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A STUDY OF RUFFED GROUSE DRUMMING SITES
IN NORTHERN MICHIGAN

Thesis for the Degree of M. S.
MICHIGAN STATE UNIVERSITY
WALTER LAWRENCE PALMER
1961

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A STUDY OF RUFFED GROUSE DRUMMING SITES
IN NORTHERN MICHIGAN

By

Walter Lawrence Palmer

AN ABSTRACT

Submitted to the School of Graduate Studies of Michigan
State University of Agriculture and Applied Science
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

DEPARTMENT OF FISHERIES AND WILDLIFE

1961

Approved

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ABSTRACT

Forty ruffed grouse (Bonasa umbellus L.) spring courtship sites were studied in 1959. Sites consisted of drumming logs and surrounding vegetation, and had been located on the Rifle River Area, Ogemaw County, Michigan, during a nine-year period from 1951 to 1959.

I recorded log dimensions, azimuth of log axis, species of log whenever possible, and distances from the drumming position to the nearest end of the log. Vegetation surrounding the logs was studied quantitatively and qualitatively by utilizing a series of quadrats and transects.

Logs averaged about 12 inches high, 13 inches wide, and almost 20 feet long. Logs used most often were larger in diameter than those used infrequently, but length did not appear to be important. Almost three-fourths of the logs were white pine (Pinus strobus) and about half of the remaining logs were other coniferous species. The drumming location was usually about five feet from the larger end of the log.

Vegetation except in the 0-2 feet tall size class, was usually more dense immediately surrounding the logs than elsewhere in the habitat. In the 0-2 feet tall size class, fewer stems were tallied near the logs than elsewhere.

No significant vegetational differences were found between logs used several years as compared with logs used less frequently.

All forty drumming logs were located in lowland vegetation types, but usually were near a lowland-upland type boundary. Although 44 woody plant species were tallied on the sites, speckled alder (Alnus rugosa), red-osier dogwood (Cornus stolonifera), willows (Salix spp.), balsam fir

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data. The text also mentions that regular audits are necessary to identify any discrepancies or errors in the accounting process.

Furthermore, it is noted that the accounting system should be designed to be user-friendly and efficient. This helps in reducing the time and effort required to enter and process data. The document also highlights the need for proper segregation of duties to prevent fraud and ensure the integrity of the financial information.

In conclusion, the document stresses that a robust accounting system is essential for the success of any business. It provides a clear framework for how to set up and maintain such a system, ensuring that all financial activities are properly recorded and reported.

The second part of the document focuses on the implementation of internal controls. It outlines various measures that can be taken to minimize the risk of errors and fraud. These include the use of standardized procedures, regular reconciliations, and the appointment of independent auditors. The text also discusses the importance of training staff on the correct use of the accounting system and the need for ongoing monitoring and evaluation of the internal control system.

Additionally, the document mentions that the accounting system should be able to generate timely and accurate financial statements. This is crucial for management to make informed decisions about the business. The text also notes that the system should be able to handle complex transactions and provide detailed reports on various aspects of the business's financial performance.

Overall, the document provides a comprehensive guide to setting up and maintaining an effective accounting system. It covers all the key aspects, from data entry and record-keeping to internal controls and financial reporting. By following the guidelines provided, businesses can ensure that their financial information is accurate, reliable, and secure.

The final part of the document discusses the role of technology in modern accounting. It highlights how the use of software and automation can significantly improve the efficiency and accuracy of the accounting process. The text mentions various accounting software options and their features, such as cloud-based access, real-time reporting, and integration with other business systems.

It also notes that while technology offers many benefits, it is not a substitute for good accounting practices. Proper training and oversight are still required to ensure that the system is used correctly and that the data is accurate. The document concludes by emphasizing that a combination of sound accounting principles and modern technology is the key to successful financial management.

(Abies balsamea), and mountain holly (Nemopanthus mucronata) were most common.

The Rifle River Area had not been lumbered for several years, and had an excessive deer (Odocoileus virginianus) population. Much of the area contained merchantable or near-merchantable stands of large-toothed aspen (Populus grandidentata) and trembling aspen (P. tremuloides) which could be harvested. Results of vegetation analyses suggested that plants which are not palatable to deer are the only species reproducing successfully, and therefore these supply the undergrowth necessary for the establishment of drumming sites.

Although no quantitative grouse population data are available for comparison, it is possible that the combined effect of inadequate timber harvest, and the excessive deer population have reduced the grouse carrying capacity of this area by reducing the percentage of the area suitable for grouse territories.

ACKNOWLEDGEMENTS

I thank Mr. H. D. Ruhl, Chief, Game Division, Department of Conservation, for initiating and urging completion of the long-term population study. The research was conducted under Pittman-Robertson Projects W-46-R and W-95-R.

Dr. R. A. MacMullan and Ralph Blouch directly supervised my work while they were biologists-in-charge of the Houghton Lake Wildlife Experiment Station. Dr. G. A. Ammann offered suggestions on field techniques from time to time and he and Dr. C. T. Black kindly edited the manuscript. Dr. L. L. Eberhardt and R. G. Heath assisted with statistical methods. Dr. John George, Patuxent Wildlife Research Center, U. S. Fish and Wildlife Service, helped design the vegetation sampling plan.

Jeanne Wheeler, Dorothy Watling and my wife Patt typed and re-typed the several versions of the manuscript.

I wish to thank Dr. G. A. Petrides, Professor of Wildlife Management, Michigan State University, who constructively criticized and edited the manuscript and finally to Dr. Peter I. Tack, Head, Department of Fisheries and Wildlife, Michigan State University who, despite an already burdensome schedule, urged completion of the report and assisted in editing the manuscript.

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INTRODUCTION

The ruffed grouse (Bonasa umbellus L.) is an important game bird in Michigan, second only to the ring-necked pheasant (Phasianus colchicus L.) in average annual kill. The kill exceeds a half-million birds during peaks of abundance, and recently has totalled approximately a third of a million birds (Ryel and Eberhardt, 1960). Improved highways, faster cars, shorter work weeks, and competition for hunting areas in southern Michigan farmland, have been responsible for an increasing interest in northern Michigan grouse hunting.

Male grouse usually select individual territories during their first fall and winter, and keep them throughout life (Eng, 1959). Once these territories are established, males become quite sedentary and probably spend all their time within an area less than a quarter-mile in radius (Palmer, 1956; Eng, 1959). Some slightly elevated object within the territory is selected on which they perform the courtship drumming act. The elevated object is usually a log, but other objects such as boulders or hummocks may be used (Edminster, 1957; Frank, 1947; Bump, Darrow, Edminster and Crissey, 1947). The drumming sound is produced by moving the wings forcefully downward and forward.

Previous Investigations

Edminster (1947) described typical cover used for drumming in New York State. He found that birds preferred young, second growth woodland, predominantly hardwood, but where a fair scattering of conifers, especially young conifers, was present. He also found that mature woodlands, solid coniferous stands, open slashings, and brushland seem to be avoided.

• **1990s:** The 1990s saw a significant increase in the number of people living in poverty, particularly in the United States. This was largely due to the economic recession of the early 1990s, which led to widespread job loss and a decline in wages.

• **2000s:** The 2000s saw a period of relative stability in poverty levels, but with a notable increase in the number of people living in poverty in the United States. This was largely due to the economic recession of the early 2000s, which led to widespread job loss and a decline in wages.

• **2010s:** The 2010s saw a significant increase in the number of people living in poverty, particularly in the United States. This was largely due to the economic recession of the early 2010s, which led to widespread job loss and a decline in wages.

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• **2100s:** The 2100s saw a significant increase in the number of people living in poverty, particularly in the United States. This was largely due to the economic recession of the early 2100s, which led to widespread job loss and a decline in wages.

Dorney (1959) in Wisconsin noted that males did not select territories in habitat devoid of forest undergrowth less than 6 feet tall.

Eng (1959) attempted the first detailed analysis of vegetation near drumming logs, but did not compare this vegetation with that elsewhere in the habitat.

Since cover, soils, and other ecological factors in northern Michigan differ considerably from the areas in which Eng's Minnesota study took place, his data are not readily applicable here.

Present Conditions in Northern Lower Michigan

Virgin forests in northern lower Michigan were cut during the middle and late nineteenth century. The logging was followed by extensive fires, which were not adequately controlled until about 1920. Much of the present-day forest cover dates from this period. As a result, large areas exist, which have pole-sized or larger trees, where undergrowth is scanty. This situation is especially apparent on poorer soils. In many areas excessive numbers of browsing deer (Odocoileus virginianus) have also helped to reduce plant reproduction. Because of these two factors, it seemed possible that the availability of suitable drumming cover is declining in this region. This in turn may be a factor affecting the abundance of ruffed grouse in Michigan.

Since males are the most sedentary segment of the population, (Palmer, 1956; Eng, 1959) I thought that a study designed to evaluate drumming sites would provide valuable information necessary for management of areas for ruffed grouse production. Although grouse are polygamous, and it is possible that cover requirements of cocks and hens differ,

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especially during the nesting season, generally the two sexes require similar habitat types.

THE STUDY AREA

During a nine year grouse population study from 1951 to 1959, forty drumming logs were located and studied on the Rifle River Area, Ogemaw County, Michigan. This 4318-acre area is largely forest, and several distinct forest cover types are present. (Table I)

TABLE 1

Cover types, and percentage of the 4318-acre
Rifle River Area, Michigan

<u>Type</u>	<u>Percentage of total area</u>
Upland Aspen	40.6
Northern swamp hardwoods	15.7
Upland grasses	12.3
Lowland willows and alder	9.4
Lakes	7.9
Northern swamp conifers	7.3
Lowland grass or sedges	4.5
Upland oak	2.1
Upland conifers	<u>.2</u>
	100.0

1. The first part of the document discusses the importance of maintaining accurate records of all transactions.

2. It also highlights the need for regular audits to ensure compliance with applicable laws and regulations.

3. Furthermore, the document emphasizes the role of transparency in building trust with stakeholders.

4. In addition, it notes that clear communication is essential for resolving any disputes that may arise.

5. Finally, the document concludes by stating that a strong commitment to ethical practices is fundamental to long-term success.

6. The following table provides a summary of the key findings and recommendations from the study.

7. It is important to note that these findings are based on a sample of participants and may not be generalizable to all cases.

8. For more detailed information, please refer to the full report attached to this document.

9. We appreciate your interest in this research and hope that the findings provide valuable insights.

10. Thank you for your time and attention.

11. Sincerely,
[Name]

12. [Title]

13. [Organization]

14. [Address]

15. [City, State, ZIP]

16. [Phone Number]

17. [Email Address]

18. [Website]

19. [Social Media Links]

LOCATING AND RECORDING DRUMMING LOG USE

I located drumming males each spring using the stalking method (Frank, 1947). The method involved walking slowly through an area listening for drumming. When I heard a grouse drum, I approached it carefully. The bird usually flushed at close range, and a search of the area disclosed the drumming log, which could be identified by the presence of several fecal droppings. Some males however, did not flush, but instead hopped down from the log and walked away, often unnoticed thus making locating of the log much more difficult.

By live-trapping and banding birds, and also by checking areas repeatedly it was apparent that some birds used more than one log. It appeared that there was a direct correlation between the birds' tendency to walk or run away upon being approached and the number of logs on which it drummed. In other words, grouse which performed on only one log apparently had a strong attachment for that log and an unwillingness to leave, and I postulated that this attachment was probably a reflection of the site's quality. The logs studied to my knowledge, were used by only one male each spring.

Once drumming logs were located, I attempted to check them in subsequent years to ascertain whether they were being used. Thus, I had a continuous record of use for most of the 40 logs for up to 8 years time (Figure 1).

DIMENSIONS, TYPES AND DIRECTIONS OF DRUMMING LOGS

I revisited each of the forty drumming logs during the summer of 1959 and secured the following information:

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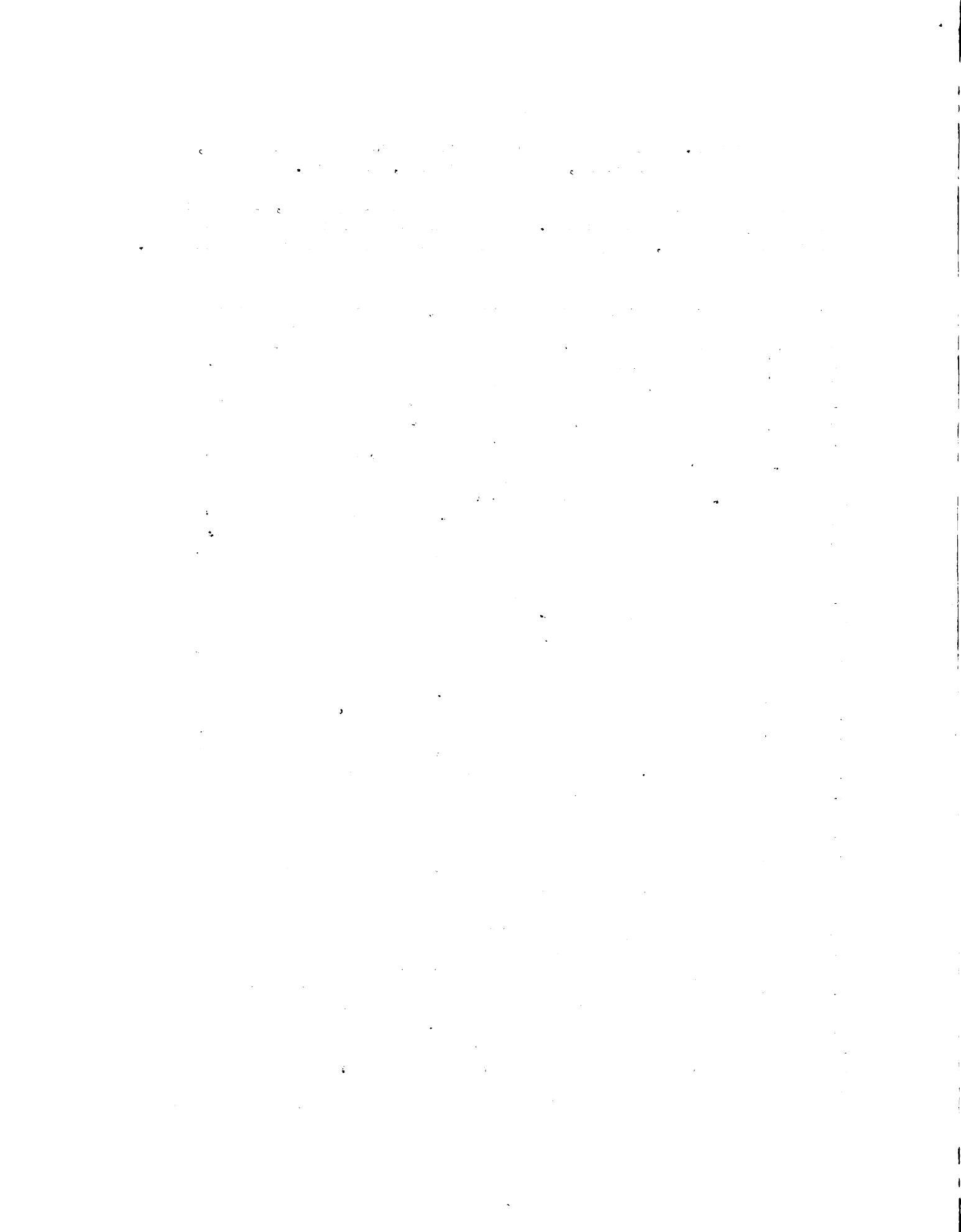
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1. Log height and width to the nearest one-half inch.
2. Length to the nearest half foot.
3. Species of log or, if very decayed, whether it was a conifer or hardwood.
4. Azimuth of log axis.
5. Distance of drumming position to nearest end of the log.

Log width varied from 8 to 21 inches with a mean of 13 inches.

Height varied from 7 to 21 inches with a mean of 11.9 inches and length ranged from 5.5 to 44 feet and average 19.8 feet (Figure 2).

Logs were then tabulated according to the number of years each had been used and observed, and a ratio was computed between the sum of the number of years used by the sum of the number of years observed. The resultant ratio was therefore an estimated probability of use in each size class for any given year (Tables 2 and 3).

Using this method of analysis, I assumed that if log diameter was one factor affecting selection the estimated probability of use for each size class would be lowest in the smaller size classes and approach unity in the larger log sizes. It appears that this was indeed true, because the probability of use in the largest diameter class was considerably larger than in the smallest class.

Thus if logs are at least 7 inches in diameter the probability of use in any year increases directly with a further increase in log size.

Log length showed little correlation with frequency of use, although I expected that longer logs would tend to be larger in diameter and therefore should be correlated with use. Although the two larger length

• The first step in the process of identifying a problem is to recognize that a problem exists. This often involves gathering information and data about the situation. Once a problem is identified, the next step is to define the problem clearly and specifically. This involves identifying the causes of the problem and the consequences of not addressing it. The third step is to generate potential solutions or strategies to address the problem. This often involves brainstorming and consulting with others. The fourth step is to evaluate the potential solutions and select the most appropriate one. This involves considering the feasibility, effectiveness, and ethical implications of each solution. The fifth step is to implement the selected solution and monitor its progress. This often involves setting up a system of accountability and reporting. The sixth step is to evaluate the results of the solution and make adjustments as needed. This involves comparing the actual results to the expected results and identifying any gaps or areas for improvement. The seventh step is to document the process and results of the problem-solving process. This involves creating a record of the problem, the solutions considered, the solution selected, and the results achieved. The eighth step is to share the results of the problem-solving process with others. This involves communicating the findings and lessons learned to relevant stakeholders. The ninth step is to reflect on the problem-solving process and identify areas for improvement. This involves considering what worked well and what could be done better next time. The tenth step is to apply the lessons learned to other situations. This involves using the knowledge and skills gained from the problem-solving process to address other problems in the future.

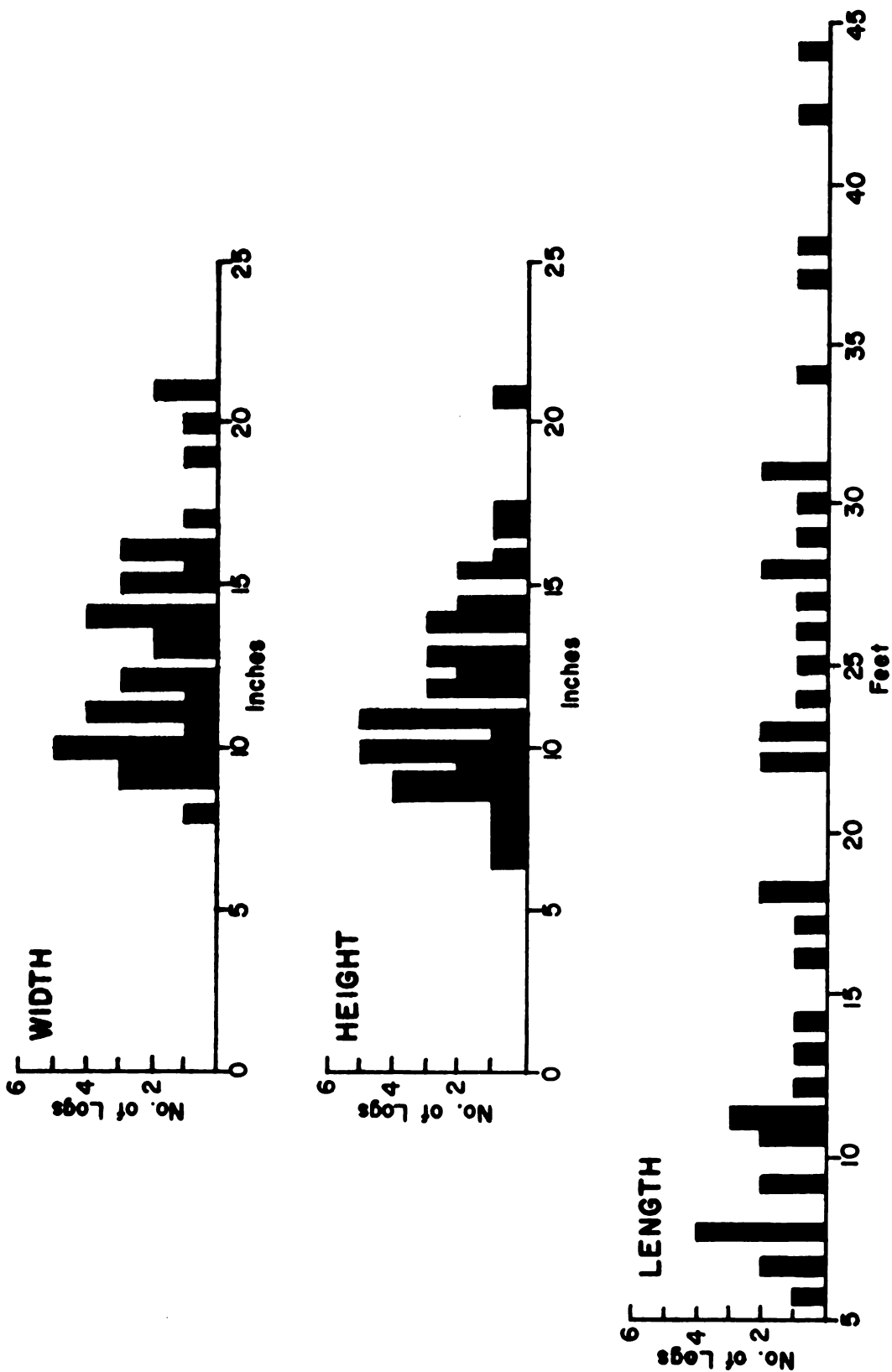


Fig. 2 Plotted frequency distribution of width, height, and length of 40 ruffed grouse drumming logs on the Rifle River Area, Michigan.

TABLE 2

The relationship between the number of years 40 ruffed grouse drumming logs were used and observed by arbitrary diameter classes, and the computed probability of use in any one year by size classes.

No. of Log	<u>7-9.5" Class</u>		<u>10-12.5" Class</u>		<u>13-15.5" Class</u>		<u>16"+ Class</u>	
	<u>Years used</u>	<u>Years observed</u>	<u>Years used</u>	<u>Years observed</u>	<u>Years used</u>	<u>Years observed</u>	<u>Years used</u>	<u>Years observed</u>
1	2	5	4	4	7	7	8	9
2	2	7	1	5	4	5	5	9
3	3	6	1	5	4	4	3	3
4	1	4	1	4	4	4	4	4
5	2	2	3	3	4	9		
6	3	6	5	5	5	9		
7			4	4	1	4		
8			4	4	4	8		
9			2	3	4	4		
10			1	3	5	7		
11			4	4	1	4		
12			5	5				
13			4	9				
14			8	9				
15			7	7				
16			4	5				
17			1	4				
18			1	3				
19			2	6				
Totals	13	30	62	92	43	65	20	25
<u>Years used</u> <u>Years observed</u> = .433		<u>Years used</u> <u>Years observed</u> $P_2 = .674$		<u>Years used</u> <u>Years observed</u> $P_3 = .662$		<u>Years used</u> <u>Years observed</u> $P_4 = .800$		

TABLE 3

The relationship between the number of years 40 ruffed grouse drumming logs were used and observed by arbitrary length classes, and the computed probability of use in any one year by size classes.

No. of Logs	5 - 15 feet		15.5-25 feet		25.5-35 feet		35.5 feet +	
	Years used	Years observed	Years used	Years observed	Years used	Years observed	Years used	Years observed
1	1	4	1	3	4	4	3	6
2	2	6	4	5	8	9	4	9
3	1	4	7	7	5	5	8	9
4	5	7	3	6	2	3	3	3
5	2	2	2	7	4	4		
6	1	4	4	8	2	5		
7	4	4	4	4	5	5		
8	1	4	1	5	4	4		
9	3	3	1	5	7	7		
10	4	4			4	4		
11	1	3						
12	5	9						
13	5	9						
14	4	9						
15	4	4						
16	1	4						
17	4	5						
Totals	48	85	27	50	45	50	18	27
	$\frac{\text{Years used}}{\text{Years observed}}$		$\frac{\text{Years Used}}{\text{Years observed}}$		$\frac{\text{Years used}}{\text{Years observed}}$		$\frac{\text{Years used}}{\text{Years observed}}$	
	=.565		=.540		=.900		=.667	

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and analysis processes, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the data remains reliable and secure throughout its lifecycle.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that the data management processes remain effective and aligned with the organization's goals.

classes were more apt to be used than the smaller classes, the difference was not consistent. Since none of the 40 logs studied was less than 5.5 feet this appears to be a minimum length requirement, but additional length apparently is not critical.

Species and types of logs used, and drumming location selected on logs

Thirty-four of the 40 logs were old, decayed conifers of which at least 26 were white pine (Pinus strobus). It was sometimes impossible to identify species. In most cases logs were either fallen trunks or had been saw-logs left behind when the virgin stands of timber were cut many years ago. Freshly fallen, wind-thrown trees, mostly large-toothed aspen (Populus grandidentata) were sometimes used, and birds invariably drummed near the butt end of these logs, apparently to take advantage of the added concealment of the exposed roots. On most logs in fact, birds seldom drummed from near the center or mid-point, but seemed to prefer a position about 5 feet from the large end.

Log directions

I recorded azimuth readings to determine whether grouse preferred logs lying in a particular direction. Twenty-eight or 70 per cent of the logs lay in a southwest to northeast direction i.e. between 0° - 90° and 180° - 270° . I did not take a random sample of directions of non-drumming logs for reasons to be explained in the following section of this report, but I would expect to find most logs lying in this general direction due to the effects of the prevailing winds. This is strictly speculation of course, and therefore the proposition of grouse selecting logs on the basis of direction cannot be settled at present.

ANALYSES OF VEGETATION

Early in the study I gave some thought to comparing vegetation near drumming and non-drumming logs. As I have previously mentioned however, the distinction between these two classes of logs is not always clear-cut. For example, most cocks select only one log on which to drum and I speculated that these are prime sites. The 40 logs I studied were of this type. On the other hand, some birds skip from one log to another, and may use four or five logs. These logs must be classed as drumming logs. Finally, logs with no evidence of use would be classed as non-drumming logs, but bias could be introduced if such logs had been used in the past and were not detected.

The ultimate objective of this study was to ascertain the characteristics of prime drumming sites so that habitat improvement practices could be directed toward perpetuation or creation of favorable habitat. Because of the difficulties and magnitude of a study involving non-drumming as well as drumming logs outlined above, and also because of the desirability of learning the requisites of the best sites, I decided to study the characteristics of the best sites only.

I experimented with several sampling methods which would enable me to ascertain these characteristics, and at the same time be able to make comparisons of site characteristics with vegetation adjacently or in the vicinity of sites. The sampling design had to meet these additional requirements: (1) vegetation had to be sampled adequately so that the data could withstand statistical treatment and, (2) the design had to be easily used in the field.

QUESTION 1 (10 marks)

1.1. The following table shows the number of employees in a company in 2010 and 2011.

Employee Category | 2010 | 2011

- Full-time employees: 120 in 2010, 130 in 2011

• Part-time employees: 80 in 2010, 90 in 2011

• Contract employees: 50 in 2010, 60 in 2011

• Total employees: 250 in 2010, 280 in 2011

1.2. Calculate the percentage change in the total number of employees from 2010 to 2011.

1.3. Calculate the percentage change in the number of full-time employees from 2010 to 2011.

1.4. Calculate the percentage change in the number of part-time employees from 2010 to 2011.

1.5. Calculate the percentage change in the number of contract employees from 2010 to 2011.

1.6. Calculate the percentage change in the number of full-time employees as a percentage of the total employees from 2010 to 2011.

1.7. Calculate the percentage change in the number of part-time employees as a percentage of the total employees from 2010 to 2011.

1.8. Calculate the percentage change in the number of contract employees as a percentage of the total employees from 2010 to 2011.

1.9. Calculate the percentage change in the number of full-time employees as a percentage of the total employees from 2010 to 2011.

1.10. Calculate the percentage change in the number of part-time employees as a percentage of the total employees from 2010 to 2011.

1.11. Calculate the percentage change in the number of contract employees as a percentage of the total employees from 2010 to 2011.

1.12. Calculate the percentage change in the number of full-time employees as a percentage of the total employees from 2010 to 2011.

1.13. Calculate the percentage change in the number of part-time employees as a percentage of the total employees from 2010 to 2011.

1.14. Calculate the percentage change in the number of contract employees as a percentage of the total employees from 2010 to 2011.

1.15. Calculate the percentage change in the number of full-time employees as a percentage of the total employees from 2010 to 2011.

1.16. Calculate the percentage change in the number of part-time employees as a percentage of the total employees from 2010 to 2011.

1.17. Calculate the percentage change in the number of contract employees as a percentage of the total employees from 2010 to 2011.

1.18. Calculate the percentage change in the number of full-time employees as a percentage of the total employees from 2010 to 2011.

1.19. Calculate the percentage change in the number of part-time employees as a percentage of the total employees from 2010 to 2011.

1.20. Calculate the percentage change in the number of contract employees as a percentage of the total employees from 2010 to 2011.

Eng (1959) used two methods to measure vegetation, the "closest tree method" described by Cottam and Curtis (1956) to study tree density and composition, and for smaller vegetation he used four milacre quadrats surrounding the logs. With these two methods, he was able to specify characteristics of flora near logs, but was not able to compare this with vegetation elsewhere in the habitat.

I suspected that vegetation within a few feet of the drumming bird might be less dense than nearby, because birds must have space in which to move their wings, and because the presence of the log might decrease the abundance of stems. Therefore, I used a series of 5 one-quarter milacre quadrats at the log. One of these (Number 5 in Fig. 3) was used to measure vegetation immediately surrounding the drumming location, and quadrats 1-4 were used to measure vegetation adjacently. Four quadrats of the same size were located 66 feet from the log, one in each cardinal direction. Quadrats were used primarily to sample the smaller vegetation.

To sample larger vegetation, I used a system of four, hundredth-acre transects (6.6 x 66 feet) laid out from the drumming location, one in each cardinal direction. (Fig. 4.) Each transect was later divided into "near" and "far" halves to determine whether plant density and composition varied between these portions.

In both sampling methods I tallied only woody vegetation, with more than half the stem diameter in the sampling unit, and stems were grouped into the following size classes: 0-2 feet tall, 2-5 feet tall, 5-8 feet tall, between 8 feet tall and 3 inches diameter at breast height, 3-6 inches dbh, 6-9 inches dbh, and 9 inches dbh and larger. All of these classes were used while tallying stems on quadrats, whereas to save time

1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. For example, a manager might notice that sales are declining or that customer satisfaction is low. Once a problem is identified, the next step is to define it more precisely. This involves determining the scope of the problem, its causes, and its effects. For instance, a manager might define a problem as "a 10% decrease in sales over the last quarter, primarily due to a loss of market share in the competitive market." This definition helps to narrow down the focus of the problem and provides a clear starting point for further investigation.

2. The second step in the process is to gather information about the problem. This involves collecting data and facts that are relevant to the problem. For example, a manager might gather data on sales trends, market conditions, and customer feedback. This information is then analyzed to identify patterns and trends that can help to explain the problem. For instance, a manager might discover that sales are declining because of a new competitor entering the market or because of a change in customer preferences. This information is then used to develop a hypothesis about the cause of the problem.

3. The third step in the process is to develop a hypothesis about the cause of the problem. A hypothesis is a statement that predicts the cause of the problem. For example, a manager might hypothesize that the decline in sales is due to a loss of market share to a new competitor. This hypothesis is then tested by gathering more information and analyzing it. For instance, a manager might compare sales data for the company with sales data for the new competitor. If the data shows that the new competitor is indeed gaining market share, then the hypothesis is supported. If not, then the hypothesis is rejected and a new one must be developed.

4. The fourth step in the process is to develop a solution to the problem. This involves identifying actions that can be taken to address the problem. For example, a manager might develop a solution that involves increasing marketing efforts, improving customer service, or developing new products. The solution is then implemented and its effectiveness is monitored. For instance, a manager might implement a solution that involves increasing marketing efforts and then monitor sales trends to see if there is an improvement. If the solution is effective, then the problem is solved. If not, then the manager must return to the first step and identify a new problem.

5. The fifth and final step in the process is to evaluate the solution. This involves assessing the effectiveness of the solution and determining whether it has solved the problem. For example, a manager might evaluate the solution by comparing sales data before and after the solution was implemented. If sales have increased, then the solution is effective. If not, then the solution is ineffective and the manager must return to the first step and identify a new problem. This step is important because it ensures that the solution is actually solving the problem and not just creating a new one.

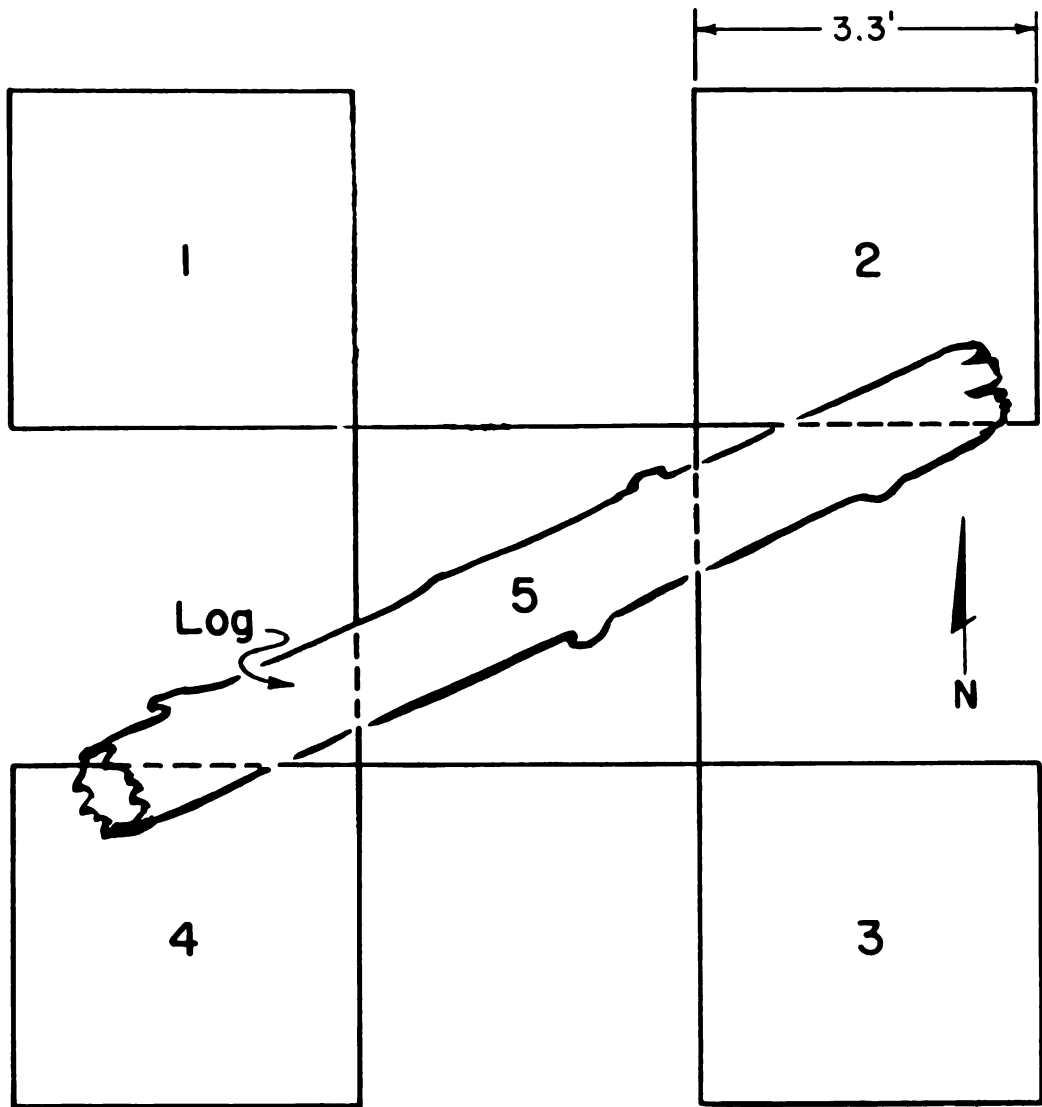


Fig. 3 Sketch of quadrat vegetation sampling design used "near" the drumming log. Each quadrat is one-quarter milacre in size. Log is hypothetical.

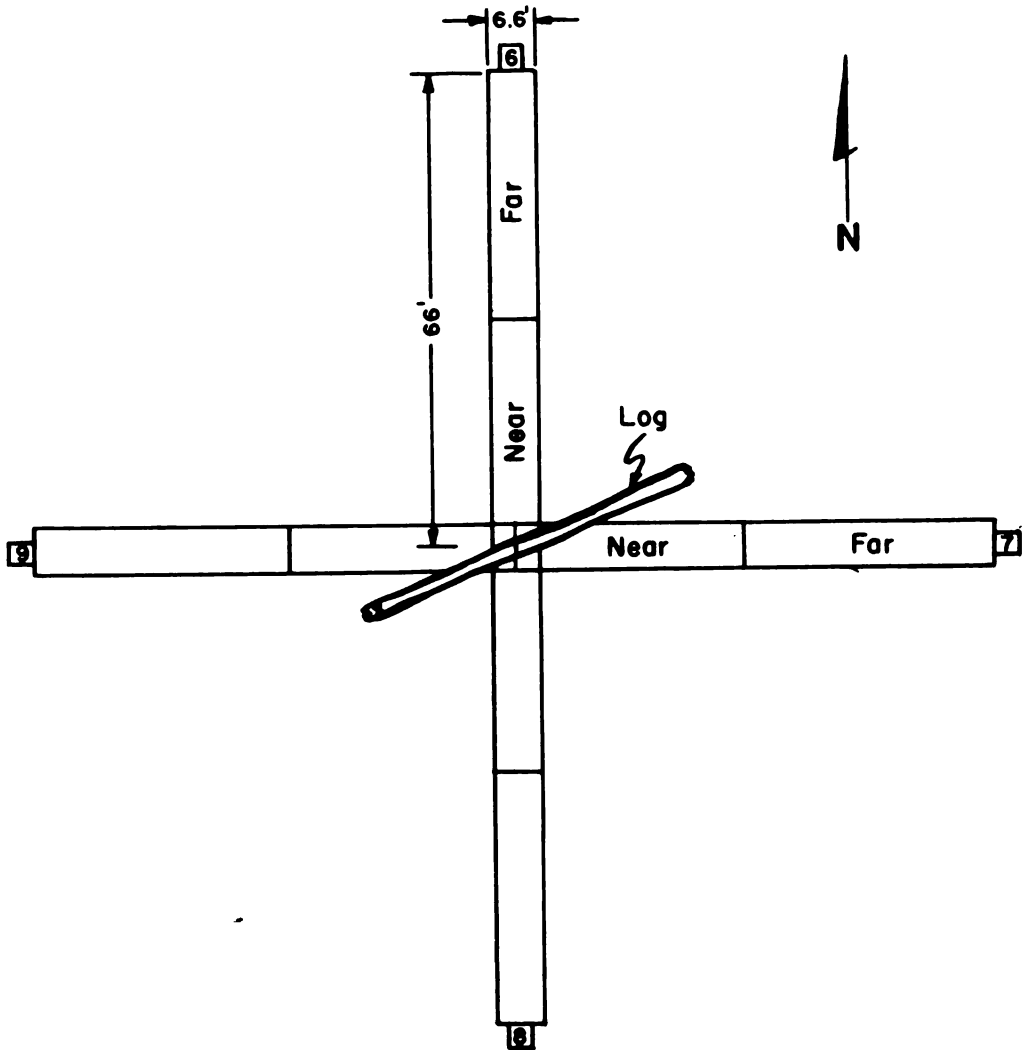


Fig. 4 Sketch of transect vegetation sampling design with "far" quadrats. Each transect is one-hundredth acre in size. Quadrats 6, 7, 8, and 9 are counterparts of quadrats 1, 2, 3, and 4.

the first two classes were omitted on the transects.

Working Procedure

I developed an orderly method of securing the needed information at each drumming location. First, I measured and recorded log size. After this I noted its general state of decay and attempted to determine species. When this was not possible, I recorded whether it had been a deciduous or coniferous species. The azimuth was then recorded and I measured the distance from the drumming location to the nearest end.

When these properties were recorded, Quadrat 5 was centered over the drumming location and laid out using a wire frame measuring 3.3 feet on a side, and with the sides in north-south and east-west directions. With this quadrat in place, I marked each corner with small sticks which later served as corners for Quadrats 1, 2, 2, and 4. Stems were then tallied on Quadrats 1-5. When herbaceous cover was very dense, it was necessary to further divide the quadrats into portions to facilitate counting.

After completing these quadrats I imbedded a jack knife in the log, placed a looped end of a white cord over the knife handle, and laid out each transect, staking the far end of the cord. I then tallied vegetation along one side and then another of the transect using the same 3.3 foot wire to delimit the outer margin of the transect that was used to lay out the quadrats. After completing each transect, its corresponding distal quadrat was laid out and tallied.

Plant Density Analysis

I converted total numbers of woody stems of all species tallied on quadrats and transects to equivalent numbers of stems per acre to determine

- \mathbb{R}^n is a vector space over \mathbb{R} with the usual operations.

Example:

Let V be the set of all functions $f: \mathbb{R} \rightarrow \mathbb{R}$ such that $f(x) = ax + b$ for some $a, b \in \mathbb{R}$.

• V is a vector space over \mathbb{R} with the usual operations. • V is a subspace of $\mathbb{R}^{\mathbb{R}}$.

• V is a vector space over \mathbb{R} with the usual operations. • V is a subspace of $\mathbb{R}^{\mathbb{R}}$.

• V is a vector space over \mathbb{R} with the usual operations. • V is a subspace of $\mathbb{R}^{\mathbb{R}}$.

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• V

Let V be the set of all functions $f: \mathbb{R} \rightarrow \mathbb{R}$ such that $f(x) = ax + b$ for some $a, b \in \mathbb{R}$.

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average densities in each size class necessary for establishment of male courtship territories (Tables 4, 5, and 6).

TABLE 4

Number of woody stems tallied by size classes on nine one-quarter milacre quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan

Size Class	Number of woody stems tallied									Total
	Quadrat Number									
	1	2	3	4	5	6	7	8	9	
0-2 ft.	80	76	127	97	91	167	140	168	214	1160
2-5 ft.	60	38	80	61	21	43	42	60	79	484
5-8 ft.	24	17	24	17	8	22	22	20	20	174
8 ft.-3 in. dbh	62	40	71	33	9	30	20	19	22	306
3-6 in. dbh	9	3	4	4	2	3	1	0	6	32
6-9 in. dbh	3	0	1	0	0	1	0	0	0	5
9 in. + dbh	1	0	0	1	0	1	1	0	0	4
Total	239	174	307	213	131	267	226	267	341	2165

TABLE 5

Number of woody stems tallied on "near" and "far" halves of one-hundredth acre transects near 40 ruffed grouse drumming logs, Rifle River Area, Michigan

Size Class	North		East		South		West		Total
	<u>Near</u>	<u>Far</u>	<u>Near</u>	<u>Far</u>	<u>Near</u>	<u>Far</u>	<u>Near</u>	<u>Far</u>	
5-8 ft.	290	266	277	242	313	199	321	242	2150
8 ft. to 3in.dbh	646	490	624	488	688	424	632	481	4473
3-6 in. dbh	59	60	70	37	68	52	58	44	448
6-9 in. dbh	14	13	10	7	11	7	11	11	84
9 in. + dbh	7	12	3	5	3	6	6	12	54
Total	1016	841	984	779	1083	688	1028	790	7209

1. The first step in the process of identifying a problem is to define the problem clearly.

- Identify the symptoms and signs of the problem.

2. The second step is to determine the causes of the problem.

- Analyze the data to identify the underlying causes.

3. The third step is to develop a solution.

4. The fourth step is to implement the solution.

5. The fifth step is to evaluate the results of the solution.

- Determine the effectiveness of the solution.
- Monitor the progress of the solution.
- Adjust the solution as needed.
- Document the results of the solution.
- Communicate the results of the solution.

6. The sixth step is to review the process and make improvements.

7. The seventh step is to conclude.

8. The eighth step is to reflect on the experience and learn from it.

- Identify the strengths and weaknesses of the process.

9. The ninth step is to share the results of the process with others.

10. The tenth step is to continue to improve the process over time.

- Regularly review the process and make adjustments.
- Seek feedback from others.
- Stay open to new ideas and approaches.

11. The eleventh step is to celebrate the success of the process.

TABLE 6

Converted average number of woody stems per acre by size classes encountered on quadrats and transects located near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

<u>Quadrats</u>	<u>Average number of stems per acre</u>
<u>Size Class</u>	
<u>Less than 5 feet tall</u>	
0-2 ft. tall	12889
2-5 ft. tall	5378
<u>More than 5 feet tall</u>	
5-8 ft. tall	1933
8 ft. tall-3 in. dbh	3400
3-6 in. dbh	478
6-9 in. dbh	56
9 in. dbh	44

<u>Transects</u>	
<u>Size Class</u>	
<u>Less than 5 feet tall</u>	
No sample taken	
<u>More than 5 feet tall</u>	
5-8 ft. tall	1344
8 ft. tall-3 in. dbh	2796
3-6 in. dbh	280
6-9 in. dbh	53
9 in. + dbh	34

Comparison of plant densities "near" and "far" from drumming logs

My first analysis consisted of determining whether vegetation "near" the log (quadrats 1-4 and "near" halves of transects) differed basically from vegetation a distance from the log (quadrats 6-9 and "far" halves of transects). To do this I used the matched pairs method described by Goulden (1952) whereby numbers of stems on paired groups of sampling units ("near" and "far") were compared for each log. Comparisons were made by each size class. This method removed the heterogeneity in plant composition and density due to inherent differences between log sites. (Tables 7, 8, 9, 10, 11, 12, 13, 14.) Values of t obtained and results of analyses are presented in Table 15.

TABLE 7

Comparison of woody plant density in the 0-2 foot tall size class on matched pairs of quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	Number of Stems Quadrats 1-4	Number of Stems Quadrats 6-9	d Quadrats 1-4 minus Quadrats 6-9
1	6	18	-12
2	14	10	4
3	17	11	6
4	9	20	-11
5	9	27	-18
6	5	6	-1
7	4	21	-17
8	5	12	-7
9	18	4	14
10	0	11	-11
11	23	7	16
12	22	23	-1
13	4	6	-2
14	11	14	-3
15	7	137	-130
16	16	11	5
17	4	9	-5
18	10	8	2
19	7	4	3
20	9	14	-5
21	6	7	-1
22	1	11	-10
23	11	48	-37
24	11	14	-3
25	8	6	2
26	3	18	-15
27	12	20	-8
28	48	24	24
29	10	10	0
30	2	9	-7
31	6	3	3
32	10	21	-11
33	7	13	-6
34	3	16	-13
35	0	31	-31
36	12	10	2
37	0	15	-15
38	12	24	-12
39	10	15	-5
40	8	8	0

$$\begin{aligned} \sum d &= -316 \\ \sum d^2 &= 22646 \\ \frac{(\sum d)^2}{40} &= 2496.4 \\ \bar{d} &= 7.9 \end{aligned}$$

$$\begin{aligned} S_{\bar{d}} &= \frac{22646 - 2496.4}{40 \times 39} = 3.5939 \\ t &= \frac{7.9 - 0}{3.5939} \\ &= 2.198 \end{aligned}$$

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

2. The second part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

3. The third part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to management and investors.

4. The fourth part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

5. The fifth part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

6. The sixth part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to management and investors.

7. The seventh part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

8. The eighth part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

9. The ninth part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to management and investors.

10. The tenth part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

TABLE 8

Comparison of woody plant density in the 2-5 foot size class on matched pairs of quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan

Log Number	Number of Stems Quadrats 1-4	Number of Stems Quadrats 6-9	d Quadrats 1-4 minus Quadrats 6-9
1	0	5	- 5
2	1	0	1
3	20	4	16
4	1	1	0
5	5	3	2
6	11	9	2
7	9	6	3
8	8	8	0
9	12	12	0
10	6	9	- 3
11	13	12	1
12	7	2	5
13	3	5	- 2
14	4	16	-12
15	7	5	2
16	18	20	- 2
17	20	13	7
18	3	0	3
19	1	7	- 6
20	0	3	- 3
21	1	3	- 2
22	3	0	3
23	1	0	1
24	1	0	1
25	2	0	2
26	3	4	- 1
27	23	8	15
28	10	12	- 2
29	2	2	0
30	1	3	- 2
31	0	1	- 1
32	0	0	0
33	4	5	- 1
34	1	8	- 7
35	23	3	20
36	7	16	- 9
37	7	7	0
38	0	1	- 1
39	0	6	- 6
40	1	4	- 3

$\Sigma d = 16$ $\bar{d} = .40$
 $\Sigma d^2 = 1424$ $S_{\bar{d}} = .954$ $t = .42$
 $\frac{(\Sigma d)^2}{10} = 6.4$

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. This section also touches upon the legal implications of failing to maintain such records, which can lead to severe consequences for individuals and organizations alike.

2. The second part of the document delves into the specific requirements for record-keeping, including the types of documents that must be retained and the duration for which they should be kept. It provides a detailed overview of the various categories of records, such as financial statements, contracts, and correspondence, and outlines the best practices for organizing and storing these documents to ensure they are easily accessible when needed.

3. The third part of the document addresses the challenges associated with record-keeping, particularly in the context of digital information. It discusses the risks of data loss, corruption, and unauthorized access, and offers strategies to mitigate these risks. This includes the use of secure storage solutions, regular backups, and access controls to protect sensitive information.

4. The fourth part of the document provides a comprehensive guide to the record-keeping process, from the initial identification of records to the final disposal of documents. It includes a checklist of key steps and a timeline for record retention, ensuring that all necessary actions are taken in a timely and efficient manner. This section also provides examples of record-keeping policies and procedures to serve as a reference for organizations.

5. The fifth and final part of the document concludes with a summary of the key points discussed throughout the document. It reiterates the importance of record-keeping and encourages individuals and organizations to take proactive steps to ensure their records are accurate, complete, and secure. The document ends with a call to action, urging readers to consult with legal and financial advisors for further guidance on record-keeping requirements.

TABLE 9

Comparison of woody plant density in the 5-8 foot size class on matched pairs of quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

<u>Log Number</u>	<u>Number of Stems Quadrats 1-4</u>	<u>Number of Stems Quadrats 6-9</u>	<u>d</u> <u>Quadrats 1-4 minus</u> <u>Quadrats 6-9</u>
1	1	0	0
2	0	2	- 2
3	0	1	- 1
4	0	4	- 4
5	7	0	7
6	1	3	- 2
7	3	2	1
8	1	0	1
9	6	5	1
10	0	3	- 3
11	10	10	0
12	0	2	- 2
13	1	0	1
14	8	9	- 1
15	2	4	- 2
16	11	0	11
17	5	10	- 5
18	0	0	0
19	0	0	0
20	1	0	1
21	0	0	0
22	0	1	- 1
23	0	0	0
24	1	1	0
25	2	0	2
26	6	6	0
27	1	0	1
28	2	2	0
29	1	0	1
30	0	0	0
31	3	3	0
32	0	0	0
33	0	1	- 1
34	0	0	0
35	6	1	5
36	3	4	- 1
37	0	7	- 7
38	0	0	0
39	0	2	- 2
40	0	1	- 1

$\sum d = -3$
 $\sum d^2 = 331$
 $\frac{(\sum d)^2}{40} = .225$

$\bar{d} = .075$
 $s_d = .46$

$t = .163$

1. The first part of the document is a list of names and titles, including "The Hon. Mr. Justice" and "The Hon. Mr. Justice".

2. The second part of the document is a list of names and titles, including "The Hon. Mr. Justice" and "The Hon. Mr. Justice".

3. The third part of the document is a list of names and titles, including "The Hon. Mr. Justice" and "The Hon. Mr. Justice".

4. The fourth part of the document is a list of names and titles, including "The Hon. Mr. Justice" and "The Hon. Mr. Justice".

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TABLE 10

Comparison of woody plant density in the 8'-3" dbh size class on matched pairs of quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	Number of Stems Quadrats 1-4	Number of Stems Quadrats 6-9	d Quadrats 1-4 minus Quadrats 6-9
1	3	0	3
2	1	1	0
3	9	5	4
4	0	0	0
5	2	0	2
6	2	4	- 2
7	4	1	3
8	1	7	- 6
9	12	2	10
10	2	4	- 2
11	4	6	- 2
12	4	0	4
13	0	1	- 1
14	3	6	- 3
15	12	2	10
16	5	0	5
17	3	3	0
18	8	2	6
19	0	0	0
20	3	2	1
21	11	0	11
22	1	1	0
23	19	1	18
24	3	0	3
25	3	2	1
26	6	2	4
27	4	0	4
28	6	1	5
29	9	0	9
30	4	0	4
31	4	3	1
32	3	16	-13
33	1	1	0
34	5	0	5
35	4	1	3
36	23	9	14
37	7	4	3
38	15	0	15
39	0	3	- 3
40	0	1	- 1
	$\sum d = 115$	$\bar{d} = 2.875$	
	$\sum d^2 = 1627$		$s = 3.154$
	$\frac{(\sum d)^2}{40} = 330.6$	$s_d = .912$	

TABLE 11

Comparison of woody plant density in the 3-9" dbh size class on matched pairs of quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	Number of Stems Quadrats 1-4	Number of Stems Quadrats 6-9	d Quadrats 1-4 minus Quadrats 6-9
1	0	0	0
2	3	0	3
3	0	0	0
4	0	0	0
5	0	0	0
6	1	1	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	1	-1
11	0	0	0
12	1	1	0
13	1	2	-1
14	0	0	0
15	0	0	0
16	0	1	-1
17	0	0	0
18	0	0	0
19	1	0	1
20	2	0	2
21	0	0	0
22	0	1	-1
23	0	0	0
24	1	0	1
25	1	0	1
26	1	0	1
27	0	1	-1
28	0	0	0
29	0	0	0
30	2	0	2
31	3	0	3
32	1	0	1
33	1	1	0
34	1	1	0
35	1	0	1
36	0	0	0
37	1	0	1
38	1	0	1
39	0	1	-1
40	1	0	1

$$\sum d = 13$$

$$\bar{d} = .325$$

$$s = 2.117$$

$$\sum d^2 = 41$$

$$\frac{(\sum d)^2}{40} = 4.225$$

$$s_{\bar{d}} = .154$$

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to support informed decision-making.

3. The third part of the document focuses on the role of technology in modern data management. It discusses how advanced software solutions can streamline data collection, storage, and analysis, leading to more efficient and accurate results.

4. The fourth part of the document addresses the challenges associated with data security and privacy. It provides guidance on implementing robust security measures to protect sensitive information from unauthorized access and breaches.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that data management practices remain effective and up-to-date.

TABLE 12

Comparison of woody plant density in the 5-8 foot class on matched pairs of transects near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	"Near" Transects	"Far" Transects	d "Near" minus "Far"
1	21	39	-18
2	12	20	-8
3	5	6	-1
4	19	20	-1
5	27	32	-5
6	8	44	-36
7	40	40	0
8	25	24	1
9	85	71	14
10	41	38	3
11	77	60	17
12	29	34	-5
13	58	26	32
14	75	57	18
15	41	29	12
16	124	18	106
17	78	52	26
18	17	5	12
19	15	10	5
20	3	2	1
21	5	3	2
22	11	15	-4
23	7	3	4
24	7	8	-1
25	26	13	13
26	40	40	0
27	48	3	45
28	32	39	-7
29	11	24	-13
30	8	10	-2
31	7	7	0
32	3	0	3
33	9	3	6
34	9	20	-11
35	61	47	14
36	36	41	-5
37	46	25	21
38	26	5	21
39	3	10	-7
40	6	6	0

$$\sum d = 252$$

$$\bar{d} = 6.3$$

$$\sum d^2 = 19576$$

$$s = 1.855$$

$$\frac{(\sum d)^2}{40} = 1587.6$$

$$s_d = 3.396$$

TABLE 13

Comparison of woody plant density in the 8'-3" dbh class on matched pairs of transects near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	"Near" Transects	"Far" Transects	d "Near" minus "Far"
1	42	45	- 3
2	67	44	23
3	65	24	41
4	45	44	1
5	52	46	6
6	15	42	-27
7	44	42	2
8	80	44	36
9	207	130	77
10	72	81	- 9
11	225	151	74
12	104	61	43
13	136	69	67
14	136	57	79
15	73	40	33
16	214	68	146
17	49	20	29
18	43	24	19
19	26	34	- 8
20	72	9	63
21	17	24	- 7
22	46	49	- 3
23	6	8	- 2
24	34	22	12
25	56	47	9
26	70	52	18
27	78	38	40
28	92	74	18
29	20	75	-55
30	26	33	- 7
31	15	22	- 7
32	35	21	14
33	35	29	9
34	28	39	-11
35	110	75	35
36	79	94	-15
37	49	34	15
38	36	33	3
39	18	17	1
40	20	25	- 5
<hr/>			
	$\Sigma d = 754$	$\bar{d} = 18.85$	$t = 3.345$
	$\Sigma d^2 = 63756$		
	$(\Sigma d)^2 = 14212.9$	$S_{\bar{d}} = 5.635$	
	$\frac{1}{40}$		

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and analysis, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the data remains reliable and secure.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that the data management processes remain effective and up-to-date.

TABLE 14

Comparison of woody plant density in the 3-9" class on matched pairs of transects near 40 ruffed grouse drumming logs, Rifle River Area, Michigan.

Log Number	"Near" Transects	"Far" Transects	d "Near" minus "Far"
1	2	1	1
2	16	16	0
3	5	1	4
4	9	9	0
5	1	2	- 1
6	0	0	0
7	10	1	9
8	4	3	1
9	0	2	- 2
10	3	2	1
11	2	0	2
12	8	10	- 2
13	3	2	1
14	0	2	- 2
15	4	3	1
16	1	9	- 8
17	4	6	- 2
18	7	6	1
19	10	5	5
20	24	13	11
21	14	7	7
22	19	12	7
23	2	4	- 2
24	9	4	5
25	13	15	- 2
26	1	4	- 3
27	2	3	- 1
28	13	7	6
29	4	3	1
30	5	15	-10
31	19	5	14
32	19	8	11
33	2	7	- 5
34	12	6	6
35	3	2	1
36	12	11	1
37	8	5	3
38	11	3	8
39	25	15	10
40	1	2	- 1

$\sum d = 76$ $\bar{d} = 1.9$
 $\sum d^2 = 1166$ $t = 2.348$
 $\frac{(\sum d)^2}{40} = 144.4$ $s_d^2 = .809$

TABLE 15

Values of t obtained by analyses of stem densities on quadrats 1-4 compared to quadrats 6-9 and "near" halves of transects compared to "far" halves surrounding 40 ruffed grouse drumming logs by arbitrary size classes using the matched pairs technique.*

<u>Size Class</u>	<u>\bar{d}</u>	<u>t value</u>	<u>Remarks</u>
<u>Quadrats</u>			
0-2 feet tall	-7.9	2.198	Significant difference in stem density on near and far quadrats. More stems on far quadrats.
2-5 feet tall	.40	.42	No significant difference in stem density between near and far quadrats.
5-8 feet tall	.075	.163	No significant difference in stem density between near and far quadrats.
8 feet tall-3 inches dbh	2.875	3.154	Significant difference in stem density on near and far quadrats. More stems tallied on near quadrats.
3-9 inches dbh	.325	2.117	Significant difference in stem density on near and far quadrats. More stems tallied on near quadrats.
<hr/>			
<u>Transects</u>			
5-8 feet tall	6.30	1.855	No significant difference in stem density between near and far halves of transects.
8 feet tall-3 inches dbh	18.85	3.345	Significant difference in stem density on near and far transects. More stems were tallied on near transects.
3-9 inches dbh	1.90	2.348	Significant difference in stem density on near and far transects. More stems were tallied on near transects.

* The t value for 39 degrees of freedom at the 5 per cent level is 2.02.

1. 在 1990 年 1 月 1 日，A 公司（一家上市公司）的净资产为 1000 万元。A 公司于 1990 年 1 月 1 日发行 1000 万股普通股，每股面值为 1 元，每股发行价格为 1.5 元。A 公司于 1990 年 1 月 1 日发行 1000 万股普通股，每股面值为 1 元，每股发行价格为 1.5 元。

项目	1990 年 1 月 1 日	1990 年 12 月 31 日	1991 年 12 月 31 日
流动资产	1000	1000	1000
非流动资产	1000	1000	1000
总资产	2000	2000	2000
流动负债	1000	1000	1000
非流动负债	1000	1000	1000
总负债	2000	2000	2000
所有者权益	1000	1000	1000
股本	1000	1000	1000
资本公积	500	500	500
盈余公积	0	0	0
未分配利润	0	0	0
所有者权益合计	1000	1000	1000

2. 在 1990 年 1 月 1 日，A 公司的净资产为 1000 万元。A 公司于 1990 年 1 月 1 日发行 1000 万股普通股，每股面值为 1 元，每股发行价格为 1.5 元。A 公司于 1990 年 1 月 1 日发行 1000 万股普通股，每股面值为 1 元，每股发行价格为 1.5 元。

It is apparent from these analyses that drumming ruffed grouse require a dense layer of undergrowth. The understory stratum in this study area is typified by alder runs or dogwood clumps. In the two size classes smaller than the 8 foot-3 inch dbh class I was not able to show differences in stem densities adjacent to the logs as compared to several feet from the logs. In the 0-2 foot tall size class I found significantly fewer stems immediately surrounding the log than elsewhere.

These findings at first appear contradictory, but the analyses are reasonable when the history of land use and the pressure of a large deer population are considered. The woody plants in the 0-2 foot tall size class represent young reproduction. It is probable that deer populations have little influence on the abundance of stems in this class. The next two size classes however, are subject to constant browse pressure by deer. Therefore the understory stratum throughout the Rifle River Area has been reduced or eliminated in some cases. The 8 foot to 3 inch dbh class is beyond the reach of deer. I made a comparison of the prevalence of deer food and non-deer food plants tallied during the study (Table 16) and the results illustrate how deer have affected plant composition. Non-deer food plants are those which deer usually refuse to eat even when subjected to extreme hardship (Duvendeck, 1952).

TABLE 16

Number of stems of woody deer food plants and non-deer food plants tallied by size classes on 360 quadrats near 40 ruffed grouse drumming logs, Rifle River Area, Michigan

<u>Size Class</u>	<u>Deer Food Plants</u>	<u>Non-deer Food Plants</u>
0-2 feet tall	656	493
2-8 feet tall	143	526
8 feet to 3 inches dbh	30	274

Plant Composition

All 40 logs were located in a lowland vegetative type. Thirty-seven woody plant species were tallied on the 360 quadrats. These 37, as well as 7 additional species were found on the transects. A check list is presented in the Appendix. Nomenclature is from Fernald (1950).

Many species were usually represented on the sampling units i.e. at least one stem occurred. This was particularly true in the smallest size class (Table 17). In this size class, 8 different species occurred in more than 5 per cent of the quadrats. Fewer species were encountered in the larger classes and these few plants therefore assumed more relative importance. In fact, in the 8 feet tall to 3 inch dbh class only 4 species occurred regularly. These included speckled alder (Alnus rugosa), balsam fir (Abies balsamea), black ash (Fraxinus nigra), and willows (Salix spp.). Alder, moreover, was tallied much more frequently than the others, and it occurred on 21 per cent of the quadrats.

Alder not only occurred frequently, but it also supplied the necessary density of stems which perhaps was more important (Table 18). In the very important tall shrub class (8 feet tall to 3 inches dbh) 73 per cent of the woody stems tallied were speckled alder.

Plant Densities Compared by Number of Years Logs were Used.

Calendar years when ruffed grouse used the 40 drumming logs were plotted (Fig. 1), and the number occurring in each years-of-use class is presented in Table 19.

QUESTION 1

• The first step in the process of identifying a problem is to define the problem.

• The second step is to identify the causes of the problem.

• The third step is to identify the effects of the problem.

• The fourth step is to identify the stakeholders involved in the problem.

• The fifth step is to identify the resources available to solve the problem.

• The sixth step is to identify the constraints on the solution.

• The seventh step is to identify the options for solving the problem.

• The eighth step is to identify the risks associated with each option.

• The ninth step is to identify the benefits of each option.

• The tenth step is to identify the costs of each option.

• The eleventh step is to identify the feasibility of each option.

• The twelfth step is to identify the desirability of each option.

• The thirteenth step is to identify the acceptability of each option.

• The fourteenth step is to identify the implementability of each option.

• The fifteenth step is to identify the sustainability of each option.

• The sixteenth step is to identify the transferability of each option.

• The seventeenth step is to identify the replicability of each option.

• The eighteenth step is to identify the scalability of each option.

• The nineteenth step is to identify the adaptability of each option.

• The twentieth step is to identify the flexibility of each option.

• The twenty-first step is to identify the robustness of each option.

• The twenty-second step is to identify the resilience of each option.

• The twenty-third step is to identify the recoverability of each option.

• The twenty-fourth step is to identify the resistance to change of each option.

TABLE 17

Number of quadrats in which at least one stem of the 37 plant species occurred and the computed relative frequency of each species by size classes.*

Species	Size Class					
	0-2'	2-8'	8'-3"	3-6"	6-9"	9'+
Alder	76 (21.1)	138 (38.3)	77 (21.4)			
Red-osier	56 (15.6)	29 (8.1)	1 (.3)			
Black ash	38 (10.6)	12 (3.3)	12 (3.3)			
Black currant	30 (8.3)	6 (1.7)				
Mountain holly	29 (8.1)	27 (8) (7.5)	4 (1.1)			
Balsam fir	29 (8.1)	9 (2.5)	15 (4.2)	14 (3.9)	2 (.6)	
Gray dogwood	30 (8.3)	11 (3) (3.1)				
Trembling aspen	10 (2.8)	2 (.6)	2 (.6)	4 (1.1)	1 (.3)	1 (.3)
Nannyberry	18 (5.0)	7 (1.9)	3 (.8)			
Red oak	16 (4.4)	2 (.6)				
Red maple	25 (6.9)	4 (1.1)	1 (.3)			
Blueberry	11 (3.1)					
Willow	6 (1.7)	16 (4.4)	10 (2.8)			
Chokeberry	11 (3.1)	8 (2.2)	2 (.6)			
Silky dogwood	7 (1.9)					
White cedar	2 (.6)	3 (.8)	4 (1.1)	2 (.6)		
Ninebark	1 (.3)					
Leatherleaf	2 (.6)	1 (.3)				
White spruce	5 (1.4)	4 (1.1)	2 (.6)			
White birch			2 (.6)	2 (.6)		
High-bush cranberry	1 (.3)					
Juneberry	2 (.6)					
Black cherry	7 (1.9)					
Hawthorn	5 (1) (1.4)					
Honeysuckle	3 (.8)					
Large-tooth aspen	1 (.3)					
Hazelnut	7 (1.9)					
Larch			1 (.3)		2 (.6)	
Balsam poplar		1 (.3)	1 (.3)	1 (.3)		
Slippery elm	1 (.3)	1 (.3)				
American elm	2 (.6)	1 (.3)				
White ash	1 (.3)					
Prickly ash	1 (.3)	1 (.3)				
Meadow-sweet	1 (.3)	1 (.3)				
White pine	1 (.3)					
White oak	1 (.3)					
Hemlock					1 (.3)	
Unknown	3 (.8)				1 (.3)	

* Figures in parenthesis are percentages. The relative frequency is computed by dividing the number of quadrats in which the species was tallied by the total number of quadrats (360).

TABLE 18

Total stems and relative density of woody plant species occurring on 360 quadrats near 40 ruffed grouse drumming sites.¹

Species	Size Class							Total stems
	0-2'	2-5'	5-8'	8'-3"	3-6"	6-9"	9"+	
Alder	186 (16.0)	234 (47.4)	106 (60.6)	223 (73.1)				750
Red-osier	160 (13.7)	52 (10.5)	1 (.6)					213
Blueberry	131 (11.2)							131
Balsam fir	91 (7.8)	3 (.6)	6 (3.4)	26 (8.5)	17 (54.8)	2 (40)		145
Gray dogwood	88 (7.6)	21 (4.2)	3 (1.7)	1 (.3)				113
Black ash	73 (6.3)	16 (3.2)	2 (1.1)	12 (3.9)	5 (16.1)		1 (25)	109
Mountain holly	60 (5.2)	79 (15.9)	16 (9.1)	7 (2.3)				162
Black currant	55 (4.7)	8 (1.6)						63
Nannyberry	52 (4.5)	9 (1.8)	12 (6.9)	4 (1.3)				77
Red maple	48 (4.1)	4 (.8)		1 (.3)				53
Leatherleaf	32 (2.7)	30 (6.0)						62
Meadow-sweet	26 (2.2)	5 (1.0)						31
Chokeberry	21 (1.8)	7 (1.4)	5 (2.9)	2 (.7)				35
Silky dogwood	17 (1.5)							17
Red oak	18 (1.5)	3 (.6)						21
Trembling aspen	14 (1.2)	1 (.2)	1 (.6)	2 (.7)	4 (12.9)	1 (20)	1 (25)	24
Black cherry	16 (1.4)			1 (.3)				17
Willow	12 (1.0)	10 (2.0)	17 (9.7)	15 (4.9)				54
Hawthorn	8 (.7)							8
White spruce	7 (.6)	3 (.6)	3 (1.7)	2 (.7)			1 (25)	16
Hazelnut	7 (.6)							7
Honeysuckle	4 (.3)							4
Large-tooth aspen	4 (.3)							4
Prickly ash	4 (.3)	2 (.4)						6
Juneberry	3 (.3)							3
American elm	3 (.3)	1 (.2)						4
White cedar	2 (.2)	1 (.2)	3 (1.7)	5 (1.6)	2 (6.5)			13
Ninebark	1 (.1)							1
Highbush cranberry	1 (.1)							1
Slippery elm	2 (.2)	1 (.2)						3
White ash	1 (.1)							1
White pine	1 (.1)							1
White oak	1 (.1)							1
Hemlock							1 (25)	1
Larch			1 (.6)		2 (6.5)			3
Balsam poplar		2 (.4)		1 (.3)	1 (3.2)			4
White birch				2 (.7)	2 (6.5)			4
Unknown	16 (1.4)	3 (.6)						19
Totals	1165	496	175	305	31	5	4	2181

¹ Figures in parentheses represent relative density, which is the percentage of total stems recorded by species by size classes.

TABLE 19

Number of drumming logs occupied by male ruffed grouse during 8 calendar years, Rifle River Area, Michigan

	<u>Number of years occupied</u>							
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Number of logs	9	5	4	13	5	0	2	2

In addition to size being a factor responsible for perennial selection in some cases, I suspected that plant densities near the logs might differ between logs used varying lengths of time.

Analysis of variance was used to test whether there was a relationship between stem density and the frequency of log use (by years). Tests were performed by the various size classes (Tables 20, 21, 22 and 23). F values obtained in analyses of all size classes were less than the required value for 5, 34 degrees of freedom at the 5 per cent level of 2.49. Thus the analyses suggested there was no relationship between stem density and frequency of log use.

From analyses of log size and vegetation density therefore, it is concluded that grouse require logs and surrounding vegetation of certain specifications. If these specifications are met, the preference for some logs from year to year cannot be explained at this time. Some other factors such as population size, or perhaps a spatial relationship exists between one site to another in the total environment which overshadows minor vegetational differences at the different sites.

QUESTION

1. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

Year	Number of visitors
1990	1,200,000
1991	1,250,000
1992	1,300,000
1993	1,350,000
1994	1,400,000
1995	1,450,000
1996	1,500,000
1997	1,550,000
1998	1,600,000
1999	1,650,000
2000	1,700,000

2. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

3. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

4. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

5. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

6. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

7. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

8. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

9. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

10. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

11. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

12. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

13. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

14. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

15. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

16. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

17. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

18. The following table shows the number of people who visited the National Gallery in London in each year from 1990 to 2000.

TABLE 20

Analysis of variance of density of woody vegetation in the 0-2 foot height class on quadrats 1-4 by numbers of years 40 ruffed grouse drumming logs were occupied, Rifle River Area, Michigan

	Number of years logs were used by grouse					
	1	2	3	4	5	7 and 8
				8		
	6	23	16	11	10	0
	14	22	4	11	7	12
Number of	17	4	10	0	3	10
woody stems	9	11	0	7	0	8
tallied in	9	7		6	12	
each year class	5			9		
	4			48		
	5			2		
	18			6		
				3		
				12		
				10		
<u>Ave. No. Stems</u>	<u>9.7</u>	<u>13.4</u>	<u>7.5</u>	<u>10.2</u>	<u>6.4</u>	<u>7.5</u>
Estimate of "between" year class variance =	32.66					F = $\frac{32.7}{75.6}$ = .43
Estimate of "within" year class variance =	75.56					

TABLE 21

Analysis of variance of density of woody vegetation in the 2-8 foot height class on quadrats 1-4 by numbers of years 40 ruffed grouse drumming logs were occupied, Rifle River Area, Michigan

	Number of years logs were used by grouse					
	1	2	3	4	5	7 and 8
	12	7	6	1	23	1
Number of	12	3	4	12	1	1
woody stems	18	1	3	9	1	4
tallied in	1	10	1	9	3	29
each year	9	12		29	7	
class	1			25		
	0			3		
	20			2		
	1			24		
				0		
				0		
				12		
				4		
<u>Ave. No. Stems</u>	<u>8.2</u>	<u>6.7</u>	<u>3.5</u>	<u>10.0</u>	<u>7.0</u>	<u>8.8</u>
Estimate of "between" year class variance =	30.10					F = $\frac{30.10}{79.54}$ = .38
Estimate of "within" year class variance =	79.54					

TABLE 22

Analysis of variance of density of woody vegetation in the 8'-3" dbh class on quadrats 1-4 by numbers of years 40 ruffed grouse drumming logs were occupied, Rifle River Area, Michigan.

	Number of years logs were used by grouse						
	1	2	3	4	5	7 and 8	
Number of stems tallied by year classes	4	5	8	1	23	7	
	3	4	5	11	4	0	
	9	0	2	4	1	0	
	0	3	3	3	5	15	
	1	12		19	3		
	1			6			
	2			4			
	12			4			
	2			9			
				6			
				3			
				0			
				3			
Ave. No. Stems	3.8	4.8	4.5	5.6	7.2	5.5	
Estimate of "between" year class variance	= 8.7					F = 8.7	= .29
Estimate of "within" year class variance	= 29.6					29.6	

TABLE 23

Analysis of variance of density of woody vegetation in the 3-9" dbh class on quadrats 1-4 by numbers of years 40 ruffed grouse drumming logs were occupied, Rifle River Area, Michigan.

	Number of years logs were used by grouse						
	1	2	3	4	5	7 and 8	
Number of woody stems tallied by year classes	1	1	0	0	0	1	
	1	1	0	0	1	1	
	1	0	0	0	1	0	
	3	0	0	1		1	
	0	0		0	1		
	0			0			
	0			3	1		
	0			2			
	0			0			
				1			
				2			
				1			
				1			
Ave. No. Stems	.67	.4	0	.85	.8	.75	
Estimate of "between" year class variance	= 2.65					F = .12	
Estimate of "within" year class variance	= 22.45					22.45	

DISCUSSION

During this population study various investigations of grouse ecology enabled me to become familiar with habitat quality in many parts of northern lower Michigan.

Although foresters are guided by multiple-use policies, in many areas mature or near-mature stands of aspen, oak, and jack pine are not being lumbered adequately, at least from a game standpoint. In many cases stands of pole-size or larger trees are characterized by scanty undergrowth, and in some areas the situation has become critical because of excessive browse removal by deer (Fig. 5, 6, 7).

In some counties over-numerous deer have been a problem for as long as 30 years (Jenkins and Bartlett, 1959). Lowland flora is composed largely of woody plants, which are unpalatable to deer, such as speckled alder, white spruce, balsam fir, and a few other species.

Upland areas where these conditions exist such as on the Rifle River Area probably are not supporting maximum numbers of ruffed grouse.

In most of Michigan ruffed grouse are underhunted. Because of this and also because habitat improvement specifically for ruffed grouse is expensive, we must rely on standard forestry practices to maintain or create ideal grouse habitat. Only on intensively used lands, such as our game areas in southern Michigan, can intensively directed management be justified. Thus it is doubly important to reduce or maintain deer populations at a sufficiently low level so that habitat quality is maintained at a level suitable for maximum grouse production concomitant with other land uses.

The first step in the process of the scientific method is to ask a question or identify a problem. This question should be clear, specific, and measurable. For example, "Does the amount of water affect the growth of a plant?" is a good question, while "Does water make plants grow?" is too vague.

Next, you need to do background research to see what is already known about the topic. This helps you to refine your question and to avoid repeating what has already been done.

The third step is to form a hypothesis, which is an educated guess about the answer to your question. A hypothesis should be testable and falsifiable. For example, "If a plant receives more water, then it will grow taller" is a hypothesis.

After forming a hypothesis, you design an experiment to test it. The experiment should be controlled, meaning that you only change one variable (the independent variable) while keeping all other variables constant (the controlled variables). The results of the experiment are the dependent variable.

Once you have collected data, you analyze it to see if it supports your hypothesis. You may use graphs, tables, or statistical tests to help you.

Finally, you draw a conclusion based on your analysis. If the data supports your hypothesis, you may accept it. If not, you may reject it and form a new hypothesis.

The scientific method is a cycle that repeats itself as you continue to explore a topic. It is a systematic way of investigating the natural world and finding answers to our questions.



Fig. 5 The upland aspen type with scanty understory occurs abundantly in northern lower Michigan.



Fig. 6 A jack pine forest near Luzerne, Oscoda County, Michigan. This vegetation type is also abundant in northern lower Michigan. Both types illustrated represent poor ruffed grouse habitat and could be noticeably improved.



Fig. 7 The "edge" between upland and lowland aspen types. Note the development of the lowland understory, composed almost entirely of speckled alder. Forest age and deer browsing pressure have eradicated the understory stratum in the upland.

SUMMARY

Forty ruffed grouse drumming logs and the nearby vegetation were studied in 1959. Minimum size of logs and plant density requirements were ascertained.

Logs were occupied by grouse for varying numbers of years. Logs used several years tended to be larger in diameter than those used infrequently, but there was little correlation between use and length of logs. Log directions occurred most often in a southwesterly - northeasterly direction, but it was not determined whether this was due to prevailing winds or whether grouse prefer this direction. Birds selected drumming locations near one end of the log, and usually this was the large or "butt" end. More than three-fourths of the logs were old conifers, of which most were white pine.

No consistent differences in plant densities were noted near logs used almost perennially as compared to logs used infrequently. Vegetation surrounding logs was also compared to vegetation elsewhere in the habitat, and comparisons were made by arbitrary size classes. Plants in the smallest size class (0-2 feet tall) were less numerous near the logs than elsewhere. In the larger size classes, particularly the 8 feet tall to 3 inch dbh class, plants were much more numerous near the log.

All logs were located in lowland vegetation types. The presence of all logs in lowland types suggests that the upland types are not suitable for the establishment of courtship sites. This unsuitability was probably due to a paucity of undergrowth, resulting from an advanced forest age and also perhaps from an overabundance of deer. Lowland types were

the fact that the \mathbb{Z}_2 -action on \mathbb{R}^n is not free, the quotient space $\mathbb{R}^n/\mathbb{Z}_2$ is not a manifold. However, the quotient space $\mathbb{R}^n/\mathbb{Z}_2$ is a manifold with boundary. The boundary is the set of points in \mathbb{R}^n that are fixed by the \mathbb{Z}_2 -action, which is the set of points (x_1, \dots, x_n) such that $x_i = 0$ for all i . This set is a linear subspace of \mathbb{R}^n of dimension n .

More generally, let G be a finite group acting on \mathbb{R}^n . The quotient space \mathbb{R}^n/G is a manifold with boundary if and only if the action of G is not free. The boundary is the set of points in \mathbb{R}^n that are fixed by some non-trivial element of G .

For example, let $G = \mathbb{Z}_2$ act on \mathbb{R}^n by reflection through the origin. The quotient space $\mathbb{R}^n/\mathbb{Z}_2$ is a manifold with boundary, and the boundary is the set of points (x_1, \dots, x_n) such that $x_i = 0$ for all i .

Another example is the action of \mathbb{Z}_2 on \mathbb{R}^n by reflection through a hyperplane. The quotient space $\mathbb{R}^n/\mathbb{Z}_2$ is a manifold with boundary, and the boundary is the hyperplane.

More generally, let G be a finite group acting on \mathbb{R}^n by reflection through a hyperplane. The quotient space \mathbb{R}^n/G is a manifold with boundary, and the boundary is the hyperplane.

For example, let $G = \mathbb{Z}_2$ act on \mathbb{R}^n by reflection through the hyperplane $x_1 = 0$. The quotient space $\mathbb{R}^n/\mathbb{Z}_2$ is a manifold with boundary, and the boundary is the hyperplane $x_1 = 0$.

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satisfactory as courtship sites, because plants growing there were unpalatable to deer and therefore escape serious browsing and can reproduce. Very few plant species supplied practically all of the necessary density, although 44 different species were tallied. Speckled alder (Alnus rugosa) was undoubtedly the most important single plant species.

Ecological conditions on the Rifle River Area are believed to be representative of many areas in Michigan, and if maximum ruffed grouse production is desired, deer numbers must be reduced and lumbering rotations shortened. In some areas, more intensive habitat improvement measures may be necessary than can be supplied by the removal of mature trees, but the least expensive means to create or maintain habitat quality is through deer herd **reduction.**

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2. The second part of the text describes the various methods used to collect and analyze data. It highlights the importance of using appropriate statistical techniques to interpret the results and to identify any trends or patterns in the data. The author also discusses the challenges associated with data collection and analysis, such as the need for large sample sizes and the potential for bias.

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A P P E N D I X

Check list of woody plants tallied near 40 grouse drumming logs. Nomenclature from Fernald, 1950.

Balsam fir (*Abies balsamea*)
Hemlock (*Tsuga canadensis*)
White spruce (*Picea glauca*)
Larch (*Larix laricina*)
White pine (*Pinus Strobus*)
Red pine (*Pinus resinosa*)
White cedar (*Thuja occidentalis*)
Willow (*Salix spp.*)
Trembling aspen (*Populus tremuloides*)
Large-tooth aspen (*Populus grandidentata*)
Balsam poplar (*Populus balsamifera*)
American hazel (*Corylus americana*)
White birch (*Betula papyrifera*)
Yellow birch (*Betula lutea*)
Swamp birch (*Betula pumila*)
Speckled alder (*Alnus rugosa*)
White oak (*Quercus alba*)
Red oak (*Quercus rubra*)
Slippery elm (*Ulmus rubra*)
American elm (*Ulmus americanum*)
Rock elm (*Ulmus Thomasi*)
Black currant (*Ribes americanum*)
Ninebark (*Physocarpus opulifolia*)
Meadow-sweet (*Spiraea alba*)
Chokeberry (*Pyrus melanocarpa*)
Juneberry (*Amelanchier huronensis*)
Hawthorn (*Crataegus sp.*)
Pin cherry (*Prunus pennsylvanica*)
Black cherry (*Prunus serotina*)
Choke cherry (*Prunus virginiana*)
Prickly ash (*Xanthoxylum americanum*)
Mountain holly (*Nemopanthus mucronata*)
Red maple (*Acer rubrum*)
Red-osier dogwood (*Cornus stolonifera*)
Gray dogwood (*Cornus racemosa*)
Silky dogwood (*Cornus obliqua*)
Leatherleaf (*Chamaedaphne calyculata*)
Blueberry (*Vaccinium sp.*)
White ash (*Fraxinus americana*)
Black ash (*Fraxinus nigra*)
Honeysuckle (*Lonicera canadensis*)
Nannyberry (*Viburnum lentago*)
High-bush cranberry (*Viburnum trilobum*)
Elderberry (*Sambucus canadensis*)

• *Staphylococcus aureus* (Staph aureus)

• *Staphylococcus epidermidis* (Staph epidermidis)

• *Staphylococcus saprophyticus* (Staph saprophyticus)

• *Staphylococcus carnosus* (Staph carnosus)

• *Staphylococcus sciuri* (Staph sciuri)

• *Staphylococcus hyicus* (Staph hyicus)

• *Staphylococcus saprocyticus* (Staph saprocyticus)

• *Staphylococcus saproplasticus* (Staph saproplasticus)

• *Staphylococcus saproplasticus* (Staph saproplasticus)

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