, reptiles and arthropods, acorn woodpeckers (Melanerpes formicivorus) use them as storehouses. The list goes on, and I am sure man is far from being aware of all that occurs in a snag. When we designed this project we were aware of these many facets of life in a snag. We also were aware of our limitations of time and adequate knowledge to sample all of these facets. These same time limitations prevented us from gathering samples of equal acreages for all types sampled. Besides the characteristics of individual snags, we decided to record three aspects of wildlife use; feeding use by woodpeckers and flickers, use by cavity nesting birds and mammals, and numbers and species of birds and mammals seen within the transect. Feeding and cavity nesting was recorded whenever evidence of this activity was encountered, regardless of whether such activity was occurring at the time.

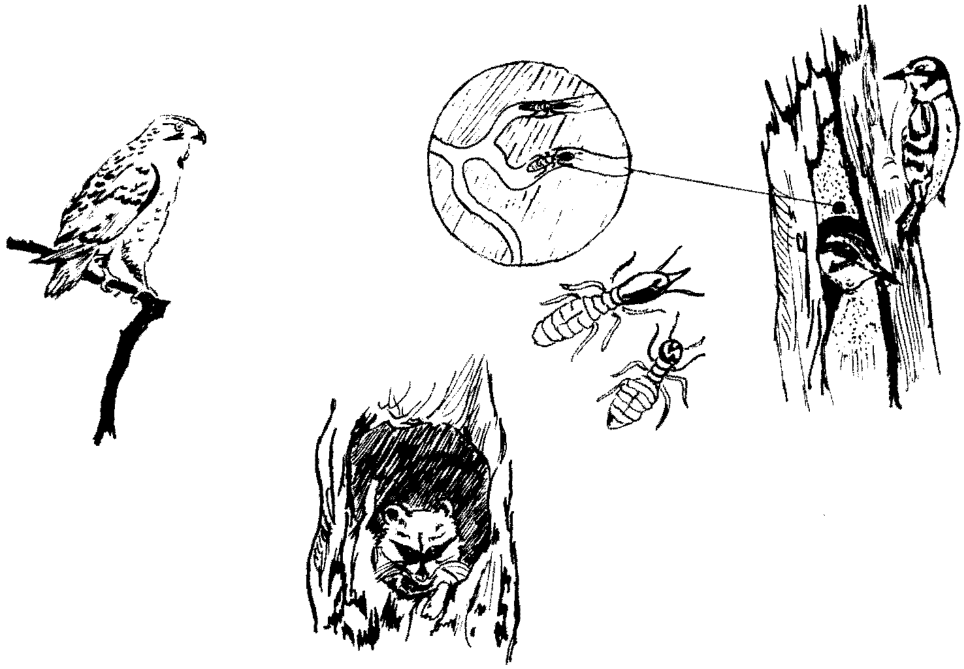


Figure 2. Some uses of snags by wildlife

We recognized that the data collecting procedure was such that only a very small number of animals on the transect would be seen. However, since the procedure would remain constant between transects, we hoped the information collected could be used as an index of relative abundance of wildlife between vegetative types. One of the problems with this is that some transects were read in May, and others as late as September. Obviously the nature and amount of wildlife activity varies tremendously between spring and fall. Therefore, I feel this data cannot even be used as an index, as originally intended. If similar transects are run during the same phenological periods in future years, it may be possible to make valid comparisons with our data. However, for purposes of this paper, I will make no references to wildlife observations.

Given the above conditions, it must be recognized that this paper deals with only two aspects of use of snags by wildlife, cavity nesting and Piciformes feeding. All conclusions drawn and recommendations made deal only with these uses. To protect the total realm of wildlife snag needs, it may be necessary to exceed these recommendations.

Much interest, cooperation and actual field assistance was given by California Department of Fish and Game, the Regional office of the Forest Service, U.C. Berkeley, College of the Siskiyous and various ranger district personnel. Without that help, this paper would not have been possible. The line drawings were done by Robert Logan of the Eldorado National Forest.

METHODS

Ten samples were taken on the Klamath National Forest, and one to the east on the Modoc National Forest (Figure 1). Four principal vegetative types were sampled: virgin Douglas-fir, twelve acres sampled; virgin true fir, six acres; logged ponderosa pine, 22.6 acres; and mixed conifer, 33.1 acres. The mixed conifer plots were further divided into three categories: virgin westside (or Coast Range), 19.2 acres; virgin eastside (or Cascade Range), 6.9 acres; logged eastside, 7 acres.

The following assortment of tools were found useful: a hand ax; a clinometer; a diameter tape; binoculars; transect tags; a cloth 100 foot tape; flagging; a topographic map of the general area; a compass; and a camera. Data was recorded in a timber appraisal cruise record book, modified for our use.

All snags over six inches dbh and five feet tall were recorded. There were six characteristics measured; species, height, diameter breast height, hardness, presence or absence of bark, and condition of limbs. Height was measured with a clinometer and diameter with a diameter tape. After some practice at measuring for height and diameter, we began estimating with an occasional measurement to make sure our estimates weren't getting too far out of line. Hardness was the most difficult characteristic to measure. We soon found that it was not possible to estimate hardness visually with any degree of accuracy. Therefore, we began carrying a hand ax to test the snag. Three degrees of hardness were recorded: hard, if it was difficult to sink the ax into the snag; soft, if the ax penetrated easily; and rotten, if the wood disintegrated on impact. Obviously there was a certain amount of subjective judgment in cases borderline between the hard and soft categories. Bark was recorded as present if it covered over 50% of the snag, otherwise absent. Limbs were recorded in three categories: present, if mostly intact; stubs, if only short stubs remained; or absent if mostly gone.

Transects were measured in segments of one chain (66 feet) square. Since one square chain equals one tenth of an acre, we were able to easily compute number of snags per acre. The approximate line of travel was selected from aerial photos and topographic maps. Transects were usually laid out so that we could leave a road, travel cross-country, and come out on another road where a vehicle had been placed. The starting and ending points were marked with metal tags, the transect line was flagged as we traveled, and compass bearings were recorded. By marking these as permanent transects future rereadings can be made for a comparison of possible changes. This might be especially interesting after a logging operation or fire occurs.

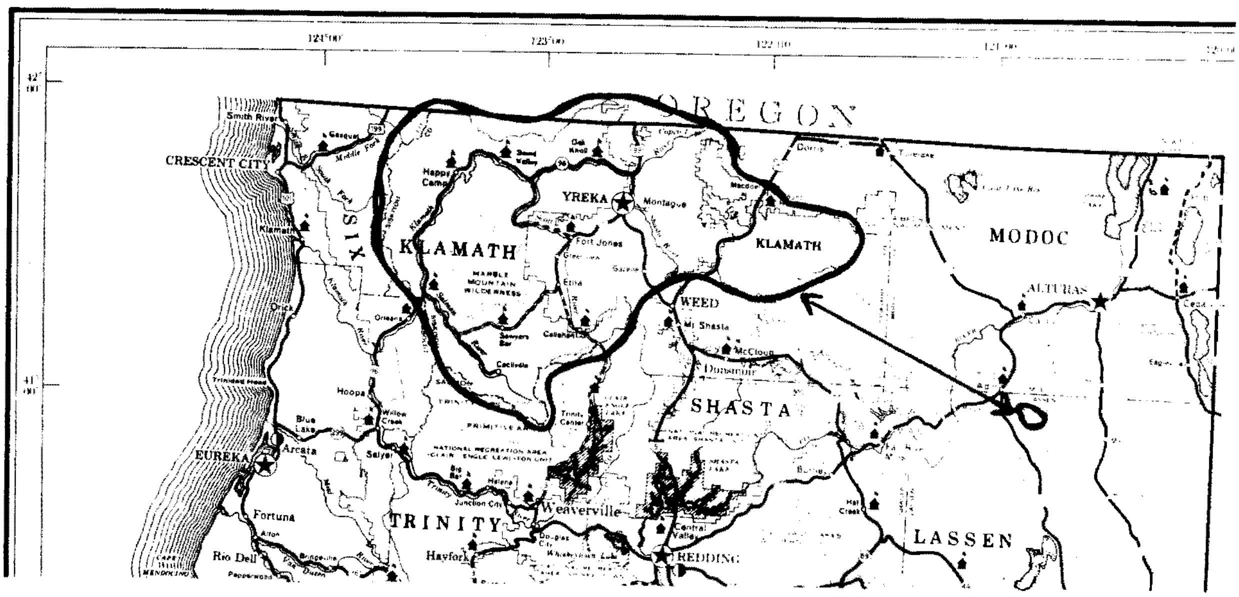


Figure 3. Study Areas

RESULTS

Data on numbers, percentages, and species of snags used will be discussed in relation to the vegetative types outlined earlier. The snag characteristics of hardness, height, dbh, bark cover and limb conditions will be discussed in terms of grand totals. The data was not statistically analyzed for degrees of significance, chance occurrence, co-variance, etc. Such analysis might lead to different conclusions than contained herein.

Virgin Douglas-fir Type (Figure 4)

Ninety-two snags were catalogued in a twelve acre sample of this type for an average of 7.7 snags per acre. Four species were involved; Douglas-fir (Pseudotsuga menziesii), 64% (59), live or black oak (Quercus kellogg), 27% (25), madrone (Arbutus menziesii), 7% (6), and sugar pine (Pinus lambertiana), 2% (2). Of the Douglas-fir, 29% (17) were used for woodpecker feeding, 2% (1) were used for nesting and that same 2% was used for feeding and nesting concurrently. Of the two sugar pine, one (50%) was used for both feeding and nesting. Of the twenty-five oak and six madrone, none were used for nesting or feeding. This lack of use of hardwoods was an interesting outcome of the study and will be discussed later.

Of the ninety-two snags then, 19% (18) were used for feeding and/or nesting. This is an average of 1.5 snags per acre actually used.

Virgin True Fir Type (Figure 5)

Thirty-three snags were catalogued in a six acre sample, for an average of 5.5 snags per acre. A note of explanation is in order regarding the sample size. We actually traversed eight acres. However, due to terrain and the road system, we were forced to cross meadows and brushfields for two acres. These two acres were eliminated from the calculations, since they were not representative of the timber type.

Of the thirty-three snags, 51% (17) were red fir (Abies magnifica), and 49% (16) were white fir (Abies concolor). Of the red fir, 71% (12) were used for feeding, 65% (11) were used for nesting and 47% (8) were used for both. Of the white fir, 63% (10) were used for feeding, 31% (5) were used for nesting and 25% (4) were used for both.

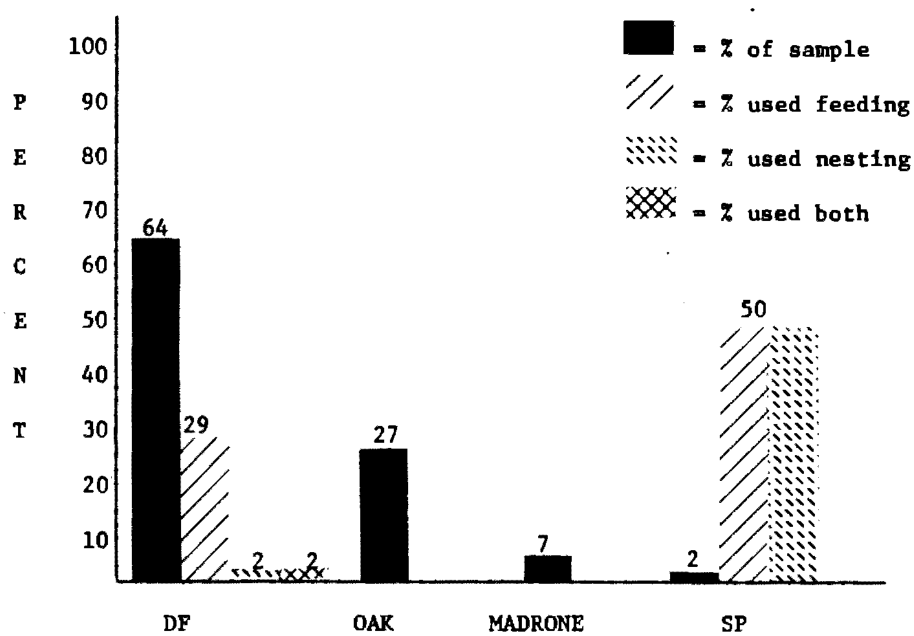
Of the thirty-three snags then, 79% (26) were used for feeding and/or nesting. This is an average of 4.3 snags per acre actually used, the highest intensity of use of the four principal vegetative types sampled.

Logged Ponderosa Pine Type (Figure 6)

Five snags were catalogued in a 22.6 acre sample, for an average of 0.2 snags per acre. Of the five, four (80%) were ponderosa pine (Pinus ponderosa), and one (20%) was an incense cedar (Libocedrus decurrens). Of the four ponderosa, two were used for feeding, three for nesting and one for both. Therefore, 100% of the ponderosa snags were used. The one cedar snag received no use.

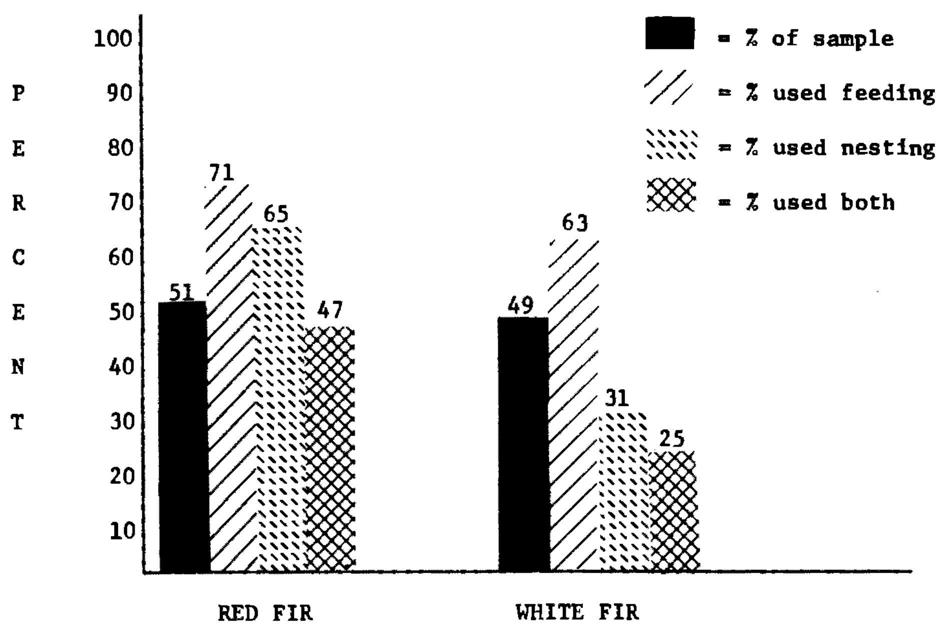
It should be noted that when surveying this type we crossed several acres of open sage with no tree cover other than an occasional juniper. Unfortunately, we failed to note the number of acres so crossed in this case. However, I believe the significance of the data for this type lies in the fact that all of the remaining ponderosa snags are being used. From other personal observations it seems that cedar is a species which has little value for use by cavity nesting or for woodpecker feeding. Therefore, it would appear that this particular type represents a situation wherein cavity nesting and woodpecker feeding may be limited by a scarcity of appropriate snags.

As a sidelight, we recorded the number of felled snags on one of the transects in this type which had been logged some fifty years ago. We found four on 8.6 acres for an average of 0.46 per acre. These were all fairly well intact, in spite of the fact that they had been lying on the ground for fifty years. This appears to indicate that this habitat type is so dry and slow growing that the rate of snag replacement is extremely



12 ac → 92 snags: 59 DF/25 Oak/6 Mad./2 S.P.
92 snags → 18 (19%) used → ave. 1.5/ac.

Figure 4. Virgin Douglas fir



6 ac → 33 snags: 17 RF/16 WF
33 snags → 26 (79%) used → ave. 4.3/ac.

Figure 5. Virgin True fir

slow. In effect then, when you fall a snag in this type, in north-central California, you have removed an important aspect of the habitat for many generations of wildlife.

Virgin West Side Mixed Conifer (Figure 7)

Ninety-six snags were catalogued in a 19.2 acre sample for an average of five snags per acre. Four species were involved: Douglas-fir 29% (28), ponderosa pine 12% (11), oak (live and California black) 56% (54), and madrone 3%. Of the Douglas-fir, 36% (10) were used for feeding, 21% (6) were used for nesting and 11% (3) for both feeding and nesting. Only one pine (9%) and one oak (2%) were used for nesting. None of the madrone were used. Of the ninety-six snags, 16% (15) were used for feeding and/or nesting. This is an average use of 0.8 snags per acre.

Virgin East Side Mixed Conifer (Figure 8)

Thirty-four snags were catalogued in a 6.9 acre sample for an average of 4.9 snags per acre. Three species were involved; Douglas-fir 24% (8), white fir 47% (16) and ponderosa pine 29% (10). Of the Douglas-fir, 75% (6) were used for feeding, and 13% (1) were used for both nesting and feeding. Of the white fir, 50% (8) were used for feeding, 13% (2) were used for nesting and 6% (1) were used for both. Of the ponderosa pine, 80% (8) were used for feeding and 10% (1) were used for both feeding and nesting.

Of the thirty-four snags, 68% (23) were used for feeding and/or nesting. This is an average use of 3.3 snags per acre.

Logged East Side Mixed Conifer (Figure 9)

Forty-five snags were catalogued in a seven acre sample for an average of 6.4 per acre. Of these, 73% (33) were white fir, 20% (9) were ponderosa pine and 7% (3) were red fir. There were no Douglas-fir on these plots. Nesting activity amounted to 15% (5) of the white fir, 33% (3) of the ponderosa and 33% (1) of the red fir. Feeding activity was not recorded on one of the plots, amounting to 1.6 acres of the sample. This eliminated all of the red fir, three of the white fir and five of the ponderosa from the feeding sample. Feeding activity was recorded on 17% (4) of the remaining thirty white fir and 25% (1) of the four ponderosa.

Of the forty-five snags, 31% (14) were used for feeding or nesting. This is an average use of 2.0 snags per acre, a figure which is recognized as possibly being low due to the failure to collect feeding data on one of the plots as discussed above.

Hardness (Figure 10)

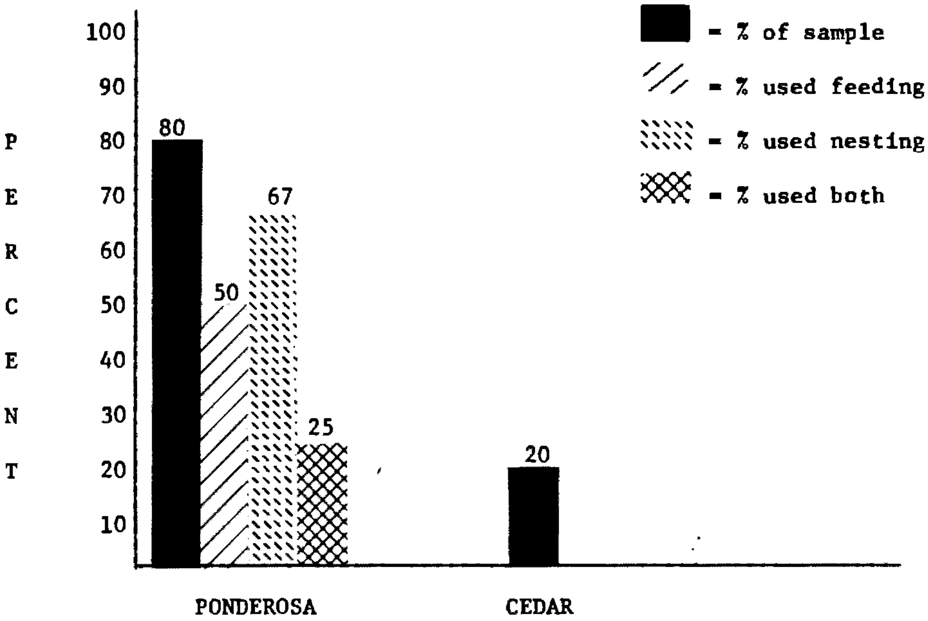
Two hundred and ninety-two snags were classified for hardness. Eighty-eight of these were oak and madrone. Only one hardwood was utilized. Therefore, they were eliminated from these calculations and those of the remaining characteristics to be discussed. Of the remaining 204 softwood (conifer) snags, 60% (123) were hard, 22% (44) were soft and 18% (37) were rotten.

The hard snags contained 53% of all of the feeding and 27% of all of the nesting use recorded. The soft snags contained 24% of the feeding and 41% of the nesting activity. The rotten snags contained 23% of the feeding and 32% of the nesting.

It is apparent that there was a slight preference for soft and rotten snags for feeding purposes. Even more dramatic was the preference shown for these snags for nesting purposes.

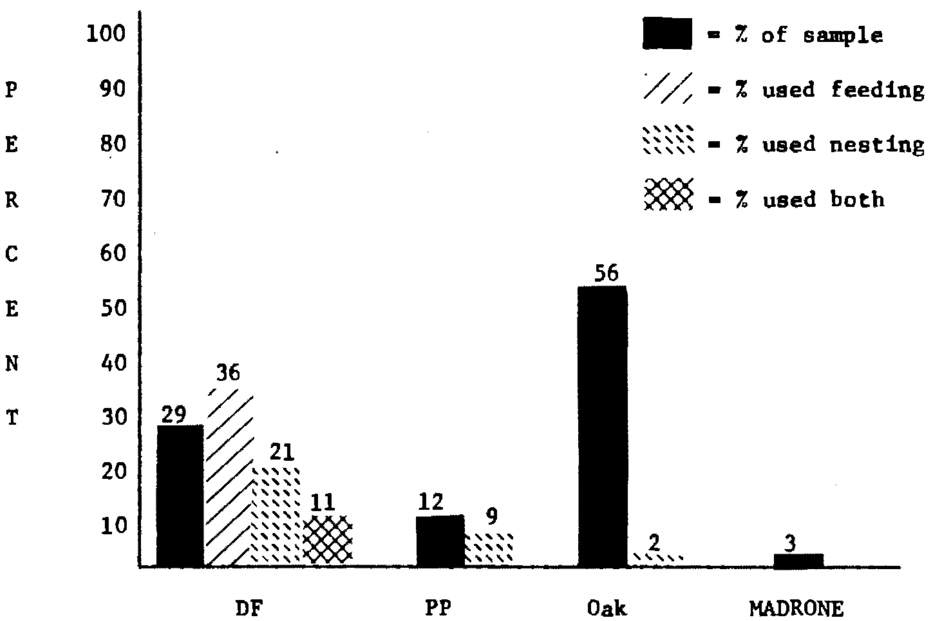
Height (Figure 11)

Height was recorded on 219 conifer snags, and was analyzed in four categories; 5-19 feet, 20-49 feet, 50-99 feet, 100-200 feet. The first break was made at 19 feet because current snag felling guides pertain only to those snags over 19 feet tall.



22.6 ac → 5 snags: 4 PP/1 cedar
5 snags → 4 (80%) used

Figure 6. Logged Ponderosa pine



19.2 ac → 9.6 snags: 28 DF/11 PP/54 Oak/3 Mad.
96 snags → 15 (16%) use → ave. 0.8/ac.

Figure 7. Virgin west side mixed conifer

Thirty-four percent of the snags were in the 5-19 foot height class, accounting for 39% of the feeding use and 30% of the nesting use. Twenty-seven percent of the snags were in the 20-49 foot class, accounting for 26% of the feeding use and 40% of the nesting use. Twenty-five percent of the snags were in the 50-99 foot height class, accounting for 26% of the feeding use and 20% of the nesting use. Finally, 12% of the snags were in the 100-200 foot class, accounting for 9% of the feeding use and 10% of the nesting use.

Two things were apparent. First, feeding activity does not seem to be influenced by height class. That is, the percent of feeding activity in each height class is similar to the total percent of sample in that class. Second, there seems to be a slight preference for the shorter (under fifty feet) snags by cavity nesters.

Diameter Breast Height (dbh) (Figure 12)

Diameter was recorded on 219 snags, and the data analyzed in three categories; 6-15 inches, 16-36 inches and 37-60 inches. Again, the first break was made at 15 inches because current snag felling guides pertain to snags greater than that diameter.

Thirty-five percent of the snags were in the 6-15 inch diameter class, accounting for 26% of the feeding use and 8% of the nesting. Forty-eight percent were in the 16-36 inch diameter class, accounting for 51% of the feeding and 62% of the nesting. Seventeen percent were 37-60 inches, including 23% of the feeding and 30% of the nesting activity.

Apparently there is a slight degree of preference shown for the larger diameter trees in feeding, and a very definite preference for them in nesting.

Bark Condition (Figure 13)

Bark condition was analyzed in two categories, present if 50% or more of the snag was covered by it, absent if not. Of the 206 softwood snags catalogued, 90% had bark and 10% did not. The 90% with bark contained 82% of the feeding and 71% of the nesting. The 10% without bark contained 18% of the feeding and 29% of the nesting. It would appear that there is a preference for barkless trees in both feeding and nesting activities.

Limb Condition (Figure 14)

Limb condition was recorded on 206 conifer snags. There were three categories: limbs present and fairly well intact, 42%; stubs only, 13%; limbs absent, 45%. The percent of feeding activity in the respective classes was 37%, 13% and 50%. The percent of nesting activity in the respective classes was 26%, 24% and 50%.

Feeding activity showed only a slight favoritism for snags without limbs. On the other hand, nesting activity definitely increased after the limbs deteriorated to the stub stage.

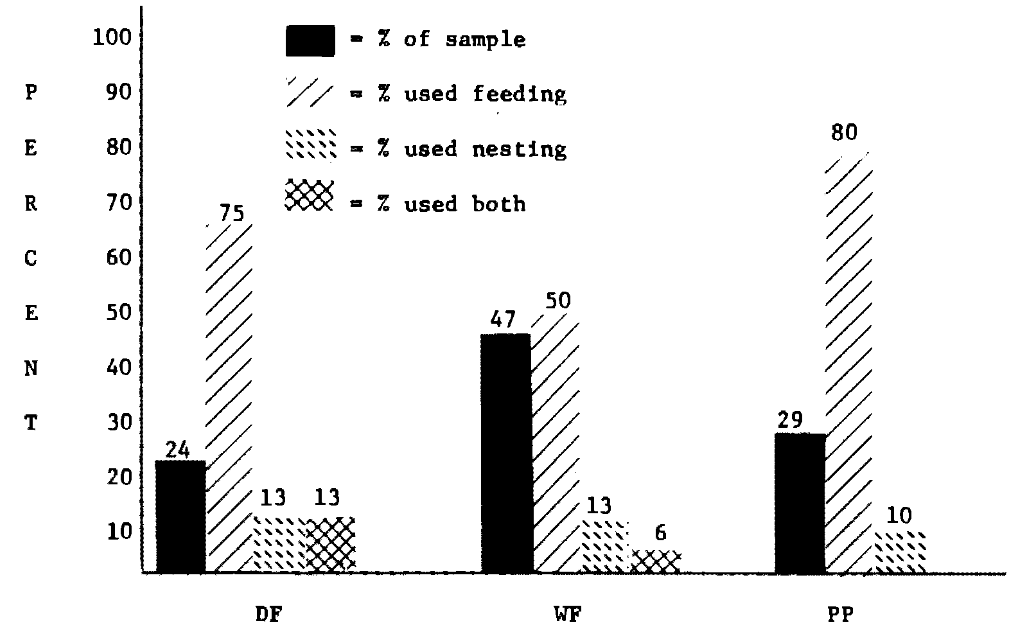
DISCUSSION

Characteristics

What then are the characteristics of the ideal wildlife snag for woodpecker feeding and cavity nesting? For feeding, the snag should: be soft or rotten, have a diameter greater than 15 inches, and be absent of bark. The height and limb condition seem to matter little. For nesting, the snag should: be soft or rotten, be 20-49 feet tall, be greater than 15" in diameter, have the bark absent and limbs absent or reduced to stubs. The trend seems to be that cavity nesting and Piciformes feeding increases as the snag deteriorates.

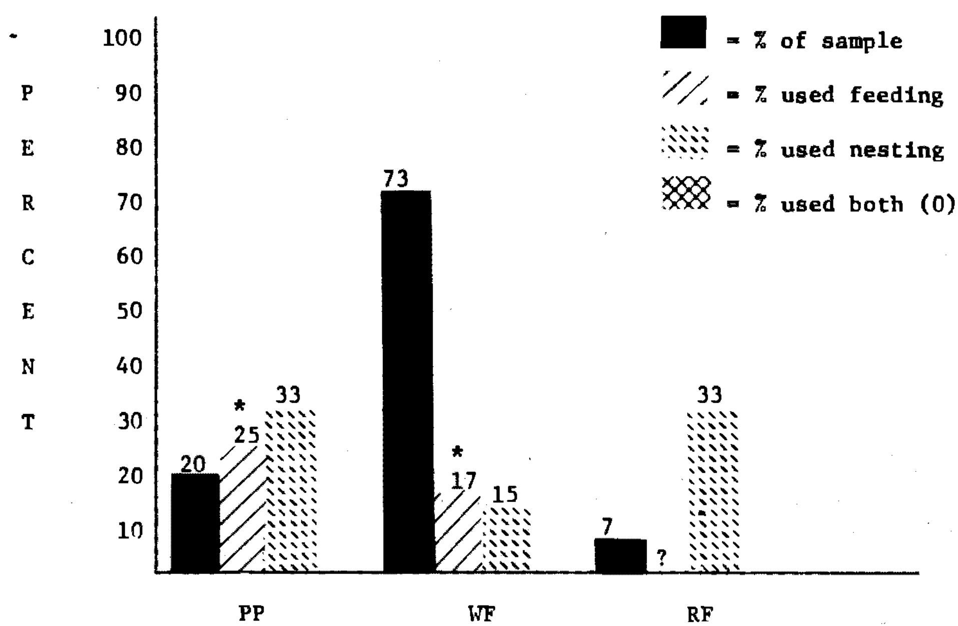
Species Preference

In our study, the preferred species for feeding and nesting, by habitat type were: Douglas-fir type, Douglas-fir; true fir type, red fir; ponderosa pine type, ponderosa pine; west side mixed conifer, Douglas-fir; east side virgin mixed conifer, no outstanding preference shown other than a slight inclination toward ponderosa for feeding; east side logged mixed conifer, a slight preference for ponderosa pine.



6.9 ac → 34 snags: 8 DF/16 WF/10 PP
34 snags → 23 (68%) used → ave. 3.3/ac.

Figure 8. Virgin east side mixed conifer



7 ac → 45 snags: 9 PP/33 WF/3 RF
45 snags → 14 (31%) used → ave. 2.0/ac.

* based on sample of 4 PP and 30 WF
? unknown amount of feeding activity

Figure 9. Logged east side mixed conifer

The fact that only one of the 79 oak snags was used for nesting was a surprising result. On reflection, however, it begins to make sense. Generally, oak snags are one of two types, either skeletons of young trees, which are very hard, or skeletons of old trees, which are little more than a hollow shell (Figure 15). Efficient nest building, apparently, is too difficult in hard snags, and old snags do not offer satisfactory structure for cavity nesters. Madrone very rarely rots while standing, even when old and dead. It is even less attractive than oaks for the uses we were studying.

Past Losses (Figure 16)

Recall that the size of snag required to be felled is one equal to or greater than 16 inches by 20 feet. Of the 207 snags classified for size, 45% (92), containing 49% of the feeding activity and 72% of the nesting activity occurred in these size classes. It would appear then, that on the Klamath National Forest, this magnitude of feeding and nesting habitat has been destroyed in areas logged up to 1971. It is logical to assume that somewhat similar losses are still occurring in logging operations on intermingled private lands.

Obviously these losses must have had a detrimental effect on wildlife. The magnitude of that effect is unknown, since it seems reasonable to assume that at least some of the displaced use would be transferred to snags of smaller dimensions.

How long it will take Mother Nature to replace these losses is an unanswered question. An inkling of the answer can be gleaned from the data collected on the logged ponderosa pine and east side mixed conifer transects. On the fifty-year old ponderosa logging site we found only three standing snags. On the fifty year old east side mixed conifer sites, we found many snags. Apparently the recovery rate varies with the vegetative site, and the rate seems to be low for the true ponderosa type.

CONCLUSIONS

Recommendations

Based on the data collected, I would recommend the following minimum average number of snags be left per acre for Piciformes feeding and cavity nesting; Douglas-fir type, 1.5; true fir type, 4.3; ponderosa pine type, to be determined through further study; west side mixed conifer type, 0.8; east side mixed conifer type, 3.3.

It should be pointed out that ideally, from the wildlife standpoint, it would be best to leave all snags. These minimums should be observed only in those cases where it is necessary to decrease the number of snags per acre due to other resource considerations.

These snags should have the characteristics described earlier (see "Discussion:" Characteristics) in discussions of the ideal snag.

Limitations of Study

The greatest shortcoming of this study has to do with the sample sizes. Obviously, these samples are far smaller than statistically desirable. Unfortunately, we did not have the time or money to gather more data. These shortcomings will be recognized as the Klamath Forest translates these findings into on-the-ground logging practices. That is, if we find a much greater density of wildlife snag use in a timber sale than was found in this study, a corresponding greater number of snags will be left.

Other questions also remain unanswered. Even if we leave an adequate number of snags in a timber sale, what happens when they have fallen over or deteriorated? Obviously, some provision must be made for replacement snags. Replacement cannot be expected to take place naturally, because the rotation age of a stand of timber is planned such as to harvest the trees before they become old and decadent, in other words, before they begin to die and form snags of adequate size for cavity nesters. A conscious effort must be made to leave a few trees solely for the purpose of making snags. How many such trees, and what ages they should be has yet to be determined.

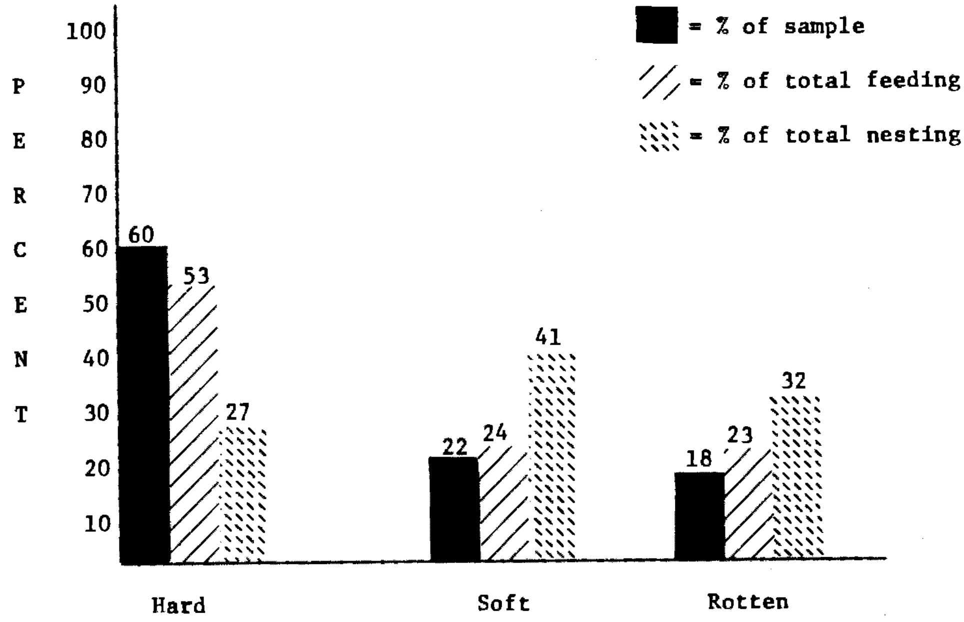


Figure 10. Hardness

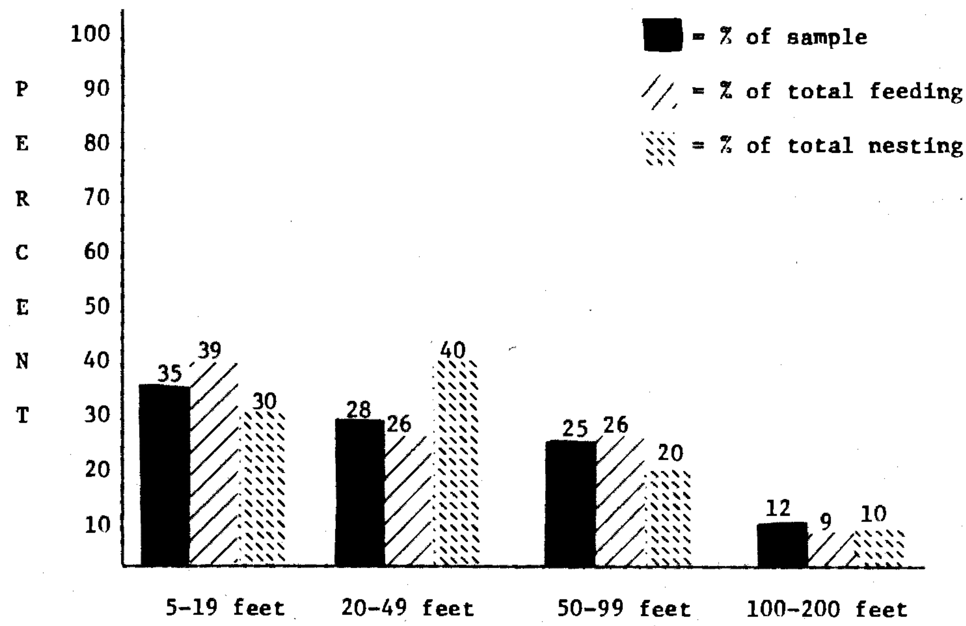


Figure 11. Height Class

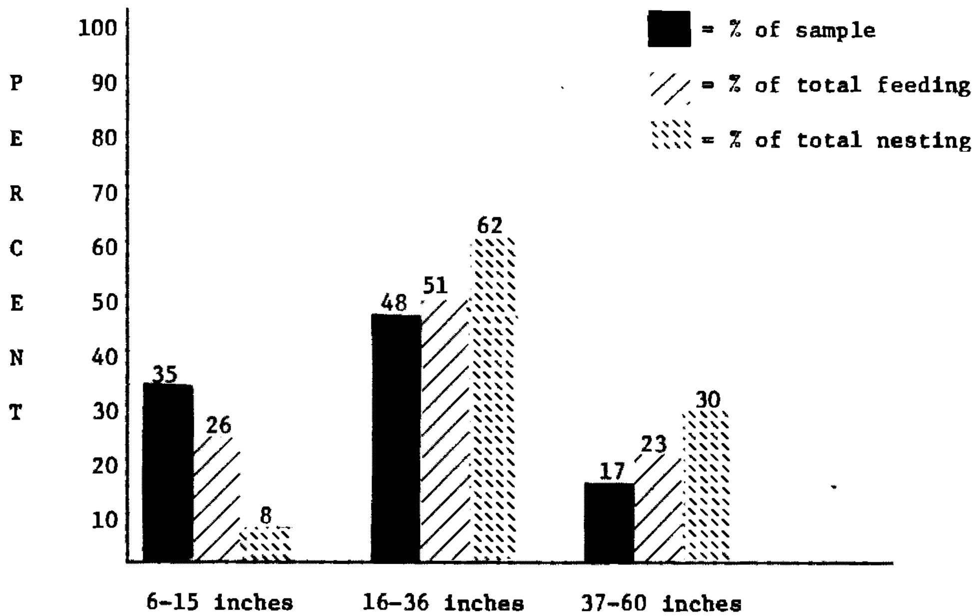


Figure 12. Diameter breast height

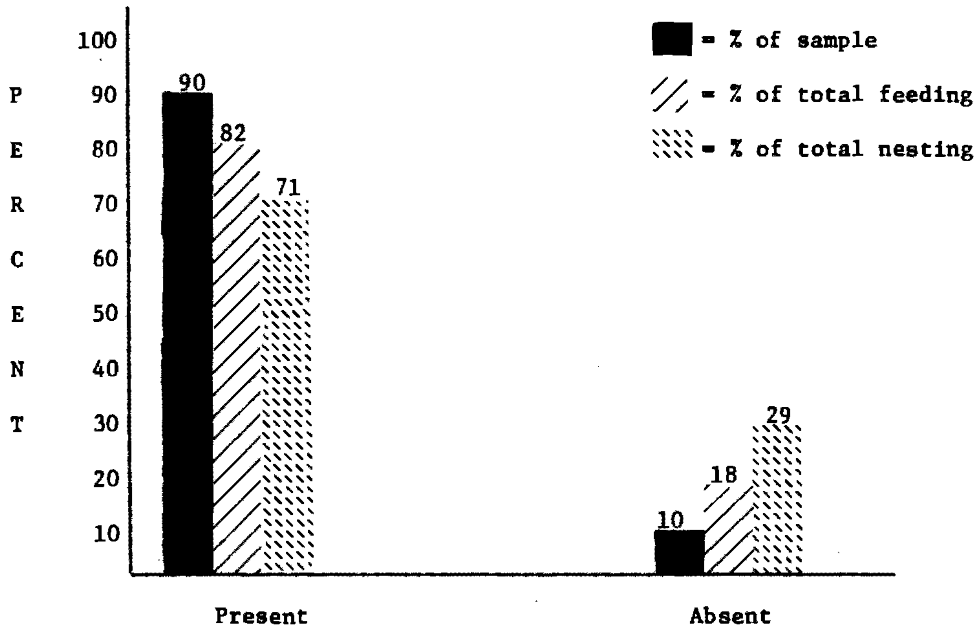


Figure 13. Bark condition

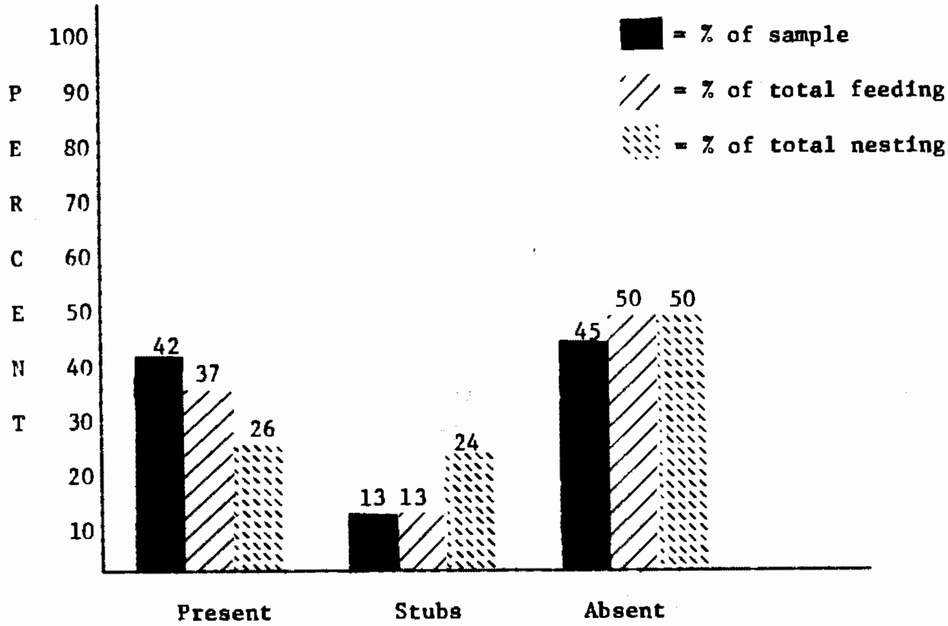
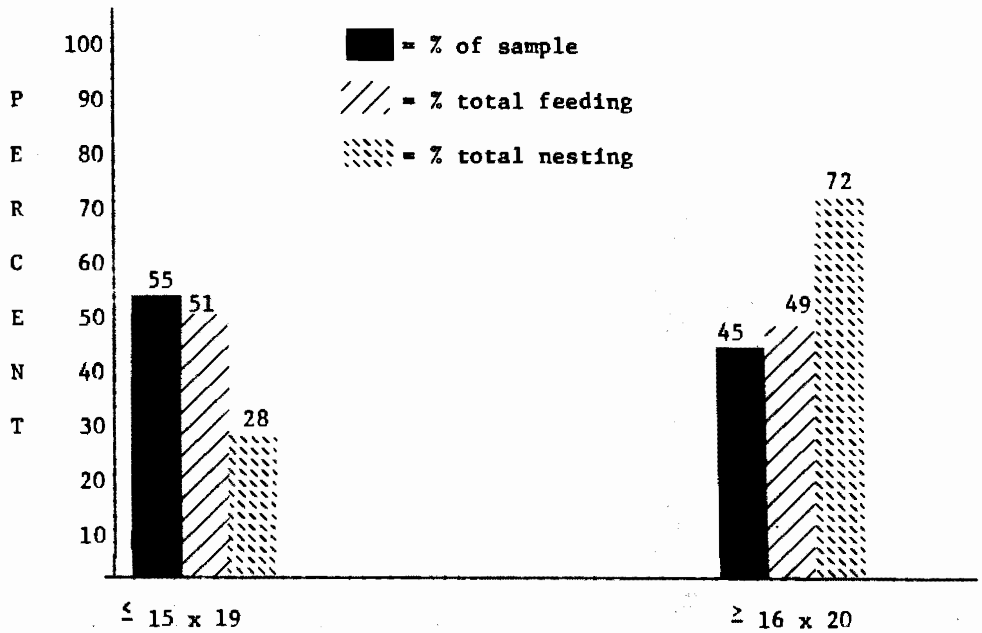


Figure 14. Limb condition



207 snags: 115 - 15 x 19/92 - 16 x 20

Figure 16. Total size classes

The question of how logging affects the habitat in other ways also needs to be answered. Simply leaving enough snags to accommodate the amount of wildlife use which occurred prior to logging may not be the answer. The habitat modification which results from logging may result in an increase in carrying capacity for cavity nesters, but we may not have left enough snags to accommodate the increase. On the other hand, the modification may have resulted in a decrease in cavity nesters, in which case we may have left too many snags.

I would hope that other National Forests, resource agencies, universities and research stations might be interested enough to further pursue investigations into these aspects of wildlife habitat and refine our results.