4-1-1980

Projected Changes in Northeastern Skiing Participation and Supply Capacity as Influenced by a Changing Economy

Marvin Kottke
University of Connecticut - Storrs

RESEARCH REPORT 60, APRIL 1980

13

Projected Changes in Northeastern Skiing Participation and Supply Capacity as Influenced by A Changing Economy

By Marvin Kottke
Department of Agricultural Economics and Rural Sociology

STORRS AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
THE UNIVERSITY OF CONNECTICUT, STORRS, CONNECTICUT 06268

TABLE OF CONTENTS

Received for publication January 28, 1980.

The research reported in this publication was supported in part by federal funds made available through the provision of the Hatch Act.

PROJECTED CHANGES IN NORTHEASTERN SKIING PARTICIPATION AND SUPPLY CAPACITY AS INFLUENCED BY A CHANGING ECONOMY

by

Marvin Kottke[1/]

INTRODUCTION

The Problem

Skiing demand in the Northeast has increased greatly in the last decade, but future prospects are clouded by the slowdown in population growth, changing age composition, energy shortages and inflation. The purpose of this study is to examine the prospects for continued growth in demand for both downhill and cross-country skiing taking into consideration socioeconomic variables that could influence changes in demand. Growth in demand for downhill skiing has important implications for future development of ski areas and expansion of lift capacities. Ultimately any expansion or contraction of the ski market can have an economic impact on recreation-oriented rural communities.

Recent annual growth of the downhill skier market averaged about 6 percent nationwide and about 16 percent in New England.[2/] Cross-country skiing is also becoming a popular winter activity with a growing number of commercial and public ski trails being developed. Most of the growth in the ski market took place during the seventies; a period dominated by the "youth culture." In contrast, the years ahead may be a transition period with relatively slow growth of population in the Northeast, an increase in household formation, a decrease in family size, an older average age of population, more women in wage-earning occupations and higher levels of per capita income. On top of all this, threat of severe energy shortages may occur from time to time.

1/ Professor, University of Connecticut. This report is based on research conducted under regional projects W-133, "Determinants of Choice in Outdoor Recreation" and NE-100, "Recreation Marketing Adjustments in the Northeast."

2/ Goeldner and Farwell [5, pp. 20-22]. These growth rates are based on average annual skier visits per ski area in a sample of 114 ski areas and included the 1976-77 snow drought year which reduced visits to Western ski areas.

Such anticipated changes raise questions about the influence of socio-economic variables on the rate and level of skier participation in the future. What effect would a "slow down" in population growth have on the ski market? Would an older population participate in skiing at a lesser rate? Are smaller families more likely to participate in skiing than larger families? Would an increase in women wage-earners and its consequential rise in per capita income lead to greater participation in skiing?

Objectives

A major aim of this study was to obtain and analyze information that would help to provide answers to the above questions. Specifically, the objectives were:

1. To measure the influence of selected socio-economic variables on downhill and cross-country skiing participation rates by Northeastern households.

2. To estimate the projected change in level of regional downhill and cross-country skiing participation between 1976 and 1982.

3. To estimate the regional downhill skiing supply capacity.

4. To obtain an origin-destination measurement of the travel distribution pattern involved in downhill skiing.

Data Sources

A primary source of data for this study was the 1976 Northeast Recreational Lodging Survey (NRLS) which included information on participation in outdoor recreation activities as well as on use of recreational lodging.1/ A total of 927 Northeastern households responded to the mail survey with useable information. The names and addresses were obtained from published telephone directories and were selected on a random basis.

Data on number of ski areas and ski lifts were obtained from the Eastern Ski Map and Vacation Guide [3] and data on skier

1/ A summary of the information on recreational lodging from the 1976 survey was reported by Kottke [8] in 1979.

origin-destination travel patterns were obtained from a 1976 mail survey of ski area operators (hereafter referred to as the 1976 Survey of Ski Area Operators) conducted by the author.

Procedure

1. The 1976 NRLS data were tabulated to provide descriptive statistics on a state basis and to provide input data for regression analysis.

2. Equations were constructed to estimate the relation between skiing participation and relevant explanatory variables.

3. A benchmark situation was established by applying 1976 average values of explanatory variables to the equations and the resulting participation rates were multiplied by the total number of participants to obtain a regional level of participation.

4. The average values of the explanatory variables were projected to 1982 on the basis of recent trends and applied to the equations; and then multiplied by total number of participants in the same manner as for the benchmark situation.

5. An estimate of total skiing supply capacity and its distribution by states was made by using data on number and types of ski lifts at all of the region's ski areas.

6. An origin-destination model of skier travel was developed using data from a sample of ski area operators.

DOWNHILL AND CROSS-COUNTRY SKIING PARTICIPATION RATES

Extent of Participation

In 1976, nearly 1.8 million Northeastern households participated in downhill skiing and over a half million households participated in cross-country skiing (Table 1).1/ The majority of the skiers resided in the larger, densely populated states of Massachusetts, New York, Pennsylvania and New Jersey. Rates of participation varied noticeably among the states.

1/ The 1.782 million downhill skier households and the .54 million cross-country skier households are not additive because some households participate in both types of skiing.

Table 1. Estimated Number of Households Participating in Skiing by States, Northeast Region, 1976.

State	Downhill Skier Households		Cross-Country Skier Households		Total Household Population July 1, 1976 1/	
	(000's)	(%)	(000's)	(%)	(000's)	(%)
ME	29	1.6	14	2.5	356	1.9
NH	26	1.5	7	1.2	257	1.3
VT	33	1.8	4	.8	167	.9
MA	261	14.7	95	17.6	1,971	10.3
RI	18	1.0	2	.4	316	1.6
CT	116	6.5	15	2.8	1,053	5.5
NY	621	34.8	246	45.6	6,381	33.2
PA	248	13.9	81	14.9	4,062	21.1
NJ	280	15.7	18	3.3	2,458	12.8
DE	9	.5	1	.2	192	1.0
MD	129	7.3	46	8.6	1,367	7.1
WV	12	.7	11	2.1	619	3.3
Total	1,782	100.0	540	100.0	19,207	100.0

1/ U. S. Bureau of Census, Current Population Reports, [14, p. 7]

Participation rates are measured in two ways; namely, (1) percent of households participating and (2) days of participation per year. The first describes the breadth of involvement within a given population. The second describes the intensity of involvement by active participants.

Percent of Households Participating

Variation in participation among the states occurs primarily in "percent of households participating." Overall 9.3 percent of the Northeastern households participated in downhill skiing and 2.8 percent participated in cross-country skiing (Table 2). These rates indicate a rather small involvement as far as the whole Northeast population is concerned. However, downhill skiing participation varied from a low of 2 percent in West Virginia to a high of 20.8 percent in Vermont. Cross-country skiing participation varied from a low of less than 1 percent in Rhode Island, New Jersey and Delaware to a high of 4.8 percent in Massachusetts. Intultively, it appears that the variation in percent participation among states is partially associated with the availability of supply. For example, it appears that downhill skiing had higher participation rates in states having extensive skiing facilities than those having few. Cross-country skiing, on the other hand, which is less dependent on developed skiing facilities varies to a lesser degree among the states. The supply of skiable space for cross-country skiing is more widely dispersed among the states than is the supply of downhill skiable space (or more importantly, the supply of uphill lift facilities).

Days of Participation Per Year

Intensity of skiing involvement as measured by "days of skiing per year" does not vary greatly among states, but it does vary noticeably among households. That is, about 20 percent of both downhill and cross-country skier households skied less than 5 days per year in 1976 while over 3 percent in each type skied over 50 days (Table 3). Of the 3 measures of central tendency, the mode is probably the best representative for an average estimate in this case.[1/] For downhill skiers the mode was 7 and for cross-country skiers the mode was 12 days per year.

1/ A subjective evaluation of the survey responses by the author suggested that the respondents may have over-stated the number of days skied, particularly in the case of responses falling in the higher brackets of the distribution. Standley-LaPage [13, p. 24] made a similar evaluation of their participation estimate for a study conducted in 1978. Their estimate for downhill skiing was a median of 13 days skied during 1977-78.

Table 2. Percent of Households Participating in Skiing by State, Northeast Region, 1976.

State	Downhill Skier Households	Cross-Country Skier Households
	(Percent of Households Participating)	
ME	8.0	3.8
NH	10.1	2.6
VT	20.8	2.6
MA	13.3	4.8
RI	5.7	.7
CT	11.0	1.5
NY	9.7	3.9
PA	6.1	2.0
NJ	11.4	.7
DE	4.5	.7
MD	9.5	3.4
WV	2.0	1.8
	(Average Rate of Participation)	
Mean	9.3	2.8

Participation in Both Downhill and Cross-Country Skiing

Out of the 1.782 million downhill skier households, 16.3 percent (.29 million) also did some cross-country skiing (Table 4). Interestingly, these dual-skiing households seem to treat the two types more as complements than as substitutes. In terms of days of participation, cross-country skiing increased as downhill skiing increased. Also the proportion of downhill skier households participating in cross-country skiing increased as the intensity of downhill skiing increased.

In another study, the NE-100 Regional Committee [1, pp. 49-50] in 1977 observed a strong complementary relationship between downhill and cross-country skiing but acknowledged that some substitution occurred among the households surveyed. If these findings of a predominantly complementary relation are correct, then the future demand for downhill skiing would probably not be adversely affected by growth in cross-country skiing.

Skier's Involvement in Other Outdoor Recreation Activities

Skier households tend to be enthusiastic about all kinds of outdoor recreation. As shown in Table 5, skier households participated in most of the major activities at a higher rate than the average for all households. Cross-country skier households were the most active having had a higher rate than downhill skiers in 7 of the 10 activities.

It may be noted that the other outdoor recreation activities listed in Table 5 take place in summer, and, therefore, would not ordinarily be considered competitive with skiing from the standpoint of time. However, some people might reduce the length of their summer vacation in order to save time for a winter vacation. Then, too, some households might reallocate their household budgets by reducing summer recreation expenditures in order to spend more for winter recreation. While the data were not analyzed to test these hypotheses, it does not appear that skier households reduce their participation in other recreation activities in order to participate in skiing. Rather the data suggest that skier households are perhaps more inclined to add-on and participate in a variety of recreation activities.

Table 3. Number of Days Households Participated in Skiing Per Year, Northeast Region, 1976.

Item	Downhill Skier Households	Cross-Country Skier Households
Days of Participation Per Year	(Percent Distribution of Households)	
1-4	19.7	19.2
5-9	29.4	16.7
10-14	14.4	26.8
15-24	24.9	11.8
25-49	7.7	13.8
50-74	3.2	4.9
75-124	.7	6.9
Total	100.0	100.0
	(Average Days of Participation)	
Mean	13.4	15.7
Median	10.3	12.6
Mode	7.0	12.0

Table 4. Participation in Cross-Country Skiing by Downhill Skier Households, Northeast Region, 1976.

Days of Downhill Skiing Participation per Year	Downhill Skier Households	Participation in Cross-Country Skiing by Downhill Skier Households	
		% of DH Skier Households Participating	Mean Days of Participation Per Year
	(000's)		
1-14	1132	9.8	6
15-49	581	20.0	11
50-124	69	83.3	53
	1782	16.3	19

Table 5. Participation in Selected Recreation Activities by Skier Households and All Households, Northeast Region, 1976.

Recreation Activity	Days of Participation			Days of Participation		
	Downhill Skier Households	Cross-Country Skier Households	All Households	Downhill Skier Households	Cross-Country Skier Households	All Households
	(Percent of Households Participating)			(Mean Days Per Year)		
Sightseeing	64	71	55	27	30	20
Swimming	60	70	43	41	38	46
Fishing	40	37	29	9	31	16
Hiking	35	75	25	24	23	47
Bicycling	45	46	23	31	51	36
Boating	52	61	22	18	36	15
Tennis	48	37	19	29	36	30
Golfing	22	32	16	17	58	29
Hunting	11	11	13	15	23	23
Gardening	8	19	11	61	43	64

FACTORS INFLUENCING THE DEMAND FOR SKIING

A basic hypothesis of this study was that changes in population growth, age composition, family income, family size and other relevant variables would affect changes in demand for downhill and cross-country skiing. As a preliminary step to the testing of this hypothesis, it may be well to briefly describe and summarize a set of relevant variables that might influence demand for skiing.

Socioeconomic Characteristics of Skier Households

Characteristics of skiers have been reported by Goeldner, Fellhauer and Kates [6], Standley-LaPage [13], and others. Typically, skiers are characterized as being relatively young and having above average income and education. In this study the mean ages of skier household heads were 33 for downhill and 41 for cross-country compared with 48 for all households (Table 6). Family incomes were about $20,000 for both types of skier households compared with about $17,000 for all households. With respect to education, 76 percent of the downhill skier households and 81 percent of the cross-country skier households had attended college compared with 55 percent for all households. Thus the typical characteristics of skiers apply to Northeastern skiers.

Some other characteristics of Northeastern skier households are shown in Table 6. Compared with all households, skier households: (1) Have smaller-sized families. (2) Have less off-work days (not as many retired). (3) Have a higher employment rate. (4) Are more likely to be single. (5) Are more likely to be renters. (6) Are more likely to use recreational lodging.

Composite Recreation Participation Characteristics

As mentioned previously skier households tend to be avid participants in a variety of outdoor recreation activities. For purposes of analysis and description in this study, such a variety of activities is called "composite recreation participation." Composite participation was used as a measure of a household's overall involvement in outdoor recreation. As such the measure roughly indicates the degree to which a household includes outdoor recreation in its life style. For this study composite recreation participation is measured on the basis of time spent in outdoor recreation and number of recreation trips taken.

Skier households were highly involved in outdoor recreation

Table 6. Socioeconomic Characteristics of Household Respondents by Type of Skiing Activity, Northeast Region, 1976.

Socioeconomic Variables	Downhill Skier Households	Cross-Country Skier Households	All Households
		(Mean Values)	
Age of Household Head (Years)	33.1	40.8	47.9
Family Income ($)	20,912	19,158	16,724
Per Capita Income ($)	10,076	9,891	7,671
Children Under 21 Years of Age	.90	.65	1.02
Family Size (No. Persons In Household)	2.48	2.31	2.83
Off-Work Days by Household Head (No.)	133	120	148
Vacation Days of Household Head (No.)	23	30	31
	(Percent Distribution of Households)		
Employment Status			
Employed	93	90	70
Retired	3	6	24
Unemployed	4	4	6
	100	100	100
Marital Status			
Married	61	70	75
Single	39	30	25
	100	100	100
Tenure of Residence			
Owner	62	63	73
Renter	38	37	27
	100	100	100

Table 6. Continued

Socioeconomic Variables	Downhill Skier Households	Cross-Country Skier Households	All Households
	(Percent Distribution of Households)		
Highest Education Level Attended by Household Head[1/]			
Grade School	0	0	0
High School	13	13	29
Technical	11	6	12
College	76	81	55
	100	100	100
Type of Recreational Lodging Used[2/]	(Percent of Households Using Lodging Type)		
Second Home Owned	13.4	15.4	6.8
Second Home Rental	17.9	9.3	8.5
Camper	36.4	53.4	19.8
Motel	66.2	54.0	37.6

1/ Attended but not necessarily completed.
2/ Lodging used on all outdoor recreation trips, not exclusively skiing trips.

as evidenced by their average recreation hours which were 358 for downhill skier households and 542 for cross-country skier households compared with 221 for all households (Table 7). Also skier households took more trips than the average for all households and spent more days on recreation trips than the average. One noticeable exception to the "greater composite participation" characteristic of skier households was their time spent on home-based recreation which was less than the average for all households and much less than that for cross-country skiers. In all of the composite measures except "time spent on conference-related trips," cross-country skier households exceeded downhill skier households indicating a very high level of outdoor recreation involvement by the former group.

A Two-Part Procedure for Estimating Demand

Measurement of demand equations for outdoor recreation activities can be viewed as a two-part estimation procedure.[1/] The first part measures the relation between the probability of a household or person participating in the activity (i.e., the percent of participation as defined earlier) and a set of explanatory variables. The second measures the relation between a household's or person's frequency of participation and a set of explanatory variables. Explanatory variables were selected from the list of characteristics presented in Tables 6 and 7 on the basis of giving the best fit to the equations.

Demand Equations for Downhill Skiing

1. Probability of Participation in Downhill Skiing

Whether or not a household participated in downhill skiing was hypothesized to be dependent on 4 variables, namely, age, composite recreation time, family income and family size. An equation was formulated as follows:

$$PrDh = f(A, R, Y, F) \qquad (1)$$

where:

PrDh = probability of a household participating in

1/ For a discussion of the rationale for a two-part demand estimation procedure see Cicchetti, Seneca and Davidson [2, pp. 78-86].

Table 7. Composite Recreation Participation by Skier Households, Northeast Region, 1976.

Measure of Composite Participation	Downhill Skier Households	Cross-Country Skier Households	All Households
	(Mean)	(Mean)	(Mean)
Recreation Hours Spent Per Year 1/	358	542	208
Recreation Trips Per Year	8.1	10.4	5.8
Home-Based Recreation (days) 2/	56	133	63
Tour-Based Recreation (days) 3/	22	28	18
Site-Based Recreation (days) 4/	25	37	23
Conference-Based Recreation (days) 5/	9	7	7

1/ Time spent in skiing plus the 10 outdoor recreation activities listed in Table 5.
2/ Spent in proximity of home.
3/ Spent in tour-type trips.
4/ Spent at a particular site for the whole trip.
5/ Spent on business related trips.

downhill skiing[1/]

A = age of household head (years)

R = time spent on a composite of outdoor recreation activities by a household member (hours/year)

Y = family income of a household ($ per year)

F = family size (number of persons)

Application of the 1976 NRLS data to the above formulation resulted in the following least squares regression equation:[2/]

$$PrDh = .2951 - \underset{(8.6*)}{.0047\,A} + \underset{(5.1*)}{.00019\,R} + \underset{(4.0*)}{.0000034\,Y} - \underset{(4.6*)}{.0253\,F} \qquad (2)$$

According to the results in Equation 2, age and family size had a negative influence while composite recreation time and family income had a positive influence on the probability of downhill skiing.

A regression equation may be used not only to show direction of influence, but also to estimate, on a qualified basis, the probability rate that would occur given different quantity levels of the explanatory variables. This latter use of the equation will be presented in a later section.

1/ PrDh is a dichotomous dependent variable quantified as follows: yes = 1, no = 0. In this study linear regression analysis was used with satisfactory results. Other methods used for dependent dichotomous variables are logit and probit analyses. See Nerlove and Press [11] for a discussion of logit analysis and Witherington and Willis [16] for a discussion of probit analysis. See Sim-Kottke [12] and Gould-Kottke [7] for applications of logit analysis.

2/ Numbers given in parenthesis are t values for this and all subsequent equations. * = significant assuming a .01 probability of error. ** = significant assuming a .05 probability of error. R^2 values were low for all regression estimates in this study. Relatively low correlation statistics are common when using regression analysis on cross-sectional data. Obviously, the regression results of this study should be interpreted as explaining only a part of the variation in skiing participation. For purposes of this study, representativeness of the data, which is measured by the t test, is of primary importance. Most of the coefficients in the equations meet the t test for statistical significance.

2. Frequency of Participation in Downhill Skiing

How often do members of a household go skiing in a year and what influence do certain variables have on that frequency?

As shown previously in Table 3, the modal rate for downhill skiing was 7 days and the mean rate was 13.4 days with a wide dispersion around the mean. Variation in the frequency of participation was hypothesized to be associated with variation in the same 4 explanatory variables used in Equation 2 plus a 5th variable called vacation days (length of a skier household's vacation). This relation was formulated as follows:

$$QDh = f(A, R, Y, F, V) \qquad (3)$$

where

QDh = days of downhill skiing per year by a skier household

A,R,Y,F = same as in Equation 2 except that the data pertain only to downhill skier households, not to all households

V = vacation days per year available to a downhill skier household.

The 1976 NRLS data were applied to the formulation with the following results:

$$QDh = 5.8753 + \underset{(.1)}{.0143}\,A + \underset{(5.2*)}{.256}\,R + \underset{(.4)}{.0000517}\,Y - \underset{(1.4)}{1.2549}\,F - \underset{(.1)}{.0057}\,V \qquad (4)$$

In this equation, the direction of influence is similar to that of the probability relation (Equation 2) except that age is positive instead of negative. This was somewhat unexpected, but it makes sense considering that years of experience may lead to greater skiing ability which could be an incentive for skiing more frequently. None of the explanatory variables, except composite recreation time, had a statistically significant influence meaning that frequency of participation apparently does not occur in well-behaved patterns. Perhaps decisions on how often to ski are made without a great deal of planning or perhaps some significant factors were omitted from the analysis.

Another variable, for example, that could logically aid in

explaining frequency variation would be the price of skiing. It is quite likely that skiing frequency diminishes as price increases (i.e., price of lift ticket plus cost of lodging and transportation). Unfortunately data on skiing prices were not obtained in the 1976 survey.

Although the equation is not as strong as desired, it does provide a reasonable framework for estimating purposes and offers insight on the variability of skiing frequency. In particular, the equation suggests a contrasting influence with regard to age. An implication of the results regarding age is that although the aging process may dampen the probability of people becoming downhill skiers, it may have a positive influence on how often they ski when and if they become downhill skiers.

Demand Equations for Cross-Country Skiing

1. Probability of Participation in Cross-Country Skiing

Cross-country skiing has only recently become a popular winter recreation activity. The dispersed and rather unstructured nature of the activity makes it difficult to predict exactly where and how its future growth will take place. However, sufficient data (from the 1976 NRLS) were available to obtain some insights on the relation between cross-country skiing and several variables. It was hypothesized that the probability of a household participating in cross-country skiing was dependent on age, composite recreation time, home-based recreation time and per capita income. The relation is written as follows:

$$PrXc = f(A,R,B,PY) \qquad (5)$$

where

PrXc = probability of households participating in cross-country skiing

A = age of household head (years)

R = time spent on a composite of outdoor recreation activities by a household member (hours/year)

B = time spent in home-based outdoor recreation (days/year)

PY = per capita income ($ per year)

Results of applying least squares regression to the data were as follows:

$$PrXc = .0312 - \underset{(.4)}{.000139\ A} + \underset{(5.5*)}{.000139\ R} + \underset{(4.7*)}{.00035\ B} + \underset{(2.1**)}{.00000196\ PY} \quad (6)$$

As in the case of downhill skiing, age had a negative influence as expected. The other 3 variables had a positive influence, also as expected, and it is particularly interesting to note the influence of home-based recreation time. A family's opportunity for and interest in home-based recreation apparently plays an important role in determining whether a family participates in cross-country skiing. One of the advantages of cross-country skiing is that it can usually be done around one's home (backyard, local park, golf course, open field, etc.)

2. Frequency of Participation in Cross-Country Skiing

The frequency relation was formulated as follows:

$$DXc = f(A,R,F,V,PY) \quad (7)$$

where

DXc = days of cross-country skiing per year by a skier houshold

A,R,PY = same as in Equation 5 except that the data pertain only to cross-country skier households, not all households

F = family size of cross-country skier households (number of persons)

V = vacation days per year available to a cross-country skier household

Application of least squares regression to the data gave the following results:

$$DXc = 22.1888 - \underset{(2.4**)}{.5522\ A} + \underset{(.9)}{.0098\ R} + \underset{(.3)}{1.0958\ F} + \underset{(.5)}{.0664\ V} + \underset{(.8)}{.000586\ PY} \quad (8)$$

In contrast to its positive influence on frequency of downhill skiing, age had a negative influence on cross-country

frequency. It may be that cross-country skiing is more demanding physically than is downhill skiing and, therefore, was done less often by older people. Another possible explanation is that because of the relative newness of the activity the benefits of long experience had probably not yet begun to show up among the 1976 NRLS respondents.

All of the other explanatory variables showed a positive influence, but were not statistically significant. Thus, variation in frequency of cross-country skiing is much like that of downhill skiing in having an elusive explanation. Whereas an inclusion of a price variable may have helped explain the variability in downhill frequency, such an inclusion for cross-country skiing would be less meaningful. Obviously, frequency of skiing depends ultimately upon the amount and frequency of snowfall, but this condition would presumably influence all households equally. In other words, variations in snowfall from year to year may influence frequency of participation in the aggregate for all households, but would not account for differences among households.

Given the foregoing considerations, it was concluded that the estimating equations for frequency of downhill and cross-country skiing give a reasonable, although not complete, explanation of variability. Furthermore, the estimating equations for probability of participation give a fairly reliable explanation of variability for both downhill and cross-country skiing. Therefore, the demand equations were used, subject to the aforementioned qualifications, to estimate a 1976 benchmark level of participation and a projected 1982 level of participation.

PROJECTED CHANGE IN LEVEL OF REGIONAL SKIING PARTICIPATION BETWEEN 1976 AND 1982

What effect would changes in age composition, income, vacation time and composite recreation time have on regional skiing participation levels over a 5 year period? What would the "net effect" be from a slowdown in population growth in conjunction with the foregoing changes? The projections presented in this section were designed to answer these questions.

Projection of Mean Values and Population Data

First a benchmark situation was established for 1976 by applying the 1976 mean values of the explanatory variables to the demand equations to obtain 1976 participation rates. Then the values of the explanatory variables were projected to 1982 and these were applied to the demand equation to obtain projected participation rates. The 1976 mean values and 1982 projected values are shown in Table 8. It should be noted that the variables would change at different rates. For example, mean age would increase 3 percent; family income would increase 6 percent; family size would decrease 6 percent and vacation days would increase 6 percent. By using the demand equation approach it is possible to obtain a "net effect" of the combined set of changes.

Results of the Demand Projection and Regional Aggregating Procedure

1. Results for Downhill Skiing

Neither probability nor frequency of participation in downhill skiing would increase greatly by 1982 according to the results (Table 9). Probability of participation would increase to .0971 and frequency would increase to 13.77 mean days (changes of 4.6 percent and 3.1 percent, respectively, from 1976). What these relatively small changes show is that positive effects of rising incomes and smaller families would be counteracted by negative effects of a rising average age.

Another source of change is through a shifter of demand which in this case is population growth. Although population of individuals was projected to grow only 1 percent, the population of households was projected to grow 7 percent (Table 8). When these population changes were incorporated into the calculation (as shifters of demand), then the regional aggregate participation was estimated to increase 8.1 percent. Most of the increase would come from a growing number of participants rather

Table 8. Structural Data and Mean Values of the Explanatory Variables, Northeast Region, 1976 and Projected 1982.

Item	Benchmark 1976	Projected 1982 1/	Percent Change 1976-82
Total Households (000)	19,207	20,550	7
Total Population (000)	56,000	56,560	1
	(Mean Values)		
Age of Household Head (Years)			
All Households	47.9	49.3	3
Downhill Skier Households	33.1	34.1	3
Cross-Country Households	40.8	42.0	3
Composite Recreation Hours per Capita (Time Spent per Year)			
All Households	208	212	2
Downhill Skier Households	358	365	2
Cross-Country Skier Households	542	553	2
Family Income ($)			
All Households	16,724	17,727	6
Downhill Skier Households	20,912	22,167	6
Cross-Country Skier Households	19,158	20,307	6
Family Size (No. Persons in the Household)			
All Households	2.91	2.74	-6
Downhill Skier Households	2.48	2.33	-6
Cross-Country Skier Households	2.31	2.17	-6
Vacation Days per Year			
All Households	32.63	34.59	6
Downhill Skier Households	22.79	24.16	6
Cross-Country Skier Households	29.78	31.57	6
Home-Based Recreation (Days)			
All Households	63	66	5
Downhill Skier Households	56	59	5
Cross-Country Skier Households	133	140	5
Per Capita Income ($)			
All Households	7,671	8,592	12
Downhill Skier Households	10,076	11,285	12
Cross-Country Skier Households	9,891	11,078	12

1/ Projections based on trend data obtained from the Statistical Abstract of the U.S. 1977 edition [15].

Table 9. Estimated Change in Downhill Skiing Participation by Households Between 1976 and Projected 1982, Northeast Region.

Item	Benchmark 1976	Projected 1982	Percent Change 1976-82
Probability of participation	.0928	.0971	4.6
No. of households participating (000)	1,782	1,995	12.0
Frequency of participation per household (days per year)			
Mean	13.36	13.77	3.1
Mode	7.0	7.21	3.1
Regional total participation by households (000 days per year)[a/]	12,474	14,384	15.3
No. of individuals participating (000)[b/]	2,851	2,993	5.0
Regional aggregate participation by individuals (000 skier-days per year)	19,958	21,576	8.1

a/ Modal frequency was used to estimate aggregate regional participation.
b/ Number of skiers per household was 65 percent of the household members.

than from an appreciable extension in frequency of participation by downhill skiers.

A 5-year growth rate of 8.1 percent would be considered a slowdown compared to the ski market's growth rates prior to 1976 (probably over 30 percent in 5 years).

2. Results for Cross-Country Skiing

According to the results of the analysis, cross-country skiing would expand 17.1 percent between 1976 and 1982 (Table 10). While frequency of participation would increase less than 1 percent, probability of participation would increase 15.3 percent.

As with downhill skiing most of the increase in aggregate participation would come from growth in number of participants rather than from greater frequency. Rising incomes and greater time spent on home-based and composite recreation would be the major contributing factors, while an aging population would be a restricting factor.

These results for cross-country skiing seem reasonable from the standpoint that the activity only recently began being widely adopted in the Northeast region. Compared to downhill skiing it still has a "lot of room" for growth. Should the 17 percent increase in demand occur, regional aggregate participation in cross-country skiing will still only be about 60 percent as large as that for downhill skiing (13.1 million vs. 21.6 million skier-days).

Table 10. Estimated Change in Cross-country Skiing Participation by Households Between 1976 and Projected 1982, Northeast Region

Item	Benchmark 1976	Projected 1982	Percent Chang 1976-82
Probability of participation	.0281	.0324	15.3
No. of households participating (000)	540	666	23.3
Frequency of participation per household (days per year)			
Mean	15.28	15.38	.7
Mode	12.00	12.08	.7
Regional total participation by households (000 days per year)[a/]	6,480	8,045	24.2
No. of individuals participating (000)[b/]	934	1,086	16.3
Regional aggregate participation by individuals (000 skier-days per year)	11,208	13,119	17.1

a/ Modal frequency was used to estimate the aggregate regional participation.
b/ Number of skiers per household was 75 percent of the household members.

DOWNHILL SKIER CAPACITY OF SKI AREAS IN THE NORTHEAST

How much skiing capacity is there in the Northeast? On many winter holidays and weekends, ski resorts are overcrowded with people often waiting in long lift lines for transportation up the hills and mountains. Usually all of the facilities, including the slopes, parking lots, toilets, restaurants and lodges, become extremely crowded. However, on weekdays, which account for most of the skiing season, conditions are usually far from being overcrowded. As a consequence, it is quite difficult for ski areas to plan an optimum amount of skier capacity. Under such erratic demand behavior, it is not uncommon for supply-capacity to be something less than what would be needed for peak demand situations.

Number and Size of Ski Areas

All of a ski area's facilities contribute to the services being supplied to skiers, however, for purposes of this study only up-hill lift facilities were used for measuring amounts of skier capacity supplied by the ski areas. In 1976, there were 218 ski areas in the Northeast (Table 11).[1/] Their daily skier capacity ran about 2000 skiers per ski area with a range from a few hundred to about 10,000 skiers. Among the state averages, the capacities ran from 933 in Rhode Island to 3,130 in New Jersey. Night skiing can increase the daily capacity of a small area substantially, which is the major reason for Connecticut's average size being comparable to that of Vermont. Some of the largest ski areas in the Northeast are located in Vermont, but there are also many small areas in that state with only a few (large or small) that offer night skiing.

State and Regional Lift Capacity

Total lift capacity for each state is the sum of all ski areas' daily capacities multiplied by the average days of operation per year. The result of this calculation is shown in

1/ A thorough census of all ski areas is difficult to obtain because there are some small ski areas that open only at certain times, usually weekends; some that are not open to the public and some that have only one or two rope tows with no other facilities. It is possible that there were more than the 218 ski areas enumerated for this study. However, the omissions probably would not add enough to regional skier capacity to have a significant effect on the results of this study.

Table 11. Estimated Number of Downhill Ski Areas, Ski Lifts and Skier Lift Capacity by States, Northeast Region, 1976.

State	Ski Areas 1/	Ski Lifts 1/ Cable type	Ski Lifts 1/ Rope tow	Ski Lifts 1/ Total	Skier Lift Capacity per Ski Area: Day time Ave. 2/	Night Ave. 3/	Daily Ave.
	(Number)	(Number)			(Number of Skiers)		
ME	19	55	7	62	1371	125	1496
NH	29	113	15	128	1966	71	2037
VT	32	141	8	149	2297	71	2368
MA	24	62	60	122	1179	450	1629
RI	3	5	5	10	850	134	984
CT	6	19	19	38	1658	725	2383
NY	66	230	63	293	1583	218	1801
PA	26	93	26	119	1667	183	1850
NJ	5	24	7	31	2620	621	3241
MD	2	5	3	8	1225	233	1458
WV	6	11	5	16	992	100	1092
Total or Regional Ave.	218	758	218	976	1682	207	1889

1/ Estimated from data reported in the 1976 Eastern Ski Map and Vacation Guide [3] (except for MD and WV which were obtained from data reported in Enzel-Urciolo [4]).

2/ Calculated by multiplying the number of lifts by the following lift capacities in skiers per day: Gondola = 1000, chair = 700, T-bar = 300, J-bar = 50, poma = 150, rope tow = 50.

3/ Estimation based on data obtained from the 1976 Survey of Ski Area Operators , University of Connecticut.

column 3 of Table 12 where, for example, Connecticut was estimated to have 1,115,000 skier-days of lift capacity. This measures an approximate maximum number of skiers that could be accommodated in the state if the ski areas operated at full capacity every day of the season.1/

Some way of deducting skier-days for times of closed or partial operations would give a more realistic estimate. In lieu of an actual count of such "less than full capacity" operations, an average utilization rate was used in this study as the representative measure of skier lift capacity. It was assumed that ski areas utilized 40 percent of their lift capacity over a season of operation. This means that on weekends and holidays ski areas were used at more than 40 percent of capacity (usually 100 percent or more) and on weekdays the areas were used less than 40 percent of capacity. Goeldner and Farwell [5] have estimated that the average utilization rate was 36.5 percent for all U.S. ski areas in 1974-1975.

Using lift capacity utilization as a measure of available skiing supply, a regional total of 17,126,000 skier-days was obtained. New York had the largest amount with about one-third of the total, followed by Vermont with 3.5 million and New Hampshire with 2.7 million skier-days available for downhill skiing.

Changes in the Regional Supply of Skier Lift Capacity

1. Changes During the 1960's

Between 1962 and 1970, the number of ski areas in New England had grown 6 percent and number of lifts had grown 17 percent (Kottke-Libera [9, p. 3]). It is interesting to note that the growth in lift capacity was accompanied with an increase in number of ski areas. This was an expansionary phase of the ski supply and although the data apply to only New England states, the trend was probably paralleled throughout the region.

2. Changes in Recent Years

Table 13 shows that the number of ski areas has appar-

1/ Operation at full capacity for the whole season could be unrealistic for the following reasons: (1) On weekdays most ski areas cut down on the number of lifts in operation. (2) Inclement weather (rain, snow storms, icy conditions, etc.) may prohibit operation on some days. (3) Some ski areas operate only on weekends. (4) Need for repairing or maintaining equipment may close down part of an operation for some time. (5) Snowmaking may close off some sections of a ski area for part of the time.

Table 12. Estimated Downhill Skier Lift Capacity of Ski Areas by States, Northeast Region, 1976.

State	Average Days of Operation Per Year1/	Downhill Skier Lift Capacity		Skier Lift Capacit Utilization2/
		State Total Per Day	State Total Per Year	State Total Per Year
	(No.)	(No. of Skiers)	(Skier-Days in 000)	(Skier-Days in 000)
ME	121	28,420	3,439	1,376
NH	114	59,050	6,732	2,693
VT	116	75,780	8,790	3,516
MA	85	39,110	3,324	1,330
RI	70	2,950	207	83
CT	78	14,300	1,115	446
NY	115	118,860	13,669	5,468
PA	80	48,120	3,850	1,540
NJ	75	16,200	1,215	486
MD	50	2,910	146	58
WV	50	6,540	327	131
Region Total	104	412,240	42,814	17,126

1/ Source: Based on data obtained from the 1976 Survey of Ski Area Operations, University of Connecticut.

2/ Based on an assumed 40 percent utilization rate. Goeldner and Farwell [5] estimated the average utilization rate to be 36.5 percent for U.S. ski areas in 1974-1975.

ently stabilized in the Northeast while the regional lift capacity has continued to expand during the 1975-1979 period. Based on the estimates made in this study, lift capacity has increased at an annual rate of about 2 percent which is roughly the same annual rate (17 percent over 8 years) that was estimated for the 1960's in New England. In other words, the supply of skier lift capacity has continued to increase at an average annual rate of about 2 percent over two different growth periods. In recent years emphasis seems to be more on expansion of existing areas and less on development of new areas.

Table 13. Changes in Number of Ski Areas and Regional Skier Lift Capacity, Northeast Region, 1975-1979.1/

Item	1975	1976	1979	Annual Percent Change 1975-1976	Annual Percent Change 1976-1979
Number of Ski Areas	219	218	214	-.5	-.6
Regional Skier Lift Capacity in Skier-Days Per Day (000)	400.6	412.2	435.9	2.9	1.9
Regional Skier Lift Capacity Utilization in Skier-Days Per Year (000)	16,665	17,126	18,133	1.8	2.0

1/ Estimated by the procedure presented in Tables 11 and 12 using data reported in the 1975, 1976 and 1979 Eastern Ski Map and Vacation Guide [3] and in Enzel-Urciolo [4].

AN ORIGIN-DESTINATION DISTRIBUTION MODEL OF DOWNHILL SKIING

Purpose of An Origin-Destination Distribution Model

At this point, skier participation and lift capacities are brought together to see what the spatial distribution pattern of skiing looks like. Ordinarily in economic analysis, the demand side and the supply side of a market are brought together in an equilibrium model to determine an optimum level of price and output. An origin-destination model serves a similar purpose in bringing two sides of a market together, but usually does so without benefit of functional attachments incorporating the influence of explanatory variables and without reference to price.1/ An origin-destination model of travel in connection with Northeastern downhill skiing is shown in Table 14. A major purpose of an origin-destination model is to evaluate how well an estimate of consumer participation balances with an estimate of producer capacity. A second purpose of such a model is to show where participants traveled from and where they traveled to. A spatial distribution pattern can be instructive for analyzing transportation and travel problems.

Balancing Regional Skier Participation With Regional Lift Capacity

In the previous sections, estimates were presented showing that in 1976 regional skier participation was 19,958,000 skier-days and skier lift capacity was 17,126,000 skier-days (Tables 9 and 12).2/ This is close to being in balance with an inclination for "demand" to exceed "supply." However, the "excess demand" can be explained as a net out-flow of skiers to areas outside of the region amounting to 2,832,000 skier-days (shown as 3,703,000 going to outside destinations and 872,000 coming from outside origins in Table 14). Most of the "exported" skier-days originated in the southern part of the region and most of the "imported" skier-days were destined for the northern part of the region (mostly from Canada).

1/ An origin-destination model can be structured in functional form to be an equilibrium market model. As such it is usually called a spatial allocation or spatial equilibrium model. For an example see Kottke [10].

2/ For a statement on the estimation procedure used to determine the distribution of skiing participation by states see Appendix Table 1.

Table 14. Origin-Destination Distribution of Downhill Skier-Days, Northeast Region, 1976

Origins	Destinations[1/] ME	NH	VT	MA	RI	CT	NY	PA	NJ	MD	WV	OR[2/]	Total	Number of Skier-Days by Origin
	(Percent Distribution)[3/]													
ME	92.9	5.1	1.9	.1									100	747
NH	6.3	67.5	25.0	1.2									100	591
VT	1.2	4.4	93.8	.1								.5	100	502
MA	3.9	50.0	23.0	21.1	.4	.8	.2					.6	100	3048
RI	4.0	41.3	16.1	6.0	29.6	3.0							100	199
CT	3.3	5.4	49.9	21.9	.8	18.4	.3						100	1578
NY	2.0	2.1	11.3	4.3		1.6	60.3		.6			17.8	100	6955
PA			.5				14.6	59.8			.7	24.4	100	2143
NJ	3.5	4.5	13.3	.9		.6	30.8	8.4	17.4		.8	19.8	100	2374
DE							15.3	6.9	13.9			63.9	100	72
MD			.6				6.2	2.6	1.3	3.5	2.7	83.1	100	1672
WV								14.3			64.9	20.8	100	77
OR[2/]	27.4	32.9	27.6	.2			11.9						100	872
Total	6.6	12.9	16.9	6.4	.4	2.1	26.3	7.4	2.3	.3	.6	17.8	100	
	(Number of Skier-Days by Destination in Thousands)													
	1,376	2,693	3,516	1,330	83	446	5,468	1,540	486	58	131	3,703		20,830

1/ Origin refers to a skier's state of residence and destination refers to location of the ski area visited.

2/ OR = outside of the Northeast region. Canada, for example, is a major OR origin and the Western region is a major OR destination.

3/ Source: The distributions for ME, NH, VT, MA, RI, CT, NY and NJ were allocated on the basis of data from the 1976 Survey of Ski Operators, Dept. of Ag. Economics, University of Connecticut. The distributions for PA, DE, MD and WV were calculated to obtain a balance between origin and destination skier-days.

Maine, New Hampshire, Vermont and West Virginia were the only states with greater lift capacity than their respective resident participation. Of course, many households ski outside of their resident state so that a balance of participation and lift capacity within states would not be expected. For example, Connecticut ski areas provide 1.3 million skier-days of lift capacity, but only 18.4 percent (.29 million skier-days) of Connecticut skiers' participation is spent in Connecticut. New York residents spend 4.3 percent (.11 million skier-days) of their participation in Connecticut. What this indicates is that a considerable amount of "trading" of skier-days among states occurs and this, in turn, implies that a considerable amount of traveling is associated with downhill skiing.

Spatial Distribution Pattern of Travel for Downhill Skiing

The volume of skier-days emanating from states with the largest populations was usually distributed among more than six states. For example, Massachusetts' volume of skier-days was distributed among seven states plus states outside of the region (Table 14). New York and New Jersey had patterns similar to that of Massachusetts, while the Northern New England states had distributions more concentrated within New England.1/

In general, wider spatial distribution patterns mean greater amounts of traveling involved in getting to ski areas. Overall, Northeastern skiers are located in relatively close proximity to ski areas compared with skiers in other regions, e.g. the Western region. Therefore, relatively short traveling time and distance has been considered an advantage of the Northeastern ski market. As stated in Kottke-Libera [9,p.12], most New England skiers can choose a ski area within 150 miles from home. The same study concluded that travel would not be reduced greatly from the existing pattern if skiers, in general, chose ski areas strictly on the basis of a least-travel cost objective. However, outside of New England where travel destinations are more dispersed, application of constraints would probably be more effective in reducing travel.

1/ Some of the differences in distribution patterns can be explained by statistical variation in sample size among the states. Obviously, larger states with large samples give a more complete representation among classes than do smaller samples. However, the difference in distribution patterns between Northern New England and New Jersey, for example, is mostly due to differences in the proximity of lift capacity.

Comparison of Projected Changes in Regional Participation and Regional Lift Capacity for Downhill Skiing

Could the projected 8.1 percent increase in downhill skiing be matched by a similar increase in lift capacity by 1982? A functional analysis of the supply side was not feasible, therefore projection of supply was done by extrapolating the 1976-1979 trend in regional lift capacity. In Table 13 it was shown that the recent annual rate of growth in regional lift capacity has been 1.9 percent. Therefore, the 1982 projected estimate was obtained by multiplying the 1976 benchmark estimate by 1.9 percent compounded annually.

A comparison of the 1982 regional participation and lift capacity estimates indicates that the two would remain relatively close to being in balance (Table 14). If lift capacity increased by 1.9 percent annually and participation "slowed down" to about 1.03 percent increase annually, then the "crowded" conditions would probably ease and give way to a more comfortable level of skiing participation. At the same time, Northeastern ski areas would likely capture a larger share of the regional ski market thereby increasing their income potential.

Table 14. Estimated Change in Regional Downhill Skiing Participation and Skier Lift Capacity Between 1976 and Projected 1982, Northeast Region

Item	Benchmark 1976	Projected 1982	Percent Change 1976-1982
	(000 Skier-Days Per Year)		
Regional aggregate downhill skiing participation1/	19,958	21,576	8.1
Regional aggregate lift capacity utilization2/	17,126	19,173	11.96

1/ These estimates were originally presented in Table 9.
2/ The benchmark estimate is "lift capacity utilization" as presented in Table 12. The 1982 projected estimate was obtained by multiplying the benchmark estimate by 1.9 percent compounded annually.

SUMMARY AND CONCLUSIONS

This study investigated the prospects for continued growth in demand for both downhill and cross-country skiing taking into account socioeconomic variables that could influence changes in demand. A major objective was to obtain information that would help answer the question: What effect would a "slow-down" in population growth, a change in age composition and rises in per capita income have on the ski market?

Data from the 1976 Northeast Recreational Lodging Survey were used to estimate demand equations. Next a 1976 benchmark rate and level of participation were estimated by applying 1976 average values of the explanatory variables to the equations. Then a 1982 projected rate and level of participation were estimated by applying projected average values to the equations. This was followed by an estimation of the regional downhill skiing supply capacity. Finally an origin-destination model of downhill skier travel was developed to bring the "demand" and "supply" estimates together and thereby to evaluate the interregional flow of "trade" in skier days among the Northeastern states.

According to the results of the analysis, participation in downhill and cross-country skiing is likely to continue expanding in the 1980's. Demand for the former is estimated to increase by 8 percent while demand for the latter would increase 17 percent between 1976 and 1982.

An increase in average age of household heads would, on the one hand, tend to reduce the proportion of households participating in both downhill and cross-country skiing. On the other hand, it would tend to increase the frequency of participation in downhill skiing, while having a slightly dampening effect on frequency of cross-country skiing. Rising incomes and smaller families would more than offset the negative effects of a rising average age. The "slow-down" in population growth would also have a dampening effect on demand, however, the number of participants would continue to increase.

Based on recent trends, downhill skier capacity would be expected to increase about 1.9 percent annually with primary emphasis on expansion of existing ski areas rather than entry of new ski areas. Thus, with a projected 1.03 percent annual increase in demand, the ski market should continue to remain close to being in balance with crowded conditions perhaps easing somewhat by 1982.

Results of the origin-destination analysis suggest that there is a considerable amount of "trading" in skier-days among

the states and that the region experiences a "net export" of about 2.8 million skier-days annually. Some of this "net export" volume would be potentially available as demand for Northeastern ski areas in the event of a travel-constraining energy shortage.

LITERATURE CITED

1. Bevins, M., T. Brown, G. Cole, K. Hock, M. Kottke, W. LaPage, R. Stammer, and D. Stynes. Changing Patterns of Outdoor Recreation Participation in Northeastern United States, Delaware Ag. Exp. Sta. Bul 427, April 1979.

2. Cicchetti, C.J.,J. J. Seneca and P. Davidson, The Demand and Supply of Outdoor Recreation, Bureau of Economic Research, Rutgers University, New Brunswick, N. J., March 1969.

3. Eastern Ski Map and Vacation Guide, the National Survey, Chester, Vermont, 1975, 1976, 1979.

4. Enzel, R. G. and J. R. Urciolo, The White Book of Ski Areas, Inter-Ski Services, Washington, D. C., 3rd Edition, 1978.

5. Goeldner, C. R. and Ted Farwell, Economic Analysis of North American Ski Areas, 1977-1978 Season, NSAA, Business Research Division, University of Colorado, 1978.

6. Goeldner, C. R., C. Fellhauer and J. Kates, The Vail Skier, Business Research Division, University of Colorado, 1976.

7. Gould, B. and M. Kottke, Demand for Motel Lodging and Outdoor Recreation Trips to Rural Environments by Northeastern Households, Storrs (Conn.) Ag. Exp. Sta. Research Report No. 53, May 1979.

8. Kottke, Marvin, A Survey of Recreational Lodging and Outdoor Recreation by Northeastern Households, Storrs (Conn.) Ag. Exp. Sta. Research Report No. 52, 1979.

9. Kottke, Marvin and Stephen Libera, Effect of Travel Constraints on the Distribution of Skiing in New England, Storrs (Conn.) Ag. Exp. Sta. Research Report No. 45, November 1975.

10. Kottke, Marvin, "Spatial, Temporal and Product-Use Allocation of Milk in an Imperfectly Competitive Dairy Industry," Am. J. Ag. Econ., 52:33-40, February 1970.

11. Nerlove, M.and J. S. Press, "Univariate Log-Linear and Logistic Models," Rand Corporation Monograph, R-1306-EDA/NIH, Santa Monica, Ca., December 1973.

12. Sim, R. and M. Kottke, Demand, Supply and Spatial Distribution of Second Homes in the Northeast, Storrs (Conn.) Ag. Exp. Sta. Research Report No. 51, February 1979.

13. Standley, Stacey and Wilbur LaPage, "Skiers: Past, Present, and Potential," Ski Area Management, Beardsley Publishing Co., North Salem, N.Y., Winter 1979.

14. U.S. Bureau of Census, Current Population Reports, Series P-25, No. 710, U.S. Government Printing Office, Washington, D. C., October 1977, p. 7.

15. U.S. Bureau of Census, Statistical Abstracts of the U.S., Washington, D. C., 1977 Edition.

16. Witherington, Jr., M. P. and C. E. Willis, The Dichotomous Dependent Variable: A Comparison of Probit Analysis and Ordinary Least Squares Procedures by Monte Carlo Analysis, Mass. Ag. Exp. Sta. Research Bul. No. 657, September 1978.

Appendix Table 1. Estimated Number of Downhill Skiers and Total Skiing Participation by States, Northeast Region, 1976.

State	Downhill Skiers 1/	Downhill Skiing Participation: Average per Skier 2/	Downhill Skiing Participation: Skier-Days
	(000's)	(Days per Year)	(000's)
ME	46.4	16.1	747
NH	41.6	14.2	591
VT	52.8	9.5	502
MA	417.6	7.3	3048
RI	28.8	6.9	199
CT	185.6	9.5	1578
NY	993.6	7.0	6955
PA	396.8	5.4	2143
NJ	448.0	5.3	2374
DE	14.4	5.0	72
MD	206.4	8.1	1672
WV	19.2	4.0	77
	2851.2	7.0	19958

1/ Calculated by multiplying the number of households by 1.6 (the average number of skiers per household).

2/ Estimated modal rate of participation. The regional mode of 7 days per skie was obtained directly from the survey results (see Table 3). The modes for the states were approximated by inspecting the distribution of means by states and using the regional mode-to-mean ratio to estimate the mode.