A DEVICE AND STANDARD VARIABLES TO DESCRIBE MICROHABITAT STRUCTURE OF SMALL MAMMALS BASED ON PLANT COVER

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(With 3 figures)

ABSTRACT

Studies quantifying habitat structure generally use several instruments. This paper aims to propose a new and efficient device to characterize microhabitat structure of small mammals. Seven measurements were taken: plant cover, litter cover, rock cover, canopy cover, and vegetative obstruction at three heights. The device is a 0.25 m^2 square wooden frame (0.50 m x 0.50 m) divided in to 100 open squares by wire mesh. Average time spent to measure each trapping station was six minutes. This new device is efficient, i.e., quick, practical, simple, and reliable. It can be used in any kind of forest. We propose this method as a standard method to describe habitat structure.

Key words: habitat, methods, neotropics, small mammals, techniques.

RESUMO

Um instrumento e variáveis-padrão para descrever a estrutura do microhabitat de pequenos mamíferos baseada na cobertura vegetal

Os estudos que quantificam a estrutura do habitat geralmente usam vários instrumentos. Este artigo objetiva propor um novo e eficiente instrumento para caracterizar a estrutura do microhabitat de pequenos mamíferos. Sete medidas foram tomadas: cobertura vegetal (herbáceos e lenhosos), cobertura de folhiço, cobertura de pedras, cobertura de dossel e obstrução foliar vertical em três alturas. O instrumento é uma tela quadrada de 0,25 m^2 (0,50 m x 0,50 m) de madeira, dividida por arame em 100 quadrados abertos. O tempo médio para medir cada estação de captura foi de 6 minutos. Este novo instrumento é eficiente, isto é, rápido, prático, simples e confiável. Ele pode ser usado em qualquer tipo de floresta. Propomos este método como padrão para descrever a estrutura do habitat.

Palavras-chave: habitat, métodos, neotrópicos, pequenos mamíferos, técnicas.

INTRODUCTION

A variety of qualitative and quantitative methods are available to characterize habitat structure (Barnett & Dutton, 1995). Qualitative studies define vegetational types using plant or floristic physiognomy. Quantitative studies measure a set of habitat variables considered important to determine local distribution of the animals studied (Morrison *et al*., 1992). Habitat structure has been quantified by several instruments (Morrison *et al*., 1992), and by a different set of variables in each study. For most studies only a few habitat variables are standard, such as canopy height and number of trees with DBH range defined (James, 1971; Dueser & Shugart, 1978; August, 1983; Thomas & Verner, 1986). Therefore, measures of habitat structure of different studies are seldom comparable.

At the same time most habitat quantification techniques take a great deal of time and effort, especially in tropical rainforests (Barnett & Dutton, 1995). We have been studying small mammal microhabitats. To lessen the problems referred to, we developed a device to measure all variables in a standard set. The device gives fast and easy readings of the variables which were chosen to minimize the well-known effect of temporal variation in habitat structure (Dueser & Shugart, 1978; Freitas, 1998). The set of variables corresponds to factors we regard as relevant to a variety of small mammal species investigated in previous studies (Birney *et al*., 1976; Dueser & Shugart, 1978; Barnum *et al*., 1992; Cassini & Galante, 1992; Morrison *et al*., 1992; Freitas, 1998).

Plant cover is considered a major determinant of local distribution and abundance of small mammals (Birney *et al*., 1976; Barnum *et al*., 1992; Cassini & Galante, 1992). Hence, the device shown in this paper chiefly measures factors related to plant cover.

Herein, we describe the new device and the set of standard variables to describe habitat structure relevant to small mammals. Habitat measurements must be repeatable and, therefore, we tested the repeatability of the proposed device which is applied to studies in forests.

MATERIAL AND METHODS

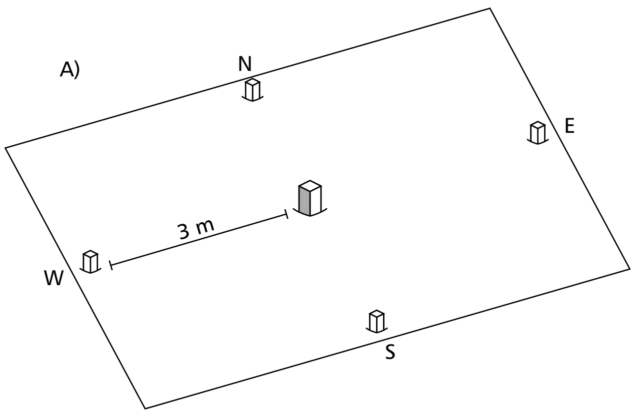
The method using the device was tested in a mountainside locality of the Atlantic Forest in the Serra dos Órgãos (22°28'28"S and 42°59'86"W), Guapimirim Municipality, Rio de Janeiro State, Brazil. Serra dos Órgãos is a mountain range running through several municipalities in Rio de Janeiro State. The general type of vegetation has been classified as Montane Pluvial Atlantic Forest (Rizzini, 1979). Three grids of 0.64 ha were established in the area at different altitudes (748 m, 652 m, and 522 m) as part of an ongoing mark-recapture study of small mammal populations. Each grid had 25 trapping stations, 20 m apart, and a stake marking the center of each trapping station. Four lateral stakes were established 3 m away from the central stake, forming a cross aligned with the cardinal points (north, south, east, and west). Hence, each trapping station had five stakes (Fig. 1A). Microhabitat variables were measured simultaneously with trapping sessions of small mammals as suggested by Murúa *et al*. (1996) and Cerqueira & Freitas (1999). In each trapping station, traps of small mammals were always placed at or near the central stake, inside the 36 m^2 square formed by the stakes.

The device is a 0.25 m^2 square wooden frame (0.50 x 0.50 m) divided in to 100 open squares by wire mesh (Fig. 1B). It measures seven microhabitat variables (Table 1).

Each measurement consists in a count of the number of squares visually obstructed, defined as any square with more than 50% visual obstruction. Squares less than 50% obstructed are considered empty. PLANT, LITTER, ROCK, and CANOPY are measured at the five stakes of each trapping station.

PLANT, LITTER, and ROCK are measured, by the observer holding the frame parallel to the ground near his knees (Fig. 2A). Portions of bare ground are also measured and added to the total area measured. PLANT, LITTER, and ROCK are measured, recalling that these microhabitat variables are complementary, their sum being equal to 100% after portions of bare ground are included. CANOPY is measured by the observer holding the frame at a horizontal position above his head, with arms extended (Fig. 2B). The observer has to measure the percentage of closed areas in the canopy. OBSTR1, OBSTR2, and OBSTR3 are measured with the frame held vertically at three heights (0.50 m, 1.00 m, and 1.50 m), as the observer stands at the central stake pointing the frame to each of the other four stakes (Figs. 2C, 2D, and 2E). The observer has to estimate the percentage of obstruction between the frame and the pointed stake by imagining a wall right behind this stake. Hence, the observer must focus only in the 3 m range between the frame and the stake. The number of logs (trunks fallen on the ground) with perimeters at breast height greater than 0.20 m) is counted inside the 36 m^2 square limited by the stakes (Fig. 1A). Estimates of plant, litter, rock, and canopy cover are made for the 36 m^2 area around the central stake limited by four lateral stakes.

The relative precision of the method was tested through a repeatability experiment. This method, a total of 25 observers using measured five trapping stations three times. A coefficient of variation (CV) was calculated based on his three repeated measures of each observer at each trapping station.



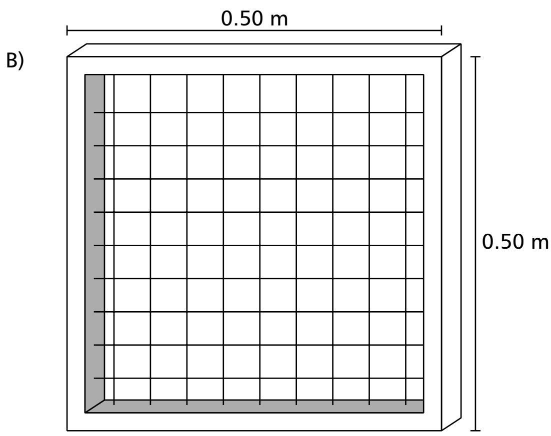


Fig. 1 — A) Square of 36 m^2 where habitat measurements were taken. The square was delimited by four stakes aligned with cardinal points (north, south, east, and west) placed 3 m away from a central staked. B) Instrument used to describe habitat structure.

TABLE 1
Description of microhabitat variables.

Variables	Description
PLANT	Plant cover on the ground
LITTER	Litter cover on the ground
ROCK	Rock cover on the ground
CANOPY	Canopy cover
OBSTR1	Obstruction from 0.00 to 0.50 m high
OBSTR2	Obstruction from 0.50 to 1.00 m high
OBSTR3	Obstruction from 1.00 to 1.50 m high

Hence, there were five CVs per observer. A mean CV was calculated for each observer, based on his five CVs. Habitat variables were measured at every trapping station in the grids during a one-year period, from February 1997 to February 1998.

The performance of each habitat variable was analyzed both separately and together. Our hypothesis was that measurements of the observers varied less than habitat measurements between trapping stations and seasons. The mean CV of observers was compared to the mean CV of habitat variables between trapping stations and seasons. The percentage of observers with mean CV lower than the mean CV of the habitat was the measure of relative precision.

To determine if observers measured similarly to each other, we compared the CV of habitat variables measured by two observers in the same day at the same trapping stations to the CV of habitat variables between trapping points and seasons. If the mean CV between measures of two observers was lower than the mean CV of habitat variables, then the measures taken by observers were considered comparable.

RESULTS

Measuring each trapping station averaged 6 minutes (SD = 2 min, N = 61). Comparing the frequency distributions of CVs of all habitat variables to CVs of all 25 observers, 17 observers were below the lower CV of habitat variables in one year. In other words, 68% of the observers varied in their replications less than the habitat variation found in each grid in each trapping session during one year of study. The relative precision of some variables was even higher individually: OBSTR3 obtained 100% of CV of replications smaller than the CV of habitat, 96% of PLANT and ROCK, 92% of OBSTR1 and CANOPY, 88% of OBSTR2, and 80% of LITTER (Fig. 3). Six out of 17 pairs of observers had mean CVs between observers lower than the mean CVs of habitat variables. Some variables were less affected than others by the readings of different observers. Hence, ROCK had 94% of the CVs between observers lower than the CV of habitat in one year, PLANT and OBSTR3 had 88%; OBSTR1, 82%; CANOPY, 77%; OBSTR2, 71%; and LITTER, 59%.

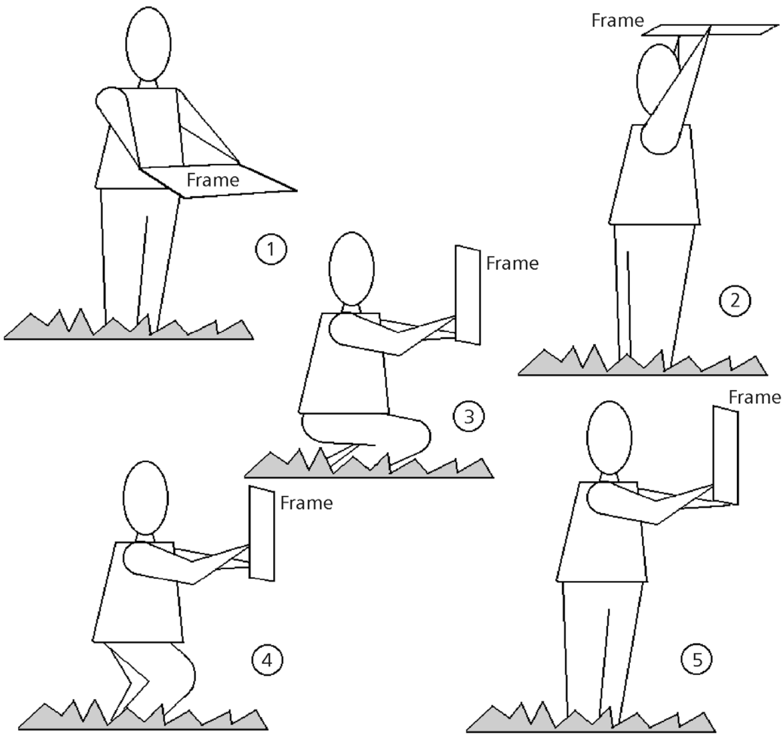


Fig. 2 — Postures of the observers measuring habitat variables, (1) PLANT, LITTER and ROCK, (2) CANOPY, (3) OBSTR1, (4) OBSTR2, and (5) OBSTR3.

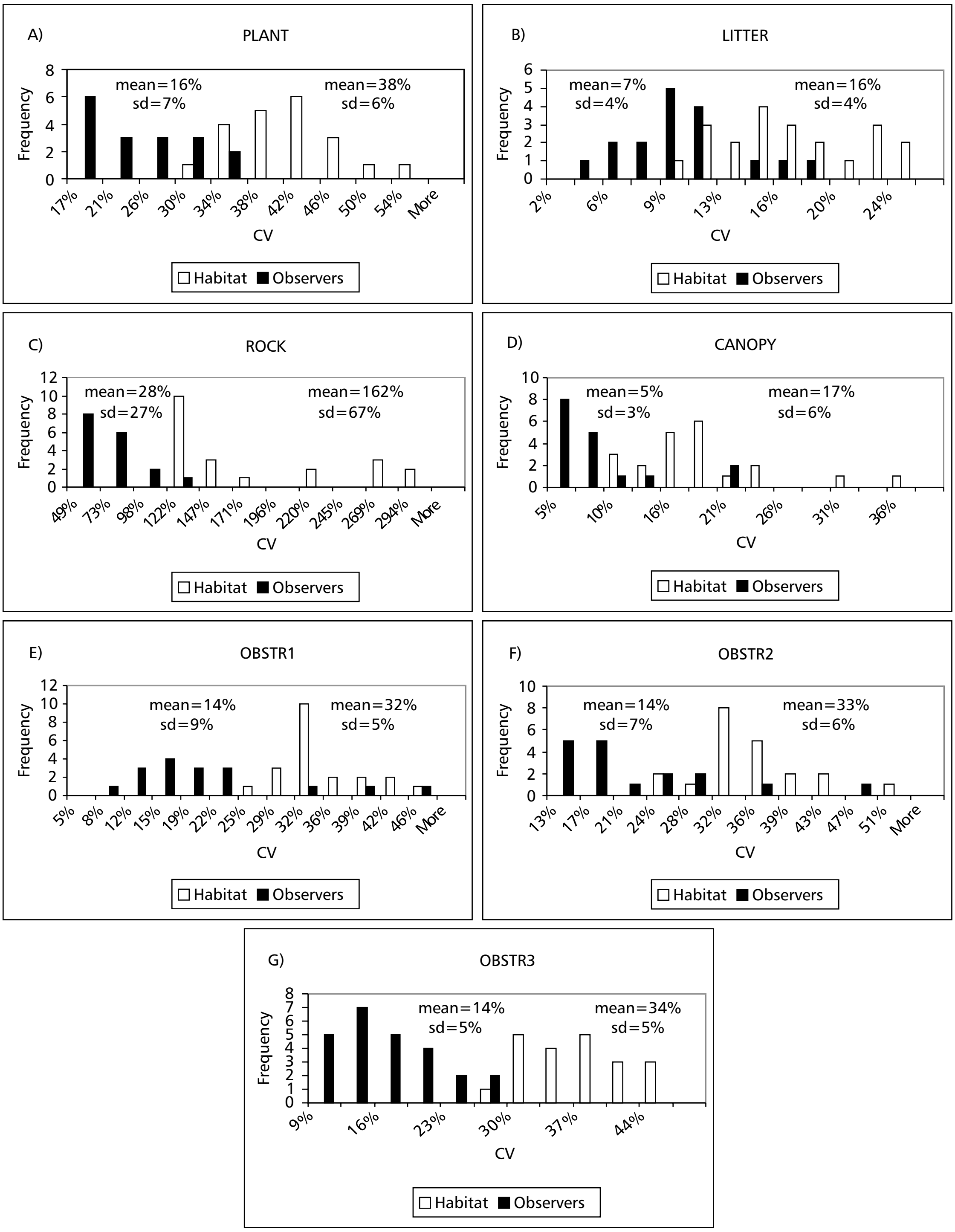


Fig. 3 — Frequency distribution of mean coefficient of variation representing observers and habitat for each variable. A) PLANT, B) LITTER, C) ROCK, D) CANOPY, E) OBSTR1, F) OBSTR2, G) OBSTR3.

DISCUSSION

The device, which allows measurements to be taken in a fast, practical, simple, reliable, and comparable fashion, is practical since its use requires only one easily transportable measurement instrument and two observers, one to take measurements and the other to write on the field form. With only seven variables to learn and measure, its methodology is simple. In addition reliability and comparability of the results were demonstrated by the repeatability experiment. This method seems faster than most of those previously described, although such information is rarely reported (e.g., James & Shugart, 1970; Dueser & Shugart, 1978; Cooperrider, 1986; Ernest & Mares, 1986; Morrison *et al*., 1992). It can be used in any kind of forest, and is now being utilized as a standard method to describe habitat structure of the Atlantic Rainforest. This method standardization makes our habitat studies comparable, consequently strengthening results and conclusions. It is also a first step to wards creating models of habitat use, similar to those developed in other regions for a variety of terrestrial vertebrates in the neotropics (Van Horne & Wiens, 1991; Fielding & Haworth, 1995; Reading *et al*., 1996).

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