ANALYSES OF ATTITUDE CHANGES IN ADULTS AFTER PARTICIPATION IN A CONSERVATION - ORIENTED BIOLOGY COURSE

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This is to certify that the

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ABSTRACT

ANALYSES OF ATTITUDE CHANGES IN ADULTS AFTER PARTICIPATION IN A CONSERVATION - ORIENTED BIOLOGY COURSE

By

Robert Edward Brown

The purpose of this study was to determine if a specially designed biology course would create in students a favorable attitude toward conservation of natural resources.

This study was concerned with attitude change and the modifying of attitudes by new experiences. Several studies had been done in the past which dealt directly with this question. The author carried out a similar study using the same parameters in an attempt to prove attitudes can be learned.

The study was carried out over the 1968-69 academic year at Miami-Dade Junior College South Campus, Miami, Florida. During the fall of the year the course was offered for the first time but enrollment was too small for an adequate sample. Winter semester, 1969, was chosen for the actual study. The course, The Natural History of South Florida, was the experimental biology class while the traditional

general education biology course was selected as the control group.

The course taught to the experimental group was unique in that the teaching was done by a staff of visiting lecturers, each competent in his area of specialty. The general theme of the course was one of conservation of natural resources. The mandate given to each of the staff members was that the conservation theme be woven into their three-hour lecture wherever feasible. The control group had no conservation information presented whatsoever.

The experimental group was exposed to those questions and problems facing them as South Florida residents. The group was highly heterogeneous in make-up with teachers numerous. In addition to the lectures every week, field trips were conducted when appropriate. The trips were on the weekend following the lecture and were of four to six hour duration. Slides, films and other audio-visual media were employed along with re-prints and other duplicated material. Students were required to turn in a term paper on one aspect of the fifteen week course that was particularly helpful or useful to them.

The instrument used for measuring attitude change was a Likert-type scale developed by Dr. George M. Laug of the New York State University, College of Buffalo, to be used with a college group, and used by Dr. Eldon Whiteman of Spring Arbor College, Spring Arbor, Michigan as he tested a college group from another angle.

The students were tested at the beginning of the course and were given the same test the last week of the semester. Both control and experimental groups were similarly tested. Individual attitude change was not tested for but rather the attitude of the group as based on changes in arithmetic means. The "F" test was employed to establish the homogeneity of variance for uncorrelated groupings and the "t" test was used to determine the significance of differences between means. The 1% level of confidence was adopted as being significant with the 5% level being of questionable significance.

Following are conclusions from this study:

1. There was a difference of 15.514 points between the experimental and the control group on the means of their pre-test, a difference significant at the 1% level of confidence.

2. There was a change in a positive direction significant at the 1% level of confidence, in attitudes of the experimental group.

3. There was no significant change in attitude of the control group for pre- to post-test.

4. Sex was a statistically significant factor in attitude with the females of the experimental group showing an attitude change significant at the 1% level over no significant change in the males.

5. It was found that place of residence had no significant influence on attitude. The suburb group showed the greatest attitude change significant at the 5% level of confidence.

6. Having had a high school course in geography allowed that group to show an attitude change significant at the 5% level of confidence.

7. The group indicating no summer camp experience showed the greatest increase in the mean significant at the 5% level of confidence.

8. Those students who had scouting experience showed a positive attitude change significant at the 5% level of confidence over those without scouting experience.

9. Age of the experimental group played a very important role in attitude change. A shift in the positive direction was shown by the over twenty-four years of age group. The observed "t" was the most significant for the entire study.

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By

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A STATISTICAL STUDY OF THE CONSERVATION ATTITUDES AMONG COLLEGE BIOLOGY STUDENTS

I. Introduction

Conservation education has been presented for many years and in many diverse ways. There have been few attempts made at assessing the effect this information might have had on the student. It has been anticipated that the presentation of conservation concepts would change attitudes and ultimately the conduct of the student in a favorable direction. It is particularly interesting to conjecture on the ultimate effect of this information on the adult who has presumably formulated rigid attitudes. The writer holds that since it is the adult who finds himself in the decision-making role as a voting, tax-paying citizen, it is he who must be reached. The experimental course which is the subject of this study was directed toward a post college and/or lay adult. The course was offered as a part of the evening college program and as such would make such a program feasible in most any college community.

In looking back, we note that too much of our management of biological resources has been on an emergency basis. There is no over-all thinking to the problem, no concept of what it is we want

from our natural resources of this land.[1] Max Stone wrote that our renewable resources need a Magna Charta[2]. This is badly needed but its development and implementation will depend on an informed public and in this area of conservation education we still have a long way to go.

A further affirmation of the critical need for education is exemplified in the statement by Allen[3] when he summarized the problem at the twenty-fourth North American Wildlife Conference:

$$\frac{\text{Resources x Culture}}{\text{Population}} = \text{Living Standard}$$

This idea, as simple and self-evident as it is, seems to teach the art of thinking and of application of thought to a situation. The study of our resources calls for a knowledge of history, geography, biology, archeology, and every other study known to man about this earth and its people[4]. There is a vast potential and a large task for

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[1]John D. Black, The Management and Conservation of Biological Resources, (Philadelphia: F. A. Davis Co., 1968), pp. 8-10.

[2]Max Stone, "Wildlife Needing a Magna Charta", The Billings, Montana Gazette, (1966), from The Management and Conservation of Biological Resources".

[3]Durward I. Allen, Our Wildlife Legacy (New York: Funk and Wagnalls, 1962), Rev. Ed.

[4]Dan Raults, "Conservation: A Way of Life", Missouri Conservationist, 13:9 (September, 1952).

the educational world to perform in relation to ecology and conservation.[1] In reality, educators hold the key to America's future. Their labors will ultimately secure the concerted publication by which conservation can be fully assured. Public action is the means, but action will not come before a consciousness is aroused. Arousing that consciousness is a major challenge to our educational system.[2] Stewart Udall has stated: "We must develop a land consciousness that will inspire those daily acts of stewardship which will make America a more pleasant and productive land."[3]

Conservationists have depended on education to reduce forest fires, to control erosion, and reduce water pollution. The power of education in resolution of common problems has been exerted through the simple utterances of Smokey the Bear; through demonstrations of contour plowing in rural counties, and through the use of research in increasing productivity of soils, improving quality of livestock, developing potential of river basins and controlling insect

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[1]E. M. Nicholson, "Handbook to the Conservation Section of the International Biological Programme", Blackwell Scientific Publication, Oxford, England, '968, p. 14.

[2]Ruben L. Parsons, Conserving American Resources. (New Jersey: Prentice-Hall, 1956), p. 468.

[3]Steward L. Udall, The Quiet Crisis, (New York: Holt, Rinehart and Winston, 1963), p. 190.

and plant diseases.[1] G. E. Hutchinson in his monograph, On Living in the Biosphere, states:

> . . . The first requirement for resource education is a faith that the job can be done. . . I doubt that a direct appeal to fear will produce any results except a disbelief in the prophets of doom. There would seem to be forces operating in society which tend to reverse the destructive processes, or which could be made to do so. . . This is, in fact, the reason why it is essential that the teachers of the colleges and universities should be enthusiastic investigators in their fields of scholarship or practitioners and critics in their arts. It ought to be possible to show that it is as much fun to repair the biosphere and human societies within it as it is to mend the radio or family car.[2]

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[1]"Conservation In The People's Hands", American Association of School Administrators, Washington, D. C., 1964, p. 17.

[2]G. E. Hutchinson, "On Living in the Biosphere" in Readings in Conservation Ecology, edited by George W. Cox, (New York: Appleton-Century-Crofts, 1969), pp. 322-3.

II. Profile of Miami-Dade Junior College

Miami-Dade Junior College is a publicly supported, two-year community college which offers educational opportunities beyond the high school level. It has been in existence since 1960 and now consists of two separate campuses with a total enrollment in excess of thirty thousand students. In addition to providing instruction to prepare students to enter the upper division of senior colleges and universities or to make immediate entry into a career field, the College seeks to prepare the individual for democratic and creative living in the home and in the community.

The college has as its central objectives the development of superior programs of education in four major areas:

1. Two years of college-level academic work acceptable for transfer to four-year colleges and universities.
2. Technical, vocational and semi-professional programs designed to prepare graduates for positions in business and industry.
3. Medically-related programs offering college-level instruction in a wide range of paramedical technologies.
4. Continuing education courses for adults who wish to broaden their education, enrich their cultural lives

and improve their personal efficiency.[1]

Students attending the South Campus are difficult to typify. The majority of them are holding part-time employment and attend classes as they can be accommodated in their schedules. The population of students is commuter. There are no residence halls. The college serves as a feeder school and sends students on to the senior institutions nationwide. All students hoping to earn the two-year degree from Miami-Dade Junior College must complete a core program of general education courses. These consist of English, Social Science, Humanities and Science. Thus many of these students take Biology 102, the general education course. Total enrollment per semester in this course runs upwards of 900 students. The instructors teaching this course have free option to choose whatever text materials and methods they like. Generally the twelve staff members have followed a consistent pattern of using similar outlines but often different textbooks and references. The college is well endowed with a large library and a vast instructional media complex, both of which allow for flexibility in teaching of courses, particularly the general education biology. It was an adult evening general education biology class who became the control group for this study.

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[1]Miami-Dade Junior College Catalog, 1969-70.

Since man is here considered in relation to his environment and since quality of environment is the major concern in any conservation program today, this course was used for the control group. This course is the college general education course given for three semester credits. There are three one-hour lectures per week for fifteen weeks. There was no deliberate attempt on the part of the instructor to impart any information relevant to conservation of natural resources. This, however, would not necessarily mean there was no reference to quality in man's environment. The assigned textbook was Buffaloe and Throneberry, "Biology". Other books recommended for supplemental reading were: Keeton, "Biological Sciences", Ville, "Biology", and Simpson and Beck, "Life", An Introduction to Biology". For each of the topics covered, the approach was one of stressing terminology, then anatomy and lastly, physiology. (See Course outline, Appendix H).

III. Plan of Study

In the process of establishing a new course, Natural History of South Florida, at Miami-Dade Junior College, it became apparent that here was an opportunity to present information to a wide range of individuals from various walks of life. It became equally apparent that a general theme of resource conservation would dove-tail well with the educational philosophy of the college. It must be emphasized that the southern part of the State of Florida, particularly Dade County (the locale of Miami-Dade Junior College), is inhabited in the majority by retirees, transient workers, students over-wintering from Northern schools, and is in general a highly mobile populus. The native-born Florida student is the rare exception. Part of the impetus for this study was predicated on the belief that the college students attending Miami-Dade Junior College are different because of their lack of identification with their new environment. It was considered that many of the students had not had time to develop an awareness of the flora and fauna, the resources or lack of them, and various other local problems.

The objectives of the course, Natural History of South Florida, were defined as follows:

a. to familiarize the public with environmental quality (conservation problems)

b. to present sufficient human ecology information so that inter-relationships between man and his environment could be recognized

c. to familiarize the students with pressing local problems which involve them directly or indirectly

d. to indicate where action should be taken and how

e. to indicate sources of information for further study

Since the previous studies dealt with freshman and sophomore age levels and therefore there was little information available on older people and how they might respond to a course such as this, the attitude survey was directed toward the adult education group. With a mean age of 32 in the experimental class and a mean age of 26 in the control group, it became obvious, as far as age is concerned, we were dealing with a mature student body.

The attitude study was selected because it has been demonstrated to be accurate in earlier studies. Dr. Eldon Whiteman did a similar study in 1965 and Dr. George Laug in 1960. The research device, the attitude scale used by these men seemed ideal for the Miami-Dade testing situation. Information from two studies was available. It was

of interest to the writer and to the administration at Miami-Dade Junior College to determine if the course in Natural History was accomplishing what had been desired. Thus the study was instigated.

Dr. Whiteman's study was used as a model and his statistical devices, parameters, etc. were the same as were used in this study. Two major factors are different; the geographical factor with the "immigrant" population and the age factor. The ages of the experimental group ranged from eighteen years to sixty years with the mean age at 33.23. Dr. Whiteman was dealing primarily with first and second year undergraduates with approximate age range of eighteen to twenty-three years. Another major question evolved; is the more mature individual more receptive to conservation education? This is one of the questions this study attempts to answer.

IV. Definitions of Terms

An "attitude" is defined as the position or stand an individual takes with respect to something.[1] The term is used in reference to the preparation of the organism for overt physical behavior and to tendency

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[1]The Isaak Walton League of America, Guidelines to Conservation, (Glenview, Illinois, 1966). pp. 56-58.

to act in mental processes.[1] Attitude can have degrees of force, expressed as "threatening attitude", "kindly attitude", or "apathy", or "indifference".

"Opinion" on the other hand is said to mean the verbalization of an attitude. Public opinion is simply the expression of collective attitude on a subject or an issue. "Belief" is conviction of the truth or reality of a thing.[2]

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[1]William Albig, Public Opinion, (New York: McGraw-Hill Book Co., 1939), p. 174.

[2]The Isaak Walton League of America.

How do individuals and groups develop certain personal and group attitudes? It is not an easy question to answer but some facts are well established:

1. Attitudes are largely a product of culture, and come from the environment.

2. Attitudes are formed early in life, usually during the formative years of training.

3. Attitudes strongly entrenched cannot be changed readily, but they can be changed.

4. Attitudes are largely formed through personal experience with strong assists from training.

5. Attitudes are expressed in countless fashions and shade into one another. They are stratified as society is stratified but may be readily distorted. [1]

This much can be said about attitude as far as conservation is concerned: "Insufficient attention has been paid by conservationists to proper individual and group attitudes of people, how they are molded, and what they should be molded toward". [2] This aspect of human behavior must receive much more concern from natural resource workers and educators if they expect conservation to become a way of life in America.

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[1]The Isaak Walton League of America, p. 57.

[2]The Isaak Walton League of America, p. 58.

CHAPTER II

STUDIES RELATED TO THE PROBLEM

I. An Analysis of Emphasis Given to Conservation in College Biology Texts

It was considered of interest to this study to make an analysis of current college biology textbooks in an attempt to note what proportion of text material was devoted to conservation.

The textbooks were collected from the college instructors' personal libraries, and for the most part were examination copies. As much as possible, the most recent publications were used.

In several instances only a small portion of a chapter was devoted to the topic of conservation. Therefore page numbers are indicated.

Whiteman[1] carried out a similar study and therefore the ten books chosen for this analysis correlate with ten of his. It is interesting to note the lack of change over as long a period as twelve years.

In every textbook there was information on ecology. Five of the ten authors devoted a chapter to conservation (50%). The remaining

[1]Eldon E. Whiteman, "A Comparative Study of the Effect of a Traditional and a Specially Designed College Course in Biology on Conservation Attitudes", Unpublished Ph. D. dissertation, Michigan State University, 1965.

50% (5 authors) did mention conservation in passing.

TABLE I

AN ANALYSIS OF TEN COLLEGE BIOLOGY TEXTBOOKS TO DETERMINE THE TREATMENT GIVEN TO CONSERVATION TOPICS

(All bracketed information refers to the comparable Whiteman analysis).

Title	Edition	Author	Chapters	Pages
BIOLOGY	1967 (62)	Villee	1 (0)	2
PRINCIPLES OF BIOLOGY	1967 (62)	Buffaloe	0 (0)	
BIOLOGY	1966 (61)	Hardin	0 (0)	
GENERAL BIOLOGY	1966 (62)	Beaver	1 (1)	4 (4)
GENERAL BIOLOGY	1966 (61)	Johnson, et al	1 (0)	14 (14)
BIOLOGY	1965 (60)	Elliott and Ray	0 (0)	
BIOTIC WORLD AND MAN	1965 (58)	Milne and Milne	1 (1)	52 (33)
BIOLOGY, AN INTRODUCTION	1964 (62)	Goodnight	1 (1)	12 (12)
PRINCIPLES OF MODERN BIOLOGY	1964 (60)	Marsland	0 (0)	
BIOLOGY AND ITS RELATION TO MANKIND	1964 (57)	Winchester	0 (0)	

II. Past Studies of Conservation Education in Colleges in the United States

It is safe to say, at this time, that very little research has been done in the area of conservation education. There are volumes of data available relevant to soil, air, water, fish and wildlife conservation, etc., but little can be found on the educational aspects.

After twelve years, the Lively and Preiss study of conservation education in American colleges, supported by the Conservation Foundation, remains a major work.[1] This study was accomplished through the use of questionnaires mailed to colleges of 7,000 enrollment or less and for larger schools, catalogs were used for information. The results of the study indicated the shortcomings of what conservation education was then being offered.

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[1] Charles E. Lively and Jack J. Preiss, Conservation Education Education in American Colleges (New York: Ronald Press, 1957).

III. Attitude Studies in Conservation

Some of the most noteworthy studies made over the last few years were those of Wievel in 1947[1], Laug in 1960[2], George in 1964[3], and Whiteman in 1965[4].

Wievel's work consisted of his own specially constructed scale. The test was in three parts: a personal data sheet; a twenty-five statement attitude scale; and a seventy-five question multiple choice achievement test. The attitude portion had a reliability coefficient of .71 and the achievement portion had a coefficient of .90.

George's study was done at Michigan State University and undertook the analysis of attitude change in the following:

a. Comparison of conservation attitudes in high school students, college students, and adults.

b. Relationships between conservation attitudes and such factors

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[1]Bernard F. Wievel, "Attitude Toward and Knowledge of Conservation possessed by Students in Iowa High Schools", Unpublished Ph. D. dissertation, Iowa State College, 1947.

[2]George M. Laug, "A Study of Expressed Attitudes of Prospective Teachers Taking Part in Practical Conservation Activities", Unpublished Ph. D. dissertation, Syracuse Univ., 1960.

[3]Robert W. George, "A Comparative Analysis of Conservation Attitudes in Situations where Conservation Education is a Part of the Educational Experience", Unpublished Ph. D. dissertation, Michigan State University, 1966.

[4]Whiteman.

as sex, education, background and conservation experience.

c. Comparison of conservation attitudes as influenced by 4-H activities and educational experience.

The major thrust of Dr. George's study was toward 4-H and related school experiences and their effects on conservation attitudes in elementary and secondary school students.

Laug did his study at the State University College at Buffalo, New York. His class was a college biology group of freshmen and sophomores. After presenting a biology course in which conservation was the dominant theme, Dr. Laug then administered. the test. The primary concern of this investigation was to determine if a significant difference existed between two means; that of the pre-test and that of the post-test. The "t" test for correlated means was used and there was an increase of 11.51 points for the experimental group. The control group decreased 3.16 points[1]. Further references will be made to Laug's work throughout this paper.

The Whiteman study[2] was modeled after the work of Laug.

Through the use of a specially designed course in biology which dealt extensively with natural resources and conservation, Dr.

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[1]George M. Laug, "Do It Yourself Conservation and Its Effects Upon Attitudes of Prospective Teachers", The American Biology Teacher, XXIV (January, 1962).

[2]Whiteman.

Whiteman was able to utilize the same parameters and statistical analyses as Laug. Whiteman's class consisted of college freshmen and sophomores at Spring Arbor College, Spring Arbor, Michigan. His control groups were two biology classes, one in Spring Arbor and the other at Northwestern College in Iowa. Utilizing the pre- and post-test questionnaires described in the appendix of this study, Whiteman arrived at the following conclusions:

1. There was a 0.29 point difference between scores of his experimental and his control group on the pre-test, a result not statistically significant.

2. There was a change in a positive significant direction at the 1% level of confidence in the attitudes of the experimental group.

3. No statistically significant changes were noted in attitude of control groups.

4. Sex was not a statistically significant factor.

5. Rural students appeared more influenced by place of residence than urban and suburban.

6. A course in geography had no significant effect on attitudes.

7. 4-H training had some value in advance in attitude.

8. Summer camp experience had some value.

9. Scouting had no significant effect on attitudes.[1]

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[1]Whiteman, Abstract.

CHAPTER III

METHODS OF INVESTIGATION

I. Development of Unit

During the early part of 1968, the writer became involved in the planning and coordinating of a new course, Biology 261, Natural History of South Florida. This course had appeared in our college catalog for some time but had never before been offered. The catalog described it as "A course which integrates and correlates certain features of the natural history of South Florida such as the geology, meteorology, flora, fauna, ecology and conservation thereof".[1]

The course was set up so that there would be no pre-requisites, and a dual enrollment procedure was established in the hope that the division of Continuing Education would draw in students. A brochure was printed and distributed throughout the schools in the county. The State Board of Education in Tallahassee had approved Natural History of South Florida for P. I. P. credit (Professional Improvement Program) which meant that teachers could use this course as part of their six credits per year requirement for maintaining their teaching certificates. All of this worked to our advantage as the class

[1]Miami-Dade Junior College Catalog, 1969-70.

began to build. The majority of students were adults, many of whom were teachers, who had been out of school for some time.

One of the requirements in establishing this course was that local experts be used as much as possible as visiting lecturers. Accordingly, the teachers of the course were local professionals who were paid an honorarium for the three-hour lecture each week. Several of the college faculty members filled in when outside community talent was not available. On this basis we were able to build a course which was highly relevant to the interests of the local populus.

The lectures were held on Wednesday evenings from seven to ten. Field trips were taken on Saturdays or Sundays when needed. Students were required to submit a term paper as one-third of the final grade. The remainder of the grade was derived from a mid-term exam and the final examination.

As coordinator of the course it became my duty to establish contacts between the college and potential lecturers and ultimately to secure their services. In selecting the staff for the course, the prime factor was their attitude toward conservation education. Every lecturer was sympathetic toward the necessity of teaching resource conservation and in every case this theme was worked into their lecture. These lectures were generally divided into three segments;

a general statement of the problem of interest by the speaker, an illustrated slide presentation or film and finally a question and answer period. Students took notes and were later tested on the material covered in the lectures.

There was no assigned textbook for the course. Students were expected to consult the college library when necessary and a list of books on assigned reading reserve was given to each student.[1] Material in the form of reprints and other handouts was distributed when necessary by the individual teachers.

[1] See Appendix B.

II. The Research Device

Any attempt to measure the individuals' attitude is admittedly difficult. The problem becomes one of selecting the most reliable and proven technique. Fortunately, such a technique had been devised prior to the 1968-69 study at Miami-Dade Junior College.

Whiteman, in his research of 1965 at Spring Arbor College, Michigan, made reference to several investigatory techniques whereby one might gather information on attitude shift. These ranged from direct observation of behavior[1], to direct questioning, to Thurstone's Method of equal appearing intervals, to Likert's Method of Summated Ratings[2]. Whiteman became aware of the study carried out by George Laug at Syracuse University, using his own design of a Likert-type scale. Laug had selected from three hundred attitude statements concerning conservation, sixty-six for the actual test. These sixty-six statements comprised the attitude test of Whiteman and of this author. The statements were printed on offset and arranged on four separate pages covered by a personal data sheet.[3] The scoring

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[1]H. H. Rommers and N. L. Gage, Educational Measurement and Evaluation, (New York: Harpers Brothers, 1955), p. 382.

[2]Rensis Likert, "A Technique for the Measurement of Attitudes," Archives of Psychology, No. 140 (June, 1932). cited in Whiteman, op. cit.

[3]See Appendix A.

was set up in such a way that each of the sixty-six statements was preceded by five answers ranging from SA (strongly agree with the statement), A (agree with the statement), U (undecided), D (disagree with the statement) to SD (strongly disagree with).

The students were instructed to circle one of the five choices. Complete agreement with the author's answer was valued at four points. One step removed from complete agreement, three points; two steps, two points; three steps removed, one point, and complete lack of agreement, zero points. The points were then tallied for the sixty-six responses.

The tests were administered during the first week of the semester (pre-test) and during the final exam week (post test). A time lapse of thirteen weeks was thought to nullify any retention of questions and answers.

The test took fifteen to twenty minutes to complete. Students were assigned numbers which were entered on the data sheet of the pre-test. Each student also entered this number on a slip of paper with his name. These slips were kept until the post-test was administered, thus allowing students to recall their assigned number for placing on the post-test. This procedure allowed for correlation of papers into sets, pre- and post-tests and yet the students remained anonymous. Before taking the test, students were asked to fill in the personal data form. This was not done on the post-test.

III. Sampling Technique

After the questionnaires were administered, both pre-test and post-test, the data was scored and coded on the data sheet of each participant. It was then decided to utilize one of the College's computers, the IBM APL/360.

The APL (A Programming Language)/360 system comprises a central computer and a number of typewriter-like terminals. Miami-Dade Junior College had leased time of the central 360 computer in Fort Lauderdale reached via the IBM console on our campus. The connection is acquired by dialing a direct line from the IBM Selectric Console to the computer and placing the telephone handset into an acoustic coupler.

The APL system was ideal for this study because of its accessibility and convenience. Unlike other computer languages such as COBOL or FORTRAN, no data cards are punched. The computer deals directly with the individual programmer and response is instantaneous.

The statistical analysis, i.e. the "F" test and the "t" test, was programmed into the memory bank of the computer. As data became available, the computer, given the raw data (and appropriate commands) was able to print-out the analysis.[1]

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[1]See Appendix G.

Accuracy was to the seventh decimal point and many checks and cross checks were built into the system. The analysis of the data[2], i.e., the observed "t" and "F" values were taken from the APL print-out and subjected to the appropriate statistical table. With this information, the decisions present in this study were made.

[2]See Appendix G.

CHAPTER IV

THE STATISTICAL TESTS

The choice of which statistical tests might be appropriate to a study such as this was limited. It was decided at the outset to attempt a continuation of the Whiteman study[1] and therefore his parameters were also used in this study.

An English scientist, writing under the pen name of Student in 1908, gave the probability distribution we now call Student's "t" distribution or simply, the "t" distribution. The "t" distribution is symmetrical about t = 0 and is bell-shaped. The "t" distribution has only one parameter. This is called degrees of freedom and related to the number of restrictions imposed upon the sample.[2]

The number of degrees of freedom (d_f) is the maximum number of variates which can be freely assigned (e.g., calculated or assumed) before the rest of the variates are completely determined. That is, it is the total number of variates minus the number of independent relationships existing among them.[3]

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[1]Whiteman

[2]Donald Meyer, Educational Statistics, (New York: The Center for Applied Research in Education, Inc., 1966) pp. 69-71.

[3]Henry Alder and Edward Roesster, Introduction to Probability and Statistics, (San Francisco: William Freeman, 1964), p. 125.

The formula for the "t" test programmed into the computer was as follows:

$$"t" = \frac{X_1 - X_2}{S\bar{X}_1^2 + S\bar{X}_2^2}$$

In order to ascertain whether or not the difference between two means is large enough to be considered real and dependable, the null hypothesis was used. This hypothesis asserts that there is no true difference between two population means, and that the difference found between sample means is therefore accidental and unimportant. It constitutes a challenge and the function of an experiment is to give the facts a chance to refute, or fail to refute, the challenge.[1]

Garrett argues that a difference is called significant when the probability is so high that it cannot be a chance occurrence (i.e., temporary and accidental) and thus represents a true difference between population means. A difference is declared not significant when it appears reasonably certain that the derived difference could have arisen from sampling procedures, hence implying no real or true difference between the means.[2]

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[1]Henry Garrett, Statistics in Psychology and Education, (new York: David McKay Company, Inc., 1966), p. 213.

[2]Garrett, p. 212.

The 1% level of confidence was used as significant in this study. The 5% level was considered of questionable significance. All levels above that were considered as non-significant. Whiteman's study[1] adhered to the same parameters.

The 1% level of confidence means there is less than one chance in a hundred that a "t" value as large as or larger than that computed could have occurred by chance. With such a "t", we could reject the null hypothesis with the confidence of being correct ninety-nine times in a hundred.[2]

According to Guilford, the criteria for significance for "t" in a normal distribution is as follows.[3]

Level of "t"	Level of Confidence	Conclusions
Below 1.65	Below 10% level	Insignificant
1.65	At the 10% level	Insignificant
1.96	At the 5% level	Significant
2.33	At the 2% level	Significant
2.58	At the 1% level	Very Significant

Some of the data was subjected to another test, the "F" test. The "F" test is employed when one wishes to determine if the sample group is in reality from the same normally distributed population. "F" furnishes a comprehensive or over-all test of the significance of

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[1]Whiteman, p. 62.

[2]Whiteman, p. 62.

[3]J. B. Guilford, Fundamental Statistics in Psychology and Education, (New York: McGraw-Hill Book Co., 1950), p. 209.

differences among means. A significant "f" does not tell us which means differ significantly, but that at least one is reliably different from some others. If "F" is not significant, there is no reason for further testing, as none of the mean differences will be significant. But if "F" is significant, we may proceed to test the separate differences by the "t" test[1].

The ultimate rationale behind the selection of the "t" test as the primary testing device is related to sample size. The "t" was designed to accommodate sampling technique for this Study.

On the basis of the "F" and "t" tests, the table of confidence levels, and the tables of the "t" tests and "F" tests in reference works, the data was analyzed as follows.

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[1]Garrett, p. 284.

TABLE 3

t-TEST FOR CORRELATED MEANS OF ALL EXPERIMENTAL GROUP PRE- AND POST-TESTING

Experimental Group	N	Mean	$\overline{D}$	$\overline{SD}$	$\overline{t}$
Pre-Test	34	190.647			
Post-Test	34	205.000	14,353	4.845	2.962

$N_1 + N_2 - 2 = d_f$

34 + 34 - 2 = 66 degrees of freedom

Table of "t"

t - (.05) - 2.00

t - (.01) - 2.65

Upon entering the "t" table[1] with sixty-six degrees of freedom, the observed "t" was found to be significant at the 1% level of confidence. The null hypothesis for means was refuted by demonstrating a difference not explainable by chance. There was an increase in the mean between the pre-test and post-test of 14.353.

In Dr. Whiteman's study, there was a significant increase of 9.063 points at the 1% level of confidence[2].

Dr. Laug's data, from his study at the State University of New York, College of Buffalo, showed a score increase of 11.51 points

[1]Henry E. Garrett, Statistics in Psychology and Education, (New York: David McKay Co., Inc., 1966), p. 461.

[2]Whiteman, p. 63.

which was significant at the 1% level of confidence.

The control group was then subjected to the same statistical analysis as the experimental group. The "t" test for testing significant difference between two means was employed.

TABLE 4

t-TEST FOR CORRELATED MEANS OF ALL MIAMI-DADE CONTROL GROUP PRE- AND POST-TESTING

Control Group	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	30	175.133			
Post-Test	30	177.433	2.300	6.016	0.382

$N_1 + N_2 - 2 = d_f$

30 + 30 - 2 = 58 degrees of freedom

Table of "t"

t - (.05) - 2.00

t - (.01) - 2.66

Upon entering the "t" table with fifty-eight degrees of freedom, the observed "t" lacked significance at either the 1% or 5% level of confidence and the null hypothesis was accepted. The mean difference between the pre- and post-tests was 2.300.

Whiteman's study showed similar results although the pre- and post-test difference was 3.309 points, still not significant[1].

[1]Whiteman, p. 65.

Laug's group showed non-significant difference.

The Miami-Dade experimental and control groups were compared on both pre- and post-test situations. Since this involved comparison of different sample groups an uncorrelated condition existed and the "F" test was employed to test for significance between variability for two groups.

TABLE 5

F-TEST FOR HOMOGENEITY OF EXPERIMENTAL AND CONTROL POPULATIONS ON PRE- AND POST-TESTING

Testing Situation	Test	N	Mean	S^2	F
Pre-Test	Exper.	34	190.647	343.581	
Pre-Test	Con.	30	175.133	536.716	1.562
Post-Test	Exper.	34	205.000	431.176	
Post-Test	Con.	30	177.433	522.712	1.189

$N_1 - 1 = d_f$

33 and 29 degrees of freedom

Table of "F"

F = (.05) - 1.85

F - (.01) - 2.41

Upon entering the "F" table[1] with thirty-three and twenty nine degrees of freedom, the "F" value for the pre-test experimental and control groups was found to be not significant at either the 5% or 1% level of confidence. The post-test comparison showed the "F" value was significant at the 5% level of confidence. Since it was earlier stated that the 1% level of confidence would be the acceptable standard for this study, in both pre- and post-testing situations the null hypothesis was accepted implying that as far as variability was concerned, the two samples could have been from the same population.

TABLE 6

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF EXPERIMENTAL AND CONTROL GROUPS ON PRE- AND POST-TESTING

Testing Situation	Test	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Exper.	34	190.647			
Pre-Test	Con.	30	175.133	15.514	5.303	2.9266
Post-Test	Exper.	34	205.000			
Post-Test	Con.	30	177.433	27.576	5.514	5.000

$N_1 + N_2 - 2 = d_f$

34 + 30 - 2 = 62 degrees of freedom

Table of "t"

t - (.05) - 2.00

t - (.01) - 2.66

[1]William Mendenhall, Introduction to Probability and Statistics, (California: Wadsworth Publishing Co., Inc., 1969), pp. 349-352.

Upon entering the "t" table with sixty-two degrees of freedom from the pre-test experiment and the pre-test control, the observed "t" was found to be significant at both the 1% and the 5% level of confidence. The difference between the means of these two groups was 15.514 points. In the post-test experimental and post-test control comparison, the observed "t" was again significant at both the 1% and 5% levels of confidence, the difference being 27.567 points. Thus the null hypothesis was rejected.

This represents a sharp contrast to the Whiteman study where the pre- and post-test comparisons were not significant.

Laug's study[1] showed significance at the 1% level of confidence.

From this point on, statistical analysis dealt only with the experimental group.

In the following table, male and female members of the experimental group were compared. The "F" test for homogeneity of variance was applied.

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[1] Laug, p. 58.

TABLE 7

F-TEST FOR HOMOGENEITY OF EXPERIMENTAL MALE AND FEMALE POPULATIONS ON PRE- AND POST-TESTING

Testing Situation	Sex	N	Mean	S^2	F
Pre-Test	Male	18	191.889	432.765	
Pre-Test	Female	16	189.250	239.563	1.806
Post-Test	Male	18	201.167	557.917	
Post-Test	Female	16	209.313	253.465	2.201

	Table of "F"
$N_1 - 1 = d_f$	F - (.05) - 2.33
17 and 15 degrees of freedom	F - (.01) - 3.37

Upon entering the "F" table at seventeen and fifteen degrees of freedom it was found that neither "F" was significant at the two levels. The null hypothesis was not rejected and so far as variability was concerned, the two samples could have come from the same population. The same data was then applied to the "t" test that follows.

TABLE 8

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF EXPERIMENTAL MALE AND FEMALE GROUPS ON PRE- AND POST-TESTING

Testing Situation	Sex	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Male	18	191.889			
Pre-Test	Female	16	189.250	2.639	6.548	0.403
Post-Test	Male	18	201.167			
Post-Test	Female	16	209.313	8.146	7.212	1.130

$N_1 + N_2 - 2 = d_f$

18 + 16 - 2 = 32 degrees of freedom

Table of "t"

t - (.05) - 2.04

t - (.01) - 2.75

Upon entering the "t" table with thirty-two degrees of freedom, neither of the observed "t"'s were found to be significant at either the 1% or 5% level of significance. Thus the null hypothesis was accepted. Female members of the class were 2.639 points lower on the pre-test than the males but 8.146 points higher on the post-test for an overall increase of 5.507 points. Whiteman's study showed a 4.014 point increase for females over males on the pre-test and a female point increase of 2.935 on the post-test.[1]

[1]Whiteman, p. 70.

In Laug's study, the men did slightly better on both pre- and post-tests than the females.

The "t" test was next employed to compare the differences between means of the pre-test and post-test of the two sexes.

TABLE 9

t-TEST FOR CORRELATED MEAN DIFFERENCES OF EXPERIMENTAL MALE AND FEMALE GROUPS ON PRE- AND POST-TESTING

Testing Situation	Sex	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Male	18	191.889			
Post-Test	Male	18	201.167	9.278	7.634	1.215
Pre-Test	Female	16	189.250			
Post-Test	Female	16	209.313	20.063	5.733	3.499

$N_1 + N_2 - 2 = d_f$

$18 + 18 - 2 = 34\ d_f$ (Male)

$16 + 16 - 2 = 30\ d_f$ (Female)

	t - (.05) - 2.04
Male	t - (.01) - 2.75
Female	t - (.05) - 2.04
	t - (.01) - 2.75

Upon entering the "t" table with thirty-four degrees of freedom, the resulting "t" of the males was not significant at either the 1% or 5% level of confidence. Then the null hypothesis was accepted. It became apparent that the females were able to raise their scores by an amount, significant at the 1% level, of 20.063 points as compared to a 9.278 for the males.

Whiteman's study showed that neither his male nor his female population raised their scores significantly.

Dr. Laug's group raised their scores 11.67 points for the males and 11.45 points for females. This was significant at the 1% level of confidence.[1]

In taking data from the personal data sheet, the area of longer residence was considered. The "t" test was carried out on comparisons between test scores made by the urban, suburban and rural groups within the experimental group.

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[1] Laug, p. 95.

TABLE 10

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF URBAN, SUBURBAN AND RURAL STUDENTS ON PRE-TESTING

Residence Pairs	N	Mean	$\overline{D}$	$\overline{SD}$	t
Urban	9	189.556			
Suburban	18	191.111	1.555	7.758	0.201
Urban	9	189.556			
Rural	7	190.857	1.301	9.150	0.142
Suburban	18	191.111			
Rural	7	190.857	0.254	9.143	0.028

$N_1 + N_2 - 2 = d_f$

$9 + 18 - 2 = 25\ d_f$ (Urb-Sub)

$9 + 7 - 2 = 14\ d_f$ (Urb-Rur)

$18 + 7 - 2 = 23\ d_f$ (Sub-Rur)

Table of "t"

(Urb-Sub)	t - (.05) - 2.06	
	t - (.01) - 2.79	
(Urb-Rur)	t - (.05) - 2.14	
	t - (.01) - 2.98	
(Sub-Rur)	t - (.05) - 2.07	
	t - (.01) - 2.81	

Upon entering the "t" table with twenty-five, fourteen and twenty-three degrees of freedom, there was found to be no significant difference between any combination at either the 1% or 5% level of confidence. The null hypothesis was accepted.

Whiteman's study showed a like result on the pre-test situation[1],

[1]Whiteman, p. 73.

while Laug indicated a small increase in the second and third groups.[1]

TABLE II

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF URBAN, SUBURBAN AND RURAL STUDENTS ON POST-TESTING

Residence Pairs	N	Mean	$\overline{D}$	$\overline{SD}$	t
Urban	9	201.556			
Suburban	18	208.500	6.944	7.791	0.891
Urban	9	201.556			
Rural	7	200.429	1.127	11.093	0.102
Suburban	18	208.500			
Rural	7	200.429	8.071	10.377	0.778

$N_1 + N_2 - 2 = d_f$

$9 + 18 - 2 = 25\ d_f$ (Urb-Sub)

$9 + 7 - 2 = 14\ d_f$ (Urb-Rur)

$18 + 7 - 2 = 23\ d_f$ (Sub-Rur)

Table of "t"

(Urb-Sub)	t - (.05) - 2.06
	t - (.01) - 2.79
(Urb-Rur)	t - (.05) - 2.14
	t - (.01) - 2.98
(Sub-Rur)	t - (.05) - 2.07
	t - (.01) - 2.81

[1] Laug, p. 83.

Upon entering the "t" table with twenty-five, fourteen and twenty-three degrees of freedom, it was noted that no value for the observed "t" was significant at either the 1% or 5% level of confidence. The null hypothesis was not rejected.

TABLE 12

t-TEST FOR CORRELATED MEAN DIFFERENCES OF URBAN, SUBURBAN, AND RURAL STUDENTS ON PRE- AND POST-TESTING

Residence	Test	N	Mean	$\overline{D}$	$\overline{SD}$	t
Urban	Pre	9	189.556			
	Post	9	201.556	12.000	7.150	1.678
Suburban	Pre	18	191.111			
	Post	18	208.500	17.389	6.873	2.530
Rural	Pre	7	190.857			
	Post	7	200.429	9.572	13.556	0.706

$N_1 + N_2 - 2 = d_f$

$9 + 9 - 2 = 16\ d_f$ (Urban)

$18 + 18 - 2 = 34\ d_f$ (Suburb)

$7 + 7 - 2 = 12\ d_f$ (Rural)

Table of "t"

(Urban) t - (.05) - 2.12
t - (.01) - 2.92

(Suburb) t - (.05) - 2.03
t - (.02) - 2.72

t - (.05) - 2.18
t - (.01) - 3.06

Upon entering the "t" table with sixteen, thirty-four and twelve degrees of freedom, the observed "t" table for the urban and rural groups were not significant at either the 1% or 5% level of confidence. The observed "t" for the suburb group showed significance at the 5% level of confidence, however, this was judged to be not significant for this study. Therefore the null hypothesis was not rejected.

Geography was considered to be a course that included resource conservation and was therefore advisable to determine what effect it would have upon students who had this subject in high school. The "F" table was used first to determine if the sample had equal variance.

TABLE 13

F-TEST FOR HOMOGENEITY OF EXPERIMENTAL GEOGRAPHY AND NO GEOGRAPHY POPULATIONS ON PRE- AND POST-TESTING

Testing Situation	Geography	N	Mean	S^2	F
Pre-Test	Yes	27	190.037	337.739	
Pre-Test	No	7	193.000	359.143	1.063
Post-Test	Yes	27	203.630	468.011	
Post-Test	No	7	210.286	253.918	1.843
				Table of "f"	
$N_1 - 1 = d_f$				F - (.05) - 3.81	
26 and 6 d_f				F - (.01) - 7.23	

Upon entering the "F" table with twenty-six and six degrees of freedom it was observed that neither of the resulting "F" for the pre-test or the post-test condition were significant at the 1% or 5% level of confidence. The null hypothesis was accepted.

Further treatment of this data by the "t" test follows.

TABLE 14

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF EXPERIMENTAL GEOGRAPHY AND NO GEOGRAPHY GROUPS ON PRE- AND POST-TESTING

Testing Situation	Geography	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Yes	27	190.037			
Pre-Test	No	7	193.000	2.963	8.087	9.366
Post-Test	Yes	27	203.630			
Post-Test	No	7	210.286	6.656	9.012	0.739

Table of "t"

$N_1 + N_2 - 2 = d_f$ t - (.05) - 2.04

$27 + 7 - 2 = 32\ d_f$ t - (.01) - 2.75

Upon entering the "t" table at thirty-two degrees of freedom it was determined that neither "t" was significant at the 1% or 5% level of confidence. The null hypothesis was not rejected. In these

samples, those not having geography did better on both the pre- and post-testing situation. Whiteman showed similar results.[1] Dr. Laug did not make this analysis.

This data was then used to indicate correlated mean differences of those having had geography and those not having had this subject.

TABLE 15

t-TEST FOR CORRELATED MEAN DIFFERENCES OF EXPERIMENTAL GEOGRAPHY AND NO GEOGRAPHY GROUPS ON PRE- AND POST-TESTING

Geography	Test	N	Mean	$\overline{D}$	$\overline{SD}$	t
Yes	Pre	27	190.037			
	Post	27	203.630	13.593	5.567	2.442
No	Pre	7	193.000			
	Post	7	210.286	17.286	10.100	1.710

$N_1 + N_2 - 2 = d_f$

$27 + 27 - 2 = 52\ d_f$ (Yes)

$7 + 7 - 2 = 12\ d_f$ (No)

(Yes) t - (.05) - 2.01
t - (.01) - 2.68

(No) t - (.05) - 2.18
t - (.01) - 3.06

[1]Whiteman, p. 80.

Upon entering the "t" table with fifty-two degrees of freedom for those who had geography or twelve degrees of freedom for those who did not, the observed "t" for those who had geography was significant at the 5% level of confidence. For the group not having had a high school geography course, the observed "t" was not significant at either the 1% or 5% level of confidence. The null hypothesis was not refuted.

Whiteman's analysis showed that the group not having had a geography course did 9.921 points better, significant at the 1% level of confidence. For Whiteman's students who had geography there was no significant increase.[1]

Summer camp experience was thought to have some bearing on conservation-resource attitudes. This data was first subjected to the "F" test for homogeneity.

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[1]Whiteman, p. 80.

TABLE 16

F-TEST FOR HOMOGENEITY OF EXPERIMENTAL SUMMER CAMP AND NO SUMMER CAMP POPULATIONS ON PRE- AND POST-TESTING

Testing Situation	Summer Camp	N	Mean	S^2	F
Pre-Test	Yes	14	190.786	295.026	
Pre-Test	No	20	190.550	377.548	1.280
Post-Test	Yes	14	202.143	241.408	
Post-Test	No	20	107.000	554.300	2.296

Table of "F"

$N_1 - 1 = d_f$ F - (.05) - 2.46

13 and 19 degrees of freedom F - (.01) - 3.66

Since neither "F" value was significant at the 1% of 5% level of confidence, the null hypothesis was not refuted.

The "t" technique was then used to compare these two groups of students on pre- and post-testing situations.

TABLE 17

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF EXPERIMENTAL SUMMER CAMP AND NO SUMMER CAMP GROUPS ON PRE- AND POST-TESTING

Testing Situation	Summer Camp	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Yes	14	190.786			
Pre-Test	No	20	190.550	0.236	6.658	0.035
Post-Test	Yes	14	202.143			
Post-Test	No	20	207.000	4.857	7.409	0.656

Table of "t"

$N_1 + N_2 - 2 = d_f$ t - (.05) - 2.04

14 + 20 - 2 = 32 degrees of freedom t - (.01) - 2.75

Upon entering the "t" table with thirty-two degrees of freedom, the observed "t" was found to be not significant at either the 1% or 5% levels of confidence. The null hypothesis was accepted. Whiteman's results were similar.

The data was then subjected to the "t" test for correlated mean differences for both groups.

TABLE 18

t-TEST FOR CORRELATED MEAN DIFFERENCES OF EXPERIMENTAL SUMMER CAMP AND NO SUMMER CAMP GROUPS ON PRE- AND POST-TESTING

Summer Camp	Test	N	Mean	$\overline{D}$	$\overline{SD}$	t
Yes	Pre	14	190.786			
	Post	14	202.143	11.357	6.424	1.768
No	Pre	20	190.550			
	Post	20	207.000	16.450	7.003	2.349

$N_1 + N_2 - 2 = d_f$

$14 + 14 - 2 = 26\ d_f$ (Yes)

$20 + 20 - 2 = 38\ d_f$ (No)

(Yes) t - (.05) - 2.06
t - (.01) - 2.78

(No) t - (.05) - 2.02
t - (.01) - 2.71

Upon entering the "t" table with twenty-six degrees of freedom for those having had summer camp and thirty-eight degrees of freedom for those not having had summer camp, the group with no summer camp proved to have a significant observed "t" value at the 5% level of confidence. Since the 1% level of confidence is the parameter for this study, the results failed to refute the null hypothesis.

Whiteman's analysis showed significance at the 5% level for those having had camp but not at the 1% level of confidence.

Laug did not carry out this test.

Scouting experience was next subjected to scrutiny to determine what value, if any, this experience might have on attitude change. The "F" test for population homogeneity was first employed. Because of sample size, no attempt was made to segregate the data into Girl Scout vs. Boy Scout.

TABLE 19

F-TEST FOR HOMOGENEITY OF EXPERIMENTAL SCOUTS AND NO SCOUTS POPULATIONS ON PRE- AND POST-TESTING

Testing Situation	Scouts	N	Mean	S^2	F
Pre-Test	Yes	21	190.714	265.537	
	No	13	190.538	469.633	1.769
Post-Test	Yes	21	203.286	377.823	
	No	13	207.769	504.947	1.336

Table of "F"

$N_1 - 1 = d_f$ F - (.05) - 2.54

20 and 12 degrees of freedom F - (.01) - 3.86

The "F" table was entered with twenty and twelve degrees of freedom and in both cases the resulting "F" was not significant at either the 1% or 5% level of confidence. Thus, the null hypothesis was not rejected and we can assume all members of this sample could have come from the same population.

Since Whiteman segregated his analysis into Girl Scout and Boy Scout groups, a direct comparison cannot be made here.

TABLE 20

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF EXPERIMENT SCOUTS AND NO SCOUTS GROUP ON PRE- AND POST-TEST

Testing Situation	Scouts	N	Mean	D	SD	t
Pre-Test	Yes	21	190.714			
	No	13	190.538	0.176	6.743	0.026
Post-Test	Yes	21	203.286			
	No	13	207.769	4.483	7.512	0.597

Table of "t"

$N_1 + N_2 - 2 = d_f$

t - (.05) - 2.04

21 + 13 - 2 = 32 degrees of freedom

t - (.01) - 2.76

Upon entering the "t" tables with thirty-two degrees of freedom, "t" values of 0.026 and 0.597 were obtained which lack significance at the 1% and 5% level of confidence. The null hypothesis was accepted.

TABLE 21

t-TEST FOR CORRELATED MEAN DIFFERENCES OF EXPERIMENTAL SCOUTS AND NO SCOUTS GROUP ON PRE- AND POST-TESTING

Scouts	Test	N	Mean	D	SD	t
Yes	Pre	21	190.714			
	Post	21	203.286	12.572	5.672	2.217
No	Pre	13	190.538			
	Post	13	207.769	17.231	9.012	1.912

$N_1 + N_2 - 2 = d_f$

$21 + 21 - 2 = 40\ d_f$ (Yes)

$13 + 13 - 2 = 24\ d_f$ (No)

Table of "t"

(Yes)	t - (.05) - 2.02
	t - (.01) - 2.71
(No)	t - (.05) - 2.86
	t - (.01) - 2.80

Upon entering the "t" table for forty and twenty-four degrees of freedom for those who had scouting and those who had not, the group having had the experience showed a "t" value significant at the 5% level of confidence. The null hypothesis was accepted.

The last data analyzed was a comparison within the experimental group of the age factor. All members of the experimental group twenty-four years of age or under were classified as "young". All members over twenty-four years of age were referred to as "mature". Neither Whiteman nor Laug carried out this analysis.

TABLE 22

t-TEST FOR UNCORRELATED MEAN DIFFERENCES OF YOUNG EXPERIMENTAL GROUP AND MATURE EXPERIMENTAL GROUP ON PRE- AND POST-TESTING

Testing Situation	Test Age Group	N	Mean	D	SD	t
Pre-Test	Young	11	194.727			
Pre-Test	Mature	23	188.696	6.031	6.923	0.871
Post-Test	Young	11	201.091			
Post-Test	Mature	23	206.870	5.779	7.780	0.743

$N_1 + N_2 - 2 = d_f$

11 + 23 - 2 = 32 degrees of freedom

Table of "t"

t - (.05) - 2.04

t - (.01) - 2.75

Upon entering the "t" table with thirty-two degrees of freedom, the observed "t" value is found to be not significant in either the pre- or post-test situation. The null hypothesis is not refuted.

The "t" test for correlated mean differences between "young" and "mature" members of the experimental group was then done.

TABLE 23

t-TEST FOR CORRELATED MEAN DIFFERENCES OF YOUNG EXPERIMENTAL GROUP AND MATURE EXPERIMENTAL GROUP ON PRE- AND POST-TESTING

Testing Situation	Test Age Group	N	Mean	$\overline{D}$	$\overline{SD}$	t
Pre-Test	Young	11	194.727	6.3		
Post-Test	Young	11	201.091	6.364	9.836	0.647
Pre-Test	Mature	23	188.696			
Post-Test	Mature	23	206.870	18.174	5.477	3.318

$N_1 + N_2 - 2 = d_f$

$11 + 11 - 2 = 20\ d_f$ (Young)

$23 + 23 - 2 = 44\ d_f$ (Mature)

(Young) t - (.05) - 2.09
t - (.01) - 2.84

(Mature) t - (.05) - 2.02
t - (.01) - 2.69

Upon entering the "t" table with twenty degrees of freedom for the pre- and post-test young group and forty-four degrees of freedom for the pre- and post-test mature group, the observed "t"'s showed a striking increase in the mean of the mature group. With an increase of 18.174 points over the pre-test, the mature group was significant

at the 1% and 5% levels of confidence and the null hypothesis was refuted. The null hypothesis was accepted for the young group.

CHAPTER V

Summary And Conclusions

The objectives of the Natural History course were:

1. to create an awareness among responsible citizens of their natural environment

2. to illustrate problems in the natural environment which man has either created or intensified

3. once the awareness developed, to encourage a conservation ethic or positive thinking relevant to conservation among the class members (i.e., conservation attitudes)

If the course accomplished these, it would be considered successful.

An important aspect of the experimental course was the analysis of the attitudes the students held toward conservation concepts. When it was determined that attitudes could be accurately evaluated, an appropriate test was devised. The attitude test was administered at the beginning of the course and again at the conclusion of the course. The numerical scores attained on the pre- and post-tests were subjected to statistical analyses. These procedures allowed the author to examine the students in terms of any attitude changes relevant to their outlook on conservation.

The initial thrust of the Natural History course was toward evening college students. The makeup of such a class was heterogeneous with great diversity in age, background and education. Both the experimental group and the control group were composed of mature individuals (over twenty four years of age).

The results of the pre- and post-attitude tests of the experimental and control classes were compared and it was noted that the experimental group showed a much greater positive attitude change than the control group. There was demonstrable evidence that the experimental group did profit from the experience. A summarization of these results follows:

A. The experimental class showed a change in attitude toward conservation concepts. This attitude shift was positive. The attitude change was significant at the 1% level of confidence. The control group showed no significant attitude change.

B. Females of the experimental group showed a positive attitude change significant at the 1% level of confidence while the males of the group showed a positive attitude change but not at the 1% level of confidence.

C. Past experiences in geography courses and in scouting were indicated in some members of the experimental group. These experiences enabled these class members to show a greater positive attitude

change (significant at the 5% confidence interval) over their associates who lacked these experiences.

D. Place of residence, i.e., country, suburb, or city, did not have any significant effect on alteration of attitudes.

E. Previous summer camp experience seemed to have a negative effect on attitude change since those students indicating no summer camp showed the greatest significant (5% level) of positive attitude change.

F. Age was analyzed. The experiment class was divided into two groupings - the mature or over 24 group and the young or 24 and under group. Of the 11 class members in the young category, the increase in positive attitude change was 6.364 while in the mature group the positive shift was 18.174. The mature group indicated a most striking increase significant at the 1% level of confidence.

Of the various parameters analyzed in this study, the last point (F) seemed highly significant. The course was designed for the evening college student. The objectives were established as an attempt to sway or even alter the attitudes of the class from apparent ignorance and apathy toward conservation problems to awareness. There was some doubt that this could be accomplished with a group of people of a mean age of 30.23, the oldest class member being 60 and the youngest 18.

The analysis of data from this study indicates the Natural History course did succeed in fulfilling the objectives and success was especially

evident in the older segment of the class. This further indicates it is possible to change attitudes toward conservation rather drastically in a group of people for whom change has always been assumed to be slow. Further considering the value of these class members in disseminating learned concepts in conservation, we may surmise that we are reaching a valuable segment of the public heretofore considered less "reachable" than the youngsters.

A study such as this leaves many questions unanswered and poses new problems. One must assume that attitudes are measurable.[1] It would have been desirable to have had larger groups with which to work but the "t" formula is especially designed for small sample size (N). Garrett defines a large sample as N = 30 or more.[2] Rationalization enters the picture when students worry about questionnaires and possible effect on their grades. No amount of reassurance seems to obviate this problem. The study brings to mind further research that needs to be accomplished. There is a need for follow-up studies with the experimental class. In three or five years how will their attitudes have changed? Are newly formed attitudes durable? Studies similiar to this should be done in other geographical areas. Does geography have a measurable

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[1]Remmers, p. 71.

[2]Garrett, p. 186.

influence on conservation attitudes? How would senior citizens react to attempts altering their conservation attitudes? These are a few of the many related problems that remain to be analyzed.

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II. Documents, Articles, Periodicals and Catalogs

"Conservation in the People's Hands", American Association of School Administrators, Washington, D. C., 1964.

Hutchinson, G. E., "On Living in the Biosphere", in Readings in Conservation Ecology, Edited by George W. Cox, (New York: Appleton-Century-Crofts, 1969).

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Miami-Dade Junior College Catalog, 1969-70.

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PERSONAL DATA QUESTIONNAIRE

1-3. Number _____ 4-9. Date _____ 10-11. Age _____ 12. Sex _____

13. Name of College _____ 14. Year in College ___

15. I have lived the greater part of my life in

(1) City _____ (2) Village _____ (3) Suburbs ___ (4) Country ___

16. My grades are

(1) Above average _____ (2) Average _____ (3) Below Average _____

Check the courses which you have taken prior to this year and also those which you are now taking. Place (H) in front of the course in question if it was a high school course and (C) for college. If a course was taken both in high school and in college use both (H) and (C).

Courses

_____ 17. General Science

_____ 18. Nature Study

_____ 19. Natural Science

_____ 20. General Agriculture

_____ 21. Vocational Agriculture

_____ 22. Industrial Arts

_____ 23. Home Economics

_____ 24. Physiology

_____ 25. Biology

_____ 26. Zoology

_____ 27. Botany

_____ 28. Physics

_____ 29. Civics

_____ 30. Chemistry

_____ 31. Geography

_____ 32. Sociology

Check those of the following activities in which you have participated.

_____ 33. 4-H Club

_____ 34. Summer Camp

_____ 35. Boy Scouts

_____ 36. Girl Scouts

_____ 37. Camp Fire Girls

_____ 38. Conservation Club

_____ 39. Nature Photography

_____ 40. Bird Clubs

_____ 41. Nature Campus

_____ 42. Hiking Clubs

ATTITUDE TOWARD CONSERVATION

We are concerned with your opinions regarding conservation. If this questionnaire is to be of any value, your responses must be honest. This is not a test and you will not be graded. For each of the following statements, encircle the letter or letters which most closely represent your idea concerning that statement. Do not respond as you think you should but instead, according to how you feel personally.

SA - Strongly agree A - Agree U - Undecided D - Disagree SD - Strongly disagree

SA A U D SD 43. Progress in our country will be retarded if we use strong conservation measures.

SA A U D SD 44. A man should be allowed to use his land as he sees fit.

SA A U D SD 45. Conservation of our forests is not necessary as we already have substitutes for wood.

SA A U D SD 46. Hunting is very poor conservation.

SA A U D SD 47. Conservation seems foolish when our standard of living is constantly rising.

SA A U D SD 48. It would be wise for the government to support a strong soil conservation program.

SA A U D SD 49. The fox kills pheasants, therefore it would be wise to destroy all foxes.

SA A U D SD 50. In the Northeast, for the last several decades, the area returned to forest has exceeded the area cleared, therefore we will soon have plenty of timber.

SA A U D SD 51. Forest conservation means that we should save as many trees as possible until they are needed.

SA A U D SD 52. If we could reforest all denuded land, we would prevent floods.

SA A U D SD 53. We should destroy all undesirable species of plants and animals in order that the most desirable species will thrive.

SA A U D SD 54. Science will be able to find a substitute for most resources when the original supply is exhausted.

SA A U D SD 55. Farmers who practice poor conservation should be forced by the government to improve their methods.

SA A U D SD 56. Flood control is most effectively achieved by building many large flood control dams on our larger rivers.

SA A U D SD 57. River mouths can best be kept free of mud by using better dredging equipment.

SA A U D SD 58. The public schools of our nation do not spend enough time in the teaching of conservation.

SA A U D SD 59. Conservation of natural resources is so slow in its results that in a lifetime it can hardly benefit a person now alive.

SA A U D SD 60. Conservation should be a very important area in the teaching of biology.

SA A U D SD 61. For persons living in the city, soil conservation has little importance.

SA A U D SD 62. Conservation is a form of socialism.

SA A U D SD 63. We are an extremely wasteful nation.

SA A U D SD 64. I consider conservation to be a minor area in the education of the average citizen for everyday living.

SA A U D SD 65. Effective conservation practice would endanger the personal liberty of a man.

SA A U D SD 66. Conservation measures are of great importance to hunters.

SA A U D SD 67. Farming today is a big business and if farmers used conservation measures on their land their profits would be cut.

SA A U D SD 68. Private business interests are responsible for many poor conservation practices.

SA A U D SD 69. The government should recommend the number and size of trees which can be cut on private land.

SA A U D SD 70. If the number of game animals in an area should become depleted, as for example deer, we can restock the area from an outside area.

SA A U D SD 71. The waste of our resources is an illustration of extreme inconsideration and selfishness.

SA A U D SD 72. The government should spend larger sums of money on erosion control.

SA A U D SD 73. Soil erosion is no great problem in most sections of the country.

SA A U D SD 74. The subject of conservation just doesn't interest me.

SA A U D SD 75. Many conservation minded people are too cautious and stand in the way of progress.

SA A U D SD 76. Conservationists in general are alarmists.

SA A U D SD 77. Wildlife is of very little concern to me as it plays very little part in my everyday life.

SA A U D SD 78. Conservationists say that a number of wild game species such as deer, are increasing in the Northeast. This proves that they have been alarmists in their predictions in the past.

SA A U D SD 79. Conservation is important but you can't change human nature.

SA A U D SD 80. Poor conservation is weakening our position as a world power.

SA A U D SD 43b. I am only concerned with our present standard of living. Future generations will be able to take care of their own.

SA A U D SD 44b. There is little I can do regarding conservation. I am only one person.

SA A U D SD 45b. Many businesses are against conservation measures because they feel the measures will restrict their activities.

SA A U D SD 46b. When resources are used up in one area we can always move to other areas.

SA A U D SD 47b. When a forest is managed for conservation purposes, it means that no trees should be cut.

SA A U D SD 48b. If as students we take part in conservation measures, it will have little value for us as we will not see the results of our labor while we are students.

SA A U D SD 49b. I would rather engage in social activities than spend some of my own time furthering the cause of conservation.

SA A U D SD 50b. If a person is not interested in conservation, he should not have to spend time learning about it.

SA A U D SD 51b. Since our forefathers did not practice conservation, we see no reason why we should.

SA A U D SD 52b. In case of forest fire, the authorities should be able, with a few limitations, to call on anyone to help fight it.

SA A U D SD 53b. The harvesting of timber, even on private land, should be strictly regulated by the government.

SA A U D SD 54b. An effective method to bring about conservation measures is to prove to the farmer that they will make the farmer more prosperous.

SA A U D SD 55b. The greatest enemy of conservation is indifference on the part of the people.

SA A U D SD 56b. If we want a healthy dove population, we should prohibit all hunting of doves.

SA A U D SD 57b. Soil erosion is a major problem in this country.

SA A U D SD 58b. I feel that if we do not take effective conservation measures in our country we may eventually decline as a major power.

SA A U D SD 59b. Water resources in our country should be classified as to the degree of pollution which would be possible for the use to which the water would be put.

SA A U D SD 60b. Floods in most river valleys could largely be controlled by digging the river channel deeper.

SA A U D SD 61b. Hunters and fishermen as a group are generally against conservation.

SA A U D SD 62b. Prevention of waste within the home falls in the area of conservation.

SA A U D SD 63b. Willful waste is a crime against humanity.

SA A U D SD 64b. To practice conservation within the home is too time consuming.

SA A U D SD 65b. The study of conservation in the field is generally more effective than studying it in the classroom.

SA A U D SD 66b. Healthy land means healthy people.

SA A U D SD 67b. Farmers often use poor farming practices because their forefathers also used poor farming practices.

SA A U D SD 68b. Human nature is such that we can never educate people to save for tomorrow.

SA A U D SD 69b. I don't know anything about living things such as trees, and therefore conservation doesn't interest me.

SA A U D SD 70b. If farmers don't use conservation measures, their land ought to be ruined.

APPENDIX B - Book List, Biology 261

ADVENTURES IN NATURE. Teal, E. W.

ALASKA: A CHALLENGE IN CONSERVATION. Cooley, R. A.

ALONG THE SEASHORE. Buck, M. W.

AMERICAN WILDLIFE AND PLANTS. Martin, A. C.

ANIMAL TREASURE. Sanderson.

CARE OF THE EARTH. Lord, R.

CARIBBEAN TREASURE. Sanderson.

CONSERVATION SOURCE BOOK. Iowa Conservation Ed. Council.

DICTIONARY OF SHELLS. Siekman, L.

ECONOMICS OF SOIL CONSERVATION. Bunce, A. C.

EDGE OF THE SEA. Carson, R. L.

EDUCATIONAL AQUARIUM. Axelrod, H. R. and Bader.

EVERGLADES, THE PARK STORY. Robertson, W. B. Jr.

FARMING OF FISH. Hickling.

FORESTRY STORY. Hofferman, H. and Shaftel

GREAT CHAIN OF LIFE. Krutch, J. W.

GREAT OUTDOORS BOOK OF SHELLS. Siekman, L.

HANDBOOK OF FLORIDA SHELLS. Siekman, L.

LAND WOOD AND WATER. Kerr, R. S.

LIFE: THE WORLD WE LIVE IN. Life Educational Staff and Barnett.

MULTITUDE OF LIVING THINGS. Milne, L. J.

NATURAL RESOURCES AND THE POLITICAL STRUGGLE. Wengert, N. O.

NATURAL RESOURCES FOR U. S. GROWTH: A LOOK AHEAD TO YEAR 2000. Landsberg, H. H.

OUR PLUNDERED PLANET. Osborn, F.

OVERLOADED ARK. Durrell, G. M.

PRACTICE OF WILDLIFE CONSERVATION. Wing, L.

QUALITY OF THE ENVIRONMENT: AN ECONOMIC APPROACH TO SOME PROBLEMS IN USING LAND, WATER AND AIR. Herfindahl, O. C.

QUIET CRISIS. Udall, S. L.

REALMS OF WATER: SOME ASPECTS OF ITS CYCLE IN NATURE. Kuenen, P. H.

SEA AROUND US. Carson, R. L.

SEA BEACH AT EBB TIDE. Arnold, A. F.

SEASHORES. Zim, H. S. and Ingle, L.

SENSE OF WONDER. Carson, R.

SILENT SPRING. Carson, R.

THE FEDERAL LANDS: THEIR USE AND MANAGEMENT. Clawson, M. and Held, B.

TWELVE SEASONS. Kurtch, J. W.

UNDER THE SEA WIND. Carson, R. L.

WILD AMERICA. Peterson, R. T. and Fisher, J.

WILDLIFE MANAGEMENT AND CONSERVATION. Trefethen, J. B.

DICTIONARY OF FISHES. Allyn, R.

DICTIONARY OF REPTILES. Allyn, R.

FISHES. Zim, H. S. and Shoemaker, H. H.

HOW TO KNOW THE AMERICAN MAMMALS. Sanderson, I. T.

KINGDOM OF THE OCTOPUS. Lane, F. W.

MAMMALS. Zim, H. S. and Hoffmeister, D. F.

REPTILES AND AMPHIBIANS. Zim, H. S. and Smith, H. M.

SNAKES. Fincher, G. S.

ZOO ANIMALS. Hoffmeister, D. F.

HANDBOOK OF BIRDS OF EASTERN NORTH AMERICA.
Chapman, F. M.

HOW TO KNOW THE BIRDS. Peterson, R. T.

INTRODUCTION TO BIRD LIFE FOR BIRD WATCHERS. Saunders, A.

EDIBLE WILD PLANTS OF FLORIDA. Michalowski, A.

HANDBOOK OF FLORIDA FLOWERS. Caterson, L. P.

HANDBOOK OF FLORIDA PALMS. McGeachy, B.

ORCHIDS AND OTHER AIR PLANTS. Craighead, F. C.

COMMON SPIDERS OF THE UNITED STATES. Emerton, J. H.

INSECT FACTS AND FOLKLORE. Clausen, L. W.

INSECT LIFE AND INSECT NATURAL HISTORY. Frost, S. W.

INSECT PESTS. Fichter, G. S.

INSECTS. Zim, H. S. and Cottam, C. A.

HOW TO KNOW ROCKS AND MINERALS. Pearl, R. M.

THE SKY AND ITS MYSTERIES. Beet, Ernest.

ASTRONOMY. Hoyle, Fred.

WILD PLANTS FOR SURVIVAL IN SOUTH FLORIDA. Morton, J. F.

COBRAS IN HIS GARDEN. Haast, William.

APPENDIX C - Biology 261 Term Paper Topics

Term papers were required and represented one-third of the student's grade.

1. Old South Florida or Gone With the 'Gator
2. Some Thoughts on Water Pollution
3. Green Turtles
4. The Biscayne Aquifer
5. The Water Supply of South Florida
6. Polluted Paradise
7. Some Aesthetic and Practical Advantages of an Ecological Approach to Landscape Planning
8. Thermal Pollution
9. Florida Coral Reefs
10. Introduction of Foreign Species to the Miami Area
11. Key Biscayne: A Historic Island of South Florida
12. What are the Everglades Good For? (Sic)
13. Meaningful Conservation for the Primary Child
14. Pesticides
15. The American Alligator
16. Conservation
17. Man and His Environment

18. The Water Situation in Everglades Park
19. Water Problems of South Florida
20. Biological Magnification and Pesticides
21. The Alligator of the Florida Everglades
22. Water Pollution at Turkey Point
23. The Gulf Stream System
24. Time for the Everglades Kite?
25. A Fragile Resource! (Estuaries)
26. Fresh Water Crisis in South Florida
27. Florida's Problem with Exotics
28. Will Man Survive?
29. Marine and Hydro-Ecology of South Florida
30. Poisonous Plants
31. Scene of Palms
32. The Tropical Hammock of South Florida
33. The Coral Reef in South Florida
34. Manatee, Anyone?

APPENDIX D - Profile of Experimental Class Biology 261[1]

A. There were 34 participants in the study.

B. Eighteen of these were males, sixteen females.

C. Ages ranged from 18 years to age 60 with the mean at 30.23.

D. The majority of the students had lived most of their life in the suburbs.

E. Occupations were highly diverse as might be expected; The breakdown by occupation is as follows:

Teachers - fifteen students

Housewives - two students

Full-time students - five students

U.S.D.A. Research - one student

Orchid Grower - one student

Office Manager - one student

Microbiologist - one student

Civil Engineer - one student

Sheet Metal Worker - one student

Landscape Architect - one student

Research Assistant - one student

Orthopedic Technician - one student

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[1]From Follow-up Cards, See Appendix E.

Truck Driver - one student

Librarian - one student

F. Years residence in Florida ranged from one to thirty-nine with a mean of 15.4.

G. Twelve members of the class indicated a teaching major, six indicated no major, six indicated liberal arts, six science, and four business.

APPENDIX E

Name _____ Student #_____ Phone #_____

Address_____Occupation_____

Major_____Age____ Yrs. Residence/Fla._____

Reasons for taking this course _____

_____

Opinion of the course _____

_____

_____

Comments or suggestions:

November 6 -- Frank Nix, Everglades National Park, South Florida. SOUTH FLORIDA WATER SITUATION. Mr. Nix will consider the water problems of the South Florida area and the work done by the corps of engineers in water conservation and flood control.

November 13 -- Dr. William Sears, Chairman, Department Anthropology, Florida Atlantic University, Boca Raton, Florida. ARCHEOLOGY OF SOUTH FLORIDA. Dr. Sears will present an illustrated lecture covering his vast experiences in the excavations of South Florida.

November 20 -- *John C. Ogden, Ornithologist, Everglades National Park. BIRDS OF SOUTH FLORIDA (emphasizing Everglades.) An informative and highly entertaining illustrated lecture on our South Florida birds. *Mr. Ogden will follow up the lecture with an exciting field trip into the Everglades area on Saturday, November 23. (Details to be announced.)

November 27 -- *Richard Klukas, Park Management Biologist, Everglades National Park. MANAGEMENT OF EVERGLADES. The emphasis in this lecture will be on vital inter-relationships between plants, animals, water, soil, and man. *An illustrated lecture followed by a trip into the Everglades on Saturday, November 30.

December 4 -- Robert Brown, Miami-Dade Junior College Biology Department. HUMAN ECOLOGY - CONSERVATION. For this final lecture of the series, an attempt will be made to interrelate the previous lecture into a meaningful pattern. Emphasis will be given to the human's effect on his surroundings.

December 10 -- Final Exam. (Administered by Birdsey, Brown and Wicks.)

AMI - DADE JUTH CAMPUS 011 S.W. 104th Street ami, Florida 33156

BIO 261

NATURAL HISTORY of SOUTH FLORIDA

Miami-Dade Junior College
South Campus - Miami, Florida

Natural History

of South Florida

(BIO 261 - 3 credits)

This course is designed to create an awareness among concerned individuals. The concepts presented will enable teachers, group leaders, parents and others to familiarize themselves with the flora, fauna and other phases of natural phenomena in South Florida. The major theme of the course will be one of conservation problems and solutions.

Information presented will enable participants to build up a personal reservoir of self-help aids in the area of audio-visual materials, books, references, journals, etc.

The course will draw upon the expertise of local authorities in various disciplines. The lectures will be given Wednesday evenings from 7:00 p.m. - 10:30 p.m. on the South Campus. Optional but highly recommended field experiences will be given on Saturday or Sunday mornings. The topics to be enhanced by field trips are indicated by an asterisk.

August 28 -- Loren Wicks, Chairman, Miami-Dade Junior College Chemistry and Earth Science Department. FLORIDA GEOLOGY. Through various audio-visual media Mr. Wicks will present a comprehensive picture of the South Florida rock formations, emphasizing relationships such as water availability and conservation.

September 4.--- Dr. Robert Schroeder, Marine Biology, currently engaged in private research on the subject, Economics of Green Turtles. Dr. Schroeder will present a lecture dealing with the economics of raising green turtles - a heretofore "wild" species facing extinction.

September 11 -- Edwin Wimmers, Supervision of Education, Museum of Science, Miami, Florida. ASTRONOMICAL PHENOMENA OF SOUTH FLORIDA. Mr. Wimmers will utilize the planetarium and observatory to illustrate the significant planets, stars, constellations which make up our night sky and significance of these on our everyday activities. THIS PROGRAM WILL BE HELD AT THE MUSEUM OF SCIENCE PLANETARIUM.

September 18 -- *Julia Morton, University of Miami, Coral Gables. EDIBLE AND POISONOUS PLANTS OF SOUTH FLORIDA. Mrs. Morton will present an illustrated lecture on the significant plants of the area in light of their economic food and survival value. *A field trip will be led by Mrs. Morton on Sunday morning, September 22. (Details to be announced.)

September 25. -- *Dr. Monroe Birdsey, Miami-Dade Junior College Biology Department. BASIC BOTANY OF SOUTH FLORIDA. Basic botanical structure and function will be presented. Emphasis will be on inter-relationships between plants and humans. *Field trip on Saturday, September 28, to Fairchild Gardens. (Details to be announced.)

October 2 -- *Dr. Monroe Birdsey, Miami-Dade Junior College Biology Department. PALMS AND RELATED SPECIES OF SOUTH FLORIDA. Dr. Birdsey, a noted authority on the Cycads, will present an illustrated lecture and techniques on identification of local palms and allied species. *Field trip on Saturday, October 26, for utilization of taxonomic keys in plant identification.

October 9 -- Mrs. William Haast, Miami Serpentarium, Miami, Florida. REPTILES OF SOUTH FLORIDA. A noted herpatologist, Mrs. Haast will present a fascinating and comprehensive study of local snakes and their significance to you, the public.

October 16 -- Gordon Dunn, Director, U.S. Weather Bureau, Coral Gables. METEOROLOGICAL PHENOMENA OF SOUTH FLORIDA. Dr. Dunn will present an overview of weather phenomena with particular emphasis on storm and hurricane tracking and innovations.

October 23 -- *Robert Brown, Miami-Dade Junior College Biology Department. THE MOLLUSCA OF SOUTH FLORIDA. Introduction to Invertebrate Animals of South Florida, with emphasis on molluscs of economic and esthetic value will be illustrated with emphasis on home study via salt water aquarium. *Field trip on Saturday, October 12, for collection purposes. (Details will be announced at a later date.)

October 30 -- Mid-term examination (administered by Birdsey, Brown and Wicks.) Film preview to follow exam. Newest informative films to be presented.

```
      ∇FF[
    ∇ X1 F
[1]     N1←⍴
[2]     N2←⍴
[3]     SUMX
[4]     SUMX
[5]     SUMX
[6]     SUMX
[7]     'MEA
[8]     'MEA
[9]     Y1←+
[10]    Y2←+
[11]    'Σ1
[12]    'Σ2
[13]    'F =
[14]    'SDX
[15]    'T =
[16]    'N1
[17]    N1,
    ∇
```

```
      EXA
MEAN OF X
MEAN OF X
Σ1 Σ= 343.
Σ2 Σ = 431
F = 1.254
SDX = 4.8
T = 2.96 2
N1,N2, SU
34  34   6
```

APPENDIX H - Biology 102, General Education Biology

Week	Topic
1	Scientific Method and Characteristics of Life
2	Principles of Chemistry; Diffusion; Osmosis; Energy
3	The Cell; Mitosis; Tissues; Organs, Organ Systems
4	The Skin; The Skeleton
5	Muscle Action
6	Circulation; Blood; Antigen-antibody Reactions
7	Respiration
8	Digestion
9	Excretion
10	Endocrines; Nervous System
11	Sense Organs; Psychobiology
12	Reproduction
13	Meiosis
14	Heredity (Genetics)
15	Origin of Life; Evolution

APPENDIX I - Course Outline Biology 261
Natural History of South Florida

Week	Topic	Lecturer
1	Florida Geology	Loren Wicks
2	Reptiles of South Florida	Mrs. William Haast
3	Astronomical Phenomena of South Florida	Frank McConnell
4	Archeology of South Florida	William Sears
5	Meteorological Phenomena of South Florida	Gordon Dunn
6	Mid-Term Exam	
7	Edible and Poisonous Plants of South Florida	Mrs. Julia Morton
8	Basic Botany of South Florida	Monroe Birdsey
9	Birds of South Florida	John Ogden
10	Management of the Everglades	Richard Klukas
11	Pollution	Paul Leach
12	South Florida Water Situation	Milton Kolipinsky
13	South Florida Mammals	Gordon Hubbell
14	Human Ecology	Robert Brown
15	Final Exam	

Lecture I

LECTURER: LOREN WICKS

Chairman of Chemistry and Earth Science Department
Miami-Dade Junior College

TOPIC: FLORIDA GEOLOGY

I. Background Information

A. Rock Types Found in Area

1. Limestone: composition, deposition, etc. characterized by Oolitic limestone, Bryozoan limestone, Key Largo (coral) limestone, Coquina
2. Granite - as base rock

B. Erosional Agents

1. Wind
2. Water; particularly underground water
3. Transportation

C. Soil Development

1. Weathering, chemical vs. physical
2. Frost
3. Plants
4. Animals

D. Soil Horizons

1. A horizon; plant and animal debris
2. B horizon; broken up bed rock
3. C horizon; bed rock (limestone here)

E. Biscayne Aquifer

1. Definition: rock units supplying water
2. Porosity vs. permeability

F. Water Table

1. Table variance and why
2. Wells in Florida
3. Ground water flow rate
4. Solution holes and caverns
5. Sink holes

G. Florida beaches

1. Composition from local limestone
2. Composition from Northern states by wave and current action
3. Long-shore currents
4. Usefulness of jetties

II. Conservation Implications (Discussion and question and answer period)

A. Preservation of shallow, pure water wells

B. Destruction of Biscayne Aquifer

C. Discussion of Florida's unique "live" Coral Reef and its use and misuse

D. Attempts by hotel owners to retain beaches in front of hotels by jetty construction

E. Effects of deep well drilling on aquifer

F. Discussion of proposal to pump raw sewage into deep underground limestone caves

III. Film: Ground Water Activity

Lecture II

LECTURER: MRS. WILLIAM HAAST

Owner of the Miami Serpentarium

TOPIC: REPTILES OF SOUTH FLORIDA

I. Background Information

A. Introduction

1. Significance of wild snakes to public
2. Classification of reptiles

B. Poisonous venoms

1. Hemo-toxic venoms, action and effects
2. Neuro-toxic venoms, action and effects

C. Description of local snakes; identifying features (slides)

1. Coral Snake
2. Copperhead
3. Diamond-back Rattle Snake
4. Cane-brake Rattler
5. Cotton-Mouth
6. Banded Water Snake
7. Brown Water Snake
8. Congo or Green Snake
9. Allen's Mud Snake
10. Red-bellied Mud Snake
11. Compressed-tail Mud Snake
12. Scarlet King Snake
13. Hog Nose Snake
14. Northern Chain Snake
15. Speckled King Snake
16. Everglades (Yellow) Rat Snake
17. Red Rat Snake (Corn Snake)
18. Black Racer
19. Coach Whip Snake
20. Ribbon Snake

D. Snake Bites

1. Treatments: folklore, suction method
2. Preferred treatment: anti-venom injection

E. Biochemistry of snake bite

1. Enzymatic action
2. Research being done now
3. New toxins produced

F. Demonstration of live venomous snakes

II. Conservation Implications (discussion and question and answer period).

A. What value are snakes

B. Usefulness of snakes in production of sera, etc.

C. Significance of reptiles in food chain

D. Destructions of reptiles for hides

E. Effect of wholesale slaughter on breeding capacity

III. Film: CBS Production with Charles Collingwood of "Adventure", 1956 at Miami Serpentarium

Lecture III

LECTURER: DR. FRANK McCONNELL

Director, Miami Museum of Science

TOPIC: ASTRONOMICAL PHENOMENA OF SOUTH FLORIDA

(Lecture given at the Museum Planetarium and Observatory)

I. Background Information

A. Demonstration of common constellations

B. Celestial navigation

C. Latitude and Longitude

D. Mythology of the stars

E. Solar and lunar eclipse

F. Visual telescopes

1. Refractor telescopes
2. Reflector telescopes

G. Magnitude of stars

H. Solar research

1. Spectrography
2. Fraunhofer lines

I. Star measurement

1. Parallax
2. Pulsating stars

J. Light Year

II. Conservation Implications (discussion and question and answer period)

A. Discussion of effect of solar and lunar cycles on harvesting and planting, etc.

B. Effects of spring and neap tides on earthworks and other man-made attempts of controlling elements

C. Extra-terrestrial exploration and ramifications regarding colonization and wise utilization of space

D. Space garbage and its connotations

E. Wise and judicious use of man's space and astrophysical technology

III. Film: The Universe

Lecture IV

LECTURER: DR. WILLIAM SEARS

Chairman, Department of Anthropology
Florida Atlantic University, Boca Raton

TOPIC: ARCHAEOLOGY OF SOUTH FLORIDA

I. Background Information

A. Definitions

1. Anthropology
2. Archaeology

B. Aspects of Man

1. A biological entity
2. A cultural entity

C. Basic controls over archaeological work

D. Choosing a Site

E. Locating a Site

F. Excavation

G. Justification

H. Dating in time and space

1. Relative dating methods
2. Absolute dating methods

I. Style patterns as diagnostic features

J. Advent of American Indian

K. Excavations in Potsherds

L. Florida Indians

1. Pre-historic, 10,000 B. C.
2. Caloosa - salt water glades
3. Ocheechobee - agricultural tribes
4. Fisheating Creek Research of lecturer

II. Conservation Implications (discussion and question and answer period)

A. What types of minds brought tribes to great power and then total demise?

B. Why were early Florida tribes successful in farming where modern man is not?

C. Discussion of modern Everglades Seminoles and how conservation has affected them (Corps of Engineers)

D. Conservation implications in day to day life of the Indian, i.e. re: overkill; overharvest, etc.

E. Relationship between leisure time and tribal artifacts or priest-culture

Lecture V

LECTURER: DR. GORDON DUNN

Director (Retired) of National Hurricane Center
University of Miami, Coral Gables

TOPIC: METEOROLOGICAL PHENOMENA OF SOUTH FLORIDA

I. Background Information

A. Overview of storm and hurricane tracking innovations

B. Experiments in weather control

1. Seeding for rain
2. Seeding for fog control

C. Hurricane structure

1. Wind velocity
2. Direction of wind movement
3. Surface water temperatures

D. Tornado structure

1. Warning
2. Tracking

E. Cape Verde Storms: August - September

F. Radar Fence (Warning System) from Boston to Key West to Brownsville, Texas

G. Electronic computers and forecasting

II. Conservation Implications (discussion and question and answer period)

A. Significance of storm warnings early enough to conserve human life

B. Damage to natural and man-made resources by hurricane damage

C. Examples of populations whose demise was attributed to one tremendous storm

D. Illustrations of close ecosystems (islands) where total destruction is followed by re-birth

E. Discussion of possible prevention of hurricanes and tornadoes and effect on human endeavor

Lecture VI

LECTURER: MRS. JULIA MORTON

Curator of Morton Collectanea
University of Miami, Coral Gables

TOPIC: EDIBLE AND POISONOUS PLANTS OF SOUTH FLORIDA

I. Background Information

A. Introduction

1. How to distinguish edible from poisonous plants
2. Process of trial and error in making distinctions

B. Wild plants for survival in South Florida by habitat (Slides)

1. Wet; Red Mangrove, White Mangrove, Black Mangrove
2. Beach; Gold Coast Fern, Salt Wort, Sea Purselane, Beach Carpet, Sea Rocket
3. Inland; Sea Blight, Glasswort, Sea Oats, Seven Year Apple, Sea Grape, Cocoplum, Yucca
4. Tropical Coastal Regions; Mahoe, Thespesia
5. Inland-Fresh Water; Water Hyacinth, Cattail, Pickerel Weed, Thalia, Swan Spaghetti (Sagittaria), Bread Rood, Pond Apple, Inland Coco Plum, Red Bay Tree (Persia), Holly (milox), Saw Grass, Sabal Palmetto
6. Inland; Royal Palm, Saw Palmetto, Elderberries, Live-Oak, Pigeon Plum, Persimmon, Coral Bean, Darling Plum, Marlberry, Locust Berry, Gopher Apple, Native Grapes, Wild Passion Vine, Wild Cucumber, Balsam Pear, Balloon Vine, Prickly Pear
7. Weeds; Spanish Needles, Spiny Amaranthus, Saw Thistle, Purseland, Peppergrass, Wild Penny Royal, Nut Grass, Nightshade (Leaves and green berries), Tread-Softly, Poke-Berry, Coontie (Cycad), Arrow Root.

C. Major Public Hazards

1. Castor Bean, fruit poison
2. Blood Berry - Christmas Berry
3. Poison Ivy
4. Poison Wood Tree
5. Florida Holly, respiratory ailments from flowers
6. Poinsettia, Wild, causes rash

II. Conservation Implications (discussion and question and answer period)

A. Effect of wholesale destruction of Sabal Palmetto (State Tree) for utilization of its fleshy root as a delicacy

B. Utilization of wild, native flora for ornamental purposes and comparison of cultivated varieties and wild varieties

C. Effect of importation of exotic plants on survival of native wild species

D. Examples of uses of native flora which have had to be eliminated or synthesized because of scarcity of native flora

E. Overall effects of encroachment of civilization into formerly uncultivated areas

III. Field Trip: A field trip was taken on Sunday morning from 8:00 A. M. to 1:00 P. M. on Key Biscayne, Florida through a tropical hammock. Mrs. Morton illustrated the flora she had discussed in the Wednesday evening class.

Lecture VII

LECTURER: DR. MONROE BIRDSEY

Professor of Biology (Botany)
Miami-Dade Junior College

TOPIC: BASIC BOTANY OF SOUTH FLORIDA

I. Background Information

A. Introduction: Discussion of Plant Ecology

B. Classification of Plants

1. Division Thallophyta
   a. Algae - green; red; brown
   b. Fungi - rusts; mushrooms, bracket; etc.
   c. Lichens; symbiosis
2. Division Bryophyta
   a. Mosses
   b. Liverworts
3. Division Pteridiophyta
   a. Ferns
4. Division spermatophyta
   a. Gymnosperma
   b. Angiospermae
      (1). Monocots
      (2). Dicots

C. Morphology

1. Leaf arrangements; alternate, opposite, whorled
2. Simple leaves
3. Compound leaves
4. Leaf forms; margin, lobes, etc.
5. Leaf shapes

D. Functions of Plants

1. Photosynthesis; description of process

2. Respiration; description of process

3. Growth responses

4. Phototropism; geotropism, photoperiodism

5. Hormones (auxins) and influence on plants

II. Conservation Implications (discussion and question and answer period)

A. Overall effects of vegetation on populus, i.e. in cooling an area, humidifying, etc.

B. Overall effects of smog and air pollution on vegetation

C. Effects of urbanization on plants and not-so-subtle changes in our lives as a result

D. Hydrologic cycle and relationships to plants, drinking water and man

E. Watershed and their significance to man. Where are Miami's watersheds located?

III. Field Trip: Dr. Birdsey led the group on a five hour field trip the Sunday morning following this lecture. The field trip was held in the Fairchild Tropical Gardens at Mattheson Hammock near Biscayne Bay.

Lecture VIII

LECTURER: JOHN C. OGDEN

Park Ornithologist
Everglades National Park, Homestead

TOPIC: BIRDS OF SOUTH FLORIDA

I. Background Information

A. Objectives of lecture

1. To illustrate complexity of bird life
2. To illustrate relationships to environments

B. Survey of species seen in Florida (350 species)

1. Florida is on West Indian Flyway
2. Migration techniques e.g., by sun and stars
3. Instinct and migration
4. Hormones and migration

C. Slides of birds

1. Water Birds: Pied-billed Grebe; Brown Pelican; White Pelican; Frigate Birds; Anhinga
2. Wading Birds: Herons and Egrets; Great White Herons (rare and endangered); Green Heron; Reddish Egret; Louisiana Heron; Night Heron; American Bittern; White Ibis (rare and endangered), Wood Storks; Roseate Spoonbills (rare and endangered), Flamingos
3. Ducks: Tree Duck; Blue Winged Teal; etc.
4. Birds of Prey: Black and Turkey Vultures; Kites (rare and endangered); White-tailed Kite; Swallow-tailed Kite; Everglades Kite; Red-shouldered Hawk; Eagles (rare and endangered); Osprey; Sparrow Hawk
5. Game Birds: Quail; Wild Turkeys; Doves
6. Rails: Purple Gallinule; Coots; Common-Gallinule
7. Ground Birds: Killdeer; Plover; Snipe

8. Shore Birds: Willet; Yellow-legs; Sandpipers; Black-necked Stilt; Ring Heron; Laughing Gull; Brown-Niddey; Least-Tern; Black Skimmer
9. Owls: Barred Owl, Screech Owl; Burrowing Owl
10. Woodpeckers: Pileated Woodpecker; Red-bellied; Hairy; Downy
11. Perching: Red-whiskered Bulbul; Mockingbird; Spotted-breasted Oriole

D. State Bird: Mockingbird

II. Conservation Implications (discussion and question and answer period)

A. Discussion of imported or exotic species and effect on native populations

B. Discussion of rare and endangered species (R & E)

C. Research being done on rare and endangered species in South Florida

D. Man as cause of rare and extinct species

E. Significance of National Audubon Society and National Parks in conservation attempts on birds

F. Examples of man's carelessness with species:

1. Plume hunting
2. "Sport" hunting
3. Hunting large Raptorial birds for food

G. Effects of pesticides on bird populations; studies in Everglades National Park on DDT intake in fish-eating species

H. Research being done to control and save species

1. Food sampling
2. Tagging
3. Counting
4. Plumage studies
5. Growth studies

III. Field Trip: A field trip was led by Mr. Ogden on the Sunday morning after the lecture, into the Everglades National Park midway between Miami and Florida's West Coast. The Shark Valley slough was the region visited.

Lecture IX

LECTURER: RICHARD KLUKAS

Park Management Biologist
Everglades National Park, Homestead

TOPIC: MANAGEMENT OF THE EVERGLADES

I. Background Information

A. History of National Park Service

B. Establishment of Everglades National Park in 1947

C. Habitat types found in park

1. Pinelands
2. Mangroves
3. Cape Sable Marl Prairie
4. Florida Bay

D. First Settlers of Area

1. Indians: 2,000 Indian mounds in park
2. Fishermen: 1850-60's
3. Buttonwood forests burned for charcoal
4. Pines used in 1900's for home-building

E. Objectives of Park Management

F. Management problems undertaken in park

1. Management of Loggerhead Sea Turtles
2. Relocation of raccoons out of Cape Sable turtle nesting area
3. Effects of storms on turtle population
4. Turtle poaching and counter-action
5. Crocodile-Alligator management
   a. Water inadequacies
   b. Poaching
   c. Significance of alligator holes to survival

6. Australian pines as a threat to native vegetation
   a. Controlled burning
7. External problems, e.g. exotics

II. Conservation Implications (discussion and question and answer period)

A. Discussion of the hydroperiod (periodic flooding) in Everglades and effect of canal system built by the Army Corps of Engineers

B. Farming possible in areas adjacent to National Park through flood control. Implications?

C. Significance of aerial irrigation (sprinklers) in farms adjacent to park

D. Whole wide area of pesticides and herbicides and espceially the "inert" DDT

E. Significance of 25,000 acres of private land within the Everglades National Park (The "hole in the do-nut")

F. Effects of fertilizers when injected into natural areas, e.g., fish kills, etc.

G. Discussion over the Miami Jet-Port being built in the Everglades adjacent to the park

H. Water-hyacinth problems and effects of biological control

I. Management practices in maintaining alligator holes through excavations and blasting; dredging of slough areas, etc.

J. Controlled burning of pinelands as opposed to wild-fires in peat areas of Everglades

K. Discussions of environmental degradation

1. Oil well drillings resulting in salt water intrusion into aquifer
2. Thermal pollution of bay from electric power generators
3. Pesticides, pollution, etc.

III. Field Trip: Mr. Klukas conducted a field trip on Sunday morning from the Everglades Park Headquarters south to Flamingo on Florida Bay, some forty miles, pointing out management areas being worked on and contemplated.

LECTURE X

LECTURER: PAUL LEACH

Director, Dade County Pollution
Control Commission, Miami

TOPIC: POLLUTION

I. Background Information

A. Introduction

1. Three constant factors; air, water, land
2. Three areas of pollution; air, water, land

B. History of pollution

1. Air pollution with start of industrial revolution

C. Kinds of air pollution

1. Gaseous
2. Particulate
3. Organic-based compounds
4. Inorganic-based compounds
5. Photo-chemical smog

D. Sources of air pollution

1. People

E. How to get rid of air pollution

1. Industrial controls

F. Water pollution

1. Septic tanks are major local problem
2. Available sewage plants largely inadequate
3. Biological processes can work, given time

G. Terrestrial pollution
   1. Chemical pollutants
   2. Waste products of all description
   3. Soda-ash deposit thrown outside municipal water-treatment plants
   4. Thin veneer of arable soil in South Florida

II. Conservation Implications (discussion and question and answer period)

A. Is it economically worth it?

B. Do we have a choice?

C. Effects of population increase such that we will exhaust

   1. Water
   2. Land
   3. Air

D. Miami aquifer supplies one and one half billion gallons of water per day. More than half is currently being used.

E. Desalinization is not the answer

F. Nuclear power may be usable, leads to no air pollution but 20% more heat as thermal pollution

G. Effects of Florida Power and Light Company's Turkey Point generators in pumping heated water into Biscayne Bay

H. Is there any real problem with thermal pollution? Should we wait until we are sure?

I. Discussion of thermal inversions. Could this happen here?

J. Is a county police agency such as the Pollution Control Commission effective?

Lecture XI

LECTURER: DR. MILTON KOLIPINSKY

Hydrobiologist, United States Geological Survey, Miami

I. Background Information

A. Hydrologic characteristics of Florida

1. Historical notes
2. Hydrologic zones
3. Rainfall
4. Major drainage areas

B. Surface water hydrology

1. Surface-water features
2. Lakes, streams, canals
3. Borrow pits
4. Ponds, marshes
5. Wet prairies, alligator holes
6. Estuaries
7. Springs

C. Ground water hydrology

1. The water table
2. Biscayne Aquifer
3. Salt-water intrusion problems
4. Floridian Aquifer
5. Water-quality characteristics of ground water
6. Ground water discharge into sea along coast

D. Water quality monitoring techniques

1. Methods for determining water quality parameters
2. Dissolved oxygen and carbon dioxide
3. Chloride content
4. Effects of water quality on biota

E. Hydrobiology

1. Aquatic communities
2. Marsh and wading bird populations
3. Quantitative sampling of aquatic organisms
4. Aquatic plant succession
5. Euthrophication
6. Plankton
7. Effects of drought on plant associations
8. Population dynamics of coastal, marine animals and coastal plant communities
9. Pollution of aquatic environments
   a. Thermal heating
   b. Pesticides

II. Conservation Implications (discussion and question and answer period)

A. Discussion of the Everglades Conservation Areas I, II, and III

B. Influence of man-made coastal canals

C. Discussion of relatively new and few studies done on thermal pollution in Biscayne Bay

D. Significance of care and treatment of Biscayne Aquifer

E. Implications of ecological "meddling" by man

F. Discussion of population "crush" or rapid urbanization into areas ill-prepared

III. Field trip: A field trip was taken on Sunday morning between 8:00 A. M. and 2:00 P. M. to the City of Miami Sewage Treatment Plant on Virginia Key in Biscayne Bay. Dr. Kolipinsky pointed out many of the areas discussed in his lecture with particular reference to the treated product being discharged into Biscayne Bay.

Lecture XII

LECTURER: GORDON HUBBLE, D.V.M.

Director of the Crandon Park Zoo, Key Biscayne

TOPIC: SOUTH FLORIDA MAMMALS

I. Background Information

A. Introduction of Class Mammalia: Nineteen orders

B. Definition of mammals

C. Ten of world's nineteen orders found in Florida

D. Listing and description of Florida mammals

1. Opossum (marsupial)
2. Short-tailed Shrew
3. Eastern Mastif Bat
4. Free-tailed Bat
5. Nine-banded Armadillo
6. Rabbits
7. Grey Squirrel
8. Fox Squirrel
9. Southern Flying Squirrel
10. Black Rat
11. Norway Rat
12. Bottle-Nosed Dolphin (porpoise)
13. Tooth Whales, Baleen Whales
14. Pilot Whales
15. Gray Fox
16. Raccoon
17. Long Tailed Weasel
18. Everglades Mink
19. Spotted Skunk - Striped Skunk
20. Otter
21. Bobcat
22. Puma
23. Black Bear
24. Manatee
25. White-tailed Deer
26. Key Deer

II. Conservation Implications (discussion and question and answer period)

A. Problems with the Manatee (Sea Cow) and its preservation

B. Significance of all these mammals in food chain

C. Example of whales and interdependencies based on plankton

D. Ramifications of man-made ecological imbalances on native mammal population

E. Discussion of importation of exotics which have escaped

F. Implications of foreign shipping entering Port of Miami and rat infestations

G. Discussion of disappearance of once common Florida mammals and why

Lecture XIII

LECTURER: ROBERT E. BROWN

Biology Department
Miami-Dade Junior College

TOPIC: HUMAN ECOLOGY AND CONSERVATION

I. Background Information

A. Definition of ecology

B. Basic principles

C. Food chains; examples

D. Water cycle (overheads and discussion)

E. Oxygen cycle

F. Relationships living organisms

1. Pyramid of Numbers

G. Biotic communities

H. Possible energy webs

I. Ecology of the sea (slides)

1. Producers - Plankton
2. Larvae
3. Scavengers
4. Carnivores (orders of)

J. Terrestrial ecology

1. Ecotones
2. Biomes
3. Effects of topography; rainfall; temperature
4. Ecological succession

K. Ecological Succession (slides)

1. From water to dry land
2. Effects of creeping sand dunes
3. Succession in an alligator hole

L. Human Ecology

1. Reiteration of Prey-Predator relationships
2. Aspects of population density
   a. Natality
   b. Mortality
   c. Immigration
   d. Emigration
3. United States population growth curve
4. Malthusian dilemma

M. Battle for survival

II. Conservation Implications (discussion and question and answer period)

A. Definition of conservation

B. History of Conservation Movement in United States

1. Theodore Roosevelt
2. G. Pinchot
3. National Wildlife Refuges
4. National Forests and Monuments
5. Ernest Seaton, John Muir, Louis Agassiz, Ed. Birge, Chancy Juday, Aldo Leopold, J. N. Darling, Hugh Bennett

C. Conservation concepts rest in minds of young people

D. Significance of reaching youngsters; emphasis on teacher's role

E. Discussions of public ignorance and apathy and how to overcome these

F. Technologies now available and developing offer hope to human welfare and survival, e.g.,

1. Steam cars
2. Artificial rain
3. Soil conditioning
4. Soil synthesizing
5. Farming of sea

III. Films:

Population Ecology: 1963, Encyclopedia Britannica

The Sea: Encyclopedia Britannica

APPENDIX J - Profile of Control Group Biology 102

A. There were 30 participants in the study.

B. Fourteen of these were males; sixteen females.

C. Ages ranged from 18 to 56 with the mean at 26.33.

D. The majority of the students had lived most of their life in the suburbs.

E. Occupations were indicated as follows:

Teachers: nine students

Housewives: five students

Full-time students: twelve

Geological survey worker: one student

Public Health Nurse: one student

Telephone lineman: one student

Air Force Sergeant: one student