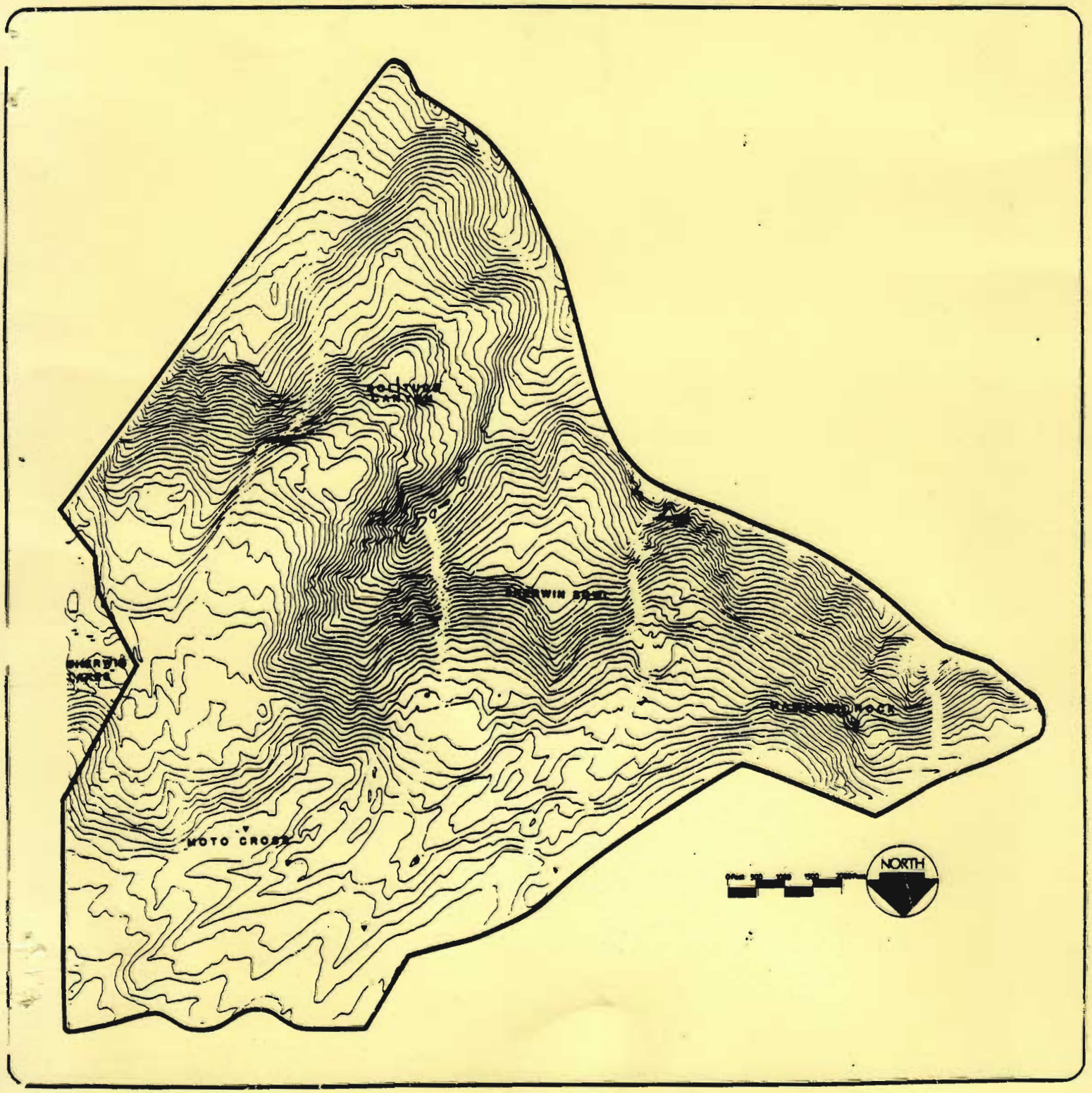
PROPOSED SHERWIN SKI AREA MULE DEER STUDIES



SHERVIN SKI AREA DEER STUDY

FALL REPORT

December 1987

Timothy Taylor

Summaries

TABLE OF CONTENTS

The investigator began monitoring the migratory movements of the Round Valley deer herd and their progression toward the proposed Sherwin Ski Area boundaries upon contract finalization on 17 April 1986. On this day, a total of 27 deer were seen during an intensive ground survey of the lower snow free portions of the Sherwin staging area. This included those areas near Laurel Mountain and the sage-brush-lava flats south of Mammoth Junction where deer are known to congregate in the spring.

A ground survey was conducted on the following day, 18 April, when the investigator hiked into the proposed ski area from the Laurel Mountain road. Throughout this survey, which followed the Sherwin road to the Mammoth Moto-Cross road and into the proposed ski area, the investigator saw no deer or deer sign to the south and west of Laurel Mountain road.

Ground surveys conducted by the investigator on the 21st, 23rd, and 25th of April 1986, revealed a steady increase of deer into the lower portions of the Sherwin staging area. The investigator counted 330 deer on a dawn road survey on 26 April 1986. On this road survey the fartest west toward the proposed ski area in which deer were seen was Summers road.

The first deer observed within the boundaries of the proposed Sherwin Ski Area was on 1 May 1986. On this day the investigator conducted an intensive two mile ground survey. Only one deer and the sign of two others was observed near the Junction of the Moto-Cross road and Sherwin road. This is two weeks later then the 16 April 1985 date of last year when the first deer was observed in the proposed ski area.

Throughout the month of May, nine ground surveys were conducted in the lower staging area portion of the proposed ski area. Six surveys were conducted in the more snow free portions of the staging area north-west of the moto-cross. The same route was walked on each survey and all deer sign was recorded. The highest number of deer observed on any one survey was 35.

Three ground surveys were conducted on the lower western portion of the proposed ski area. This included that area west of the gravel pit and the U.S. Forest Service meadow to Hidden Pond. Only one deer was observed during these three surveys. However, deer tracks were

observed far into the gravel pit, and deer tracks and droppings were seen as far west as Hidden Pond on each of the surveys. The third of these surveys conducted on 29 May 1986, revealed heavy deer sign in the form of tracks and droppings from the gravel pit to Hidden Pond, with the greatest amount of sign being seen near the southern edge of the Mammoth Meadow.

An additional four ground surveys were conducted in Solitude Canyon. The first deer sign in the form of tracks was observed on 26 May 1986 on Solitude Flat. And trails made by migrating deer were observed in the snow over Solitude Pass on 27 May 1986. This is exactly nine days later then last years 17 May 1985 date when deer tracks were first seen on Solitude Flat.

SHERWIN SKI AREA DEER STUDY

SPRING REPORT

JULY 1987

Timothy J. Taylor

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

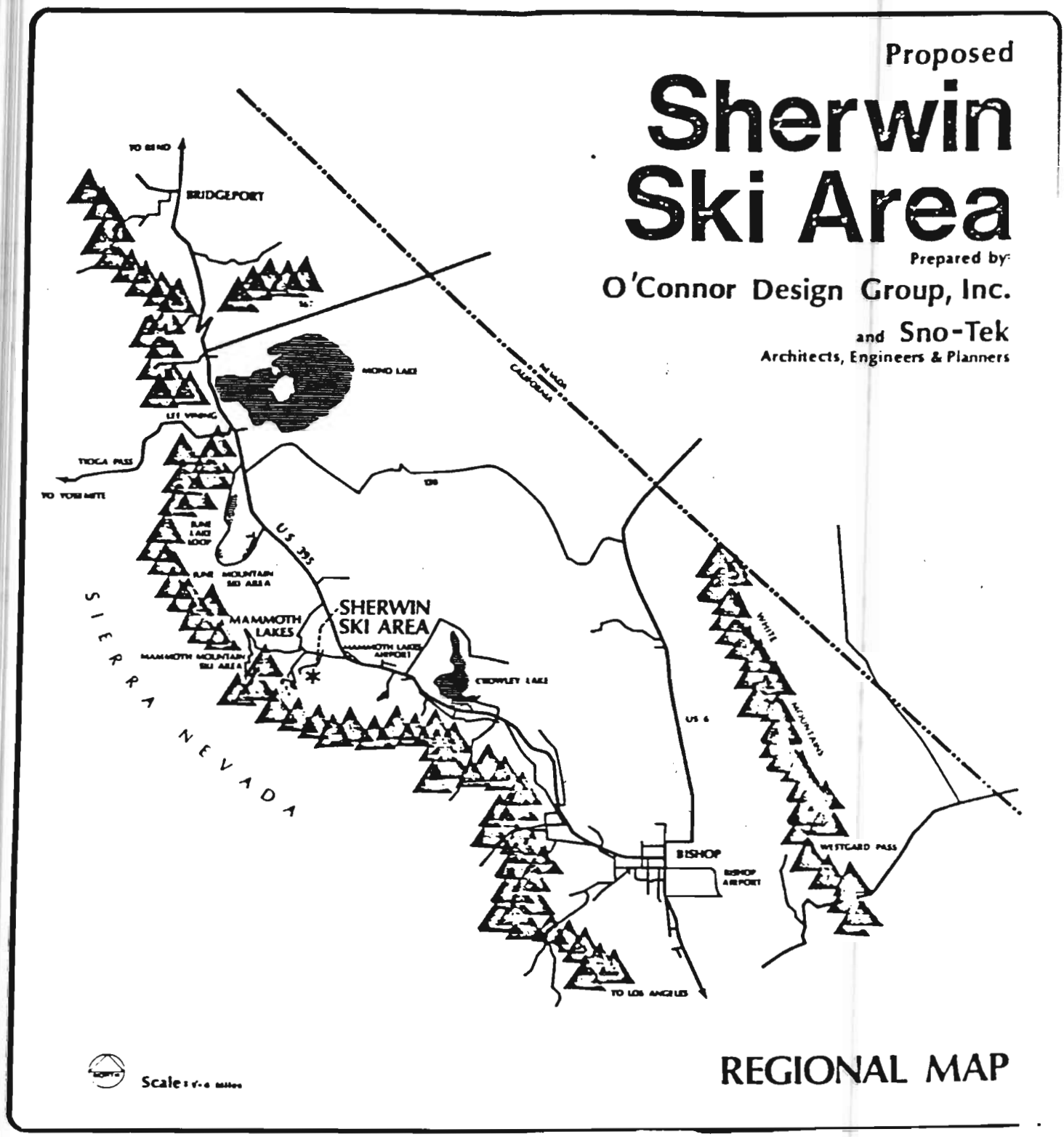


Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

ACKNOWLEDGEMENTS

The investigator is currently working under contract with O'Connor Design Group of Mammoth Lakes, California, with the cooperation of the California Department of Fish and Game (DFG). All road survey and radio telemetry data used in this report were provided by Thomas E. Kucera from a concurrent study of Eastern Sierra Deer, and are used with his permission; they may not be cited or published without the permission of Thomas E. Kucera.

STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10 - 15, 23 and 24 of T.4S, R.27E, in the Mammoth Ranger District Inyo National Forest (Fig. 2) (Kucera 1985). The area comprises approximately 2,000 acres of steep, generally north-facing terrain, varying in elevation from 8,000 to 11,000 feet, and lies between the Sherwin Creek drainage on the east and the Mammoth Lakes basin on the west.

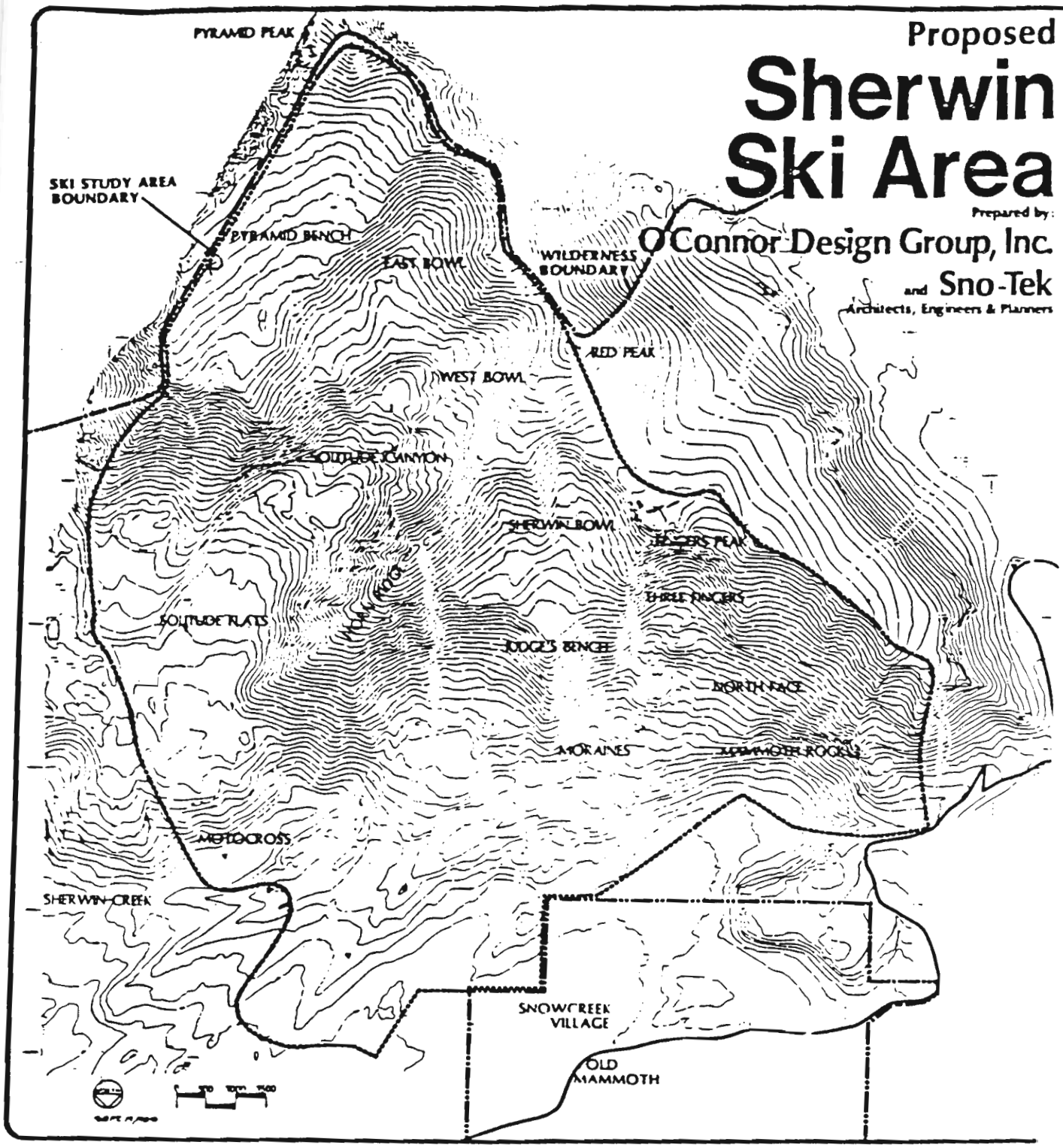


Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

A. Ground surveys.

In order to determine the timing, intensity and duration of deer spring staging activities and the size and "boundaries" of staging area habitat, ground surveys were conducted throughout the lower Chaparral/Sagebrush Scrub portion of the Study Area along two fixed routes (Fig. 3). Route A covered an area south of Sherwin Creek Road and north of the Moto-Cross and east of the trail leading to Mammoth Rock. Route B covered the lower western part of the Study Area from the Mammoth Rock Trail west to the slide area at Hidden Pond, including the Southern edge of the Mammoth Meadow, the United States Forest Service (U.S.F.S.) stock meadow and the gravel pit. On each ground survey all deer observed were counted and classified according to sex and age and their locations plotted on an aerial photo. Any deer sign encountered during a ground survey was also recorded. Transect routes were alternated on consecutive surveys after 13 May 1986, once snow conditions allowed.

In order to determine the timing and intensity of migration through the Study Area, ground surveys were conducted in Solitude Canyon. During the first ground survey into the canyon, a 20 foot long section was cleared to bare dirt on all major deer migration trails. On subsequent surveys into the canyon the amount of fresh sign observed crossing all cleared areas was noted.

B. Telemetry

Radioed animals were located from the ground and from a DFG fixed-wing aircraft. All marked deer observed in or near the Study Area were identified as to wintering area and their locations plotted on an aerial photo. All unmarked deer observed in or near the Study Area were classified according to sex and age and their locations recorded.

C. Road surveys

During spring and early summer of 1985 and 1986, weekly dawn road surveys were conducted from a vehicle in and near the Study Area to determine the timing, pattern and intensity of deer migration (Fig. 4). Each week a fixed route was driven along Sherwin Creek Road, Summers Road and the Moto-Cross Road between U.S. Highway 395 and Old Mammoth Road. During each survey all deer observed were counted and their locations recorded.

Figure 3. Location of the two ground survey routes and the Staging Area within the Sherwin Study Area.

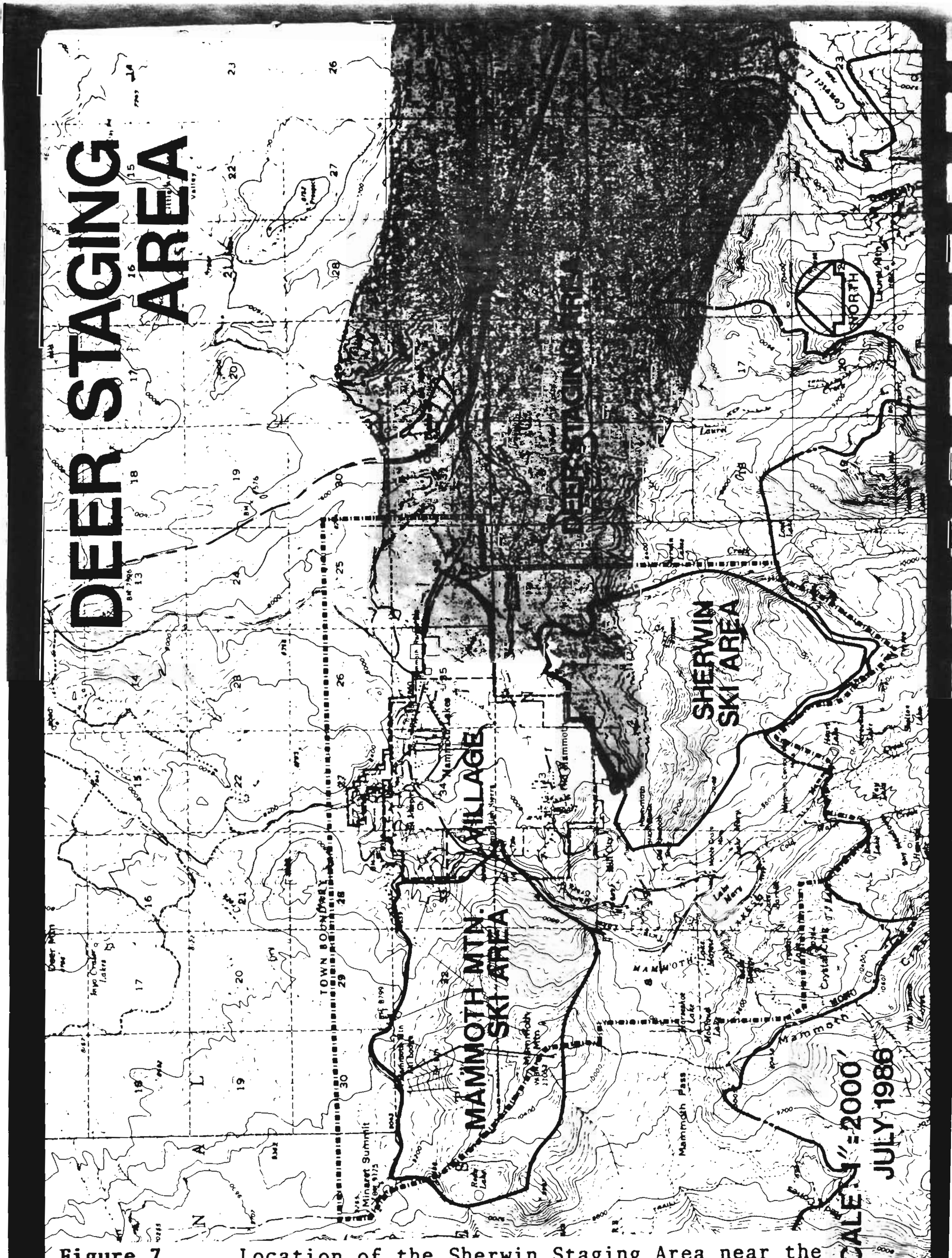
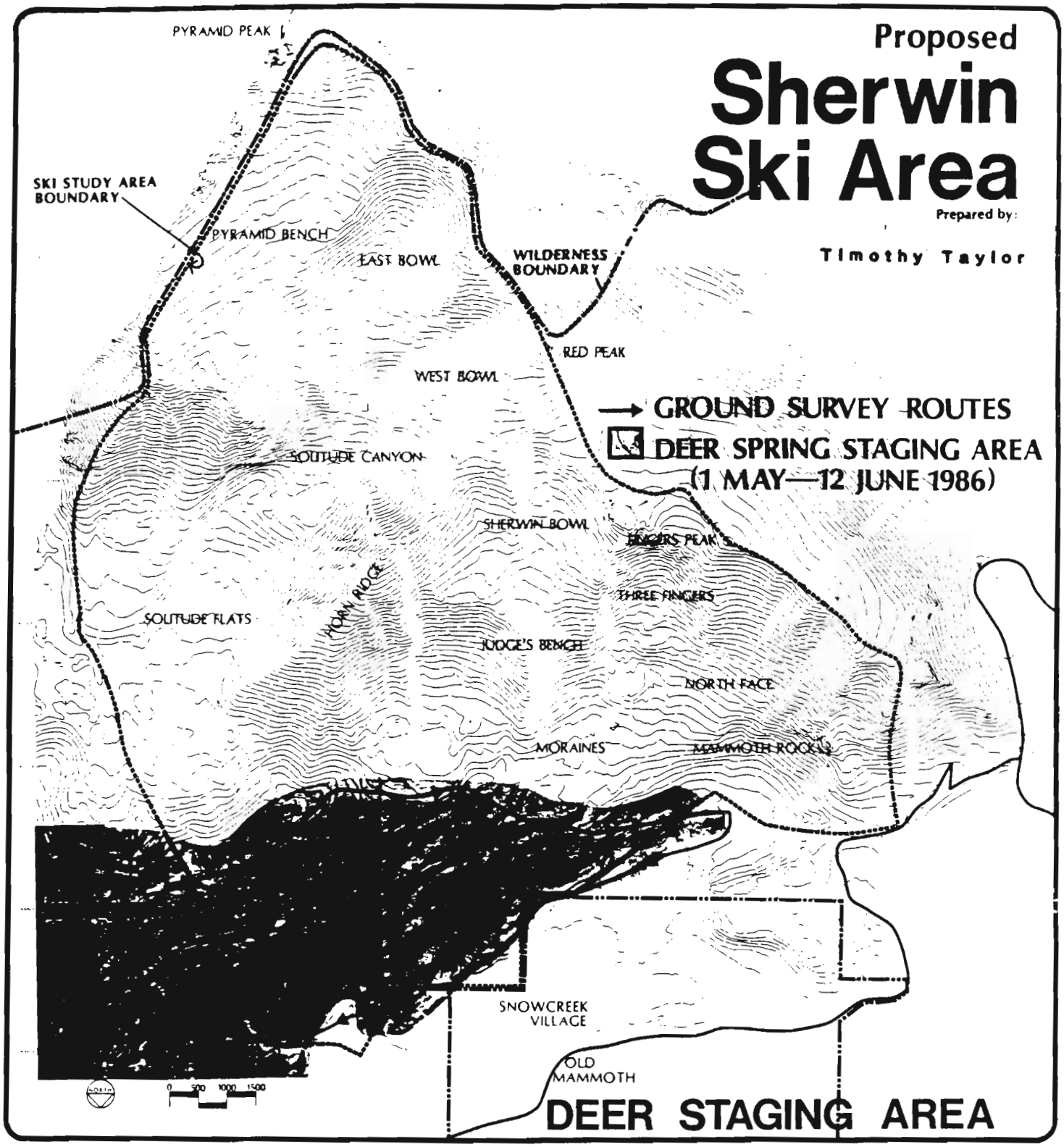


Figure 7. Location of the Sherwin Staging Area near the Town of Mammoth Lakes, California.



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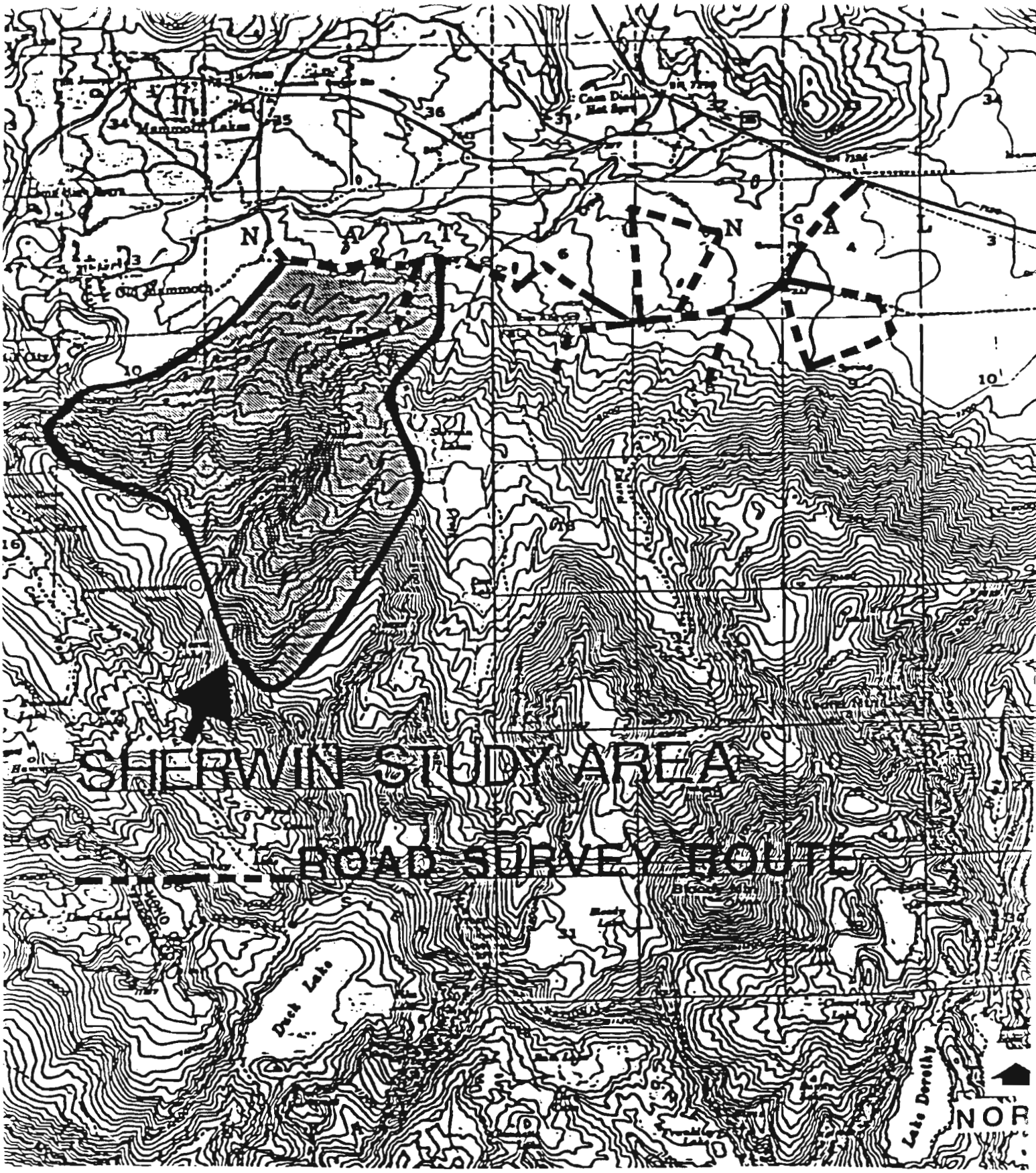

Figure 4. Location of dawn road survey route in and near the Sherwin Study Area.

RESULTS

Spring 1986

A total of 20 ground surveys were conducted throughout the Chaparral/Sagebrush Scrub or staging area portion of the Study Area between 18 April and 18 June 1986 (Fig. 3). Thirteen of these surveys were conducted along route A and 7 surveys along route B. A total of 116 deer were observed along route A during the 13 surveys. The majority of these deer were observed along the eastern border of the Study Area, within a few hundred meters north of the Moto-Cross. Only 17 deer were observed along route B. Of these 17, 10 were observed along the eastern portion of the survey route, 4 just south of the gravel pit area and 3 near the southern edge of the Mammoth Meadow. The greatest number of deer observed on any one survey was 35, seen along route A on 26 May 1986. After 26 May the number of deer and fresh sign observed along both survey routes diminished dramatically. On a survey conducted along route A on 12 June, no deer or fresh sign were observed.

Figure 5 shows the results of the early dawn road surveys conducted in spring 1985 and 1986 (Kucera, Unpublish.). It can be seen that the pattern of 1986 closely resembles that of 1985 with the number of deer counted on the first road surveys of each year being between 300 and 400 and increasing to more than 600 before falling off as animals migrated to their summer ranges. The only differences between the two years exists in the timing and intensity of migration. Road surveys were started eleven days later in 1986 than in 1985 (15 April 1985 and 26 April 1986) and yet the number of deer observed on each of the starting dates were nearly the same. In 1986, the first deer were not observed in the lower portion of the Sherwin Staging Area near Highway 395 until 17 April; the first deer were observed in the Study Area in 1986 on foot on 1 May. In 1985, deer were first observed in the Study Area on foot on 17 April (Kucera 1985). It can also be seen from the road survey data that deer numbers began to decrease approximately 10 days earlier in 1985 than in 1986 as animals started to migrate to their summer ranges.

Another way of determining the temporal pattern of spring migration through or near the Study Area is shown in Figure 6. (Kucera, Unpublish.). Here the cumulative percent of radioed deer crossing the Sierra Crest is plotted by date for the spring

migrations of 1985 and 1986. In 1985, the first radioed deer left the staging area to migrate over the crest on 15 May. Road survey data (Fig. 5) for 1985 show a similar trend with the number of deer counted in the staging area declining after 15 May. In 1986, the first radioed deer migrated over the Sierra Crest on 25 May, 10 days later than in 1985. Despite this difference in the timing of migration between the two years, a higher percentage of radioed deer (62%) had moved over the crest by 1 June 1986 than by the same date in 1985. The road survey results for 1986 (Fig. 5) also display a more rapid departure of animals from the staging area than in 1985, with the number of deer counted decreasing sharply after 23 May.

In spring of 1985, the last radioed deer to cross the Sierra Crest was on 23 June. In spring 1986, the last radioed deer to cross the crest was on 15 June. Despite the extremes found between the two years, the mean crossing date of radioed deer over the crest is the same, 3 June.

Similar results in the timing and intensity of migration for spring 1985 and 1986 can also be shown from data collected on ground surveys conducted in Solitude Canyon and the Mammoth Rock area. In 1985, the first deer sign seen in Solitude Canyon was on 16 May (Kucera 1985); in 1986, the first deer sign observed in Solitude Canyon was on 25 May. The first deer sign observed under Mammoth Rock and near the Lake Mary Road in 1986 was on 23 May.

Figure 7 shows the Sherwin Staging Area near the town of Mammoth Lakes, California. The area extends immediately to the south and east of the Mammoth Lakes Village and includes most of the lower Chaparral/Sagebrush Scrub and mixed conifer portion of the Study Area. Figure 3 better shows the staging area "boundaries" in the study area. They include the southern edge of the Mammoth Meadow to the slide area near Hidden Pond; the U.S.F.S. stock meadow; and about half of the gravel pit area.

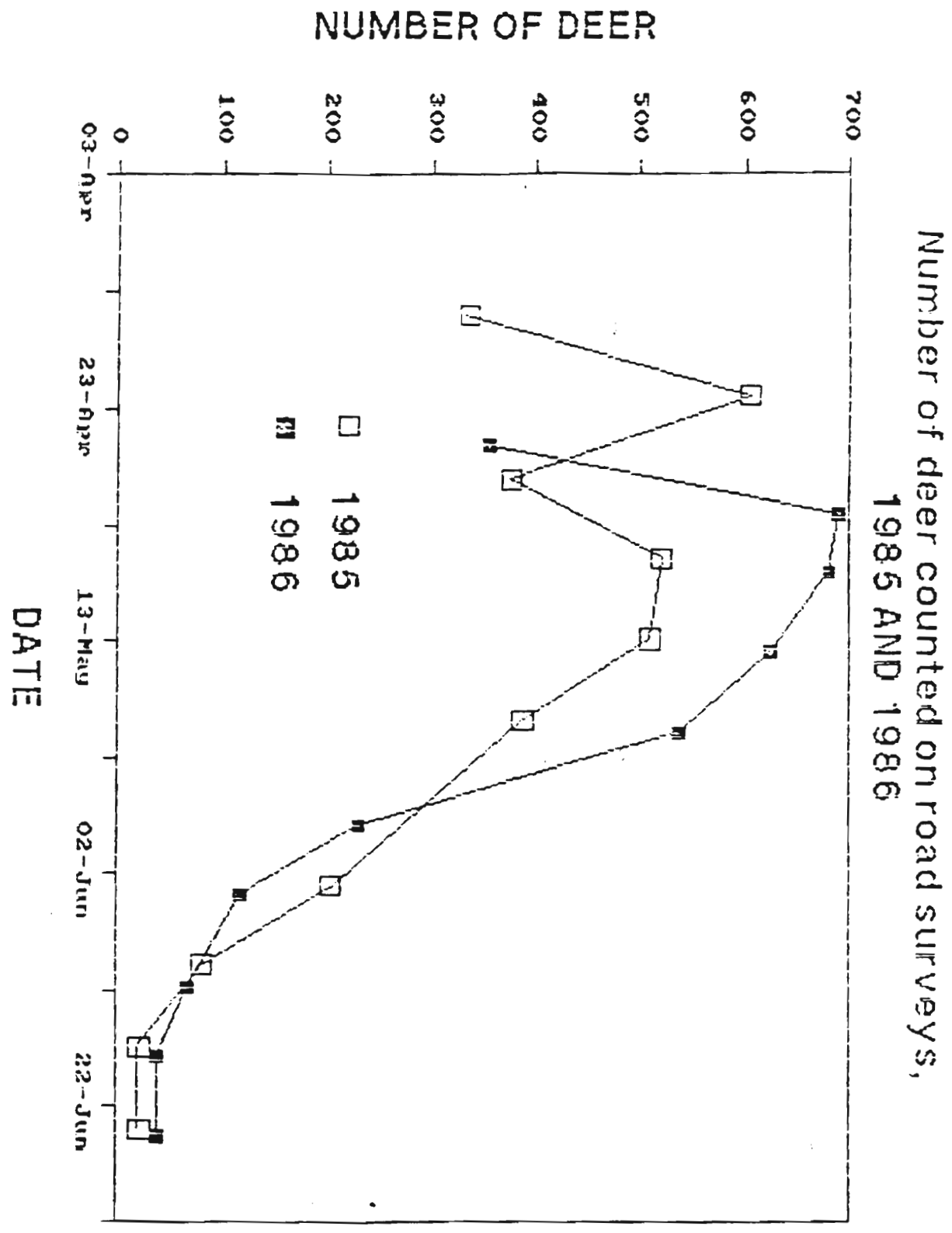

Figure 5. Deer counted on dawn road surveys, Spring 1985 and 1986.

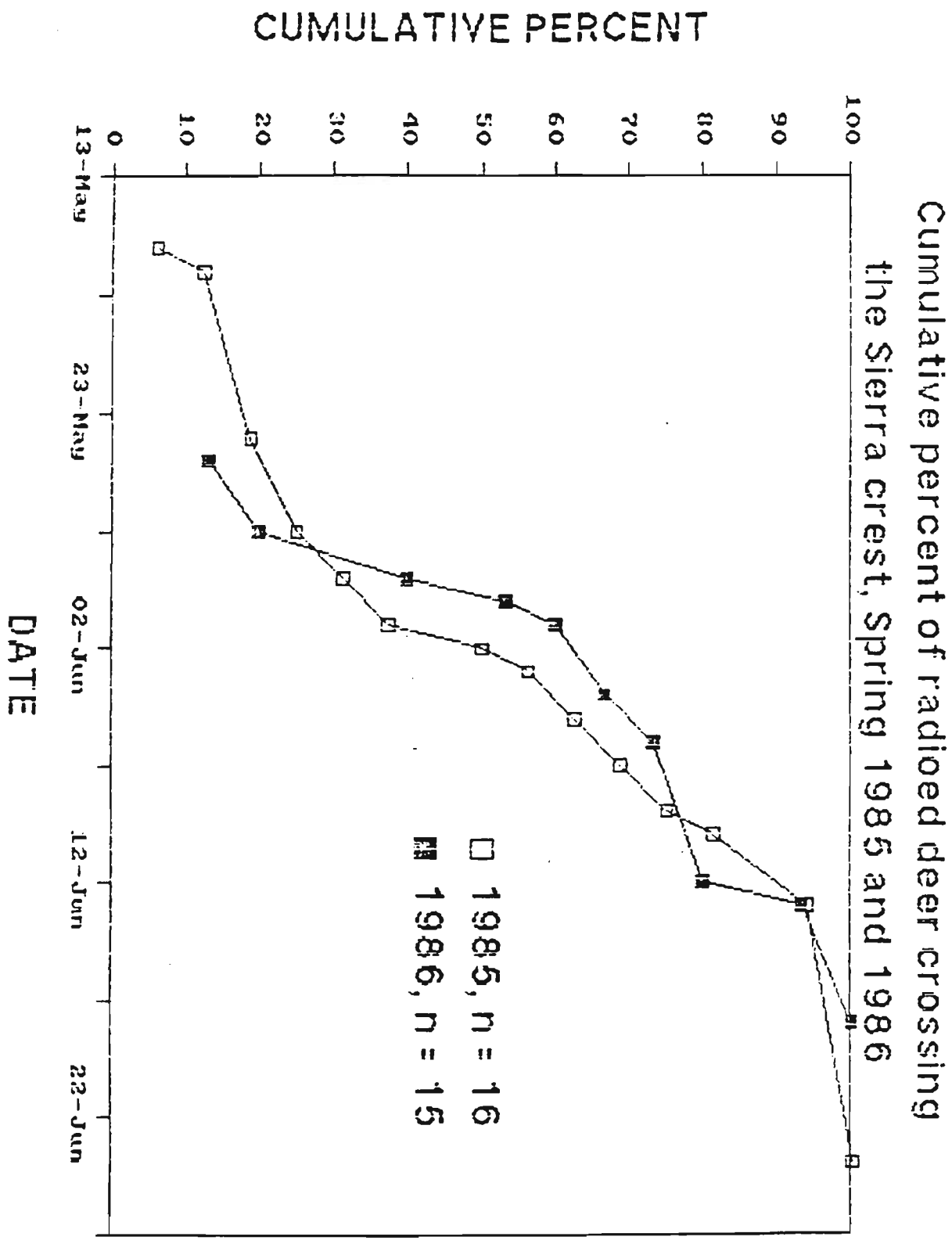

Figure 6. Cumulative percent of radioed deer crossing the Sierra Crest and moving through or near the Study Area by date for Spring 1985 and 1986.

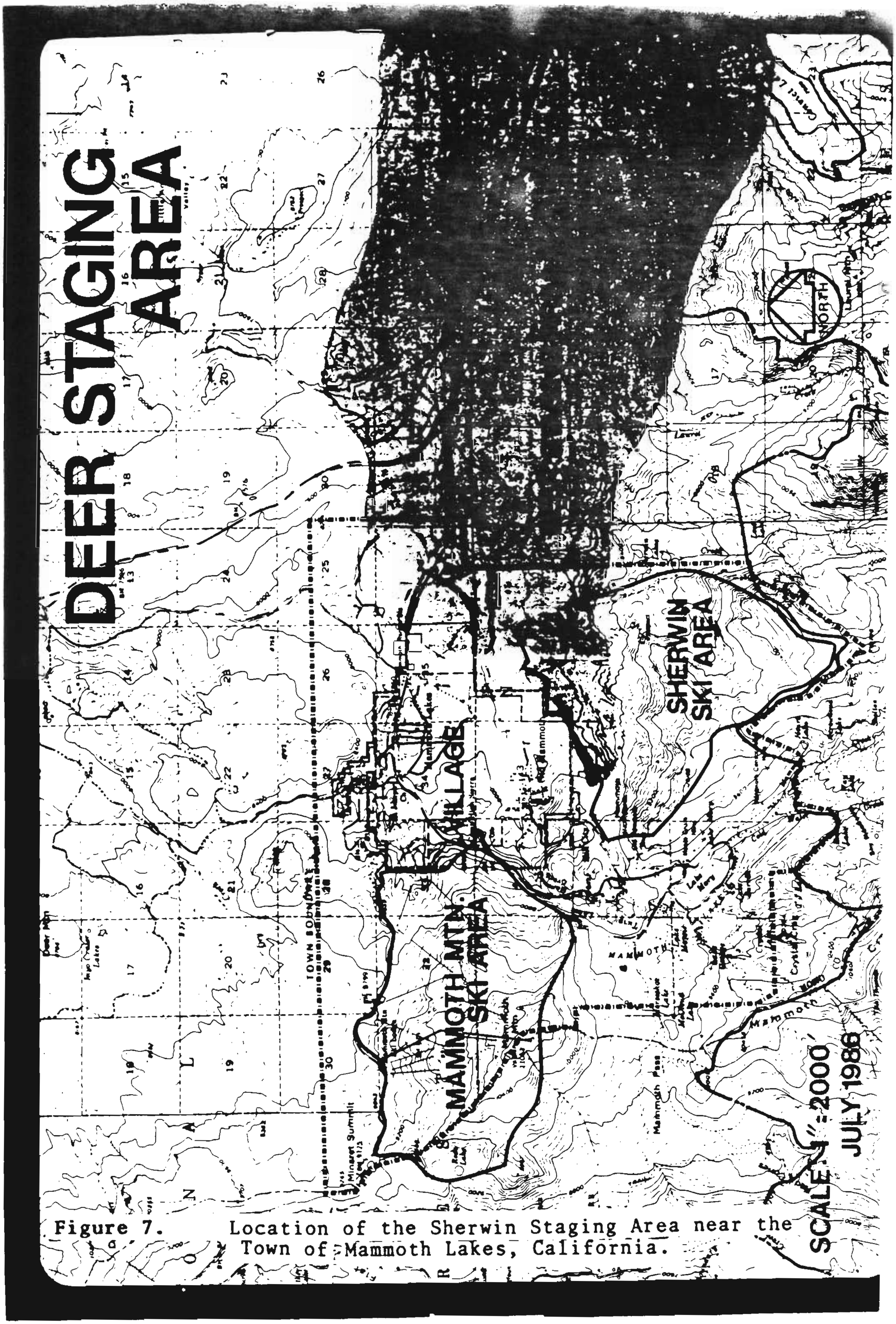

Figure 7. Location of the Sherwin Staging Area near the Town of Mammoth Lakes, California.

DISCUSSION

With the completion of this report comes a third year of data regarding spring deer migration in and around the proposed Sherwin Ski Area. The information in this report combined with two previous years of spring data will help eliminate any guess work that may arise concerning deer migration and staging near Mammoth Lakes.

In spring of 1984 and 1985, deer have left the Round Valley wintering area in early April (Kucera 1985). Because of heavier snow conditions in spring of 1986, deer did not leave the winter range until mid April (Kucera, Unpublish.). Soon after leaving the winter range, deer arrive in the lower portion of the Sherwin Staging Area near Highway 395. Once the first animals arrive in the staging area, deer numbers quickly increase to several thousand by the beginning of May. Deer spend approximately 3 to 6 weeks in the staging area before moving to their western Sierra summer ranges (Kucera 1985).

The enormity and importance of the Sherwin Staging Area should not be underestimated. It occupies a vast amount of land which extends immediately to the south and east of the Mammoth Lakes Village (Fig. 7..), and consists primarily of Chaparral/Sagebrush Scrub and mixed conifer vegetation.

Much of the lower portion of the proposed Sherwin Ski Area consists of these same vegetative types, and is also used by deer for spring staging. The map in Figure 3 shows the "boundaries" of the staging habitat in the Study Area. These "boundaries" cannot be clearly defined and only represent areas of more concentrated deer use.

Only 133 deer were observed during 20 ground surveys conducted throughout the lower staging portion of the Study Area. However, these were only animals visable from the transect line. Undoubtedly, due to uneven, broken terrain and the presence of free roaming dogs seen in the Mammoth Meadow and the U.S.F.S. stock meadow, many deer in the Study Area in spring 1986 were not observed.

In spring of 1984, the first deer were observed in the Study Area on 20 April; in 1985, the first deer were observed in the Study Area on 17 April. Both spring of 1984 and 1985 followed winters of

normal snowfall amounts in the Mammoth area. In the winter of 1983-84, 169.5 total inches of snowfall were measured between October and May at a location near the Study Area with an elevation of approximately 8,000 feet. Between October and May in the winter of 1984-85, 224.0 total inches of snowfall were measured at the same location (U.S.F.S., Unpublish.).

In the winter of 1985-86, one of above average snowfall and precipitation, 294.3 inches of snow were recorded between October and May. In spring 1986, deer arrived in the Sherwin Staging Area near Highway 395 several days later than in spring 1984 and 1985. The first deer were observed in the Study Area approximately two weeks later in spring 1986 than in 1984 and 1985. Deer were also found to migrate through the Study Area exactly 10 days later in 1986 than in 1985.

These differences in the timing of migration over the last three years are undoubtedly related directly to the amount of snow remaining on the ground in the spring. In spring of 1986, a considerably greater amount of snow covered the east slope of the Sierra than in 1984 or 1985, thus resulting in a later migration. Wallmo (1981) also noted that movements of migratory animals, although habitual, maybe accelerated or delayed by unseasonal snowfalls or melts of the snow blanket.

If this information is to be used to predict the timing of future spring migrations, it should be remembered that it can only be used when applied to spring seasons of identical climatic conditions.

SHERWIN SKI AREA DEER STUDY

SPRING REPORT

August 1986

Timothy Taylor

LIST OF FIGURES

INTRODUCTION

The proposal to develop the Sherwin Ski Area in Mammoth Lakes, Mono County, California (Fig. 1) has generated much concern over potential adverse impacts of this development on migratory Rocky Mountain mule deer (Odocoileus hemionus hemionus). Extensive information regarding deer and other wildlife use in the area was collected for the ski area feasibility study in 1984 and 1985 (Kucera 1985). In the spring and fall of 1986, additional information regarding deer migration within the proposed Sherwin Ski Area was collected (Taylor 1986). The objective of the present work is to gather site-specific information regarding the timing, pattern, and intensity of deer migration within the proposed Sherwin Ski Area in the spring and fall of 1987. The information presented in this report combined with spring migration data from 1984, 1985, and 1986 will be used by resource managers for the purpose of avoiding potential conflicts between deer migration and ski area operation activities.

ACKNOWLEDGEMENTS

The investigator is currently working under contract the Dempsey Construction Corporation of Mammoth Lakes, California, with cooperation of the United States Forest Service (USFS) and the California Department of Fish and Game (DFG).

STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10 - 15, 23 and 24 of T. 4 S, R. 28 E, in the Mammoth Ranger District Inyo National Forest (Fig. 2) (Kucera 1985). The area comprises approximately 2,000 acres of steep, generally north-facing terrain, varying in elevation from 8,000 to 11.000 feet, and lies between the Sherwin Creek drainage on the east and the Mammoth Lakes Basin on the west.

Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

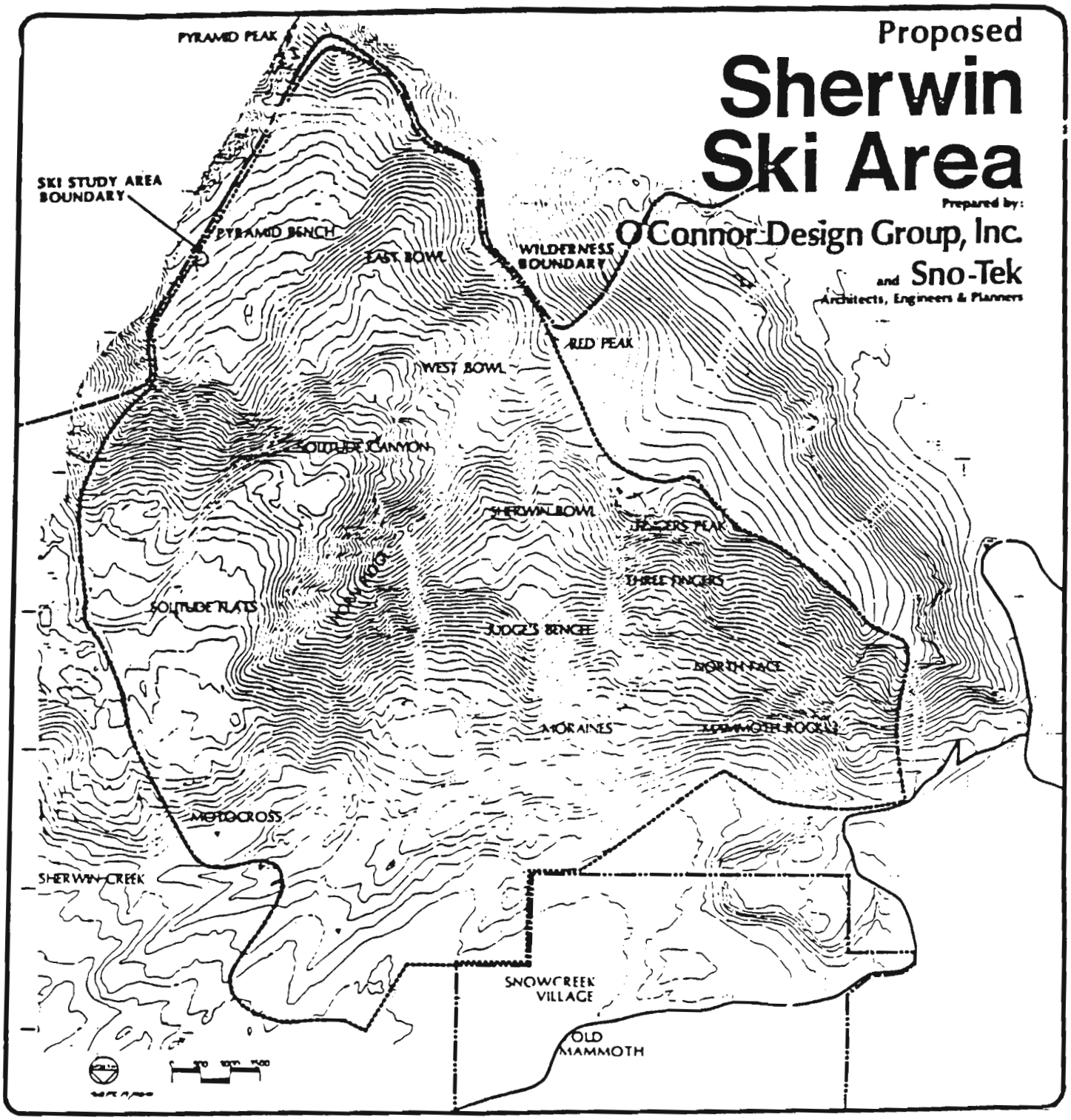

Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

In order to determine the timing, pattern, and duration of deer migration through the Study Area in the spring of 1987, ground surveys were conduct in Solitude Canyon and near Mammoth Rock between 1 May and 30 June 1987. Prior to any deer movements through the Study Area, a twenty foot section of each major migration trail was cleared to bare ground. On each survey all deer trails were inspected and an attempt was made to quantify the number of tracks crossing each cleared area. All cleared areas were brushed clean of tracks and debris after each survey. All deer observed during ground surveys were counted and classified according to sex and a

RESULTS

Spring 1987

A total of 22 ground surveys, 16 in Solitude Canyon and 6 near Mammoth Rock, were conducted between 29 April and 27 June 1987. Ground surveys were conducted in Solitude Canyon on 29 April, and 5, 9, 11, 13, 14, 15, 19, and 25 May and 1, 3, 8, 11, 16, 22, and 27 June. Within the vicinit of Mammoth Rock, surveys were conducted on 29 April, and 5, 11, and 15 M and 8 and 11 June.

In the winter of 1986-87, a total of 100.7 inches of snowfall was record at the Mammoth Ranger Station, elevation 7,800 feet (U.S.F.S., Unpublish In the spring of 1987, the first deer were observed in the lower, stagin area portion of the Study Area on 14 April. Deer sign was first observe in Solitude Canyon and Solitude Pass on 14 May. The peak of deer moveme through Solitude Canyon in spring of 1987 occurred approximately between May and 3 June. After 3 June, deer movement through Solitude Canyon continued on a gradually declining basis until 22 June. On a ground sur conducted on 27 June, no deer or fresh deer sign was observed in Solitud Canyon. The first migratory deer sign observed in the vicinity of Mamm Rock and the Lake Mary Road was on 11 May.

In the winter of 1985-86, a total of 294.3 inches of snowfall was recorc at the Mammoth Ranger Station (U.S.F.S., Unpublish.). In the spring of 1986, the first deer were observed in the lower portion of the Study Are near Sherwin Road on 1 May (Taylor 1986). The first deer sign observed Solitude Canyon and over Solitude Pass in spring 1986 was on 25 May. Th peak of deer movement through Solitude Canyon in spring 1986 was approximately between 25 May and 10 June. Deer movement through Solitud Canyon in spring of 1986 continued until 24 June, after which no deer or fresh sign was observed. The first deer sign observed on migration tra in the Study Area leading toward Mammoth Pass was on 23 May.

In the winter of 1984-85, 224.0 total inches of snowfall was recorded at the Mammoth Station (U.S.F.S., Unpublish.). Deer were first observed in the lower portion of the Study Area near Sherwin Road in the spring of 1985 on 17 April (Kucera 1985). The first deer sign observed in Solitude Canyon and Solitude Pass in spring 1985 was on 16 May. According to radio telemetry data (Kucera 1985), deer movement through Solitude Canyon in spring 1985 continued until approximately 24 June. Also, in spring 1985, deer first began leaving the Study Area and migrating over Mammoth Pass on approximately 16 May.

In the winter of 1983-84, 264.0 total inches of snowfall was recorded at the Mammoth Ranger Station (U.S.F.S., Unpublish.). For the spring of 1984, no data exists on the dates in which deer first began migrating through the Study Area. However, because 264.0 inches of snowfall lies between total amounts recorded for the winters of 1984-85 (224.0 inches) and 1986-87 (294.3 inches), it seems logical to assume that deer movement through Solitude Canyon in the spring of 1984 probably began sometime between 16 and 25 May. It can also be assumed from data collected in spring 1985, 1986, and 1987 that deer movement through Solitude Canyon in spring 1984 probably ended by no later than 24 June.

DISCUSSION

In the winter of 1985-86, one of above average snowfall and precipitation, 293.4 inches of snow were recorded between October and May. In the winter of 1986-87, one of below average snowfall, 100.7 inches of snow were recorded within the same time period. Thus, the winters of 1985-86 and 1986-87 represent two extremes in total snowfall amounts for the eastern Sierra. Despite these differences, only 11 days separate the dates in which deer first began moving through Solitude Canyon and over Solitude Pass. It can also be seen from spring migration data collected over the last three years that very little difference exists within the timing at which deer movements through Solitude Canyon ended.

Throughout the last three years a difference of only 12 days separate the timing in which deer first began migrating past Mammoth Rock toward the Mammoth Lakes Basin and Mammoth Pass.

Regardless of the amount of snowfall received during any one winter, it is probably safe to assume from data collected over the last three years that spring deer migration through the Study Area will begin no earlier than the first week in May and end no later than 1 June. Provided the Sherwin Ski Area is developed, the data collected over the last three years should be used by ski area officials and resource managers for the purpose of eliminating any conflicts between deer migration and ski area activities. The spring migration data presented in this report should serve as a foundation by which guidelines governing the timing of ski area operations can be established.

LITERATURE CITED

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Taylor, T. J. 1986. Sherwin Ski Area Deer Study - Spring Report. Typescript. Pp. 3 - 16.

U.S.F.S., 1983-87. Unpublished. United States Forest Service, Mammoth Lakes, Mono County, California 93546.

Ron Thomas

SHERWIN SKI AREA DEER STUDY

SPRING REPORT

August 1986

Timothy Taylor

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Recent wildlife research in the proposed Sherwin Ski Area in Mammoth Lakes, Mono County, California (Fig. 1) has generated much concern over potential adverse impacts of this development upon migratory Rocky Mountain mule deer (Odocoileus hemionus). Although extensive information regarding mule deer use within the proposed ski area has already been collected (Kucera 1985), additional data is needed to better determine:

1. the timing, pattern, duration and intensity of mule deer use within the boundaries of the proposed Sherwin Ski Area during the spring and fall migrations of 1986, and

2. the size and "boundaries" of deer spring staging habitat within the proposed Sherwin Ski Area.

This report will be used as an addendum to the 1984 and 1985 Sherwin Ski Area Deer and Wildlife Study recently completed by Thomas E. Kucera.

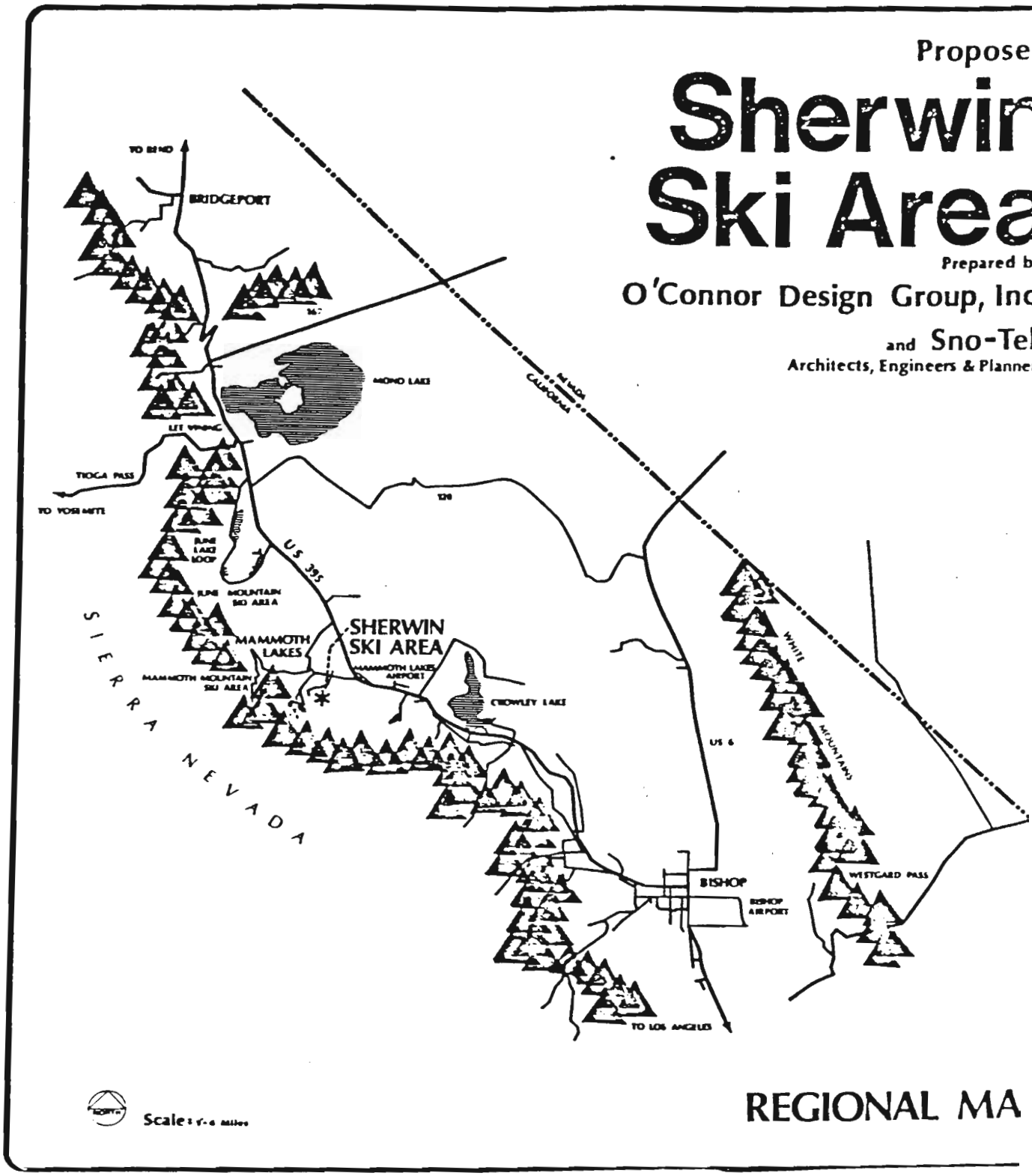

Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

INTRODUCTION

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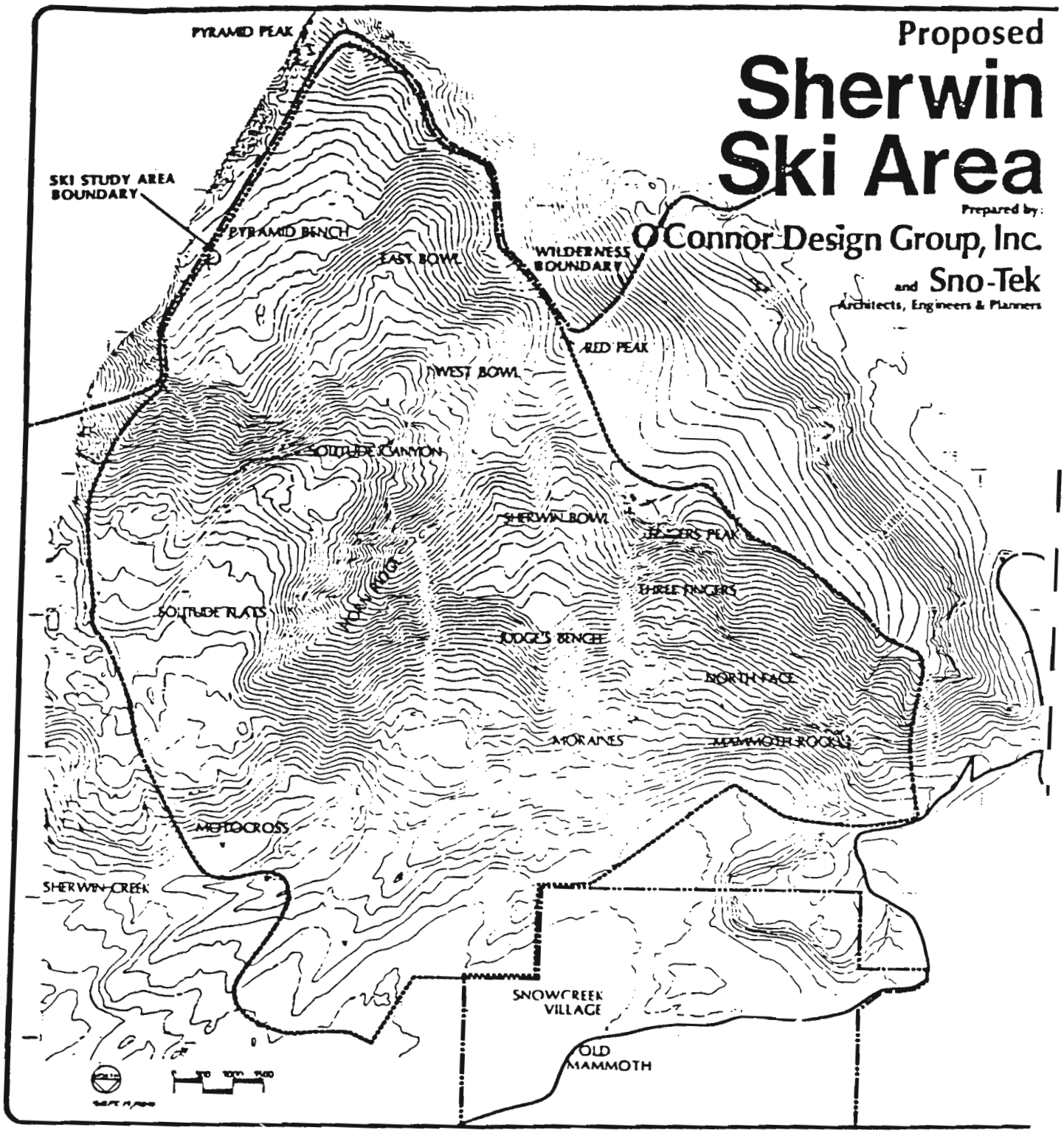

Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

A. Ground surveys.

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In order to determine the timing and intensity of migration through the Study Area, ground surveys were conducted in Solitude Canyon. During the first ground survey into the canyon, a 20 foot long section was cleared to bare dirt on all major deer migration trails. On subsequent surveys into the canyon the amount of fresh sign observed crossing all cleared areas was noted.

B. Telemetry

Radioed animals were located from the ground and from a DFG fixed-wing aircraft. All marked deer observed in or near the Study Area were identified as to wintering area and their locations plotted on an aerial photo. All unmarked deer observed in or near the Study Area were classified according to sex and age and their locations recorded.

C. Road surveys

During spring and early summer of 1985 and 1986, weekly dawn road surveys were conducted from a vehicle in and near the Study Area to determine the timing, pattern and intensity of deer migration (Fig. 4). Each week a fixed route was driven along Sherwin Creek Road, Summers Road and the Moto-Cross Road between U.S. Highway 395 and Old Mammoth Road. During each survey all deer observed were counted and their locations recorded.

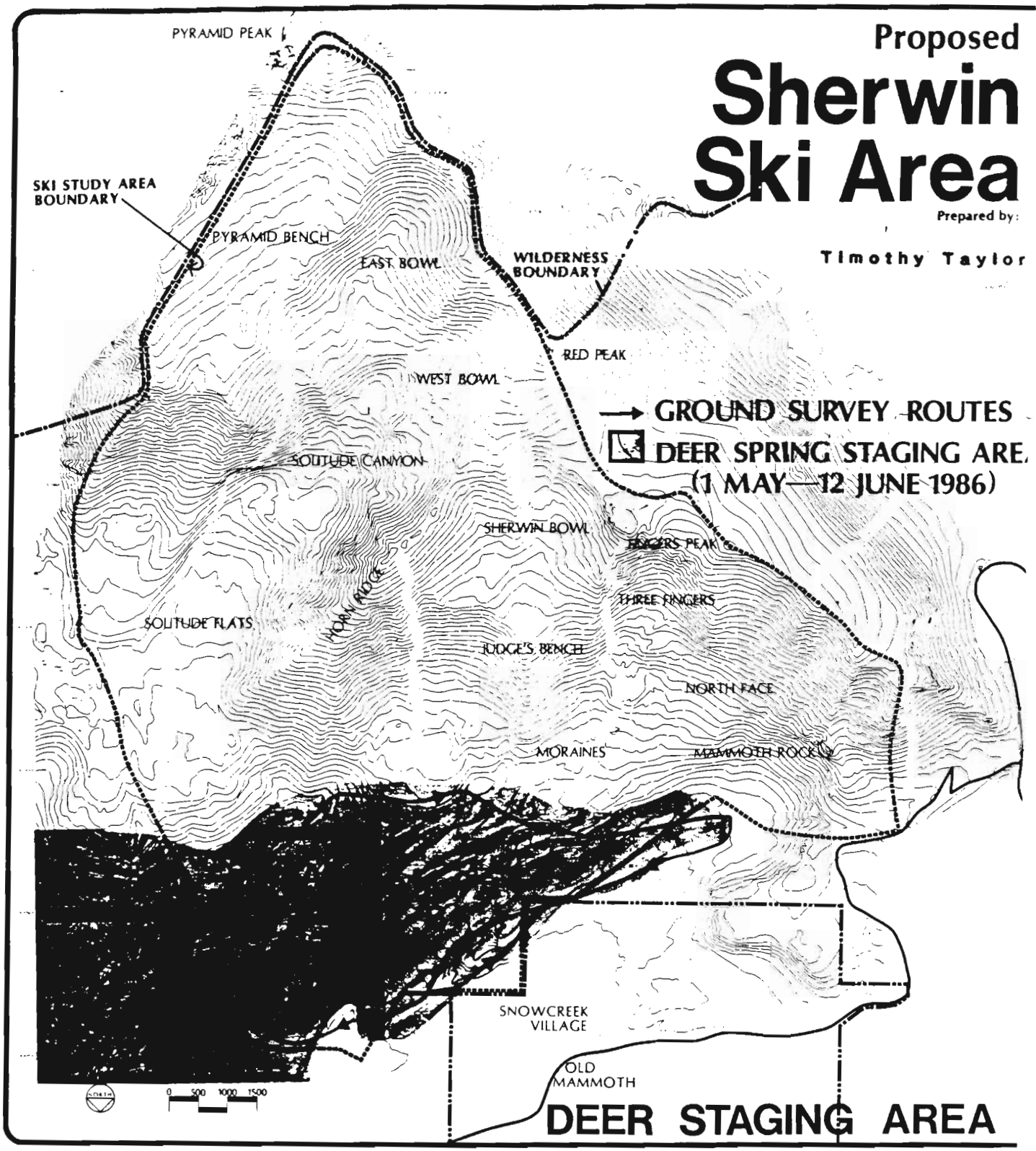

Figure 3. Location of the two ground survey routes and the Staging Area within the Sherwin Study Area.

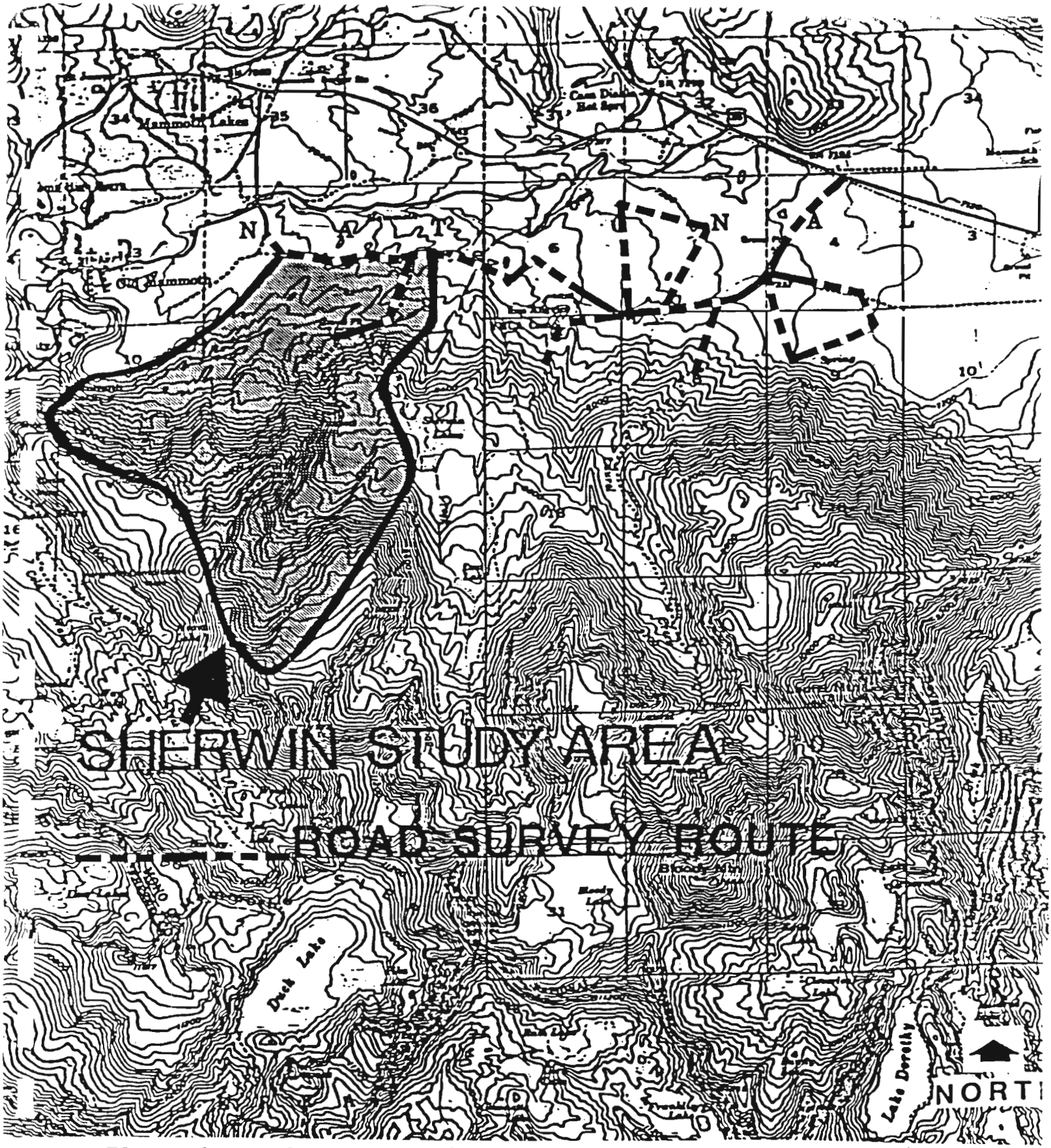

Figure 4. Location of dawn road survey route in and near the Sherwin Study Area.

RESULTS

Spring 1986

A total of 20 ground surveys were conducted throughout the Chaparral/Sagebrush Scrub or staging area portion of the Study Area between 18 April and 18 June 1986 (Fig. 3). Thirteen of these surveys were conducted along route A and 7 surveys along route B. A total of 116 deer were observed along route A during the 13 surveys. The majority of these deer were observed along the eastern border of the Study Area, within a few hundred meters north of the Moto-Cross. Only 17 deer were observed along route B. Of these 17, 10 were observed along the eastern portion of the survey route, 4 just south of the gravel pit area and 3 near the southern edge of the Mammoth Meadow. The greatest number of deer observed on any one survey was 35, seen along route A on 26 May 1986. After 26 May the number of deer and fresh sign observed along both survey routes diminished dramatically. On a survey conducted along route A on 12 June, no deer or fresh sign were observed.

Figure 5 shows the results of the early dawn road surveys conducted in spring 1985 and 1986 (Kucera, Unpublish.). It can be seen that the pattern of 1986 closely resembles that of 1985 with the number of deer counted on the first road surveys of each year being between 300 and 400 and increasing to more than 600 before falling off as animals migrated to their summer ranges. The only differences between the two years exists in the timing and intensity of migration. Road surveys were started eleven days later in 1986 than in 1985 (15 April 1985 and 26 April 1986) and yet the number of deer observed on each of the starting dates were nearly the same. In 1986, the first deer were not observed in the lower portion of the Sherwin Staging Area near Highway 395 until 17 April; the first deer were observed in the Study Area in 1986 on foot on 1 May. In 1985, deer were first observed in the Study Area on foot on 17 April (Kucera 1985). It can also be seen from the road survey data that deer numbers began to decrease approximately 10 days earlier in 1985 than in 1986 as animals started to migrate to their summer ranges.

Another way of determining the temporal pattern of spring migration through or near the Study Area is shown in Figure 6. (Kucera, Unpublish.). Here the cumulative percent of radioed deer crossing the Sierra Crest is plotted by date for the spring

migrations of 1985 and 1986. In 1985, the first radioed deer left the staging area to migrate over the crest on 15 May. Road survey data (Fig. 5) for 1985 show a similar trend with the number of deer counted in the staging area declining after 15 May. In 1986, the first radioed deer migrated over the Sierra Crest on 25 May, 10 days later than in 1985. Despite this difference in the timing of migration between the two years, a higher percentage of radioed deer (62%) had moved over the crest by 1 June 1986 than by the same date in 1985. The road survey results for 1986 (Fig. 5) also display a more rapid departure of animals from the staging area than in 1985, with the number of deer counted decreasing sharply after 23 May.

In spring of 1985, the last radioed deer to cross the Sierra Crest was on 23 June. In spring 1986, the last radioed deer to cross the crest was on 15 June. Despite the extremes found between the two years, the mean crossing date of radioed deer over the crest is the same, 3 June.

Similar results in the timing and intensity of migration for spring 1985 and 1986 can also be shown from data collected on ground surveys conducted in Solitude Canyon and the Mammoth Rock area. In 1985, the first deer sign seen in Solitude Canyon was on 16 May (Kucera 1985); in 1986, the first deer sign observed in Solitude Canyon was on 25 May. The first deer sign observed under Mammoth Rock and near the Lake Mary Road in 1986 was on 23 May.

Figure 7 shows the Sherwin Staging Area near the town of Mammoth Lakes, California. The area extends immediately to the south and east of the Mammoth Lakes Village and includes most of the lower Chaparral/Sagebrush Scrub and mixed conifer portion of the Study Area. Figure 3 better shows the staging area "boundaries" in the study area. They include the southern edge of the Mammoth Meadow to the slide area near Hidden Pond; the U.S.F.S. stock meadow; and about half of the gravel pit area.

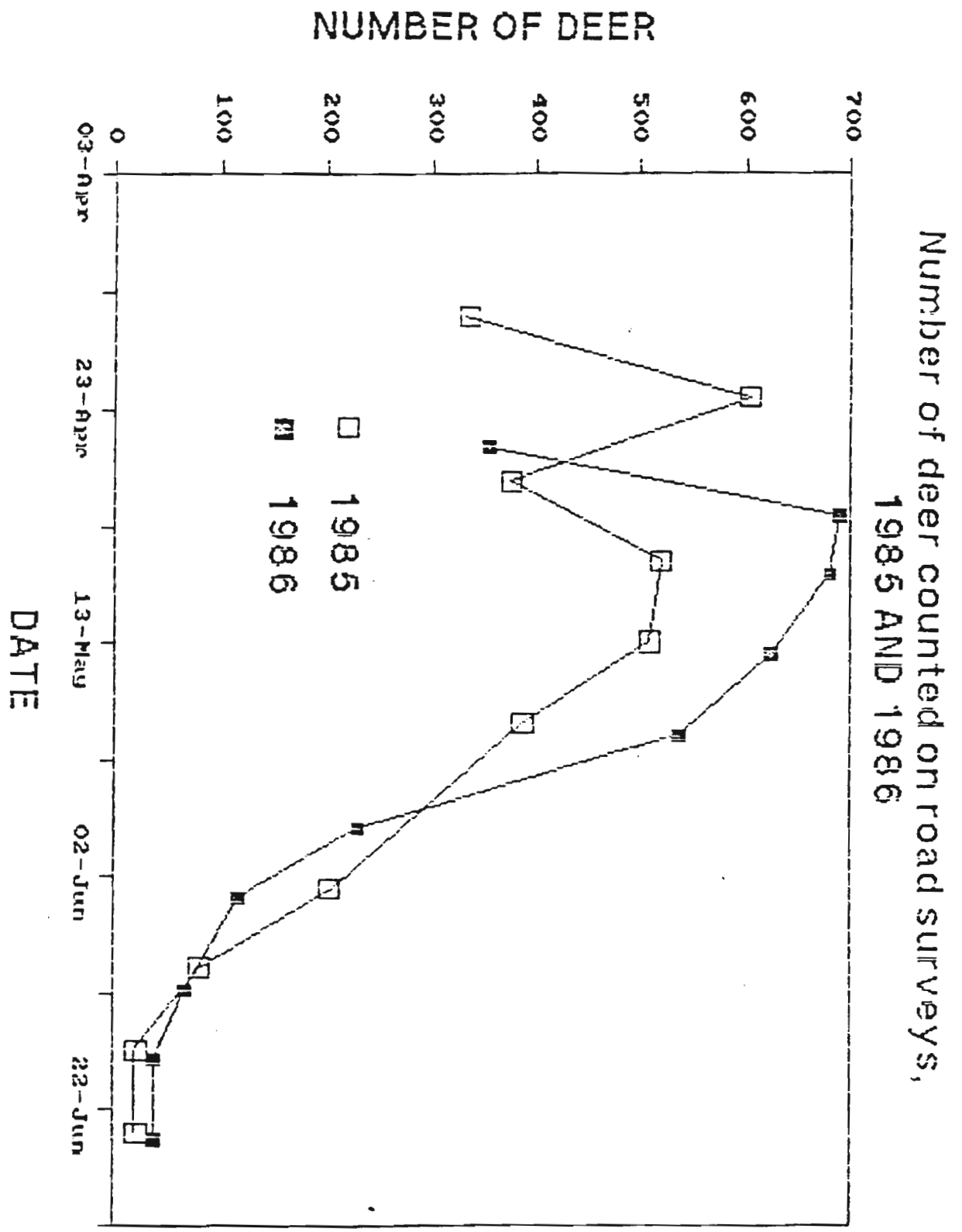

Figure 5. Deer counted on dawn road surveys, Spring 1985 and 1986.

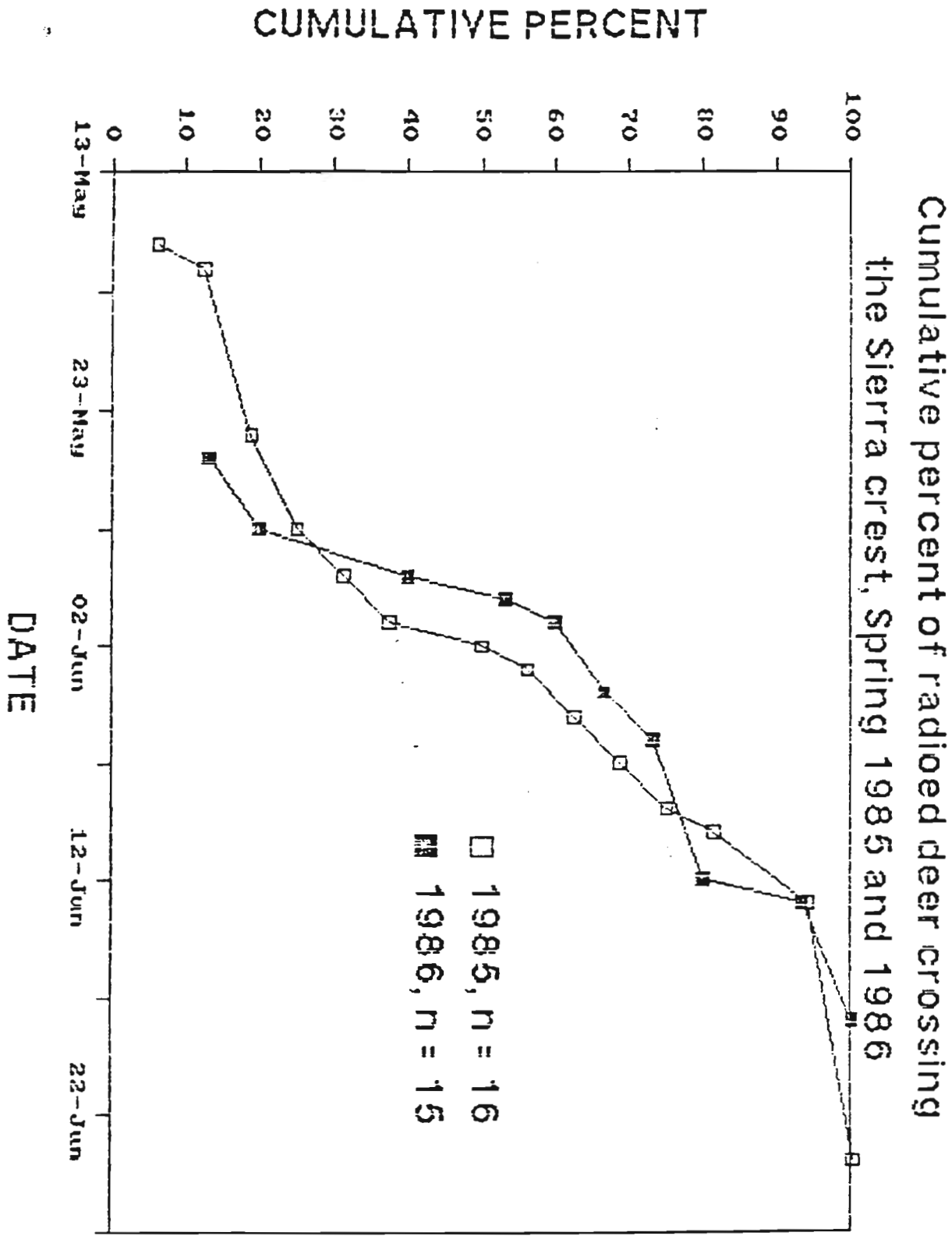

Figure 6. Cumulative percent of radioed deer crossing the Sierra Crest and moving through or near the Study Area by date for Spring 1985 and 1986.

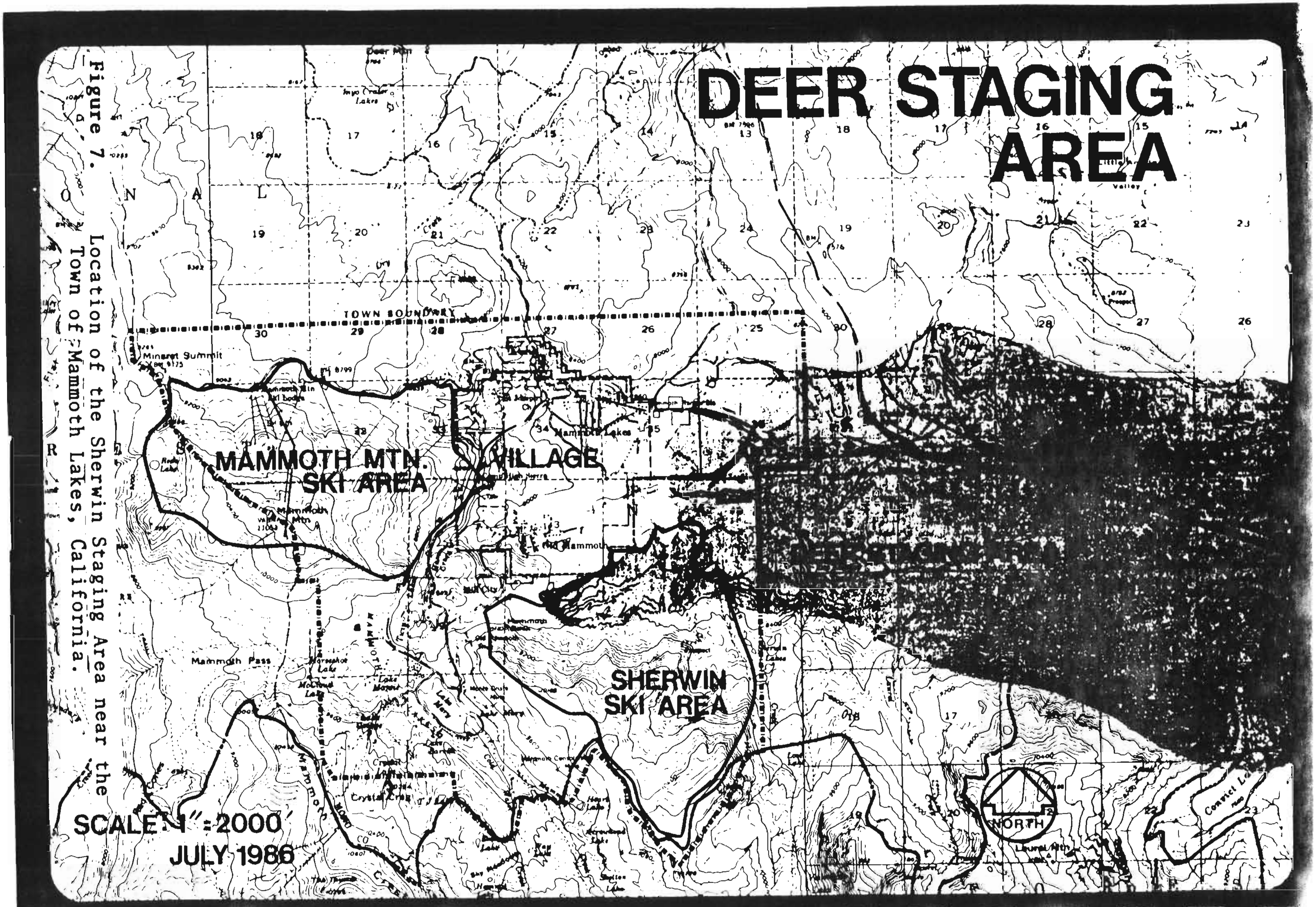

Figure 7. Location of the Sherwin Staging Area near the Town of Mammoth Lakes, California.

DISCUSSION

With the completion of this report comes a third year of data regarding spring deer migration in and around the proposed Sherwin Ski Area. The information in this report combined with two previous years of spring data will help eliminate any guess work that may arise concerning deer migration and staging near Mammoth Lakes.

In spring of 1984 and 1985, deer have left the Round Valley wintering area in early April (Kucera 1985). Because of heavier snow conditions in spring of 1986, deer did not leave the winter range until mid April (Kucera, Unpublish.). Soon after leaving the winter range, deer arrive in the lower portion of the Sherwin Staging Area near Highway 395. Once the first animals arrive in the staging area, deer numbers quickly increase to several thousand by the beginning of May. Deer spend approximately 3 to 6 weeks in the staging area before moving to their western Sierra summer ranges (Kucera 1985).

The enormity and importance of the Sherwin Staging Area should not be underestimated. It occupies a vast amount of land which extends immediately to the south and east of the Mammoth Lakes Village (Fig. 7..), and consists primarily of Chaparral/Sagebrush Scrub and mixed conifer vegetation.

Much of the lower portion of the proposed Sherwin Ski Area consists of these same vegetative types, and is also used by deer for spring staging. The map in Figure 3 shows the "boundaries" of the staging habitat in the Study Area. These "boundaries" cannot be clearly defined and only represent areas of more concentrated deer use.

Only 133 deer were observed during 20 ground surveys conducted throughout the lower staging portion of the Study Area. However, these were only animals visable from the transect line. Undoubtedly, due to uneven, broken terrain and the presence of free roaming dogs seen in the Mammoth Meadow and the U.S.F.S. stock meadow, many deer in the Study Area in spring 1986 were not observed.

In spring of 1984, the first deer were observed in the Study Area on 20 April; in 1985, the first deer were observed in the Study Area on 17 April. Both spring of 1984 and 1985 followed winters of

normal snowfall amounts in the Mammoth area. In the winter of 1983-84, 169.5 total inches of snowfall were measured between October and May at a location near the Study Area with an elevation of approximately 8,000 feet. Between October and May in the winter of 1984-85, 224.0 total inches of snowfall were measured at the same location (U.S.F.S., Unpublish.).

In the winter of 1985-86, one of above average snowfall and precipitation, 294.3 inches of snow were recorded between October and May. In spring 1986, deer arrived in the Sherwin Staging Area near Highway 395 several days later than in spring 1984 and 1985. The first deer were observed in the Study Area approximately two weeks later in spring 1986 than in 1984 and 1985. Deer were also found to migrate through the Study Area exactly 10 days later in 1986 than in 1985.

These differences in the timing of migration over the last three years are undoubtedly related directly to the amount of snow remaining on the ground in the spring. In spring of 1986, a considerably greater amount of snow covered the east slope of the Sierra than in 1984 or 1985, thus resulting in a later migration. Wallmo (1981) also noted that movements of migratory animals, although habitual, maybe accelerated or delayed by unseasonal snowfalls or melts of the snow blanket.

If this information is to be used to predict the timing of future spring migrations, it should be remembered that it can only be used when applied to spring seasons of identical climatic conditions.

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Preliminary summary of deer research completed by Timothy Taylor in the proposed Sherwin Ski Area for 17 April 1986 through 29 April 1986.

SHERWIN SKI AREA DEER STUDY

SPRING REPORT

JULY 1988

Timothy J. Taylor

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The proposal to develop the Sherwin Ski Area in Mammoth Lakes, Mono County, California (Fig. 1) has generated much concern over potential adverse impacts of this development on migratory Rocky Mountain mule deer (Odocoileus hemionus hemionus). Extensive information regarding deer and other wildlife use in the area was collected for the ski area feasibility study in 1984 and 1985 (Kucera 1985). In the spring and fall of 1986 and 1987 additional information regarding deer migration within the proposed Sherwin Ski Area was collected (Taylor 1986, Taylor 1987)). The objective of the present work is to gather site-specific information regarding the timing, pattern, and intensity of deer migration within the proposed Sherwin Ski Area in the spring and fall of 1988. The information presented in this report combined with spring migration data from 1984, 1985, 1986, and 1987 should be used by resource managers for the purpose of avoiding potential conflicts between deer migration and ski area operation activities.

ACKNOWLEDGEMENTS

The investigator is currently working under contract the Dempsey Construction Corporation of Mammoth Lakes, California, with cooperation of the United States Forest Service (USFS) and the California Department of Fish and Game (DFG).

STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10 - 15, 23 and 24 of T. 4 S, R. 28 E, in the Mammoth Ranger District Inyo National Forest (Fig. 2) (Kucera 1985). The area comprises approximately 2,000 acres of steep, generally north-facing terrain, varying in elevation from 8,000 to 11.000 feet, and lies between the Sherwin Creek drainage on the east and the Mammoth Lakes Basin on the west.

Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

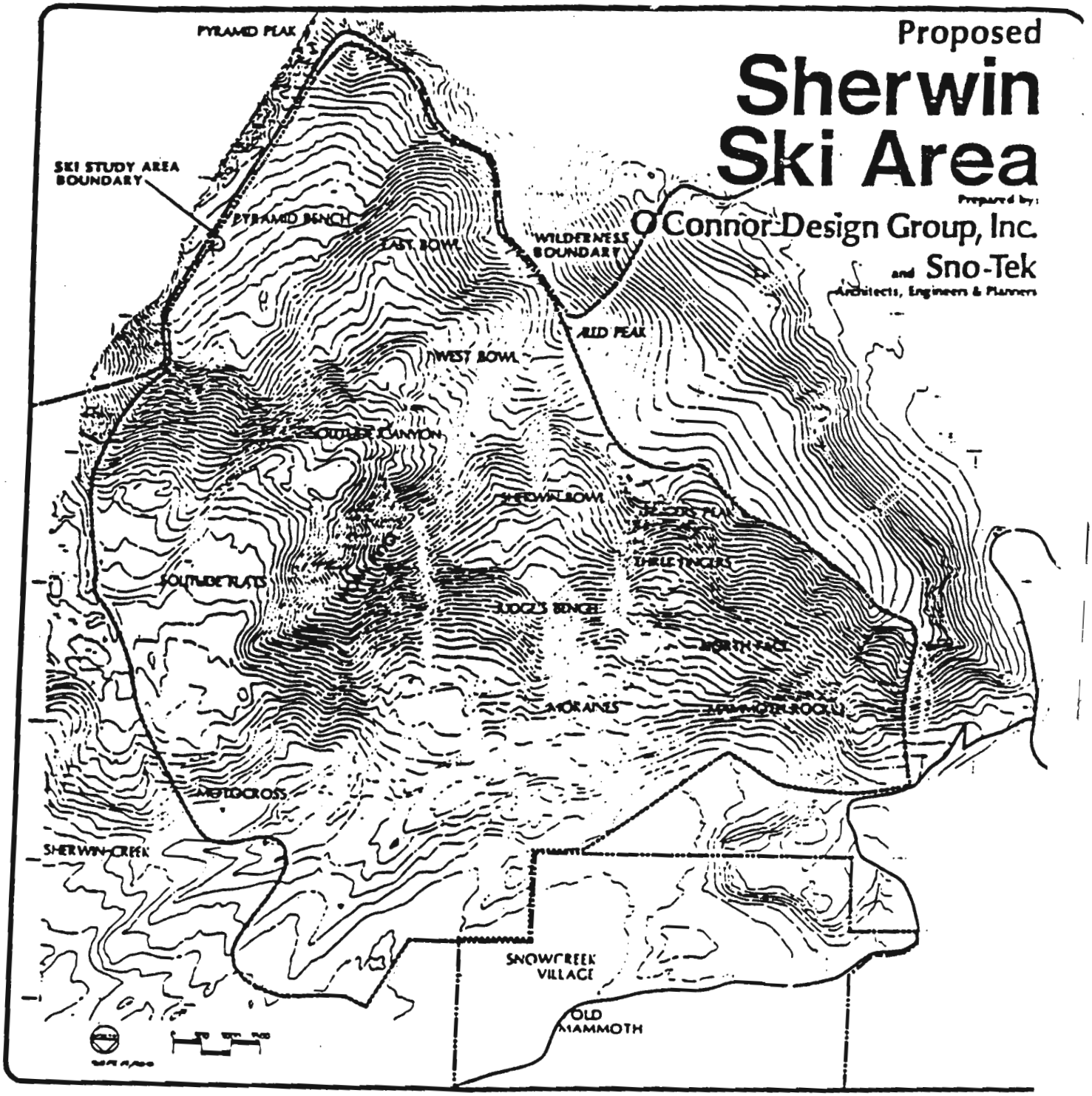

Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

In order to determine the timing, pattern, and duration of deer migration through the Study Area in the spring of 1988, ground surveys were conducted in Solitude Canyon and near Mammoth Rock between 7 May and 30 June 1988. Prior to any deer movements through the Study Area, a twenty foot section of each major migration trail was cleared to bare ground. On each survey all deer trails were inspected and an attempt was made to quantify the number of tracks crossing each cleared area. All cleared areas were brushed clean of tracks and debris after each survey. All deer observed during ground surveys were counted and classified according to sex and age.

RESULTS

Spring 1988

A total of 17 ground surveys, 15 in Solitude Canyon and 2 near Mammoth Rock, were conducted between 7 May and 26 June 1988. Ground surveys were conducted in Solitude Canyon on 7, 12, 16, 21, 24, and 28 May and 3, 6, 9, 11, 14, 17, 20, 24, and 26 June. Within the vicinity of Mammoth Rock, surveys were conducted on 12 and 16 May.

In the winter of 1987-88, a total of 143.0 inches of snowfall was recorded at the Mammoth Ranger Station, elevation 7,800 feet (U.S.F.S., Unpublish). In the spring of 1988, fresh deer sign was first observed in the lower, staging area portion of the Study Area on 12 April. Deer sign was first observed in Solitude Canyon and Solitude Pass on 16 May. Deer movement through Solitude Canyon appeared to be heaviest during the first week in June, with a gradual, uneven diminution in deer activity through 24 June. On a ground survey conducted on 26 June, no fresh migratory deer sign was observed on any of the major travel routes inspected in Solitude Canyon. In the spring of 1988, the first migratory deer sign observed in the vicinity of Mammoth Rock and the Lake Mary Road was on 12 May.

In the winter of 1986-87, a total of 100.7 inches of snowfall was recorded at the Mammoth Ranger Station (U.S.F.S., Unpublish.). In the spring of 1987, the deer were first observed in the lower, staging area portion of the Study Area on 14 April. Deer sign was first observed in Solitude Canyon and Solitude Pass on 14 May. The peak of deer movement through Solitude Canyon in spring of 1987 occurred approximately between 14 May and 3 June. After 3 June, deer movement through Solitude Canyon continued on a gradually declining basis until 24 June. On a ground surveys conducted on 27 June, no deer or fresh deer sign was observed in Solitude Canyon. The first migratory deer sign observed in the vicinity of Mammoth Rock and the Lake Mary Road was on 11 May.

In order to more easily compare and contrast the timing and pattern of deer

movement through the Sherwin Study Area over the last 5 years, spring migration data collected from 1984 through 1988 is presented in Table 1.

Table 1. Timing of 5 spring migrations through the Sherwin Study Area in relation to total annual snowfall amounts recorded at the 7,800 foot level near Mammoth Lakes, California, 1984-1988.

Year	Total Annual Snowfall (IN.)	Start of Migration	End of Migration
1983-84	264.0	16 May	24 June
1984-85	224.0	16 May	24 June
1985-86	294.3	25 May	24 June
1986-87	100.7	14 May	24 June
1987-88	143.0	16 May	24 June

17.4
$s = 4.336$ $s^2 = 18.8009$ $S_{\bar{x}} = 3.76018$

In the winter of 1985-86, a total of 294.3 inches of snowfall was recorded at the Mammoth Ranger Station (U.S.F.S., Unpublish.). In the spring of 1986, the first deer were observed in the lower portion of the Study Area near Sherwin Road on 1 May (Taylor 1986). The first deer sign observed in Solitude Canyon and over Solitude Pass in spring 1986 was on 25 May. The peak of deer movement through Solitude Canyon in spring 1986 was approximately between 25 May and 10 June. Deer movement through Solitude Canyon in spring of 1986 continued until 24 June, after which no deer or fresh sign was observed. The first deer sign observed on migration trails in the Study Area leading toward Mammoth Pass was on 23 May.

In the winter of 1984-85, 224.0 total inches of snowfall was recorded at the Mammoth Station (U.S.F.S., Unpublish.). Deer were first observed in the lower portion of the Study Area near Sherwin Road in the spring of 1985 on 17 April (Kucera 1985). The first deer sign observed in Solitude Canyon and Solitude Pass in spring 1985 was on 16 May. According to radio telemetry data (Kucera 1985), deer movement through Solitude Canyon in spring 1985 continued until approximately 24 June. Also, in spring 1985, deer first began leaving the Study Area and migrating over Mammoth Pass on approximately 16 May.

In the winter of 1983-84, 264.0 total inches of snowfall was recorded at the Mammoth Ranger Station (U.S.F.S., Unpublish.). For the spring of 1984, no data exists on the dates in which deer first began migrating through the Study Area. However, because 264.0 inches of snowfall lies between total amounts recorded for the winters of 1984-85 (224.0 inches) and 1986-87

$t = \frac{17.4 - 16}{3.76018} = .3723$

$t = 4$ $\pm = 3.747$ $s = 4.247$

(294.3 inches), it seems logical to assume that deer movement through Solitude Canyon in the spring of 1984 probably began sometime between 16 and 25 May. It can also be assumed from data collected in spring 1985, 1986, 1987, and 1988 that deer movement through Solitude Canyon in spring 1984 probably ended by no later than 24 June.

DISCUSSION

Despite extremes in total snowfall amounts recorded over the last five winters, there has been little variation in the timing of spring migration through the Sherwin Study Area. In fact, there is only an 11 day differential in the timing of deer migration through the Sherwin Study Area between years of above normal and below normal precipitation. From spring migration data collected over the last five years it can also be seen that little difference exists in the timing at which deer movements through Solitude Canyon ended.

Regardless of the amount of snowfall received during any one winter, it is probably safe to assume from data collected over the last five years that [redacted] The purpose of the spring migration data presented in this report is to provide consistent and current information regarding the timing, pattern, and intensity of deer movement through the proposed Sherwin Ski Area. This information is useful only if incorporated into mitigation designed to reduce conflict between the timing of ski area operation activities and deer migration. Thus far, no mitigation concerning the modification of ski area operation activities based on deer presence has been presented in the Preferred Alternative of the Sherwin Ski Area Draft Environmental Impact Statement. If this trend is to continue, then the data collected over the last 5 years will have no apparent value except for the biological interest in which it may provide.

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LIST OF FIGURES

INTRODUCTION

The proposal to develop the Sherwin Ski Area in Mammoth Lakes, Mono County, California (Fig. 1) has generated much concern over potential adverse impacts of this development on migratory Rocky Mountain mule deer (Odocoileus hemionus hemionus). Extensive information regarding deer and other wildlife use of the area was collected for the ski area feasibility study in 1984 and 1985 (Kucera 1985). In the spring and fall of 1986 and spring of 1987, additional information regarding deer migration within the proposed Sherwin Ski Area was collected (Taylor 1986, Taylor 1987). The objective of the present work is to gather site-specific information regarding the timing, pattern, and intensity of deer migration within the proposed Sherwin Ski Area in the fall of 1987. The information presented in this report will be combined with fall migration data collected in 1984, 1985, and 1986 and will be used by resource managers and ski area officials for the purpose of avoiding potential conflicts between deer migration and ski area operation activities.

ACKNOWLEDGEMENTS

The investigator is currently working under contract for the Dempsey Construction Corporation of Mammoth Lakes, California, with cooperation of the United States Forest Service (USFS) and the California Department of Fish and Game (DFG).

STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10 - 15, 23 and 24 of T. 4 S, R.28E, in the Mammoth Ranger District Inyo National Forest (Fig. 2) (Kucera 1985). The area comprises approximately 2,000 acres of steep, generally north-facing terrain, varying in elevation from 8,000 to 11,000 feet, and lies between the Sherwin Creek drainage to the east and Mammoth Lakes Basin to the west.

Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

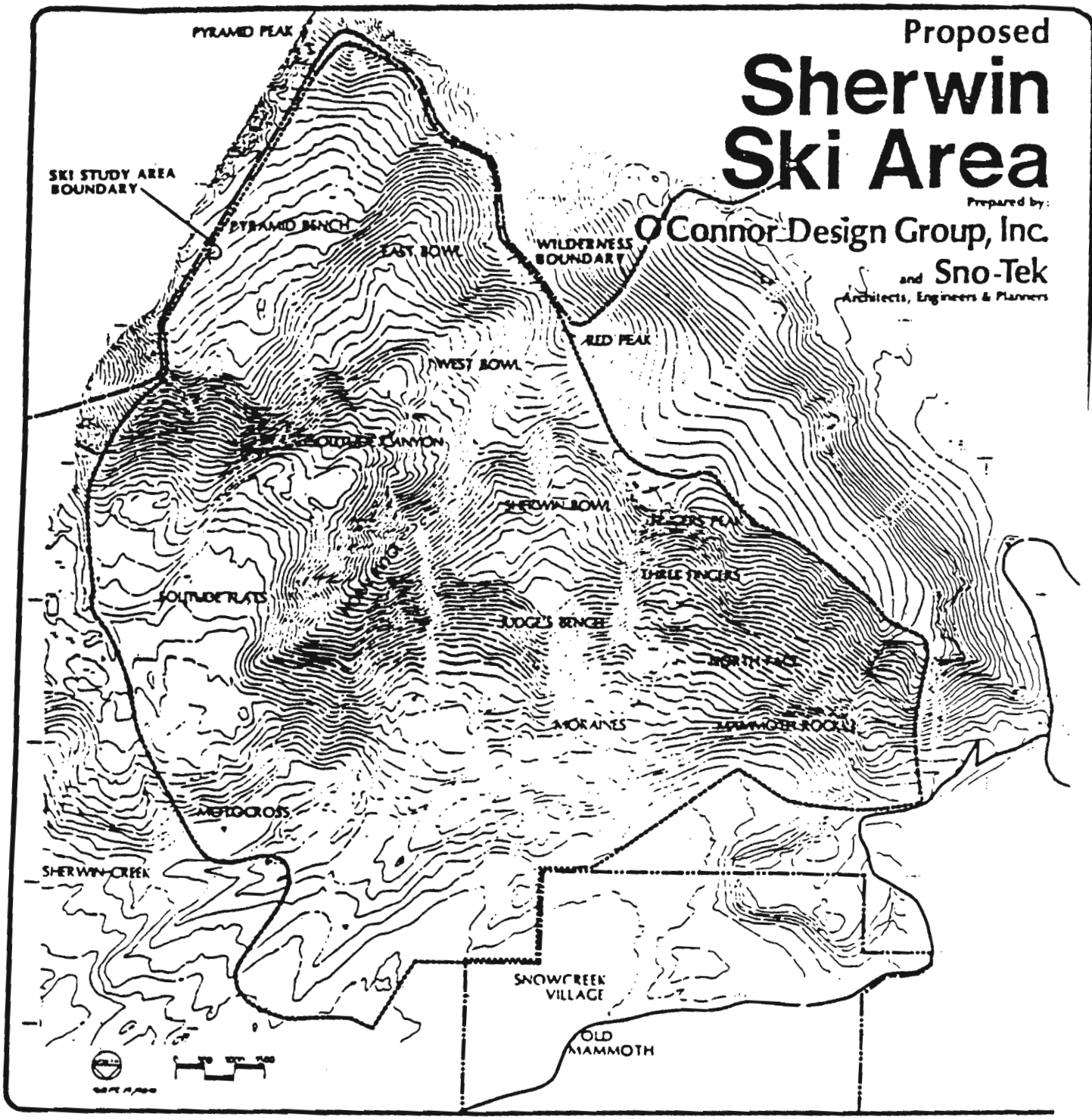

Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

In order to determine the timing, pattern, and intensity of deer migration through the Study Area in the fall of 1987, ground surveys were conducted in Solitude Canyon and near Mammoth Rock between 16 September and 23 November 1987. Prior to any deer movements through the Study Area, a twenty foot section of each major migration trail was cleared to bare ground. During each survey all major deer trails were inspected on foot and an attempt was made to quantify the number of tracks crossing each cleared area. All cleared areas were brushed clean after each survey so as to obliterate old tracks and create a medium for new tracks. All deer observed during surveys were counted and classified to sex and age (adult, yearling, or fawn), and their locations plotted on an aerial photo. In addition, any other wildlife species of particular management interest or their sign observed during surveys were also recorded and mapped.

RESULTS

Fall 1987

A total of 21 ground surveys, 18 in Solitude Canyon and 3 near Mammoth Rock, were conducted between 18 September and 23 November 1987. Ground surveys were conducted in Solitude Canyon on 18, 23 and 28 September, 2, 5, 9, 13, 16, 23, 28, and 30 October, and 2, 3, 6, 7, 13, 21, and 23 November 1987. Within the vicinity of Mammoth Rock surveys were conducted on 13, and 16 October, and 3 November 1987.

In fall 1987 deer began migrating through the Study Area on 13 October. This movement, which was rather minor, was initiated by a small weather system which entered the region on 11 October bringing with it cooler temperatures and .07 inches of rain at the 7,800 foot level (USFS, Unpublish.). Ground surveys conducted on 16, 23, 28, and 30 October revealed a gradual, but steady flow of deer movement through the Study Area. The height of deer movement through the Study Area in fall 1987 occurred between 2 and 6 November. During this time 5.5 inches of snow was recorded at the 7,800 foot level near the town of Mammoth Lakes (USFS, Unpublish.). During ground surveys conducted on 7 and 13 November, only a few new track sets were observed on major migration trails in Solitude Canyon. On ground surveys conducted on 21 and 23 November, no deer or fresh deer sign was observed in Solitude Canyon. Thus, the 1987 fall migration through the Sherwin Study Area lasted approximately one month, from 11 October through 13 November.

In order to more easily compare and contrast the timing and patterns of deer movement through the Sherwin Study Area over the last 4 years, fall migration data collected from 1984 through 1987 is presented in Table 1.

It can be seen that deer movement through the Study Area in fall of 1984, 1986, and 1987 began during the second week of October. Migration during fall 1985 initially began on 11 September when an early fall storm deposited 1 foot of snow at the 7,800 foot level causing several hundred deer to migrate. However, deer movement through the Study Area in fall

1985 was most concentrated in early October. In all years, the start of fall migration was initiated by weather.

Weather also directly influenced the length of fall migration. For instance, the 1984 fall migration was the shortest of the 4 years lasting only 16 days (8 October - 24 October). During this 16 day period a total of 14.6 inches of snow fell at the 7,800 foot level near Mammoth Lakes (USFS, Unpublish.). The majority of movement in fall 1984 occurred on 16 and 17 October during a storm which deposited seven inches of snow at the 7,800 foot level. In contrast, the fall migration of 1986 was the longest of the 4 years lasting approximately 55 days, from 13 October to 7 December (Taylor 1986). During this period only 8.5 inches of snow was recorded at the 7,800 foot level near Mammoth Lakes (USFS, Unpublish.). The peak of migration in fall 1986 was immediately subsequent to a storm on 7 November which deposited 4.5 inches of snow at 7,800 feet. Following the storm on 7 November, deer movement through the Study Area continued gradually until 7 December.

Table 1. Timing of 4 fall migrations through the Sherwin Study Area in relation to fall storm precipitation amounts recorded at the 7,800 foot level near Mammoth Lakes, California, 1984-1987.

Year	Dates of Fall Storms	Amount of Daily Precipitation (IN.)	Start of Migration	End of Migration
1984	30 Sept.	0.3		
	1 Oct.	0.1		
	9 Oct.	0.37	8 Oct.	
	16-17 Oct. *	0.7		24 Oct.
1985	11 Sept.	1.0	11 Sept.	
	19 Sept.	0.2		
	27 Sept.	0.07		
	7-8 Oct. *	0.65		
	12 Oct.	0.12		
	20-23 Oct.	0.66		
	13 Nov.	1.65		14 Nov.
1986	25 Sept.	0.4	13 Oct.	
	7 Nov. *	0.45		
	19 Nov.	Trace		7 Dec.
1987	11 Oct.	0.07	11 Oct.	
	2-3 Nov. *	0.25		
	6 Nov.	0.3		13 Nov.
	18 Nov.	Trace		
	23 Nov.	0.3		

* Peak of migration.

Little difference exits in the timing of spring deer movements (beginning and ending dates) through the Study Area over the last 4 years (Table 2). In the winter of 1985-86, one of above average snowfall and precipitation, 293.4 inches of snow were recorded between October and May. In the winter of 1986-87, one of below average snowfall, 100.7 inches of snow were recorded within the same time period (USFS, Unpublish.). Thus, the winters of 1985-86 and 1986-87 represent two extremes in total snowfall amounts for the eastern Sierra. Despite these differences, only 11 days separate the dates in which deer first began moving through the Study Area. It can also be seen from spring migration data collected over the last 4 years that very little difference exists within the timing at which deer movements through the Study Area ended.

Table 2. Timing of 4 spring migrations through the Sherwin Study Area in relation to total annual snowfall amounts recorded at the 7,800 foot level near Mammoth Lakes, California, 1984-1987.

Year	Total Annual Snowfall (IN.)	Start of Migration	End of Migration
1983-84	264.0	16 May	24 June
1984-85	224.0	16 May	24 June
1985-86	294.3	25 May	24 June
1986-87	100.7	14 May	27 June

OTHER WILDLIFE

Although the present work was designed specifically to address deer migration within the proposed Sherwin Ski Area, all other wildlife species or their sign encountered during ground surveys which are of particular management concern were also recorded. On 28 September 1987, 1 set of mountain lion (Felis concolor) tracks was observed in Solitude Canyon on the Prospect Road. On 23 November, 2 sets of mountain lion tracks were observed in the Study Area, one near the Mammoth Rock and one on the Prospect Road. In addition, sign of black bear (Ursus americanus) was observed on 3 November on Solitude Flat near a deer carcass.

DISCUSSION

Timing of fall migration through the Study Area varied annually by as much as 2 months and was related to the timing and severity of fall storms. Also, the timing as well as the severity of fall storms appears to directly influence the intensity of migration. Thus, given the

unpredictability of seasonal weather patterns it is very difficult if not impossible to predict when fall migration may occur and to what degree. Possibly the only way to avoid potential conflict between ski area operations and deer migration during the fall is to carefully monitor deer movements using radio telemetry and ground reconnaissance of the Study Area prior to and during migration.

The timing of spring migration has been remarkably consistent over the last 4 years with little variation occurring between the beginning and ending dates of deer movement through the Study Area. From data collected over the last 4 years, it may be safe to assume that all future spring deer migrations through the Study Area will begin no later than the first week in May and end no later than 1 July. Provided the Sherwin Ski Area is approved, spring migration data should be used for the purpose of establishing mitigation measures aimed at reducing conflicts between deer migration and ski area activities. Because of the apparent consistency in the timing of spring migration, data collected over the last 4 years should serve as a foundation by which guidelines governing the timing of ski area operations can be established.

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U.S.F.S., 1983-87. Unpublish. United States Forest Service, Mammoth Lakes, Mono County, California 93546.

SHERWIN SKI AREA DEER STUDY

FALL 1988

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Dempsey Construction Corporation
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January 1989

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The proposal to develop the Sherwin Ski Area (SSA) in Mammoth Lakes, Mono County, California (Figure 1) has generated great concern over the effects of such a development on two migratory herds of Rocky Mountain mule deer (Odocoileus hemionus). The two herds of concern are the Sherwin Grade and Buttermilk herds, which winter in Round Valley near the base of the eastern escarpment of the Sierra Nevada, approximately 20 airline miles to the southeast of the SSA. Kucera (1985) estimated that approximately one-half of all deer which winter in Round Valley migrate through the SSA on their way to and from summer range located on the west side of the Sierra Nevada.

The spring migration begins in early April, when deer leave the winter range and move in a northwesterly direction, along the base of the eastern escarpment of the Sierra Nevada, to a large spring staging area located to the immediate south and east of Mammoth Lakes. Here, they remain for three to six weeks until they are ready to move to their western Sierra summer ranges (Kucera 1985). Deer arrive on the summer range in May and June, produce fawns in July, and begin their fall migration back to the winter range in October. Fall migration is more rapid than that of spring and is usually triggered by the first significant fall snow storm. One local telemetry study (Taylor 1988a) has shown that during the fall deer typically use the same migration routes and holding areas as in the spring when returning to the winter range.

Deer migration through the SSA occurs along two main routes. The first and most major route crosses through the Sherwin Lakes area and up Solitude Canyon to Solitude Pass, where it connects with the upper Mammoth Lakes Basin and Duck Pass. The second migration route is situated at the base of the Study Area, below Mammoth Rock. It provides access for deer to the Mammoth Lakes Basin, Mammoth Pass and the Middle Fork of the San Joaquin.

Since 1984, the proponents of the SSA have funded deer studies which have determined the timing and intensity of annual spring and fall migrations through the proposed ski area. This information has been extremely useful for the purpose of establishing the exact dates at which seasonal migrations through the SSA begin and end. It has also been useful for determining the pattern of annual spring and fall migrations in

Figure 1. Location of the proposed Sherwin Ski Area near Mammoth Lakes in Mono County, California.

relation to weather and for delineating boundaries between staging and migration areas.

The objective of the present investigation is to provide the appropriate resource managers and project proponents with site-specific information regarding the timing and intensity of mule deer migration through the proposed SSA during the fall of 1988. This information, when combined with fall migration data collected in 1984, 1985, 1986, and 1987, can be used for the purpose of avoiding potential conflicts between the timing of deer migration and ski area construction and operation activities.

ACKNOWLEDGEMENTS

The investigator is currently working under contract for the Dempsey Construction Corporation of Mammoth Lakes, California, with cooperation of the United States Forest Service (USFS) and the California Department of Fish and Game (DFG).

STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10 - 15, 23 and 24 of T. 4 S, R.28E, in the Mammoth Ranger District Inyo National Forest (Figure 2) (Kucera 1985). The area comprises approximately 2,000 acres of steep, generally north-facing terrain, varying in elevation from 8,000 to 11,000 feet, and lies between the Sherwin Creek drainage to the east and Mammoth Lakes Basin to the west.

Figure 2. Location of the present Study Area near the Town of Mammoth Lakes, California.

METHODS

In order to determine the timing, pattern, and intensity of deer migration through the Study Area in the fall of 1988, ground surveys were conducted in Solitude Canyon and near Mammoth Rock between 7 September and 14 November 1988. Prior to any deer movements through the Study Area, a twenty foot section of each major migration trail was cleared to bare ground. During each survey all major deer trails were inspected on foot and an attempt was made to quantify the number of tracks crossing each cleared area. All cleared areas were brushed clean after each survey so as to obliterate old tracks and create a medium for new tracks. All deer observed during surveys were counted and classified to sex and age (adult, yearling, or fawn), and their locations plotted on an aerial photo. In addition, any other wildlife species of particular management interest or their sign observed during surveys were also recorded and mapped.

RESULTS

Fall 1988

A total of 18 ground surveys, 15 in Solitude Canyon and 3 near Mammoth Rock, were conducted between 18 September and 23 November 1988. Ground surveys were conducted in Solitude Canyon on 7, 12, 18, 21, 26, and 30 September, 5, 9, 14, 17, 23, and 29 October, and 3, 7, 14 November 1988. Within the vicinity of Mammoth Rock surveys were performed on 13 and 23 October, and 7 November 1987.

Deer movement through the Study Area in the fall of 1988 began between 14 and 17 October. On 14 October only a few sets of migratory deer tracks were observed within Solitude Canyon. During a subsequent survey conducted on 17 October, heavy tracking was recorded on all major deer migration trails within Solitude Canyon. This movement, which was not initiated by weather, continued at a steady rate until approximately 29 October. During a survey conducted on 3 November, only four track sets were observed within Solitude Canyon.

In the fall of 1988, the only movement which appeared to be influenced

by weather occurred on 12 and 13 November, during which time 8.5 inches of snow fell at the 7,800 foot level near Mammoth Lakes (USFS, Unpubl.). During a survey conducted on 14 November, immediately subsequent to this storm, tracks of approximately 15 deer were observed in Solitude Canyon.

In order to more easily compare and contrast the timing of the 1988 fall migration with that of other fall migrations, data collected over the last 5 years (1984-1988) is presented in Table 1.

In all years, with the exception of 1988, fall migration through the Study Area was patterned by fall snow storms. This has resulted in some differences and similarities between years in the timing and intensity of deer movement through the Study Area. For example, the 1984 fall migration was the shortest of the 5 years lasting only 16 days (8 October-24 October) (Kucera 1985). During this 16 day period a total of 14.6 inches of snow fell at the 7,800 foot level near Mammoth Lakes (USFS, Unpublish.). The majority of movement in fall 1984 occurred on 16 and 17 October during a storm which deposited 7 inches of snow at the 7,800 foot level. In contrast, the fall migration of 1986 was the longest of the 5 years lasting approximately 55 days, from 13 October to 7 December (Taylor 1986). During this period only 8.5 inches of snow was recorded at the 7,800 foot level near Mammoth Lakes (USFS, Unpublish.). The peak of migration in fall 1986 occurred immediately subsequent to a storm on 7 November which deposited 4.5 inches of snow at 7,800 feet. Following the storm on 7 November, deer movement through the Study Area gradually continued until 7 December. Conversely, the timing and duration of the 1987 and 1988 fall migrations were quite similar. Deer movement through the Study Area in the fall of 1987 began on 11 October and lasted 34 days, until 13 November (Taylor 1987). In 1988, deer movement through the Study Area began on 17 October and lasted 36 days, until 14 November.

The greatest similarity among years in the timing of migration exists between the beginning and ending dates of deer migration through the Study Area. With the exception of 1985, deer movement through the Study Area typically begins by around mid-October. Migration in the fall of 1985 initially began on 11 September when an early storm deposited 1 foot of snow at the 7,800 foot causing several hundred deer to migrate. In 1985, 1987, and 1988, fall migration through the Study ended around mid-November.

Table 1. Timing of 5 fall migrations through the Sherwin Study Area in relation to fall storm precipitation amounts recorded at the 7,800 foot level near Mammoth Lakes, California, 1984-1988.

Year	Dates of Fall Storms	Amount of Daily Precipitation (IN.)	Start of Migration	End of Migration
1984	30 Sept.	0.3		
	1 Oct.	0.1		
	9 Oct.	0.37	8 Oct.	
	16-17 Oct. *	0.7		24 Oct.
1985	11 Sept.	1.0	11 Sept.	
	19 Sept.	0.2		
	27 Sept.	0.07		
	7-8 Oct. *	0.65		
	12 Oct.	0.12		
	20-23 Oct.	0.66		
	13 Nov.	1.65		14 Nov.
1986	25 Sept.	0.4	13 Oct.	
	7 Nov. *	0.45		
	19 Nov.	Trace		
	7 Dec	0.4		7 Dec.
1987	11 Oct.	0.07	11 Oct.	
	2-3 Nov. *	0.25		
	6 Nov.	0.3		13 Nov.
	18 Nov.	Trace		
	23 Nov.	0.3		
1988	17 Oct. *		17 Oct.	
	12 Nov.	0.85		
	13 Nov.	0.03		
	14 Nov.	Trace		14 Nov.

* Peak of migration.

Little difference exits in the timing of spring deer movements (beginning and ending dates) through the Study Area over the last 5 years (Table 2). In the winter of 1985-86, one of above average snowfall and precipitation, 293.4 inches of snow were recorded between October and May. In the winter of 1986-87, one of below average snowfall, 100.7 inches of snow were recorded within the same time period (USFS, Unpublish.). Thus, the winters of 1985-86 and 1986-87 represent two extremes in total snowfall amounts for the eastern Sierra. Despite these differences, only 11 days separate the dates in which deer first began moving through the Study Area. It can also be seen from spring migration data collected over the last 5 years that little difference also exists within the timing at which deer movements through the Study Area ended.

Table 2. Timing of 5 spring migrations through the Sherwin Study Area in relation to total annual snowfall amounts recorded at the 7,800 foot level near Mammoth Lakes, California, 1984-1988.

Year	Total Annual Snowfall (IN.)	Start of Migration	End of Migration
1983-84	264.0	16 May	24 June
1984-85	224.0	16 May	24 June
1985-86	294.3	25 May	24 June
1986-87	100.7	14 May	27 June
1987-88	143.0	16 May	24 June

DISCUSSION

The beginning of fall migration through the SSA in 1988 occurred independent of fall storms. In fact, the only movement which occurred in relation to weather, on 14 November, was quite minimal. Therefore, it appears that migration through the SSA typically begins by around mid-October, regardless of whether or not fall storms occur.

The intensity and duration of fall migration through the SSA is much less predictable. These factors are dictated almost entirely by the number and severity of fall storms. For example, the fall migration of 1984 lasted approximately 16 days (8 October-24 October). During this time over ten inches of snow fell at the 7,800 foot level (USFS, Unpubl.). In contrast, the 1986 fall migration occurred over a 55 day period (13 October-7 December), during which time only 12.5 inches of snow fell at the 7,800 foot level (USFS, Unpubl.).

Because the start of deer movement through the SSA has been somewhat consistent over the last five years, it can be determined that under normal snowfall conditions migration typically does not begin prior to 1 October. Likewise, four of the last five migrations have ended prior to mid-November. Thus, it can be determined that under normal circumstances migration should end by mid-November. However, the possibility of an early migration, as in 1985, or late migration, as in 1986, is always present. Therefore, as previously recommended, deer movements should be carefully monitored using radio-telemetry in order to avoid potential conflicts between the timing of ski area construction and operation activities and deer migration.

As shown in Table 2 the timing of spring migration has been remarkably consistent over the last five years, with little variation occurring between the beginning and ending dates of deer movement through the SSA. From data collected over the last five years it is logical to assume that deer movement through the SSA will begin by mid-May and end no later than 1 July, regardless of winter snowfall amounts.

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REC
STUDY

SHERWIN SKI AREA DEER and WILDLIFE STUDY

FINAL REPORT

December 1985

Thomas E. Kucera

DEPARTMENT OF FISH AND GAME
Mono Wildlife Unit
P.O. Box 15
Coleville, CA 96107

RECEIVED DEC 23 1985

December 14, 1985

Mr. Allan O'Connor
O'Connor Design Group
P.O. Box 1717
Mammoth Lakes, CA 93546

Allan:

I recieved your note and the copy of Fred Glover's Scope of Activities and Responsibilities. I couldn't reply sooner because I've needed time to give this issue some thought.

I fully appreciate the effort and costs you've expended toward defining wildlife values associated with the proposed ski area. I strongly feel that the results of the Kucera work will adequately describe those values and I certainly do not oppose the concept of obtaining additional input through the Glover effort. However, the original study agreement did not include these additional activities nor was this addition based on any DFG input or recommendation.

Since formal DFG approval of the "Scope of Activities & Responsibilities of Fred Glover" might imply official sanction of the resulting work, I must decline to sign the document. I will, however, look forward to critically evaluating the final results of Dr. Glover's efforts, the Kucera study, or any such project aimed at defining wildlife values, impacts to the resource, and proposed mitigation measures.

Sincerely,

Ron

Ron Thomas
Mono Wildlife Biologist

LIST of FIGURES

INTRODUCTION

The proposal to develop the Sherwin Ski Area in Mammoth Lakes, Mono County, California (Figs. 1 and 2), initiated concern over potential adverse impacts of such a development on local wildlife. Much of the land on which the ski area is to be located is managed by the U.S. Forest Service (USFS), which is legally mandated by the National Forest Management Act of 1976 to conserve diversity of plant and animal communities and monitor wildlife population trends when planning land management activities. Wildlife surveys have been conducted in the area (USDA, 1981a); however, more intensive and extensive information is required to determine:

1.) the timing, pattern and intensity of mule deer (Odocoileus hemionus) use in the area,

2.) the existence of critical deer areas (e.g., fawning and migration) within the proposed ski area,

3.) the presence, relative abundance, and habitats of those wildlife species defined by the USFS as Sensitive, Management Indicator, Special Interest, or Harvest species which are expected to occur in the proposed ski area (USDA, 1981a), and

4.) potential mitigating activities to be incorporated into the development plan, if the ski area is developed.

ACKNOWLEDGMENTS

This investigation was conducted under a contract from the O'Connor Design Group, Mammoth Lakes, California, with the cooperation of and a Special Use Permit from the USFS, Mammoth Ranger District, Inyo National Forest, and with the cooperation of the California Department of Fish and Game (DFG). The Principal Investigator took over the contract on 1 May 1984 from the original consultant and merged the present study into a larger investigation of Eastern Sierra deer supported by the Bishop Resource Area of the Bureau of Land Management (BLM), DFG, Inyo and Mono Counties, the University of California, Berkeley, and several private funding organizations. The design of the wildlife study is based on consultations with USFS biologists Clint McCarthy and Pat Stygar. Much of this investigation, both fieldwork and graphics, was done by Timothy Taylor.

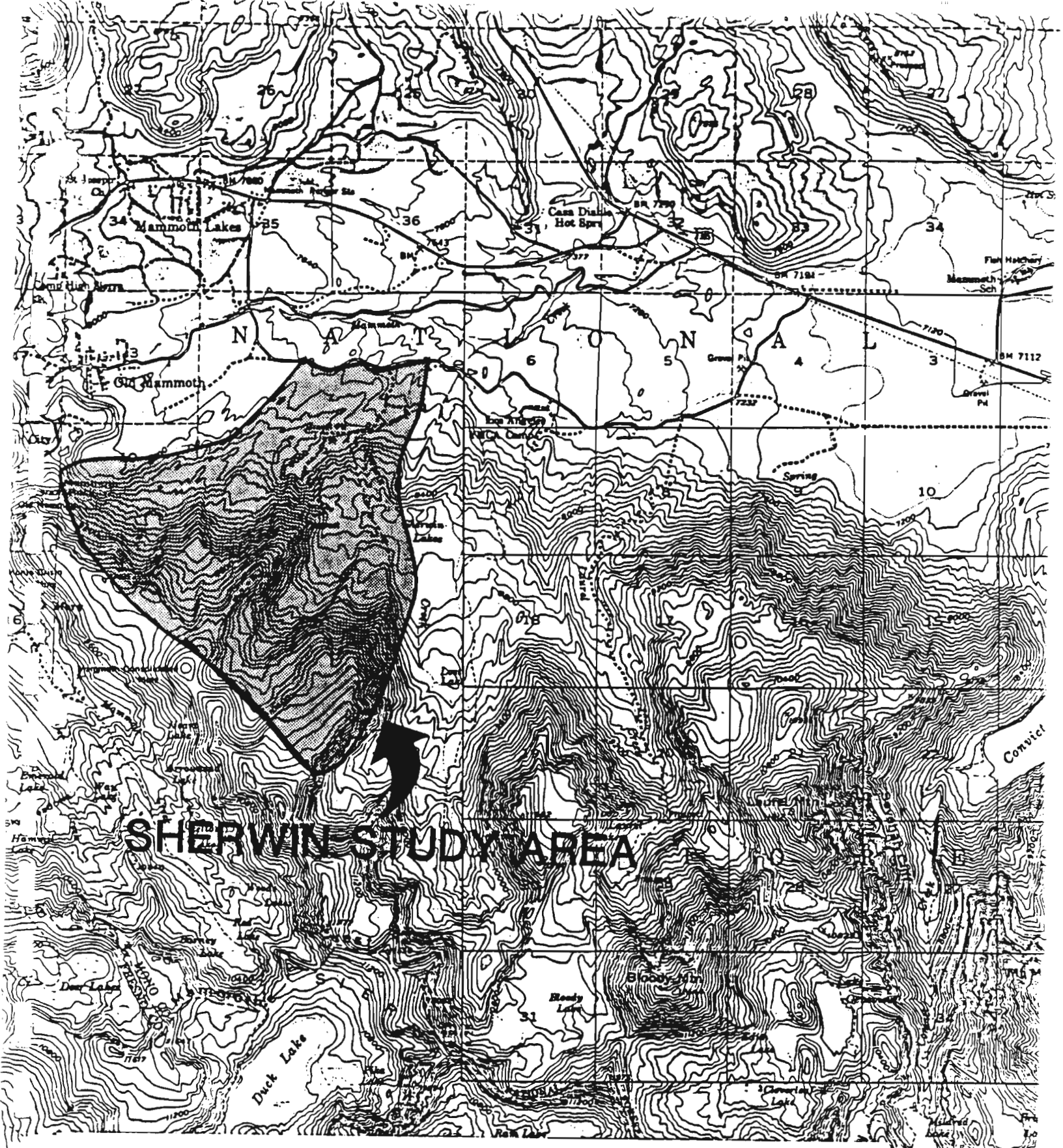
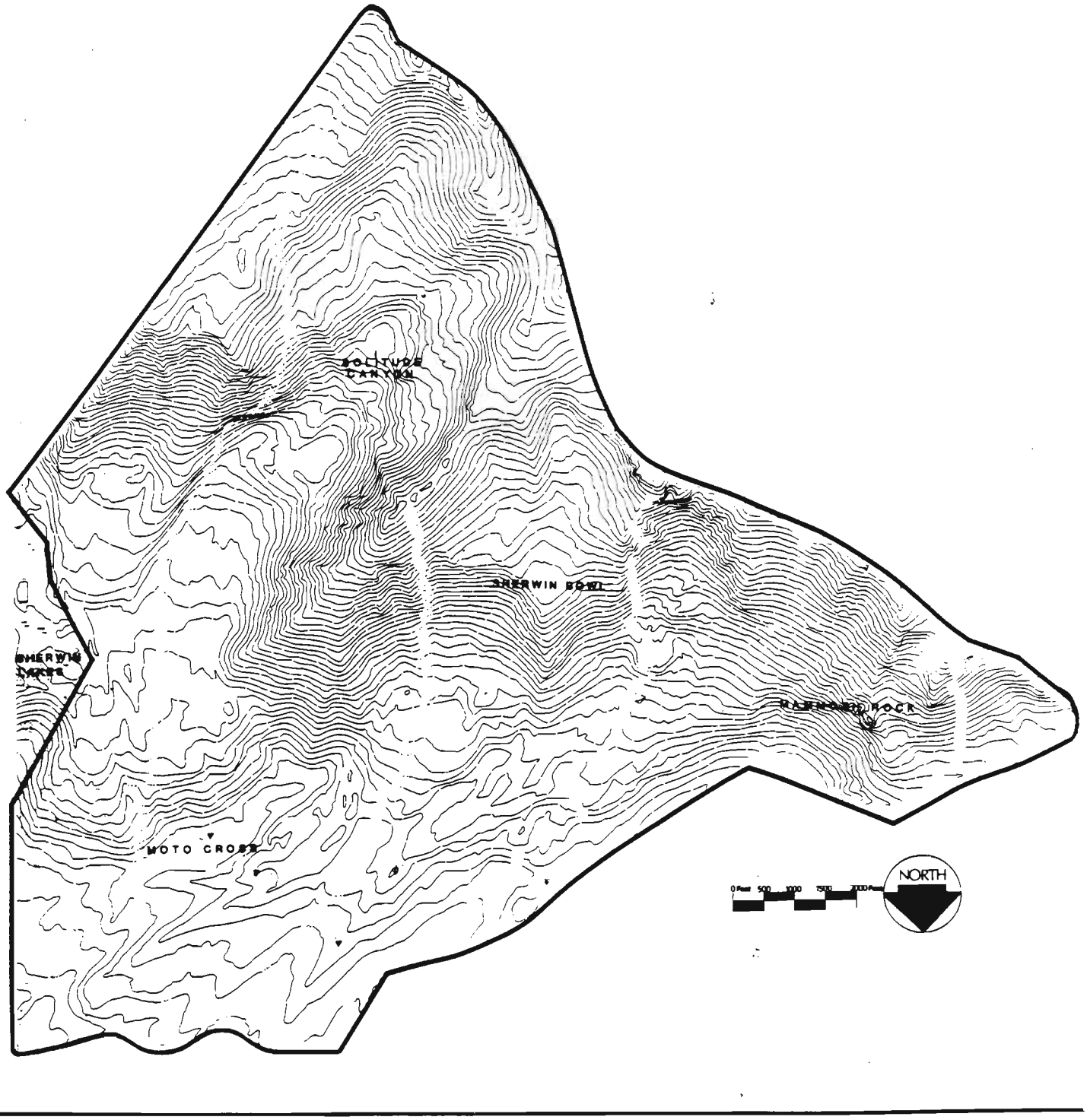


Figure 2. Location of the present Study Area near the town of Mammoth Lakes, California.


SOLITUDE CANYON
SHERWIN BOWL
SHERWIN LAKES
RAINBOW ROCK
MOTO CROSS
NORTH

METHODS

A. Deer

1.) Capture and Marking

In May 1984, 6 adult female mule deer were captured in and near the Study Area by use of tranquilizer darts; 3 more were captured in April and May 1985 (Fig. 5). These animals were fitted with radio-transmitter collars, provided by DFG, and released. In addition, during January - March 1984 and 1985, 212 deer were captured in Round Valley, approximately 15 miles northwest of Bishop, California, and 30 miles southeast of the Sherwin Study Area, in conjunction with a larger ecological study of Eastern Sierra deer (Kucera, unpublished) (Fig. 1). Thirty-two of these deer (13 males and 19 females) were fitted with radio collars; all received numbered ear tags, and 81 adult does which did not receive a radio collar received individually numbered "marking collars".

2.) Telemetry

Following capture, the locations of radioed deer were determined throughout the year, both from the ground and from a fixed-wing plane provided by DFG. A total of 37 telemetry flights were made between 16 April 1984 and 14 November 1985. Flights were taken throughout the year, but were concentrated during spring (April-June) and fall (September-October) migration periods. Numerous day hikes and backcountry trips were taken throughout the summer and fall to locate radioed animals on their summer range and during migration.

Within the Study Area, the original plan to monitor deer locations by triangulation was modified due to the large error in signal location induced by the very steep and rocky terrain. Only locations based on visual sightings of radioed animals are reliable in such terrain, and only these are included in this report. Due to safety considerations, night monitoring of radioed deer was not attempted.

Observations of marked but un-radioed deer in or near the Study Area were made throughout the course of daily field work, and locations of these were plotted on aerial photos. Because only one marked deer summered in the Study Area in 1984, the attempt to estimate deer population size in summer by use of the Lincoln Index (Connolly, 1981) was abandoned.

3.) Pellet Transects

In order to determine the amount and timing of summer deer use, 30 randomly located, permanently marked pellet group transects (Neff, 1968) were established in the Study Area, which was divided into three strata according to vegetation type (Fig. 6). The location of each of the 10 transects per stratum was selected by choosing two random numbers corresponding to a grid system overlaid on an aerial photo of the area. The compass orientation of each transect was the same, and was determined randomly. Each transect consisted of 10, 1/400 acre circular plots spaced 50 feet apart; the plots were marked by a 3/8 inch rebar stake, 3 feet high and painted for visibility, at the center.

Transects were read monthly during snow-free periods by counting the number of pellet groups found in each plot, after which all pellets were removed. The average number of pellet groups/transect, multiplied by 40, gives number of groups/acre/month. Dividing this by 13, the average number of pellet groups deposited by deer per day, yields number of deer days/acre/month. The vegetative characteristics of each transect were also described.

4.) Road Surveys and Migration

During late summer and fall (20 August - 29 October) of 1984, and throughout the snow-free period of 1985 (15 April-28 October), a weekly dawn road survey was conducted from a vehicle in and near the Study Area to determine the timing and pattern of migration (Fig. 7). Beginning at 1/2 hour before official sunrise, a fixed route was driven, mainly along Sherwin Creek Road between Old Mammoth and Highway 395, including the Moto-cross area. All deer observed were counted and classified by age and sex. The beginning and end of the transect were alternated on consecutive surveys. Surveys were less frequent in summer 1985 (24 June-23 Aug), after the spring migration had passed, and were performed weekly again beginning 10 September 1985. During the fall migration the frequency of road surveys was increased when storms occurred.

Immediately after significant snowfall, as well as throughout the spring migration peiod, the Study Area was inspected on foot. Deer observed were classified, and migration trails evident in the fresh snow or on the soil were plotted on an

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Figure 6. (Overleaf) Locations of the deer pellet transects in the Sherwin Study area.

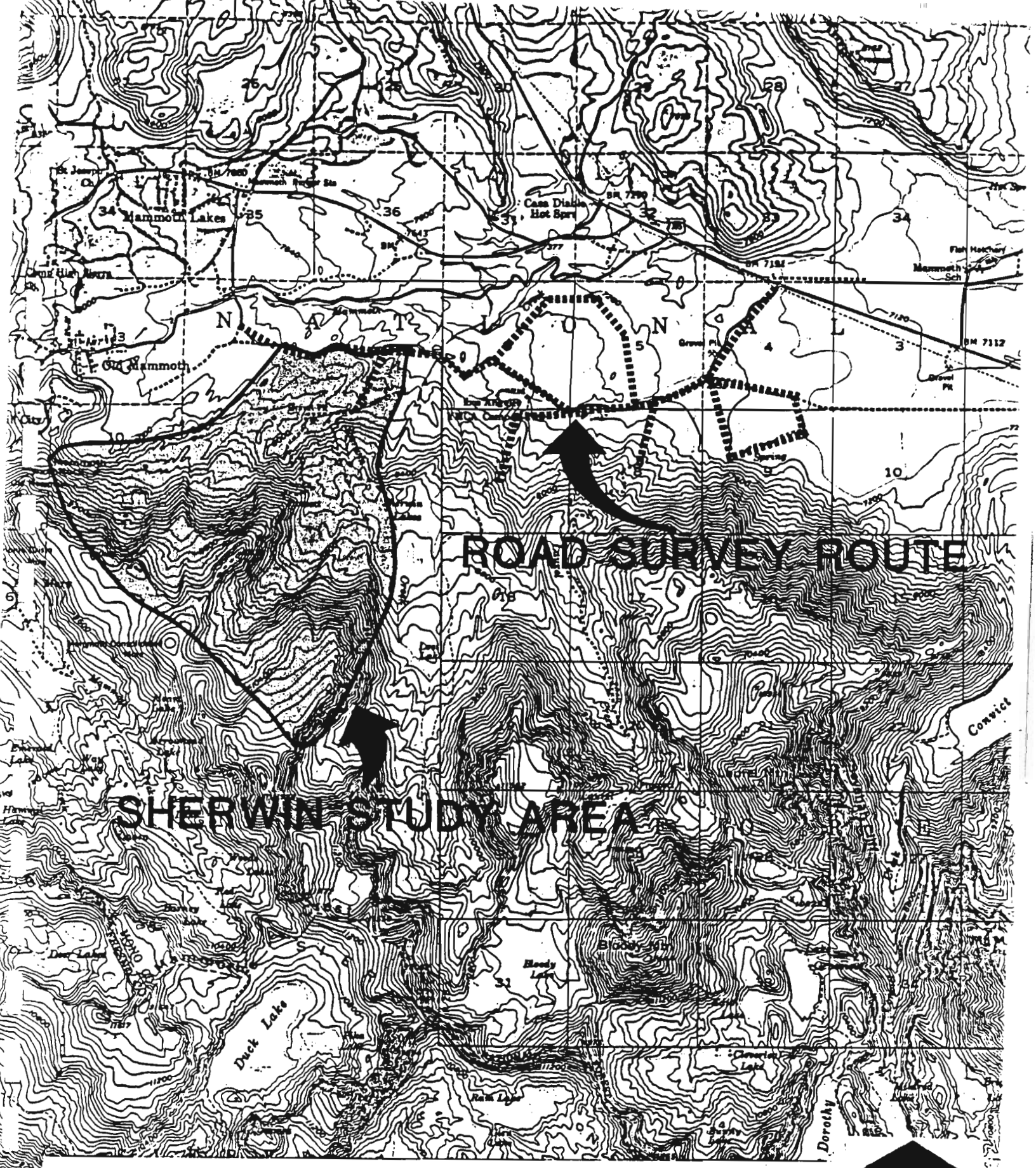


Figure 7. Location of the dawn road survey in and near the Sherwin Study Area.

3.) Owls

* How many surveys were done locations, dates etc.

The presence of spotted owls (Strix occidentalis), great gray owls (S. nebulosa), both Sensitive species, and flammulated owls (Otus flammeolus), a Special Interest species, ~~was~~ were determined by the use of recorded calls played at night in areas of potential owl habitat as mapped by the Forest Service (USDA, 1981a). One night per week during May and June, beginning one-half hour after official sunset, these areas were visited. Recorded owl calls were played at approximately 100m intervals along the transect route, and any responses noted.

4.) Blue Grouse (Dendragopus obscurus)

Blue grouse, a harvest species, did not require any surveys specifically directed toward them, but during the course of fieldwork in the Study Area, all sightings of blue grouse or sign, e.g., droppings, booming, etc., were noted and plotted on an aerial photo.

5.) Management Indicator Avian Species

Those Management Indicator species to be expected in the Study Area (USDA, 1981a), specifically yellow-bellied sapsuckers (Sphyrapicus varius), Williamson's sapsuckers (S. throideus), hairy woodpeckers (Picoides villosus), pygmy nuthatches (Sitta pygmea) and brown crepers (Certhia familiaris), were surveyed by using a variation of the plot technique outlined by Dedon and Barrett (1982) and Raphael (1983). During late May and June, when breeding birds are most conspicuous, an observer visited a plot as soon after dawn as possible, sat quietly, and tallied the number of each of the above species detected (visually and aurally) during 5 successive 10-minute intervals. Other bird and mammal species were noted as time allowed. Two plots per day were visited. When adults of the above species were observed, attempts were made to find nest locations. Plot locations were based on the vegetation types described and the deer pellet plots already established in the Study Area. Five plots each were selected randomly in the Whitebark Pine and Chaparral/Sagebrush Scrub vegetation types, and 10 randomly placed plots were used in the Mixed Conifer type. In addition, 1 extra plot was placed in Whitebark Pine, 2 extra in Mixed Conifer, and 3 extra in Chaparral in areas likely to be disturbed by the ski area, for a total of 26 plots in the Study Area.

6.) Carnivores

The presence of Sierra Nevada red fox (Vulpes vulpes necator), pine marten (Martes americana), and fisher (M. pennanti), all

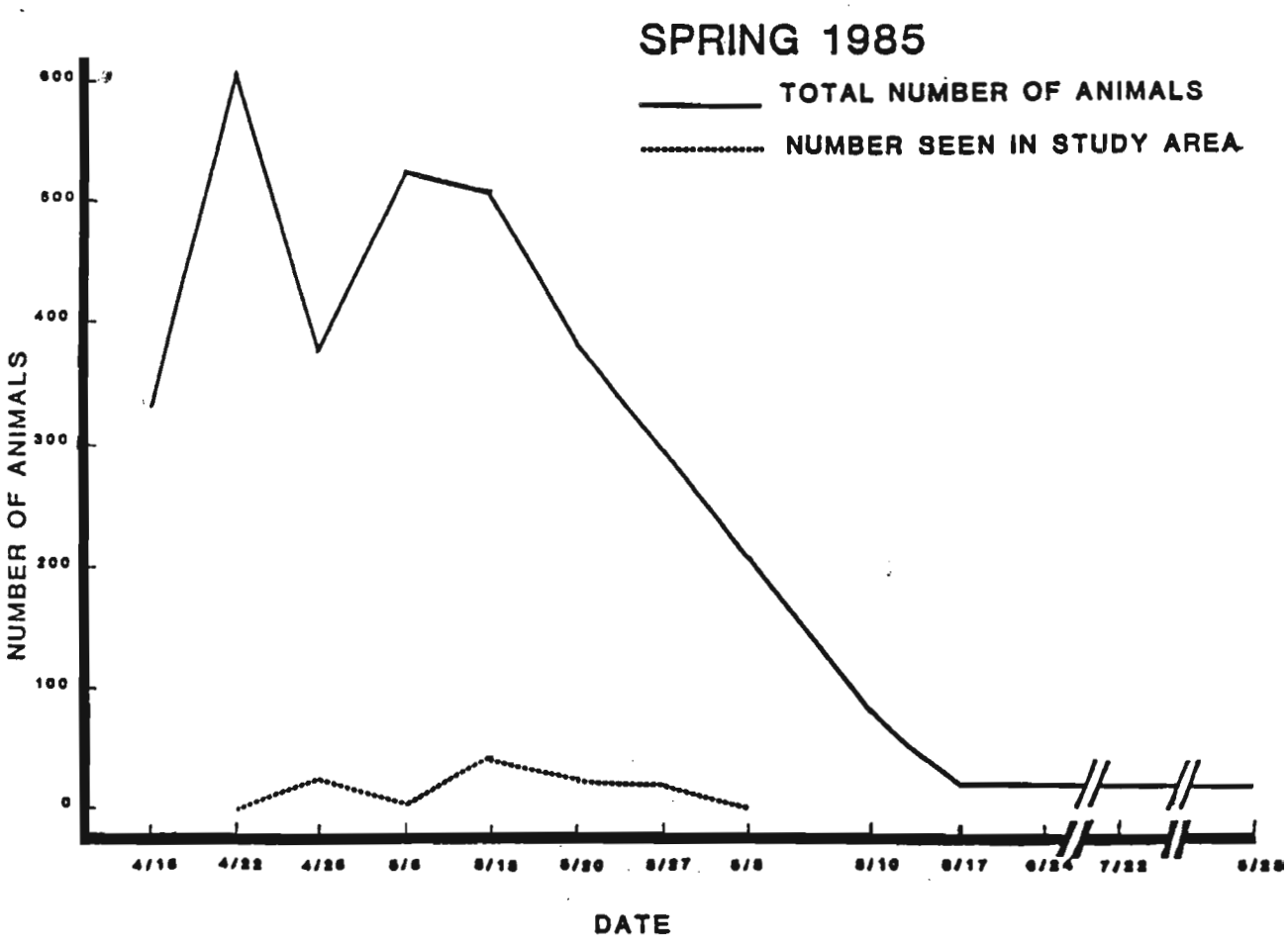


Figure 8. Deer counted on the dawn road survey, Spring 1985.

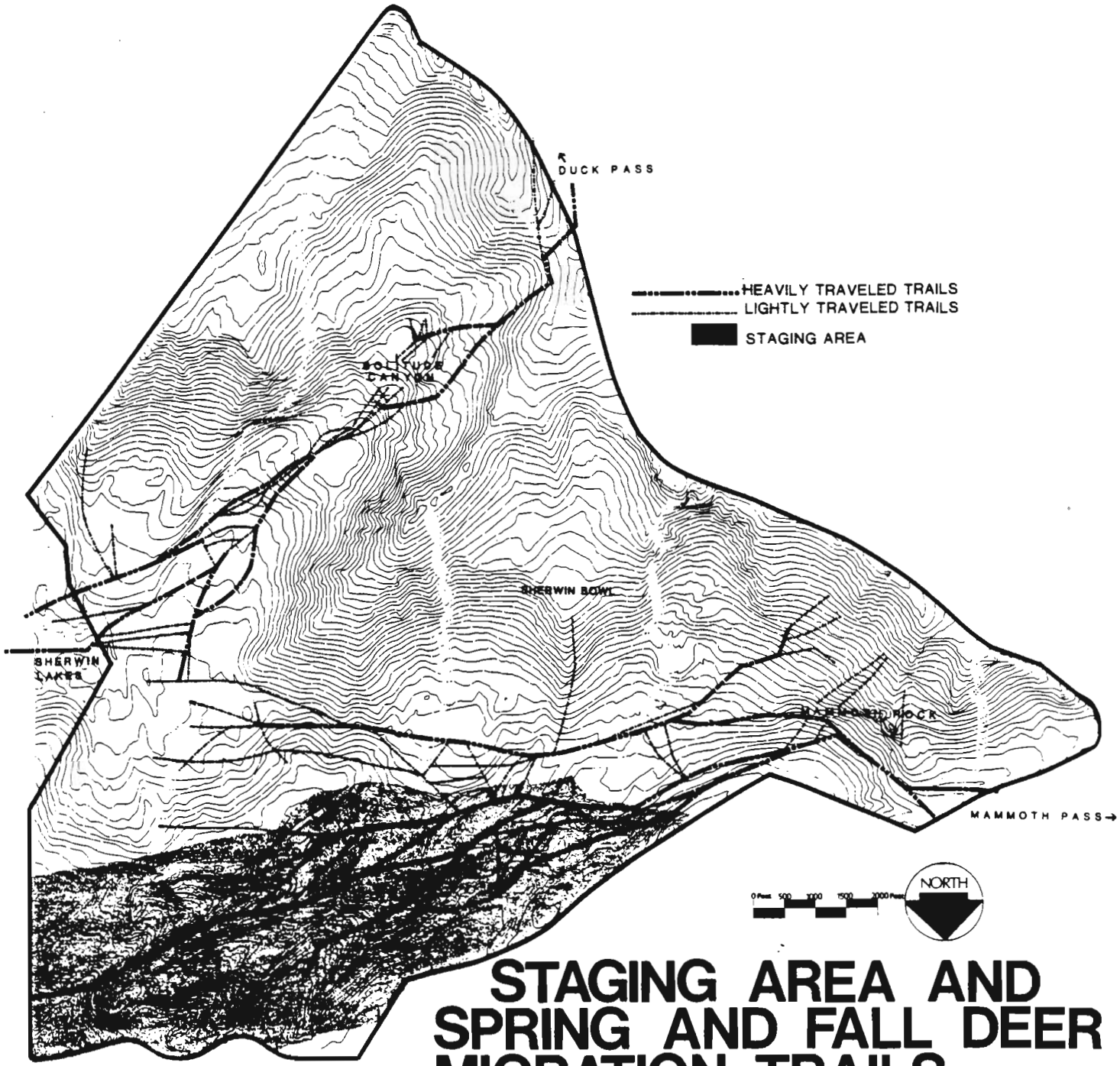
spring (Fig. 9). An additional 36 marked, un-radioed deer (14 males, 19 females, 3 fawns) from Round Valley also were observed in the same area (Fig. 9).

Of the 9 does radioed during spring migration in or near the Study Area, the summer locations of 8 were determined precisely, as were the summer locations of the 17 radioed deer and 4 of the marked but unradioed deer (2 males, 2 females) from Round Valley seen in or near the Study Area (Fig. 10). These animals summered from near Agnew Pass on the north to Florence Lake on the south, which represents an airline distance of some 33 miles, and comprises several hundred square miles of the Sierra Nevada.

Of the does radioed in or near the Study Area, 8 of 9 summered outside it: three went to the Fish Creek drainage, one went to the North Fork of Mono Creek, and another went as far as Florence Lake. One doe summered on Mammoth Pass, and one was located only generally in the summer, southwest of Lake Thomas A. Edison. One radioed doe remained in the Study Area during the summer of 1984 and was located and sighted frequently (Fig. 11). She remained in the Mixed Conifer/Chaparral/Sagebrush Shrub, and produced one fawn. In 1985, she shifted her summer range about 2 miles northeast, near Mammoth Creek. The final doe summered about 2 miles east of the Study Area.

During 141 days of summer fieldwork in the Study Area between 6 June and 15 October 1984 and 6 June and 7 September 1985, 32 un-marked deer (20 does, 6 bucks, 3 fawns and 3 unidentified) were seen. The locations of these sightings are shown in Fig. 11. None of the bucks was seen more than once, and although does are difficult to recognize individually, it is unlikely that many of these were seen repeatedly. The paucity of deer sign observed in the Study Area makes it unlikely that many of the deer remained throughout the summer.

The results of the pellet transects are presented in Table 1 (Pg. 23). Assuming a defecation rate of 13 pellet groups/day (Neff, 1968), summer deer use in the Study Area ranged from 0 deer days/acre/month in Mixed Conifer in June and Chaparral in July, to 7.1 deer days/acre/month in Chaparral in May and June. While probably not a precise measure of the amount of deer use of the various vegetation types, these data do provide an index of relative use of different vegetation types by month.



STAGING AREA AND SPRING AND FALL DEER MIGRATION TRAILS

2. Fall/Winter

Figure 12 shows the results of the dawn road survey from late August through October in both 1984 and 1985. A different pattern of migration is evident in the two years.

In 1984, with the first significant snow of the year on 16-17 October, a large wave of deer moved through the Study Area (Fig. 12a). More than 100 deer were counted on the October 18 dawn road survey. During surveys three days before and four days after this, 2 and 4 deer were counted, respectively. No deer were seen on 29 October 1984, after which the roads were closed by snow and the surveys discontinued.

No large peak of deer movement was evident on the Fall 1985 survey (Fig. 12b). The largest number counted, 38 on 12 September, followed an unusually early snowfall of about one foot at the base of the Study Area, and up to three feet at Solitude Pass. Subsequent storms, with the exception of one on 7 October, show little temporal relation to deer counted on the road surveys.

In order to get another picture of the temporal pattern of fall migration, the cumulative percent of radioed deer crossing the Sierra Crest and moving through or near the Study Area was plotted by date for 1984 and 1985 (Fig. 13). The 1984 data (Fig. 13a) mirror the pattern of the 1984 fall migration shown by the road survey data (Fig. 12a), with 73% (8 of 11) of the radioed deer crossing the crest in response to a storm on 16-17 October. In 1985 (Fig. 13b), it can be seen that a few (3 of 18, or 17%) crossed immediately subsequent to the storm on 11 September. Fully half (9 of 18) of the radioed deer crossed the crest on 8 and 9 October, following a storm on 7-8 October. The rest appeared gradually through 13 November, when the last radioed animal migrated through, in response to a major winter storm. No deer were known to pass through after mid-November, 1985.

For 1985, Fig. 13 probably presents a better picture of the timing and pattern of Fall migration than does the road survey (Fig. 12b), which did not detect major movement on 7-9 October. This may largely be due to the fact that deer hunting season was

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Figure 12. (Page 25) Deer counted during dawn road surveys, and daily precipitation; a. Fall 1984; b. Fall 1985.

Figure 13. (Page 26) Cumulative percent of radioed deer crossing the Crest and moving through or near the Study Area by date; a. Fall 1984; b. Fall 1985.

State of California

The Resources Ager

Memorandum

To : File

Date : July 14, 1985

From : Department of Fish and Game, Ron Thomas, Wildlife Biologist

Subject: Wildlife Habitat Survey of Mammoth Mountain Ski Area

Yesterday I hiked the circumference of Mammoth Mtn. at the 9500-10,000 foot elevation. The purpose was to examine habitat conditions on the ski area and to check on reports that deer are abundant in the developed areas.

In fact, the developed runs are nearly totally denuded of vegetation and many are seriously eroded. Scattered deer sign was found only in those areas not developed for skiing, and in one pocket of undisturbed habitat among ski runs on the east slope at about 8700 feet elevation. The most concentrated (but still sparse) deer sign was found on the south slope where no ski development has disturbed soils and vegetation. Here, ample cover is provided by conifer stands and the open forb-grass slopes provide forage. Two major deer migration trails were found in that area and one was located on the north-west slope, in undisturbed habitat among developed ski runs.

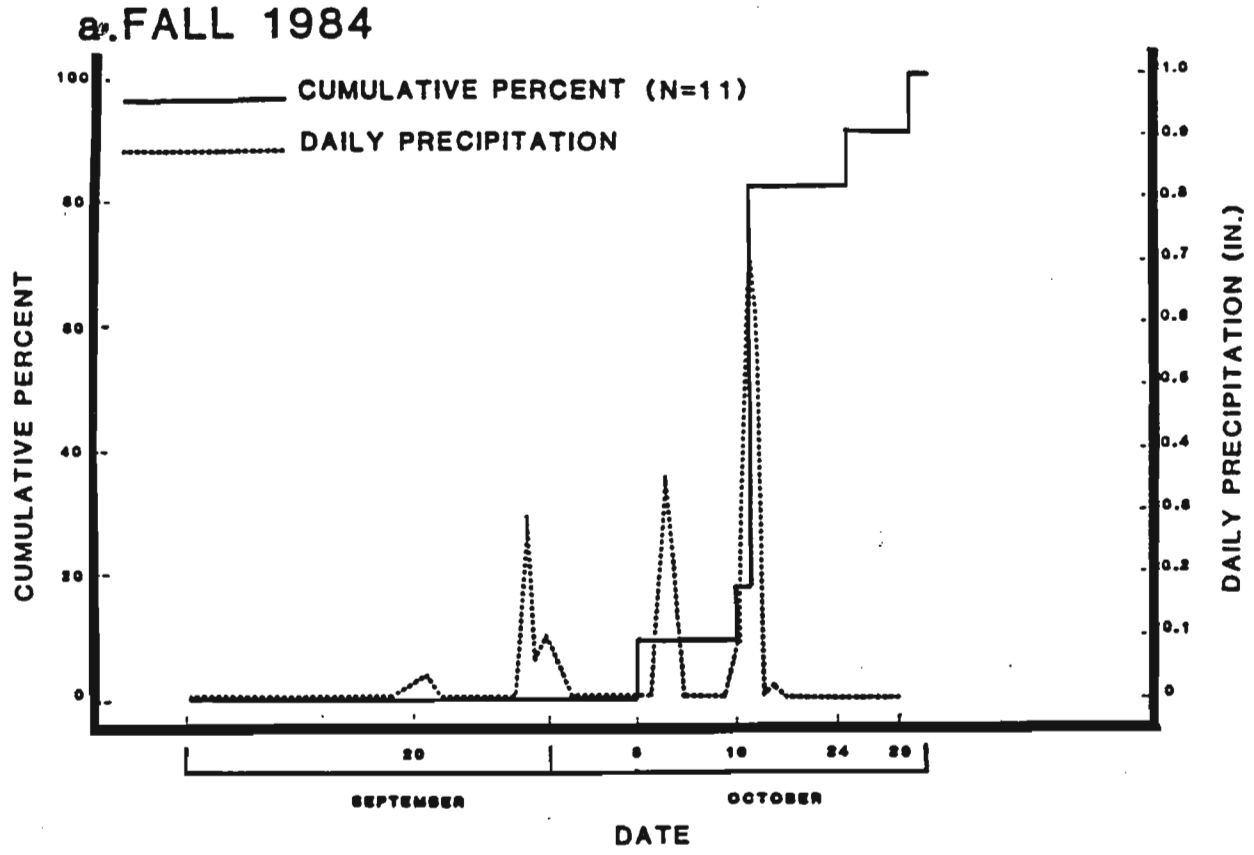
Water is very scarce or absent where I hiked, yet pipelines are conveying water to sprinkle new runs. However, no serious attempts at revegetation are apparent. The source of the piped water is unknown; the question is whether spring flows have been usurped for ski area development, to the detriment of wildlife habitat needs.

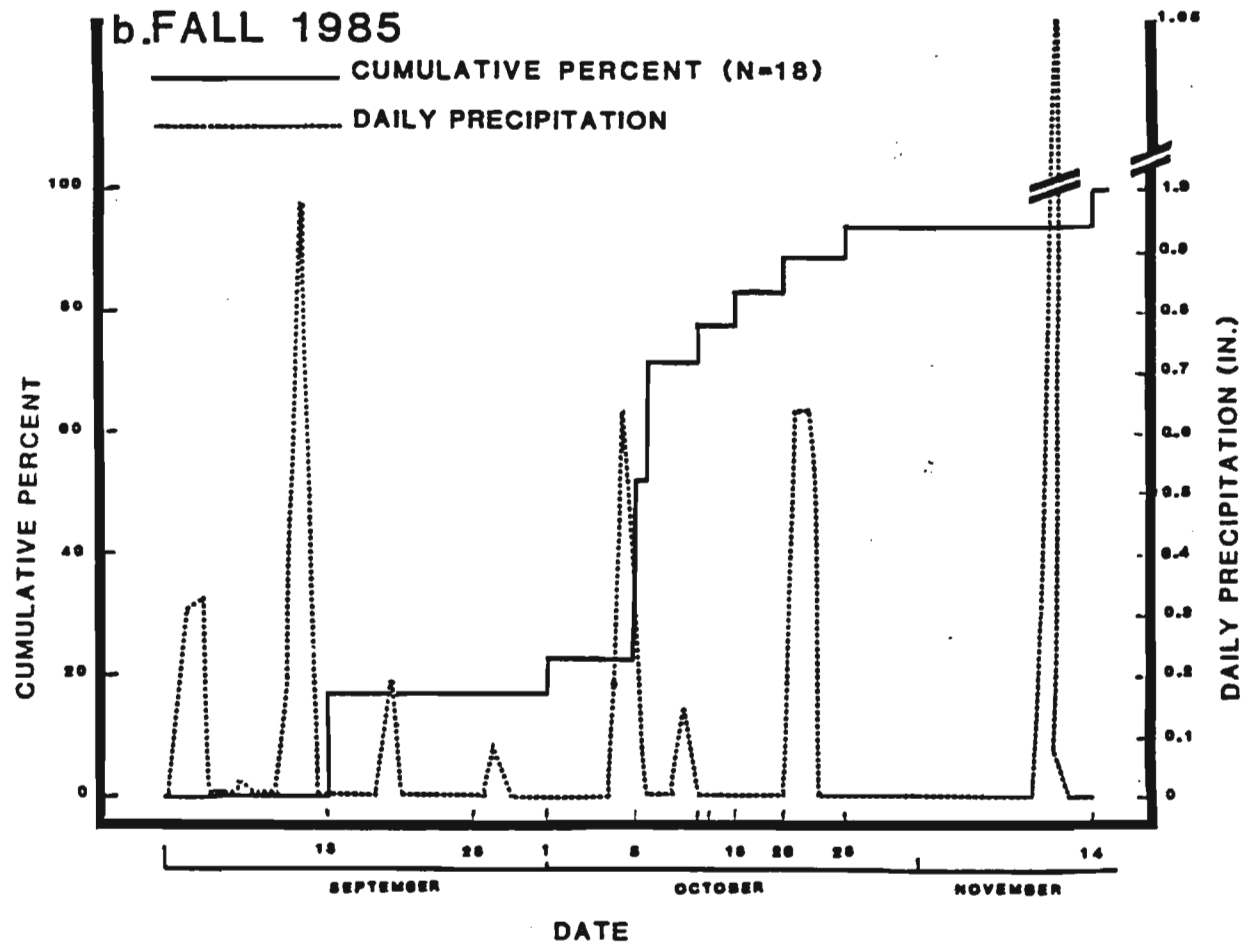
My conclusions are: 1) Due to poor soils and probable scarcity of water, it is likely that Mammoth Mountain was never very high quality wildlife habitat. 2) Any habitat values it once may have provided have been effectively wiped out in those major areas where ski development has occured. 3) Except for a few rodents, no wildlife or wildlife sign was seen in the areas fully developed for skiing. 4) Serious soil erosinn is occuring at many locations in existing ski runs and will increase with current management where expanded new disturbance is now occuring. Soils, plantlife, habitats, and stream quality will suffer further. 5) There is much to be learned on Mammoth Mountain about ski area development and its effects on natural resources.

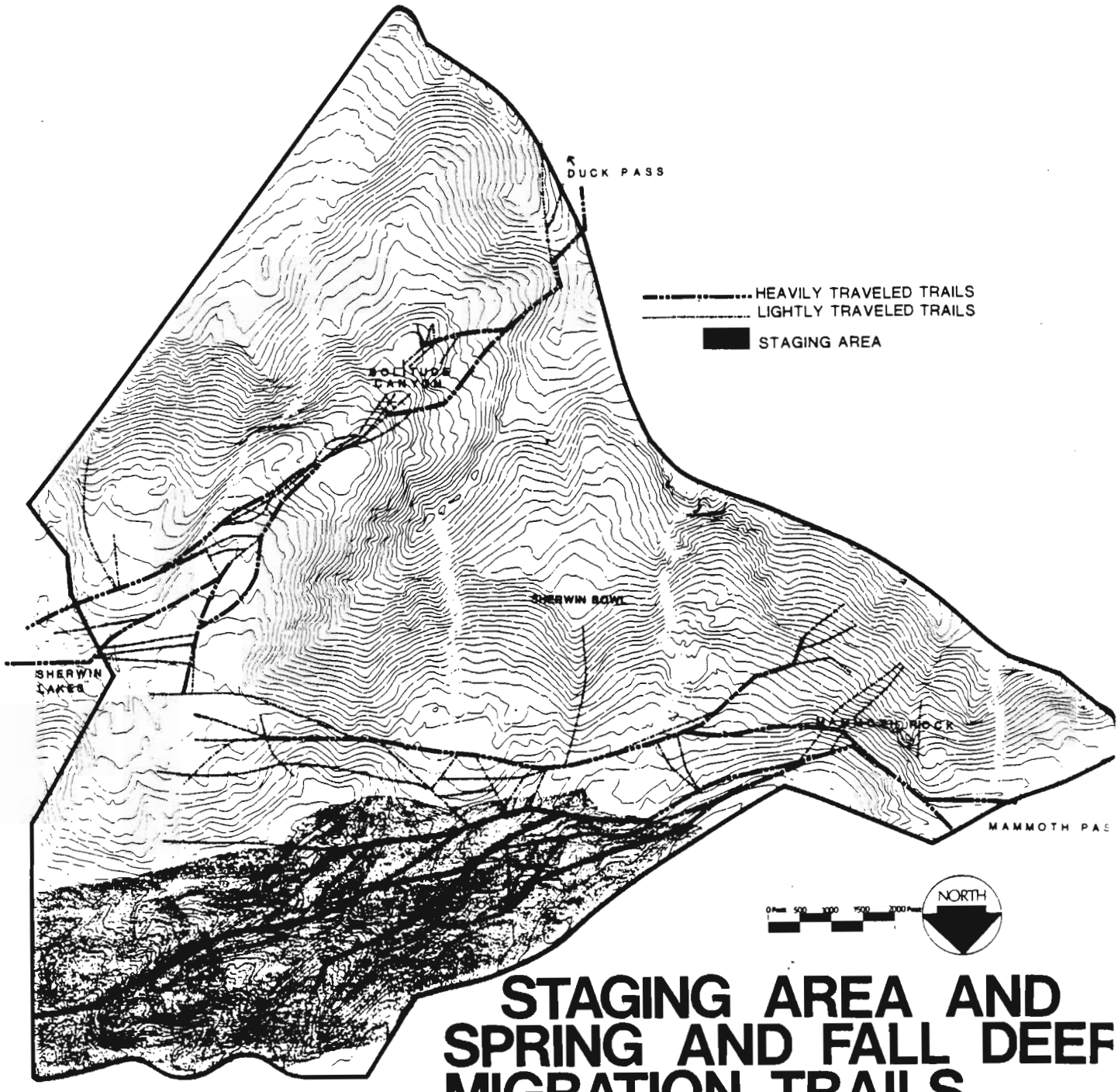
(Photos available)

R.D. Thomas
Wildlife Biologist

FIG. 13


a. FALL 1984
CUMULATIVE PERCENT (N=11)
DAILY PRECIPITATION
CUMULATIVE PERCENT
DAILY PRECIPITATION (IN.)
100
80
60
40
20
0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
5
10
24
29
SEPTEMBER
OCTOBER
DATE


b. FALL 1985
CUMULATIVE PERCENT (N=18)
DAILY PRECIPITATION
CUMULATIVE PERCENT
DAILY PRECIPITATION (IN.)
100
80
60
40
20
0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
18
26
1
5
15
22
29
14
SEPTEMBER
OCTOBER
NOVEMBER
DATE



STAGING AREA AND SPRING AND FALL DEEF MIGRATION TRAILS

B. Other Wildlife

1.) Diurnal Raptors

Areas of potential goshawk habitat (USDA, 1981a), primarily old-growth Mixed Conifer, were examined on foot on 26-28 and 30 June 1985. No birds or sign were seen. One goshawk was seen in the Study Area in the course of other fieldwork on 31 May 1985. This was in aspens at the base of the slope in the northwestern part of the Study Area, below Mammoth Rock. This area was searched extensively and visited several more times over the summer, but no other birds or evidence of goshawk activity were found.

Potential praire falcon nesting areas were examined on 5-7 June 1985. Cliffs by "Rock Chute", just west of Sherwin Bowl, as well as Mammoth Rock and Solitude Canyon were examined for the presence of adults or evidence of breeding. No prairie falcons or sign were observed. In the course of other fieldwork, prairie falcons were seen on 6 June 1985 along the crest above Mammoth Rock, and on 30 June and 12 and 20 September 1985 at the top of Solitude Pass.

2.) Owls

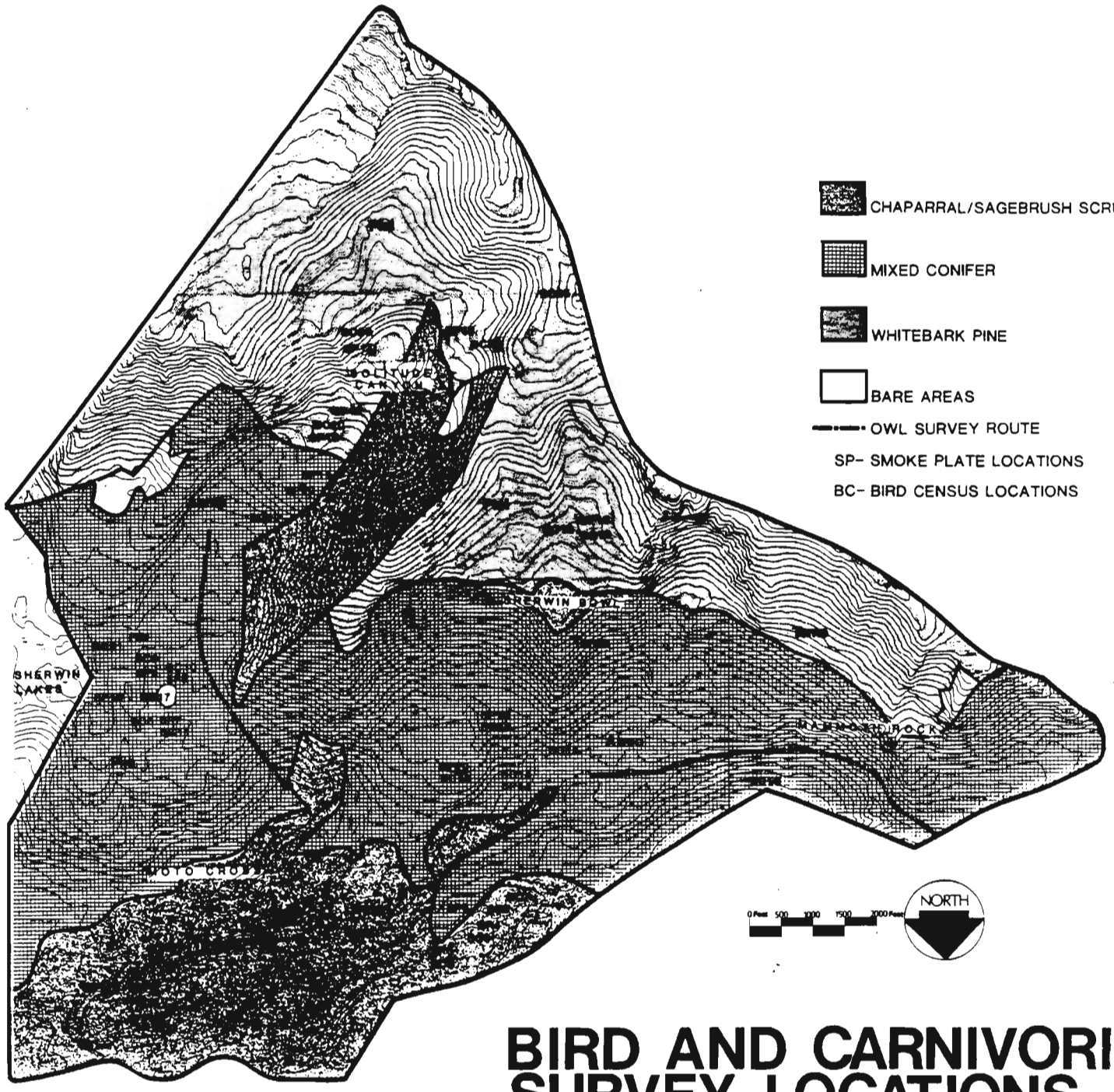
Beginning on 22 May, and continuing once per week through 15 July, 8 owl surveys were conducted. The survey route, mainly through old-growth Mixed Conifer, is shown in Fig. 15. No responses were elicited from recorded calls of flammulated, spotted, or great gray owls. In the course of other fieldwork, the only owl observed was a great-horned owl (Bubo virginianus), seen on 23 July and 15 August about 1/4 mile west of the Moto Cross.

3.) Blue Grouse

Blue grouse and sign were seen and heard commonly throughout the Study Area, in all three major vegetation types and at all elevations. Hens with chicks were seen on 18 June 1985 in an aspen grove in Solitude Canyon, on 26 June below Sherwin Bowl in a patch of Chaparral, and on 12 July in the meadow area in the northwest part of the Study Area.

4.) Management Indicator Avian Species

The locations of the bird survey plots are shown in Fig. 15. Beginning on 28 May and continuing through 20 June 1985, the avian Management Indicator species were surveyed. None were detected in either the Chaparral or Whitebark Pine type. One



BIRD AND CARNIVORE SURVEY LOCATIONS

yellow-bellied sapsucker was observed on plot BC-15. Williamson's sapsuckers were found at Bird Census Plots BC-8 (3 individuals), BC-10 (2 individuals), BC-11 (1 individual), BC-17 (2 individuals), and BC-21 (2 individuals). These plots are all old-growth Mixed Conifer around a sand flat, and areas of large (30-40" DBH) Jeffery pines.

Hairy woodpeckers were found only on plot BC-10 (2 individuals). No pygmy nuthatches were found during the survey. Brown creepers were found on plots BC-8, BC-11, BC-12, BC-13, BC-15 (all 1 individual in each), and BC-21 (2 individuals).

5.) Carnivores

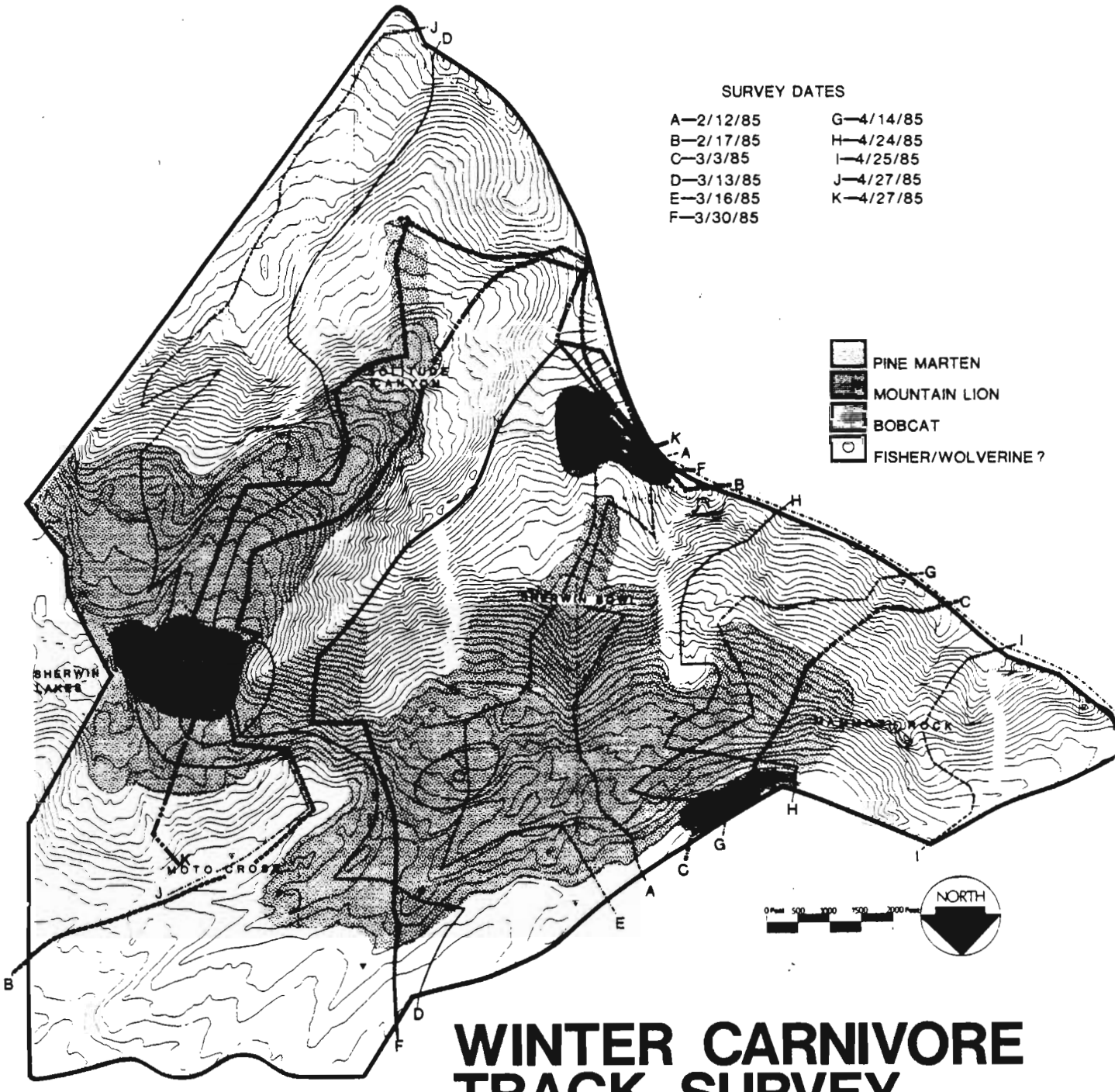
Between 25 June and 13 August 1985, smoke plates were placed on the plots shown in Fig. 15. Marten tracks were found on plots SP-7 near the sand flat, and SP-14 below Sherwin Bowl, in Mixed Conifer, and on plot SP-13 in Whitebark Pine in Solitude Canyon. The tracks of possibly a Sierra Nevada red fox were found on plot SP-16 in Whitebark Pine above Sherwin Bowl, but this is only tentative, because the tracks were somewhat smeared by rain. No fisher tracks were seen. Many plots had coyote tracks, and all had rodent tracks, especially Spermophilus and Eutamias.

Tracks and sign from racoon (Procyon lotor) and black bear (Ursus americanus) were seen in the Moto Cross, mountain lion sign (tracks, scat, and one apparently lion-killed radio-collared deer) was observed in Solitude Canyon, and badger (Taxidea taxus) diggings were seen in the Chaparral.

The winter carnivore survey found marten tracks throughout a wide portion of the Study Area, particularly the Mixed Conifer (Fig. 16). Larger tracks, possibly of fisher or wolverine (Gulo gulo), were seen on two occasions, once at he base of Solitude Canyon, and once west of the Motocross, below Sherwin Bowl. Mountain lion tracks were found above Sherwin Bowl, and bobcat (Felis rufus) tracks were observed at the base of Solitude Canyon. Coyote tracks were found along the top of the ridge. No red fox tracks were observed.

DISCUSSION

Deer begin leaving the winter range, near Bishop, in early April. There is a gradual upward drift to the Study Area and environs, where deer congregate for periods as long as six weeks. These "staging areas" are typical of migratory mule deer (Leopold et al., 1951; Russell, 1932). In 1984, the first deer were observed in the staging area on 20 April; in 1985, the first deer were observed in the Study Area proper on 17 April.



WINTER CARNIVORE TRACK SURVEY

Deer remain in these holding areas, primarily in the Chaparral/Sagebrush Scrub and lower conifer areas, for 3 - 6 weeks until ready to move to their western Sierra summer ranges.

During May and June, deer move through the Study Area on two main routes. One is through the Sherwin Lakes area and up Solitude Canyon to Solitude Pass, then through the upper Mammoth Lakes Basin and over Duck Pass into the Fish Creek drainage. Some of these deer ultimately move as far as Lake Thomas A. Edison and beyond. Deer sign was first noticed in Solitude Canyon on 16 May 1985; there is typically snow on the passes when the deer cross.

The other major migration route is along the base of the Study Area, below Mammoth Rock, and toward Mammoth Pass, giving access to the Middle Fork of the San Joaquin. Additionally, some deer passing through the Study Area move north and cross the Crest along San Joaquin Ridge north of Mammoth Mountain, summering in the Minarets and Agnew Pass area. Approximately 3000 deer participate in the migration from the Buttermilk and Sherwin Grade herds, which winter in Round Valley near Bishop. An unknown number of deer from the Casa Diablo herd also may be involved in this migration. These same routes are used during the fall migration.

The summer locations of individually marked or radioed deer known to pass through or near the Study Area (Fig. 10) demonstrate that this area serves as part of the migratory route of deer which summer over a large part of the Southern Sierra Nevada. The radioed deer which travelled farthest to the south summered just below Florence Lake, on the South Fork of the San Joaquin. The radioed deer summering farthest north was near Agnew Pass. Hundreds of square miles are included in the summer range of these deer. Given this large summering area, the large number of deer passing through the Study Area may not be surprising.

Only one radioed deer summered in the Study Area, and she stayed in the Mixed Conifer/Chaparral/Sagebrush Scrub vegetation at the base of the mountain in 1984 (Fig. 11). In 1985, she summered about 2 miles to the northeast. Other summer observations of deer in the Study Area (Fig. 11) indicated that summer use is relatively light, probably due to the absence of water and poor forage in much of the area. Most of the observations of deer were made in the Chaparral/Sagebrush Scrub vegetation, where browse conditions are more favorable. Even here, however, deer in summer are much more rare than in other nearby areas, such as above the spring at the northern face of Laurel Mountain, about 2 miles southeast of the Study Area. Heavy human presence in the area may be at least partly responsible for this difference in deer density.

alteration resulting in earlier successional vegetation would likely favor summering deer. There are no threatened or endangered species present, and only one sensitive species, pine marten, is present in any appreciable numbers. Sierra Nevada red fox, fisher, spotted and great gray owls, and goshawks and prairie falcons are absent or occur only rarely.

Thus, the approximately 3,000 deer which use the area for staging and migration are of greatest concern. Unfortunately, wildlife science is still at a stage where accurate and reliable predictions of impacts of projects upon wildlife are often difficult or impossible. This is particularly true regarding long-lived, vagile, intelligent species. The difficulty in the present case arises from the temporary, but absolutely critical, use that migratory deer make of the Study Area. Converting a certain number of acres of summer or winter habitat from one type of vegetation to another and predicting impacts on deer is relatively easy. Predicting the consequences of a major development in an important migration corridor is much more difficult. The area seems to work just fine now; the question is, how much worse will it be made by a ski development?

The timing and nature of deer use, and the timing of use by skiers, present both opportunities and constraints. The constraints are conceptually very simple: the less human disturbance, the less deleterious impact on migrating deer. The opportunities arise from the fact that most deer use occurs when there is little skiing to be done, i.e., spring and fall. Spring is the time with most potential for conflict; in years of heavy snowfall, deer could be present in the staging area, or attempting to move over Solitude Pass or by Mammoth Rock, while ski conditions were still favorable. In the fall, most deer will pass through the Study Area before the ski season is underway; pre-season activities (maintenance, preparation of facilities, etc.), however, could nevertheless pose some problems.

Deer use is concentrated through Solitude Canyon, and along the base of the Study Area, both major migration routes. In general terms, minimizing impacts to deer must involve planning to minimize human presence in Solitude Canyon and along the base of the ridge when deer are present, placing permanent stuctures as far as possible from migration routes, and screening those structures with vegetation or natural topographic features. The first can be achieved through a monitoring system to determine the presence of deer in the spring and a contingency plan to cease operations when migration occurs. The latter two can be achieved only through careful and thoughtful design. The ultimate success of such features, however, can only be determined empirically.

APPENDIX 1

Terrestrial vertebrates potentially occurring in the Study Area.

1 = Sighted, or sign observed, in Study Area during this study.
2 = Reported in Study Area by U.S. Forest Service.
3 = Sensitive, special interest, or harvest species, as defined by U.S. Forest Service.

A. Birds

Northern goshawk	*Accipiter gentilis* 1,2,3
Sharp-shinned hawk	*A. striatus*
Cooper's hawk	*A. cooperi* 1
Red-tailed hawk	*Buteo jamaicencis* 1,2
Golden eagle	*Aquila chrysaetos* 1
Prairie falcon	*Falco mexicanus* 1,3
American kestrel	*F. sparvarius* 1
Blue grouse	*Dendragopus obscurus* 1,2,3
White-tailed ptarmigan	*Lagopus leucurus* 1
Sage grouse	*Centrocercus urophasianus* 2,3
Mountain quail	*Oreortyx pictus* 1,2,3
Band-tailed pigeon	*Columba fasciata* 2,3
Mourning dove	*Zenaida macroura* 1,3
Flammulated owl	*Otus flammeolus* 3
Great horned owl	*Bubo virginianus* 1,2
Northern pygmy owl	*Glaucidium gnoma* 3
Burrowing owl	*Athene cunicularia* 2
Spotted owl	*Strix occidentalis* 3
Great gray owl	*S. nebulosa* 3
Northern saw-whet owl	*Aegolius acadicus*
Common poor-will	*Phalaenoptilus nuttallii* 1
Vaux's swift	*Chaetura vauxi*
White-throated swift	*Aeronautes saxatalis* 1
Broad-tailed hummingbird	*Selasphorus platycercus*
Rufous hummingbird	*S. rufus* 2, 1
Calliope hummingbird	*Stellula calliope*
Yellow-bellied sapsucker	*Sphyrapicus varius* 1,2
Williamson's sapsucker	*S. thyroideus* 1
Hairy woodpecker	*Picoides villosus* 1,2
Downy woodpecker	*P. pubescens*
White-headed woodpecker	*P. albolarvatus* 1,2
Black-backed woodpecker	*P. arcticus*
Northern flicker	*Colaptes auratus* 1,2

Red crossbill	Loxia curvirostra 1
Green-tailed towhee	Pipilo chlorurus 1
Vesper sparrow	Pooecetes gramineus
Dark-eyed junco	Junco hyemalis 1
Chipping sparrow	Spizella passerina
Brewer's sparrow	S. breweri 1
White-crowned sparrow	Zonotrichia leucophrys 1
Fox sparrow	Passerella iliaca 1
Song sparrow	Melospiza melodia 1

B. Mammals

Vagrant shrew	Sorex vagrans
Little brown myotis	Myotis lucifugus
Long-eared myotis	M. evotis
Long-legged myotis	M. volans
California myotis	M. californicus
Pika	Ochotona princeps 1,2
White-tailed jackrabbit	Lepus townsendii 1,2,3
Black-tailed jackrabbit	L. californicus 1,2,3
Mountain beaver	Aplodontia rufa
Eutamias spp.	1,2
Yellow-bellied marmot	Marmota flaviventris 2
Belding's ground squirrel	Spermophilus beldingi 1
Calif. ground squirrel	S. beecheyi 1
Golden-mantled ground squirrel	S. lateralis 1
Douglas' squirrel	Tamiasciurus douglassii 1,2
Northern flying squirrel	Glaucomys sabrina
Northern pocket gopher	Thomomys talpoides 1
Deer mouse	Peromyscus maniculatus
Bushy-tailed wood rat	Neotoma cinerea
Western jumping mouse	Zapus princeps
Microtus spp.	
Porcupine	Erethizon dorsatum 1
Raccoon	Procyon lotor 1
coyote	Canis latrans 1,2,3
Red fox	Vulpes vulpes 1 (?)
Black bear	Ursus americana 1,3
Marten	Martes americana 1
Fisher	M. pennanti 1 (?)
Ermine	Mustela erminea
Long-tailed weasel	M. frenata 1

SHERWIN SKI AREA DEER STUDY - PRELIMINARY REPORT

31 December 1984

Thomas E. Kucera

LIST of FIGURES

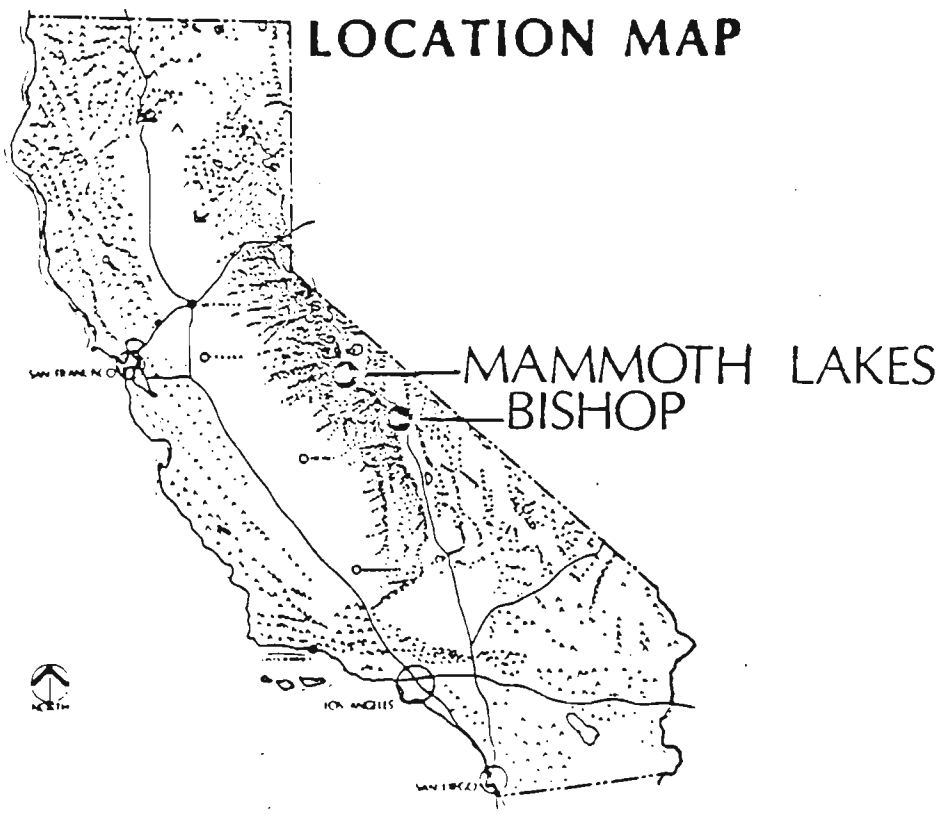


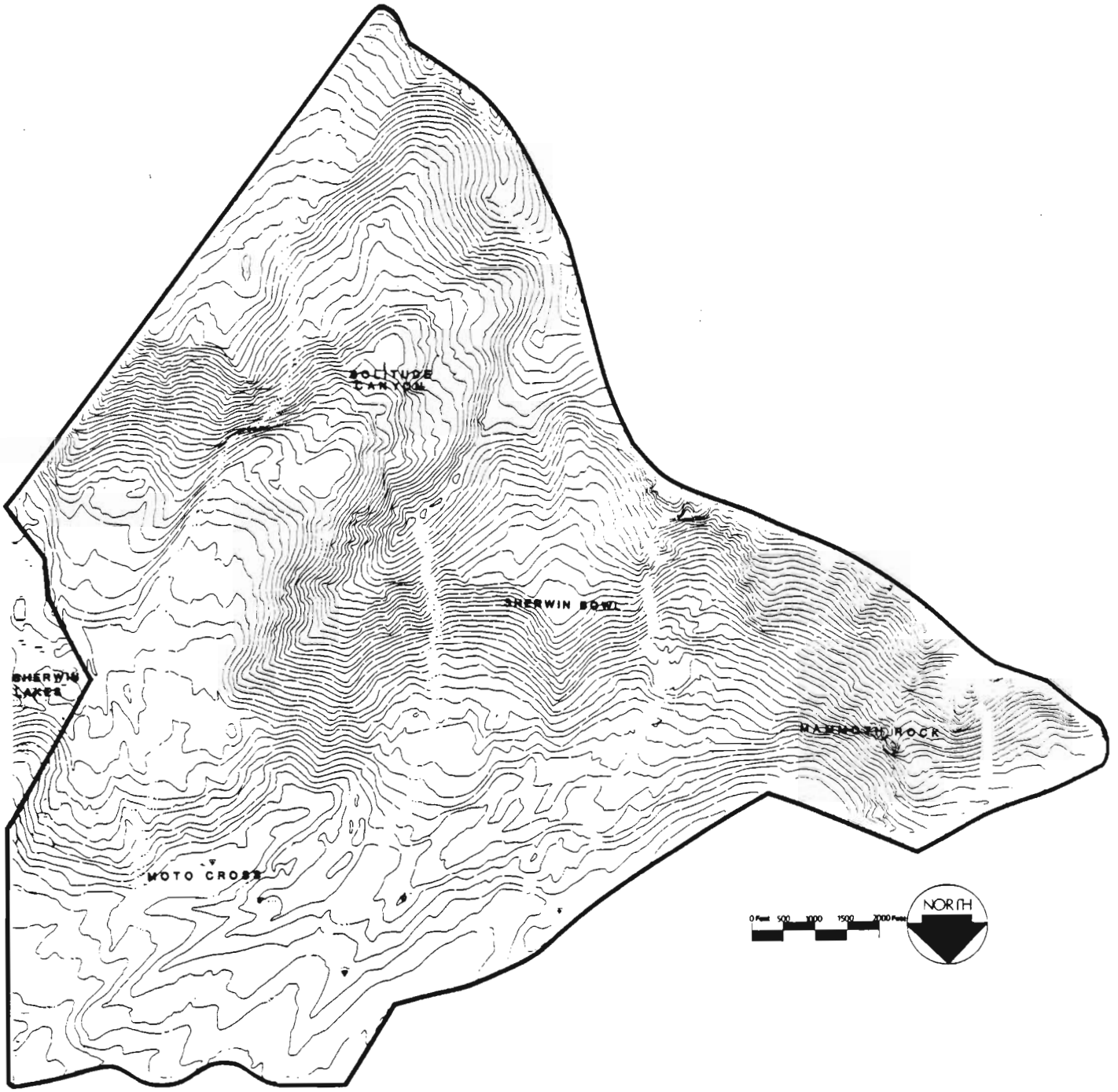
Figure 1. Location of the proposed Sherwin Ski Area in California.

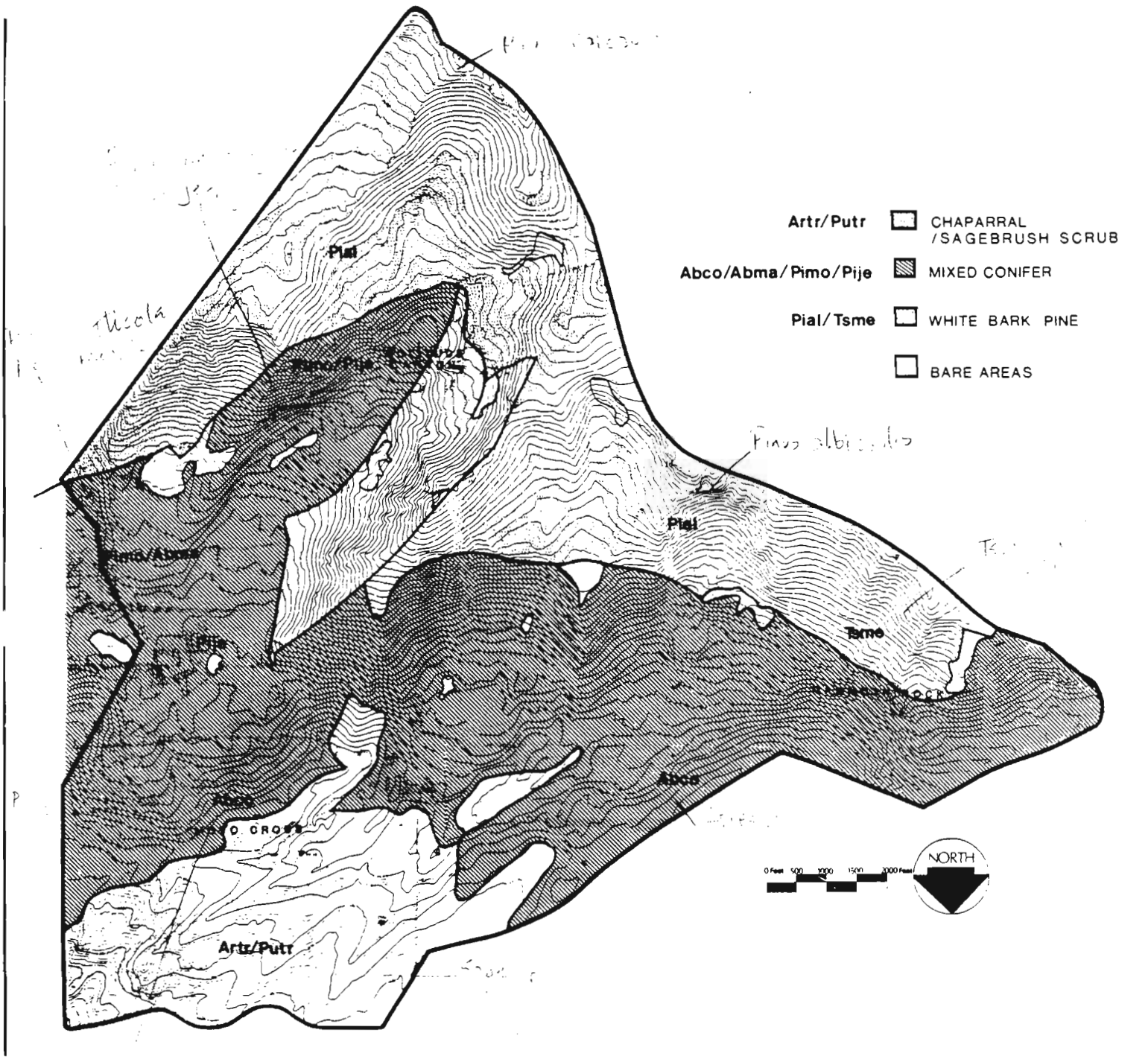
STUDY AREA

The proposed Sherwin Ski Area, hereafter designated the Study Area, is located in Sections 10-15, 23, and 24 of T.4S, R.27E, in the Mammoth Ranger District, Inyo National Forest (Fig. 3). The area comprises approximately 2,000 acres of steep, generally north-facing, mountainous terrain, varying in elevation from 8,000 to 11,600 feet, and lies between the Sherwin Creek drainage on the east and the Mammoth Lakes basin on the west. Most of the land is managed by the Inyo National Forest, Mammoth Ranger District; some of the flat and rolling land at the base of the steep slopes is privately owned. There is no commercial logging in the area. Limited grazing (70 AUM's) by horses and mules occurs in the northwest part of the Study Area (USDA, 1981a).

Present road access is limited to a four-wheel drive dirt road, approximately one mile in length, which enters the area from the east, climbs the steep slopes on the northwest flank of Solitude Canyon, and terminates at an abandoned mining prospect. Access is restricted by a locked gate at the start of this road (USDA, 1981a). An off-road motorcycle recreation area, the Moto Cross, also is present at the base of the eastern side of the Study Area.

Two main vegetation types were identified within the area by the U.S. Forest Service (USDA, 1981a) using the CALVEG (USDA, 1981b) classification system (Fig. 4). The first type of vegetation is Mixed Conifer (Jeffrey pine (Pinus jeffreyi), white fir (Abies concolor) and red fir (A. magnifica)). The second is Whitebark Pine (P. albicaulis). A third vegetation type, composed of a mixture of Chaparral (manzanita (Arctostaphylos patula) and tobaccobrush (Ceanothus velutinus)) and Sagebrush Shrub (bitterbrush (Purshia tridentata) and sagebrush (Artemesia tridentata)) is found on the rolling hills at the base of the mountains.


SOLITUDE CANYON
SHERWIN BOWL
SHERWIN LAKES
MAMMOTH ROCK
MOTO CROSS
0 Feet 500 1000 1500 2000 Feet
NORTH


Artr/Putr
CHAPARRAL /SAGEBRUSH SCRUB
Abco/Abma/Pimo/Pije
MIXED CONIFER
Pial/Tsme
WHITE BARK PINE
BARE AREAS
Pial
Pimo/Abma
Pije
Tsme
Abco
Artr/Putr
NORTH

METHODS

A. Capture and Marking

In May 1984, six adult female mule deer were captured in or near the Study Area by use of tranquilizer darts (Fig. 5). These animals were fitted with radio-transmitter collars, provided by DFG, and released. In addition, during January - March 1984, 111 deer were captured in Round Valley, approximately 15 miles northwest of Bishop, California, and 35 miles southeast of the Sherwin Study Area, in conjunction with a larger ecological study of Eastern Sierra deer (Kucera, 1984). Twenty of these deer (8 males and 12 females) were fitted with radio collars; all received numbered ear tags, and 32 adult does which did not receive a radio collar received numbered "marking collars".

B. Telemetry

Following capture, the locations of radioed deer were determined throughout the year, both from the ground and from a fixed-wing plane provided by DFG. A total of 18 telemetry flights were made between 16 April and 9 November 1984. Numerous day hikes and backcountry trips were taken throughout the summer and fall to locate radioed animals on their summer range and during migration.

Within the Study Area, the original plan to monitor deer locations by triangulation was modified due to the large error in signal location induced by the very steep and rocky terrain. Only locations based on visual sightings of radioed animals are reliable in such terrain, and only these are included in this report. Due to safety considerations, night monitoring of radioed deer was not attempted.

Observations of marked but un-radioed deer in or near the Study Area were made throughout the course of daily field work, and locations of these were plotted on aerial photos. Because only one marked deer remained in the Study Area in summer, the attempt to estimate deer population size in summer by use of the Lincoln Index (Connolly, 1981) was abandoned.

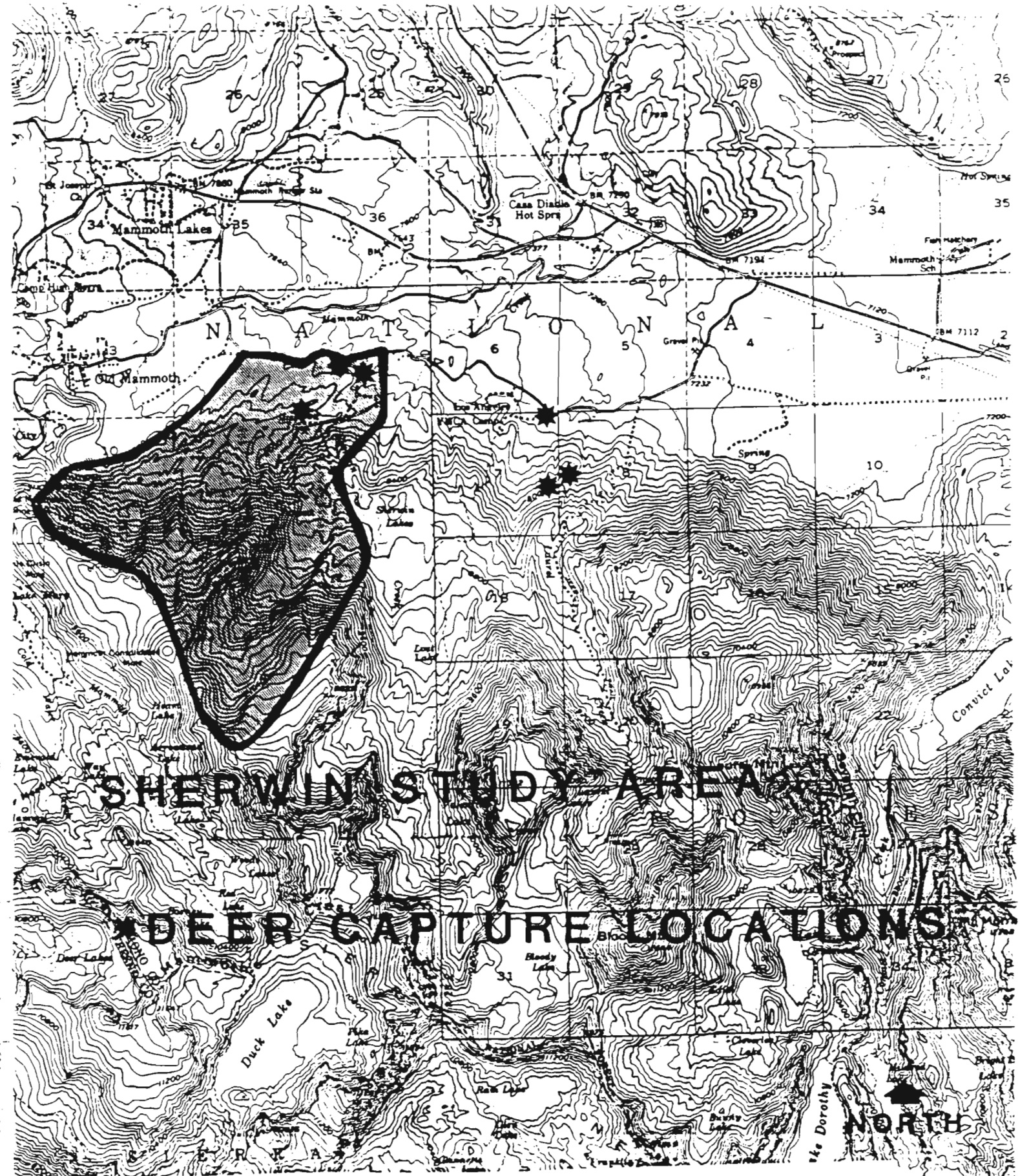


Figure 5. Capture locations of deer in and near the Sherwin Study area.

C. Pellet Transects

In order to determine the amount and timing of summer deer use, 30 randomly located, permanently marked pellet group transects (Neff, 1968) were established in the Study Area, which was divided into three strata according to vegetation type (Fig. 6). The location of each of the 10 transects per stratum was selected by choosing two random numbers corresponding to a grid system overlaid on an aerial photo of the area. The compass orientation of each transect is the same, and was determined randomly. Each transect consists of 10, 1/400 acre circular plots spaced 50 feet apart; the plots are marked by a 3/8 inch rebar stake, 3 feet high and painted for visibility, at the center. Transects are read monthly by counting the number of pellet groups found in each plot. The vegetative characteristics of each transect were also described.

D. Fall Migration

During late summer and fall (20 August - 29 October), a weekly dawn road survey was conducted from a vehicle in and near the Study Area to determine the timing and pattern of migration (Fig. 7). Beginning at 1/2 hour before official sunrise, a fixed route was driven, and all deer observed were counted and classified by age and sex. The beginning and end of the transect were alternated on consecutive surveys.

Immediately after significant snowfall, the Study Area was inspected on foot. Deer observed were classified, and migration trails evident in the fresh snow were plotted on an aerial photo. Because of the number of animals using the same narrow trails, using a track count method to estimate numbers was unworkable.

E. Other Wildlife

During the course of fieldwork in the Study Area, observations of other wildlife species, or their sign, were made, and locations plotted on an aerial photo.

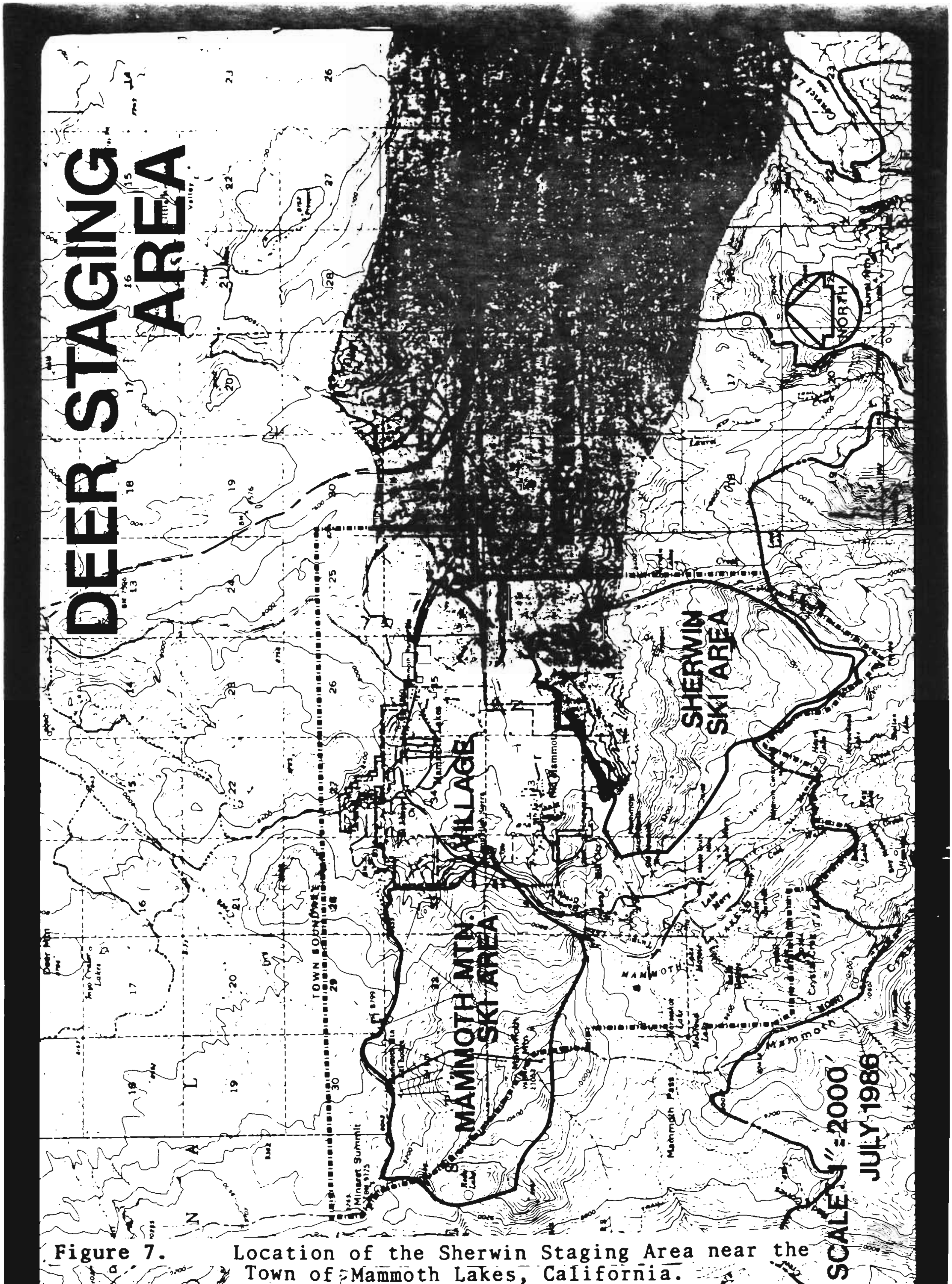
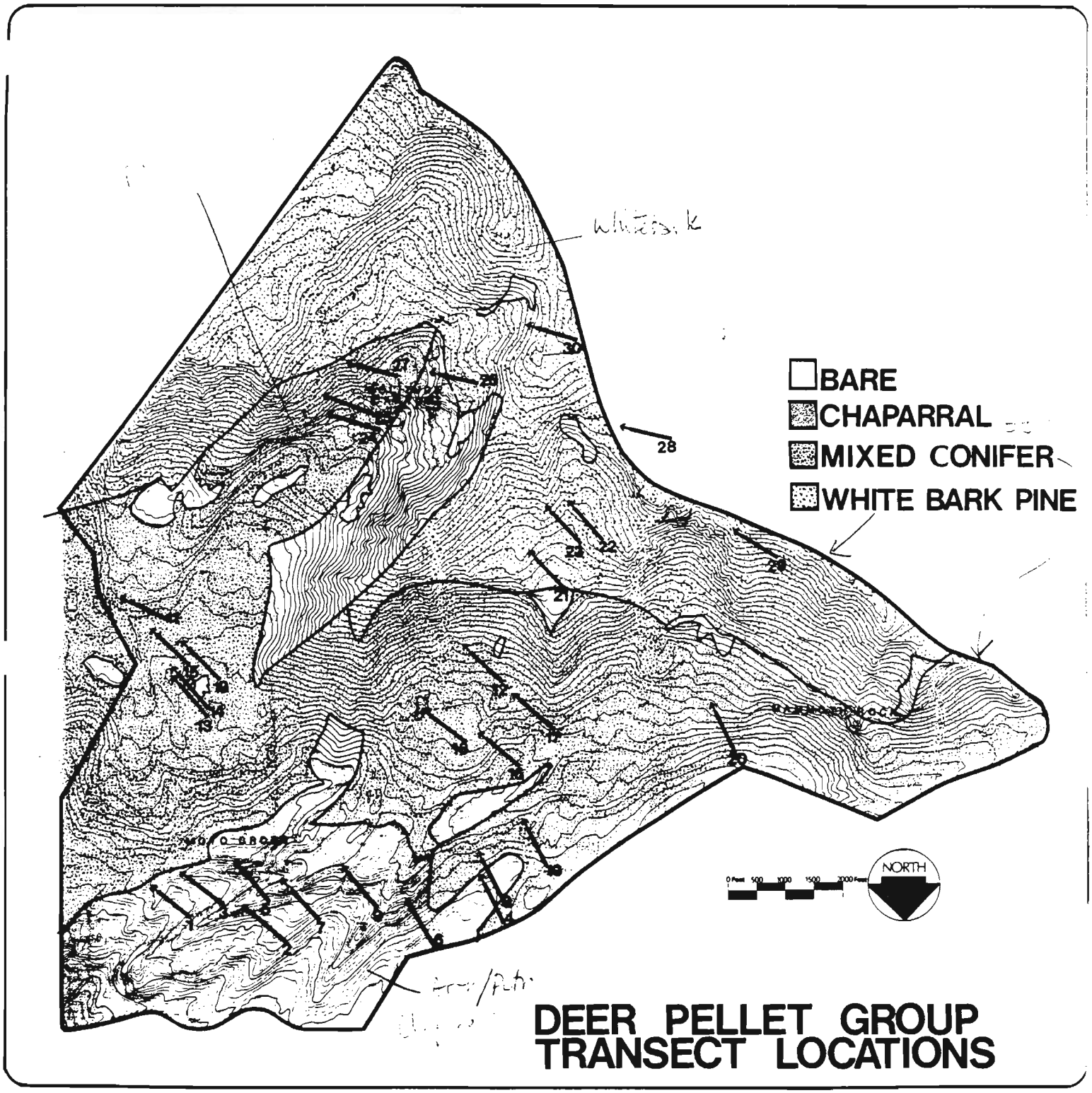


Figure 7. Location of the Sherwin Staging Area near the Town of Mammoth Lakes, California.



DEER PELLET GROUP TRANSECT LOCATIONS

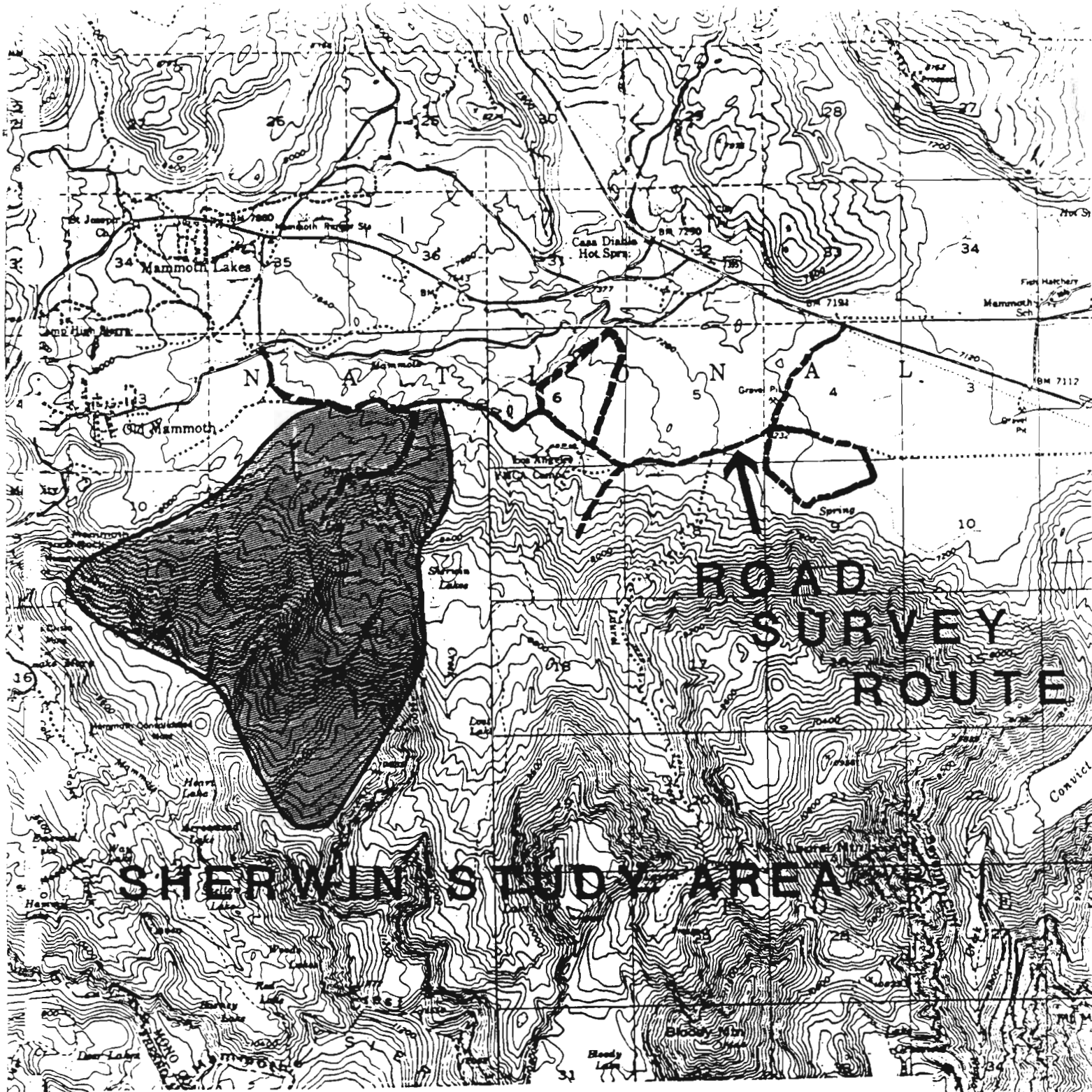


Figure 7. Location of the dawn road survey in and near the Sherwin Study Area.

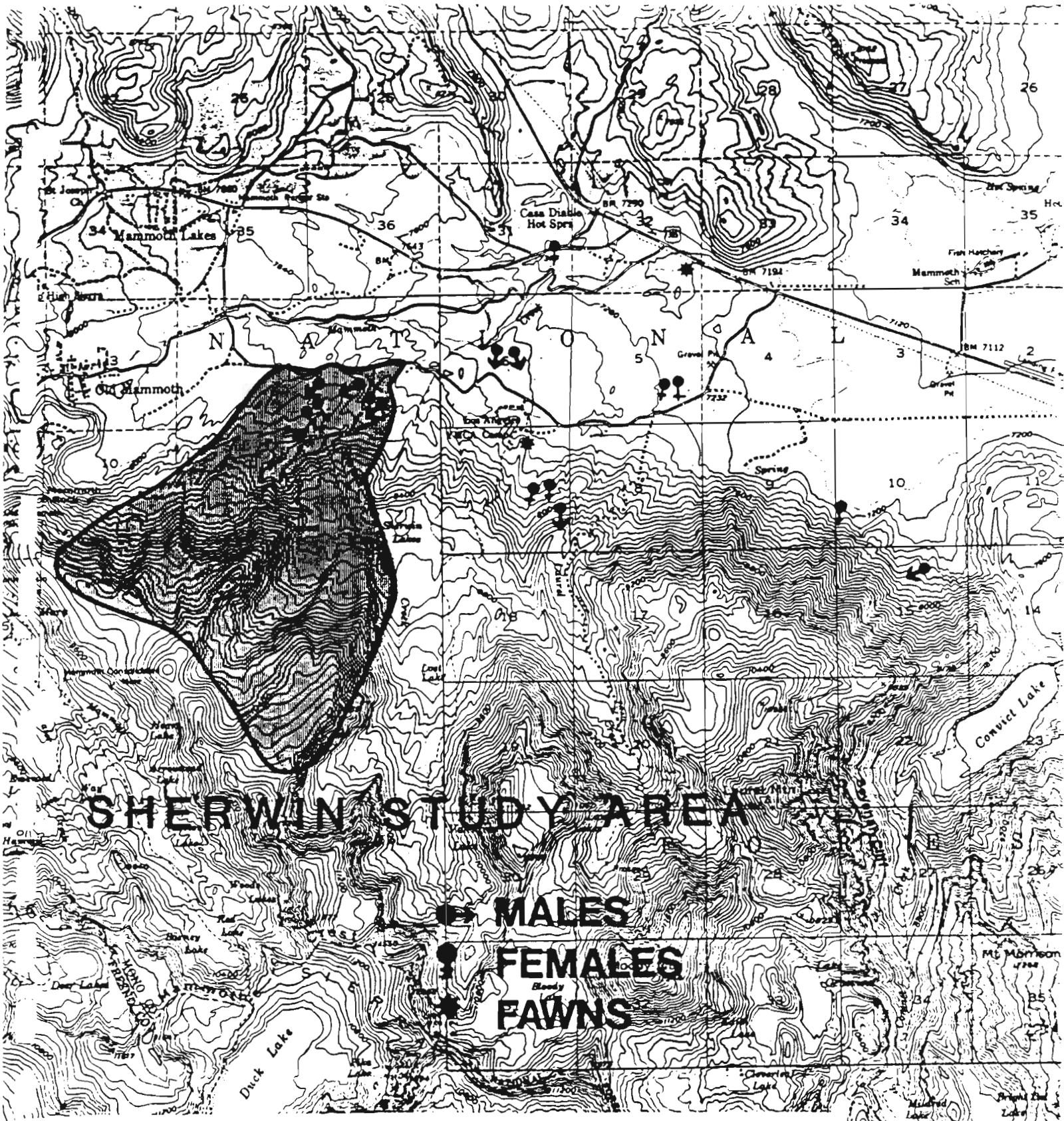


Figure 8. Locations of deer radioed or marked near Bishop, observed in or near the Sherwin Study Area.

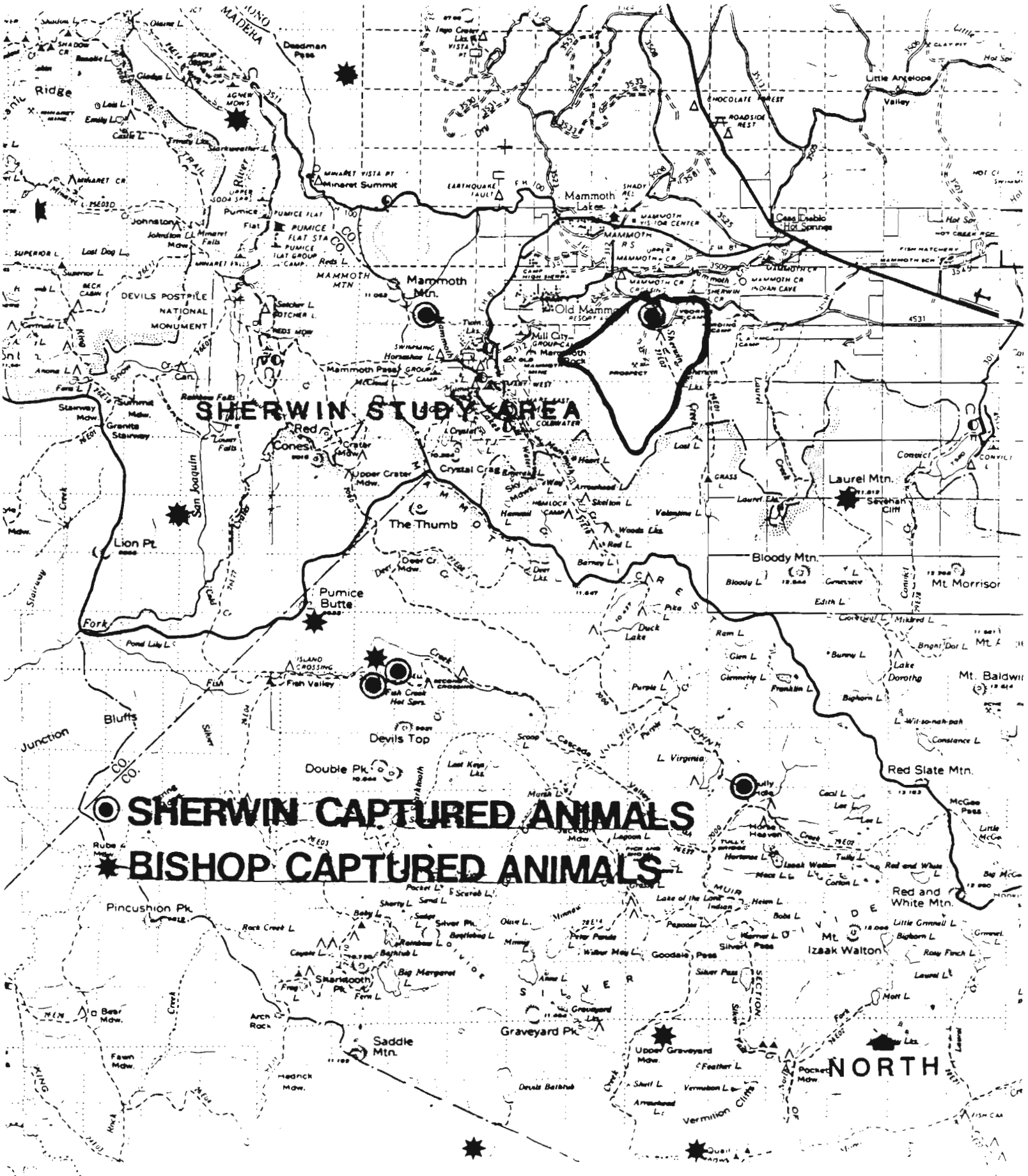
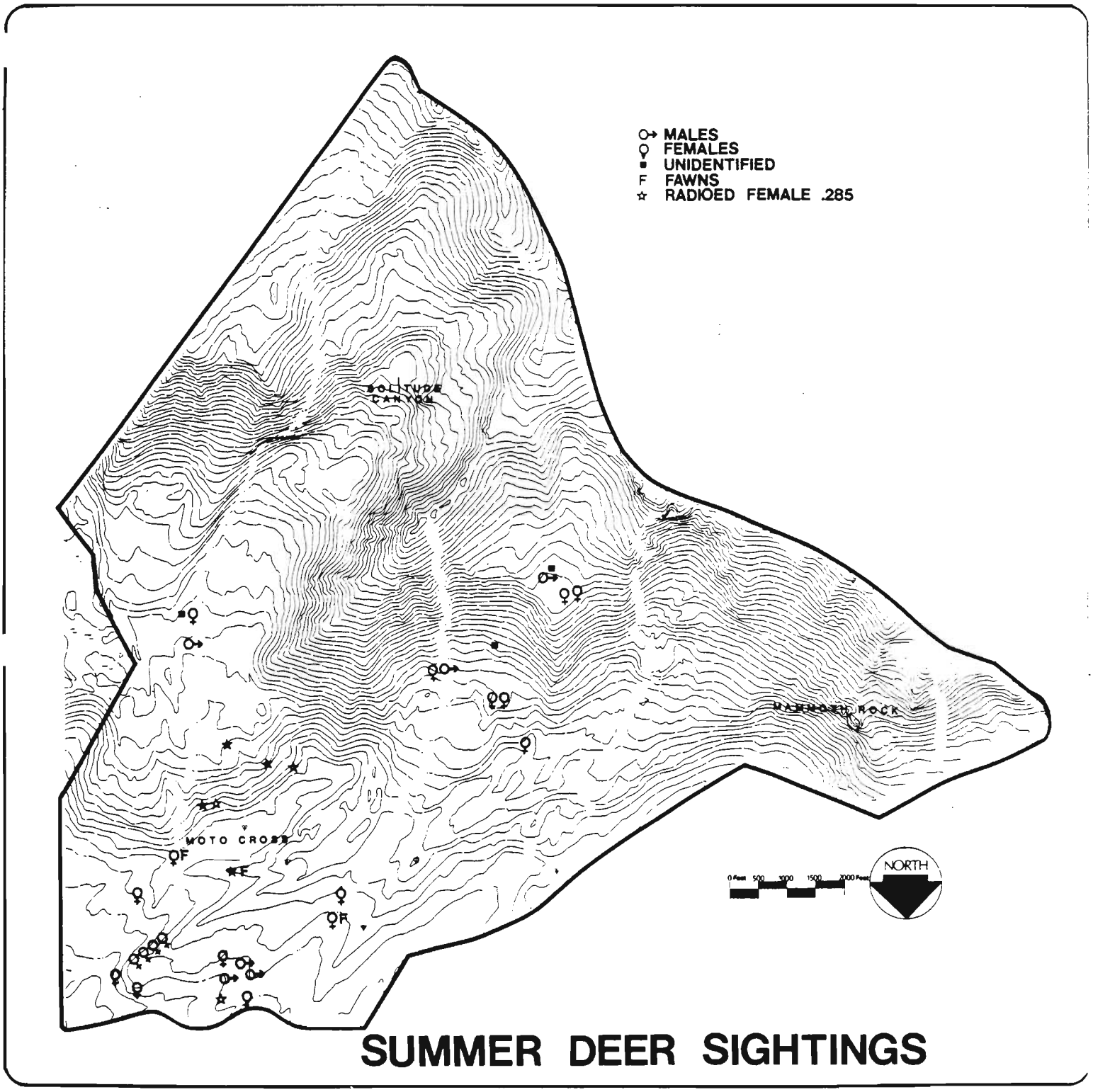


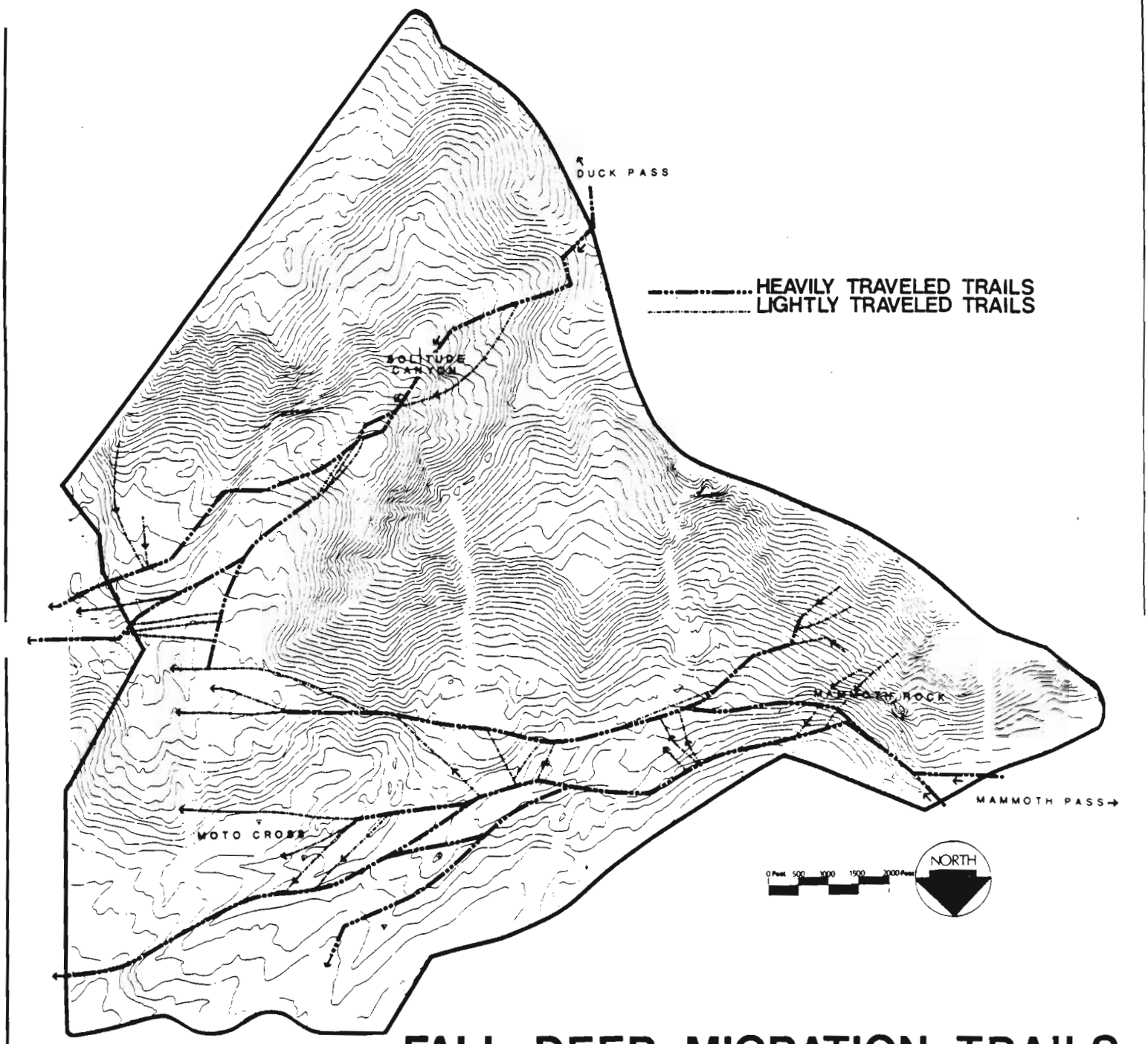
Figure 9. Summer locations of radioed and marked deer observed in or near the Sherwin Study Area during spring migration.



SUMMER DEER SIGHTINGS

Stratum	Chaparral		Mixed Conifer		Whitebark Pine	
Month	Aug.	Sept.	Aug.	Sept.	Aug.	Sept.
# Pellet groups	2	4	3	3	1	1
Avg./transect	0.2	0.4	0.3	0.3	0.1	0.125
Avg./acre	8	16	12	12	0.4	0.5
Deer days/acre	.62	1.2	0.92	0.92	0.30	0.38

TABLE 1. Results of the deer pellet transects in the Sherwin Study Area, Summer 1984.



FALL DEER MIGRATION TRAILS

B. Fall/Winter

The results of the dawn road surveys are shown in Fig. 11. Little movement of deer is apparent through the middle of October. With the first significant snow of the year on 16-17 October, a large wave of deer moved through the Study Area. More than 100 deer were counted on the October 18 dawn road survey. During surveys three days before and four days after this, 2 and 4 deer were counted, respectively. No deer were seen on October 29th, after which the roads were closed by snow and the surveys discontinued.

On the afternoon of 17 October, immediately after the snow, a trip was made on foot up Solitude Canyon. Heavy deer trailing was obvious in the fresh snow, and 62 deer were seen moving down the canyon during about one hour of observation. A U.S. Forest Service observer (White 1984) reports counting as many as 100 deer per hour crossing the Sherwin Crest on 17 October 1984.

The migration trails mapped in the fresh snow are shown in Fig. 12. Two general migration routes are evident: one comes east from Mammoth Pass, passes near Mammoth Rock, and traverses the base of the Study Area, splitting into several trails. The second presumably comes from Duck Pass, enters the Study Area at the top of Solitude Canyon, descends the Canyon and, joining segments of the Mammoth Pass trail, turns east to go through Sherwin Lakes.

It is impossible to estimate with any precision the number of deer involved in this migration. From the number of animals counted in short periods of time, and from the depth of the trails and amount of other sign, it is obvious that hundreds of animals are involved.

By the beginning of November, all deer radioed in and near the Study Area, and all surviving radioed deer known to have passed by during the spring migration, had returned to the winter range in Round Valley, joining both the Sherwin Grade and Buttermilk herds.

C. Other Wildlife

A list of vertebrates potentially occurring on the Study Area, originally compiled by the U.S. Forest Service (U.S.D.A. 1981b) is presented in Appendix 1. Animal species or their sign (tracks, droppings, calls, mounds, etc.) observed during the course of fieldwork on this study are indicated, as are those species observed by Forest Service personnel.

DISCUSSION

Deer begin leaving the winter range around mid-April. There is a gradual upward drift to the Study Area and environs, where deer congregate for periods as long as six weeks. These "holding areas" are typical of migratory mule deer (Leopold et al., 1951; Russell, 1932). The first radioed deer was observed in the holding area on April 20th; the last was observed on May 24th. On May 16, a count in a drainage one mile east of the Study Area yielded about 200 deer.

Most of these deer probably use the migration trails evident in the snow in October (Fig. 12). One heavily used spring route observed in the present work went up Solitude Canyon, over into the Mammoth Creek drainage, along the east side of this drainage and over Duck Pass into the Fish Creek drainage. Snow was present both at the top of Solitude Canyon (10,500') and on Duck Pass (10,800') when these deer passed over in May.

Only one radioed deer summered in the Study Area, and she stayed in the Mixed Conifer/Chapparral/Sagebrush Shrub vegetation at the base of the mountain (Fig. 10). Other summer observations of deer in the Study Area (Fig.10) indicated that summer use is relatively light, probably due to the absence of water and poor forage in much of the area. Most of the observations of deer were made in the Chaparral/Sagebrush Shrub vegetation, where

CONCLUSIONS

From this first year of study, it appears that the timing, pattern, and intensity of deer activity in the Sherwin Study Area are as follows: In April and May, thousands of deer leave their winter range near Bishop, and possibly other winter ranges (e.g. Casa Diablo), and drift up to the Mixed Conifer/Chaparral/ Sagebrush Shrub in and surrounding the Study Area. They remain here for periods up to a month or longer. By June, most deer have crossed the Sierra Crest, many moving up through Solitude Canyon, over Sherwin Crest and then to Duck Pass. Many others move west through the Study Area, passing near Mammoth Rock and then continuing over Mammoth Pass. Summer deer activity in the Study Area is light; it seems unlikely that more than a dozen deer summer there, although some fawns are produced. With the first major snowstorm of the fall, many hundreds of deer come rapidly through the Study Area and move directly to the winter range.

In the next year's work, a major emphasis will be placed upon quantifying the number of deer involved in both spring and fall migrations. Road surveys will be performed throughout all snow-free months, and remote sensors will be placed in strategic locations to count the number of deer moving through the Study Area. Other work, e.g., pellet transects, radio-telemetry, etc., will be continued.

Hammond flycatcher	*E. hammondii* 1,2
Dusky flycatcher	*E. oberholseri* 2
Western wood peewee	*Contopus sordidulus* 2
Olive-sided flycatcher	*Nuttalornis borealis* 1
Horned lark	*Eremophila alpestris* 2
Violet-green swallow	*Tachycineta thalassina* 2
Steller's jay	*Cyanocitta stelleri* 1,2
Common raven	*Corvus corax* 1
Clark's nutcracker	*Nucifraga columbiana* 1,2
Mountain chickadee	*Parus gambeli* 1,2
White-breasted nuthatch	*Sitta carolinensis* 1,2
Red-breasted nuthatch	*S. canadensis* 1,2
Pygmy nuthatch	*S. pygmea*
Brown creeper	*Certhia familiaris* 1,2
House wren	*Troglodytes aedon* 1,2
Canyon wren	*Catharus guttatus* 2
Rock wren	*Salpinctes obsoletus*
Sage thrasher	*Oreoscoptes montanus*
American robin	*Turdus migratorius* 1,2
Hermit thrush	*Catharus guttatus* 2
Mountain bluebird	*Sialia currucoides* 1,2

APPENDIX 1

Terrestrial vertebrates potentially occurring the Study Area.

1 = Sighted, or sign observed, in Study Area during this study.
2 = Reported in Study Area by U.S. Forest Service.
3 = Sensitive, special interest, or harvest species, as defined by U.S. Forest Service.

A. Birds

Goshawk	Accipiter gentilis 1,2,3
Sharp-shinned hawk	A. striatus
Cooper's hawk	A. cooperi 1
Red-tailed hawk	Buteo jamaicencis 1,2
Golden eagle	Aquila chrysaetos 1
Prairie falcon	Falco mexicanus 1,3
American kestrel	F. sparvarius 1
Blue grouse	Dendragopus obscurus 1,2,3
Sage grouse	Centrocercus urophasianus 2,3
Mountain quail	Oreortyx pictus 1,2,3
Band-tailed pigeon	Columba fasciata 2,3
Mourning dove	Zenaida macroura 1,3
Flammulated owl	Otus flammeolus 3
Great horned owl	Bubo virginianus 1,2

Wolverine	Gulo gulo
Badger	Taxidea taxa 1
Striped Skunk	Mephitis mephitis
Mountain lion	Felis concolor 1
Bobcat	Felis rufus 3
Mule deer	Odocoileus hemionus 1,3

C. Amphibians

Western toad	Bufo boreas
Yosemite toad	B. canorus
Pacific treefrog	Hyla regilla
Mountain yellow-legged frog	Rana mucosa

D. Reptiles

Western fence lizard	Sceloporus occidentalis
Sagebrush lizard	S. graciosus
Northern alligator lizard	Gerrhonotus coeruleus
Rubber boa	Charina bottae
Gopher snake	Pituophis melanoleucus
Common kingsnake	Lampropeltis getulus
Western terrestrial gartersnake	Thamnophis elegans

Pine siskin	Carduelis pinus 2
Lesser goldfinch	C. psaltria
Red crossbill	Loxia curvirostra
Green-tailed towhee	Pipilo chlorurus 1
Vesper sparrow	Pooecetes gramineus
Dark-eyed junco	Junco hyemalis 1
Chipping sparrow	Spizella passerina
Brewer's sparrow	S. breweri
White-crowned sparrow	Zonotrichia leucophrys 1
Fox sparrow	Passerella iliaca 1

B. Mammals

Vagrant shrew	Sorex vagrans
Little brown myotis	Myotis lucifugus
Long-eared myotis	M. evotis
Long-legged myotis	M. volans
California myotis	M. californicus
Pika	Ochotona princeps 2
White-tailed jackrabbit	Lepus townsendii 1,2,3
Black-tailed jackrabbit	L. californicus 1,2,3