North Central Forest Experiment Station 9.02

CENTRAL HARDWOOD NOTES

Wildlife Habitat Evaluation

To evaluate wildlife habitat you need to answer the following questions related to the three basic habitat components-food, water, and cover.

1. Is the area you are evaluating a single forest stand, shrubland, or grassland which will provide a single uniform habitat type? Or, are you evaluating a large forest management area made up of a number of stands whose age, density, species mix, etc., are (or could be) different and thus provide (or could provide) a number of different habitats?

The answer to this question will determine what wildlife species you can manage the unit for, and will also determine the type of evaluation procedure you should use. For example, a 40-acre woodlot could support a squirrel population nicely, but would only meet part of the needs of a deer population.

2. What single species or group of species do I want to evaluate the area for?

This is probably the most difficult question to answer. Yet, answering it is absolutely essential before you can evaluate the habitat. One must identify the species so the proper habitat characteristics can be evaluated. Even if you want a general assessment of a stand's potential for wildlife, you need to select a list of species you are interested in and evaluate the habitat value for each. There is no realistic way of averaging across species for a single 'wildlife" habitat value.

Many wildlife species have habitat requirements which overlap. So, selection of a particular species for your management objective may exclude some but not all other wildlife species from your area. Selecting white-tailed deer would not exclude squirrel or quail. Selecting bobwhite quail might, however, limit viable populations of squirrel or other species due to the greater difference in habitat needs.

3. Why am I conducting this evaluation?

The answer to this question will off en determine the information needed including the level of detail and accuracy. If the evaluation is part of an environmental impact analysis for a land management practice on a particular endangered species, then the species' habitat needs will dictate procedures. The procedures should provide sufficiently detailed answers to withstand judicial scrutiny. If the habitat evaluation is to provide a private landowner information on what a woodlot

"is good for," then the techniques employed can be less specific. The best habitat evaluation may be a simple 'walk-through" by the landowner and an experienced wildlife professional to provide a general idea of the habitat value of the land.

Evaluation Tools

Evaluating an area's capability to support a population of a given wildlife species means measuring habitat characteristics that are important to the well-being of that species. Habitat characteristics often include tree species, density, and age distribution; presence of snags or cavities; make-up of ground vegetation; distance to water; or special features such as caves. Measurements can be general such as present or absent; high, medium, or low density; or very detailed, precise quantities.

Key habitat characteristics can be combined mathematically, graphically, or subjectively to provide **a** habitat value. The habitat evaluation method can be a simple **1** -sheet questionnaire needing **general** categorical answers, or mathematical computations requiring substantial amounts of fairly precise data. Commonly used habitat evaluation techniques lie between these two extremes. If you need a detailed evaluation of the wildlife habitat on your property, you should seek professional assistance from the wildlife section of your state conservation agency; Federal agencies such as the Fish and Wildlife Service, Forest Service, or Soil Conservation Service; or a local university or college which has a forestry or wildlife extension program.

Habitat Suitability Index (HSI)

A habitat evaluation using a HSI results in an estimate of the value of the area for a wildlife species. It is a relative measure used to compare one piece of land (a single stand or uniform habitat unit) with another or with the theoretical optimum. It is not an estimate of the wildlife population size.

Habitat suitability procedures are available for many wildlife species and require measuring a number of habitat variables. The procedure for a particular wildlife species tells you which habitat variables to measure, how to measure them, and how to combine them to produce the final index. This index will indicate which variables may be limiting. So you may be able to improve the habitat for the species of interest by treating the stand to enhance the limiting variables. High index values indicate better habitat than low values.

Appendix 1 contains an example of how to use HSI for the eastern gray squirrel.

Pattern Recognition (PATREC)

This procedure provides an estimate of an area's potential wildlife population size by combining habitat variables with the known probabilities of animal presence or

absence. It is most appropriate for evaluating multiple stands (forest compartment or larger). As its name implies, it is based on recognizing the likelihood of a high or low population of animals being present given a certain pattern or arrangement of habitat types.

Again, you must first choose which wildlife species you want. The PATREC procedure for the chosen species will tell you which habitat variables to measure, how to measure them, and how to combine them to get the potential population estimate.

The value for each habitat variable measured provides a probability estimate of both high and low populations of the selected wildlife species in the area. This method also uses an overall probability of there being a high or low population of the wildlife species based on historical experience in this or similar areas. These probabilities are all mathematically combined to provide an estimate of the likelihood of there being a high or low population in the area. This final estimate is combined with historical high and low density estimates to produce a potential population estimate for the selected wildlife species in the area surveyed.

When you have the final estimate, you can then look at the variables and determine which ones might be improved by some treatment in order to increase the potential population.

Appendix 2 shows how to use the PATREC procedure adopted by the Mark Twain National Forest for the eastern wild turkey.

Habitat Evaluation

The procedures and the habitat values discussed are generally more readily available for popular game species and publicly sensitive endangered species, than for other species which have not had such high research or management focus. Having an evaluation procedure (HSI, PATREC, or other) is just one part of the evaluation process. You also need inventory data to determine values for habitat variables.

Habitat features such as average tree d.b.h., or stand age and density, can be obtained from standard forest inventories. Unique habitat features such as snags of a given size, ponds of a certain depth, etc., often require separate, specifically designed surveys. Unfortunately, most habitat evaluation procedures do not provide detailed habitat survey guidelines. The HSI procedures published by the U.S. Fish and Wildlife Service are a notable exception.

The habitat values provided by these evaluation procedures are more than relative comparisons between areas. The procedures can also be used to identify which habitat variable is most deficient in support of your selected wildlife species. By inserting different values for a given habitat variable that can be altered

through management while holding the value of all other variables constant, you can estimate where you can obtain the greatest wildlife benefit for management investments made.

The precision of the evaluation procedure depends on the precision of the habitat variable estimates. If only a general indication of wildlife value is needed, use rough, easily obtained estimates of habitat data. If the evaluation is more critical, then the habitat survey must be carefully designed to produce precise estimates of habitat conditions. In the latter case, the assistance of a natural resource professional (wildlife biologist, forester, field research scientist) is essential.

Finally, the user must realize that the habitat suitability index or potential population estimate provided by these evaluation procedures are indirect estimates. Interpretation of the resulting index or estimate must be tempered with a clear understanding of the limitations and assumptions within the evaluation procedure. And, realizing it is only an index or estimate, it should be only a part of the information used to make land management decisions for wildlife.

References

Allen, A.W. 1982. Habitat suitability index models: gray squirrel. FWS/OBS-82/10.19. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 11 p. (The USFWS publishes a series of habitat evaluation procedures for many wildlife species. These can be obtained by writing: Habitat Evaluation Procedures Group, Western Energy Land use Team, U.S. Fish and Wildlife Service, 2625 Redwing Road, Fort Collins, CO 80526 and specify which species model you desire. Most models available are in a general form that must be adjusted for local use.)

Sweeney, J.M.; Dijak, W.D. 1985. Ovenbird habitat capability model for an oak-hickory forest. In: Proceedings of the annual conference of the Southeastern Association of Fish and Wildlife Agencies. 39: 430-438.

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APPENDIX 1

How to Determine Habitat Suitability Index for Gray Squirrels

Measure the following habitat variables:

- v1 = Percent crown cover of trees that produce hard mast that are 10 inches d.b.h. and larger (oaks, hickories, walnut, pecan, beech).
- V2 = Number of different tree species that produce hard mast.
- V3 = Percent crown cover of overstory trees in the overstory.
- V4 = Average d.b.h. of all overstory trees.
- V5 = Percent crown cover of shrubs.

Assume the inventory produced the following values for each variable:

- V1 = 25 percent
- v2 = 2
- V3 = 90 percent
- V4 = 12 inches
- V5 = 30 percent

Convert these values to indexes using figure 1. For this example, follow the dashed lines on the charts. This conversion provides the following indexes:

- V1 = 0.60
- v2 = 0.50
- v3 = 0.88
- v4 = 0.70
- v5 = 1.00

Combining the first 2 variables provides an index of winter food availability:

$$\sqrt{V1 \times V2} = \sqrt{0.6 \times 0.5} = 0.55$$

Combining the other 3 variables provides an index of cover:

$$\sqrt{v3 \times v4 \times v5} = \sqrt{0.88 \times 0.70 \times 1.00} = 0.78$$

The habitat suitability index is the lowest of the 2 values (0.55) that result from combining the variables, and indicates that winter food is the limiting habitat factor, and as a median value indicates that the stand can be considered moderate to good habitat for gray squirrels.

To increase winter food availability will require increasing the crown cover of hard mast species and/or the number of hard mast producing species. You cannot increase the number of hard mast species at this stage. However, a thinning that removes non-mast species would in the long run increase the crown cover of the hard mast producers and thus increase the index for winter food availability.

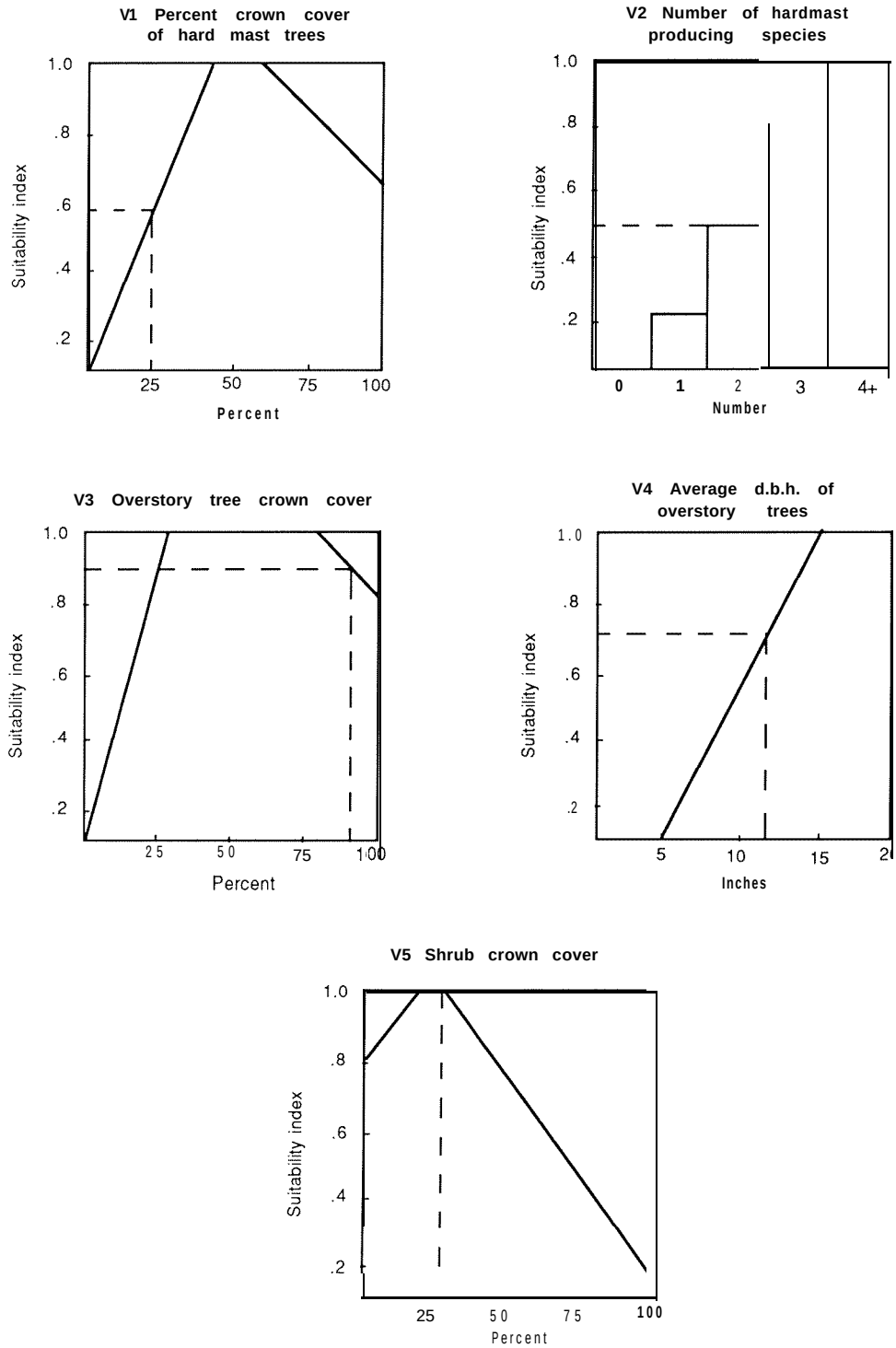

Figure 1 .--Habitat suitability variables and indexes for gray squirrel.

APPENDIX 2

Pattern Recognition Procedure for Eastern Wild Turkey on the Mark Twain National Forest

This procedure requires measuring the 8 habitat variables listed in table 1.

Assume the habitat inventory provides the following values:

V1 = 50 percent
V2 = 50 percent
V3 = 35 percent
V4 = 100 percent
V5 = None
V6 = 100 percent
V7 = None
V8 = 100 percent

Then select the high and low probabilities from table 1 that correspond to the measured values. This produces the following tabulation:

	Probability	
Variable	High	Low
1	**0.15**	**0.25**
2	**0.15**	**0.30**
3	**0.15**	**0.30**
4	**0.50**	**0.10**
5	**0.05**	**0.50**
6	**0.05**	**0.50**
7	**0.05**	**0.50**
8	**0.40**	**0.10**

The calculations are performed as follows:

Multiply all of the high probabilities:
High = 0.15 x 0.15 . . . x 0.05 x 0.40 = 0.00000002

Multiply all of the low probabilities:
Low = 0.25 x 0.30 x 0.50 x 0.10 = 0.0000225

Divide High by High + Low
High probability = 0.00000002/(0.00000002 + 0.0000225) = 0.0009

Divide Low by High + Low:
Low probability = 0.0000225/(0.00000002 + 0.0000225) = 0.9991

Multiply the high and low probabilities by the respective historical population densities (table 1) and add the resulting values:

Population density = (0.0009 x 24) + (0.9991 x 8) = 8.01

The estimated potential population for the current habitat is 8 birds per 1,000 acres.

The potential population can be increased by manipulating some of the habitat variables to increase the high probabilities. In this case, there are several options that could be considered. We could convert some of the open areas from hay or pasture to cultivated crops or food patches and plant wildlife shrubs in others. This would increase the high estimates for variables 5, 6, and 7. We might also plant forest trees in some of the open areas to eventually reduce the total area in open and semi-open habitats.

Table 1 *.-High **and** low probabilities for eastern wild turkey habitat variables*

Variable	Class	Probabilities	
		High	Low
1[1]	Percent of the area in open and semi-open habitats (old fields, pasture, hay or crop land) excluding forest regeneration areas, by distribution class (poor, medium, well).		
	16-40 well distributed	0.50	0.10
	5-15 well distributed or 16-40 poorly distributed	0.25	0.15
	5-15 medium to well distributed or 41-65 well distributed	0.15	0.25
	41-65 medium to poorly distributed or More than 65 open or Less than 5 open	0.10	0.50
2	Percent of area in open and semi-open habitats without regard to distribution.		
	15-24	0.30	0.20
	25-40	0.50	0.10
	41-60	0.15	0.30
	Less than 15 or more than 60	0.05	0.40

(Table continued)

(Table continued)

Variable	Class	Probabilities High	Probabilities Low
3	Percent of total forested area in oak-hickory, oak-cedar, and oak-pine types 50 years of age or older.		
	Less than 30	0.05	0.40
	30-44	0.15	0.30
	45-59	0.30	0.20
	Greater than 59	0.50	0.10
4	Percent of area in oak-hickory, oak-pine, and pine in sawtimber-size stands with 20 to 30 percent ground cover of forbs, grasses, and low shrubs.		
	Less than 20	0.05	0.40
	20-39	0.15	0.30
	40-49	0.30	0.20
	Greater than 49	0.50	0.10
5	Percent of open and semi-open habitats in crop lands (cultivated).		
	15-29	0.15	0.30
	30-49	0.30	0.15
	50-60	0.50	0.05
	Less than 15 or greater than 60	0.05	0.50
6	Percent of open and semi-open habitats in hay or pasture, either cool or warm season grasses.		
	20-30	0.50	0.05
	31-40	0.30	0.15
	41-50	0.15	0.30
	Less than 20 or greater than 50	0.05	0.50
7	Percent of open and semi-open habitats in shrub-grass habitats.		
	1 O-20	0.50	0.05
	21-30	0.30	0.15
	31-40	0.15	0.30
	Less than 10 or greater than 40	0.05	0.50
8	Percent of total area within one-half mile of permanent water.		
	Less than 25	0.10	0.40
	25-49	0.20	0.30
	50-74	0.30	0.20
	Greater than 74	0.40	0.10
	Historical population probability	0.20	0.80
	Historical population density in birds per 1,000 acres	24	8

[1] How well the open lands are distributed (poor, medium, well) can be determined by diagrams available from the Wildlife Biologist, Mark Twain National Forest, 401 Fairgrounds Road, Rolla, MO 65401.