

Ironwood Forest National Monument Access, Travel Route Inventory and Visitor Use Study

Final Report



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List of Figures	5
List of Tables	6
Appendices	6
Executive Summary	7
Where do Visitors Currently Enter and Access the IFNM?	7
What is the Current Condition of the Access Points into IFNM?	7
What is the Legal Status of these Access areas?	7
What are the Current Types of Routes in IFNM?	7
What is the Current Status of Legal Access of the Routes in IFNM?	8
What are the Current Conditions of the Routes in IFNM?	8
What levels of Maintenance are required on Each Route in IFNM?	8
Where are the Existing Recreation Sites?	8
What are their Current Purposes and Level of Impacts?	8
What type of Use is Evident at these Recreation Sites?	8
How much use do these Recreation Sites currently experience?	8
What are the Major routes and Destinations that Visitors Use when Traveling Within IFNM?	8
When Does Recreation Use Occur?	9
Where is the majority of Recreation Use Occurring in IFNM?	9
What is the Dominant Recreation Activities Occurring in IFNM?	9
Do Visitors to IFNM Know that they are on Public Lands?	10
Are Visitors Aware of Ironwood Forest is a National Monument?	10
What are the Social and Resource Management Issues that the Visitors Perceive as Critical that Threaten IFNM?	10
Is the Visitor Use of IFNM Equally Distributed Throughout the Day and Season?	11
Has there been an increase in Nighttime use since the onset of the study?	11
Introduction	12
Methodology	14
Access, Transportation Route Mapping and Recreation Site Inventory	14
Who Currently Owns and Manages the Routes in IFNM?	18
What is the Current Legal Status of the Routes in IFNM?	19
What are the Current Classes of Routes in IFNM?	20
What are the Current Conditions of the Routes in IFNM?	21
What levels of Maintenance are required on Each Route in IFNM?	22
What ROS Class are Associated with Each of the Routes in IFNM?	23
Recreation Site Assessment	25
Where are the Existing Recreation Sites?	25
What type of Use is Evident at these Recreation Sites?	25
How much use do these Recreation Sites currently experience?	25
What are their Current Purposes and Level of Impacts?	25
Monitoring Visitor Flows and Patterns of Use in IFNM	29

How Many Visitors Come to IFNM Annually?.....	31
Results from the Visitor Use Survey for IFNM.....	32
What are the Preferred Times for Visiting IFNM?	32
What is the Typical Size of the Parties the Visit IFNM?	34
Where do those who Visit IFNM Typically Reside?	35
What is the Frequency of Visits to IFNM?	35
How Many Visitors Indicated That It Was Their First Visit?	35
How Do Visitors Typically Learn About IFNM?	35
What are the Preferred Months for Visiting IFNM?.....	36
How Many Visitors are Typically Encountered During a Visit to IFNM?.....	36
How Many Visitors Consider Trash to be a Major Management Issue?	36
Are Visitors Attracted to IFNM because it is a National Monument?.....	37
How Many Visitors Bring Dogs to IFNM?	37
What Modes of Transportation Do Visitors Use In IFNM?	37
What Are Preferred Recreation Activities Practiced by Visitors to IFNM?.....	38
What was the Overall Visitor Satisfaction in IFNM?.....	39
What Factors Do Visitors Cite as Important to the Recreation Experience?	40
What are the Typical Travel Patterns of Visitors in IFNM?	42
Recreation Visitation in the Ragged Top Mountains.....	47
Monitoring Visitor Flows Using Automated Counters in IFNM.....	48
An Assessment of Data from Counters Over the Sampling Period.....	53
An Assessment of Visitors Using Mechanical Counters at Ragged Rear.....	55
An Assessment of Visitors Using Mechanical Counters at Pad #3	57
An Assessment of Visitors Using Mechanical Counters at Pad #5	58
Is There Equal Distribution Between Night and Day Visitor Use in IFNM?	59
Has there been an increase in Nighttime use since the onset of the study?	60
What are the Benefits of Using Counters for Acquiring Data on Visitor Use in IFNM?	61
Recreation Site Impact Assessment.....	62
What Type of Recreation Groups Frequent IFNM and Occupy the Campsites?.....	62
What are the Impact Conditions of the Inventoried Campsites in IFNM?	63
Survey of Local Hunters in IFNM.....	66
What Type of Game Do Hunters Target in IFNM?.....	66
What Percentage of the Hunters Camped Over night in IFNM?.....	66
What are the most Popular Hunting Times of the Year in IFNM?.....	66
How Often Do Hunters Visit IFNM and what are the Typical Party Sizes?.....	66
Travel Simulation Modeling for IFNM.....	67
RBSim Multi-Agent simulation of Visitor Travel Patterns.....	68
Developing the Simulation Network for IFNM.....	69
Agent Trip Schedules the Represent Expected Visitation Patterns	70
Arrival/Departure Rates for Typical Trips in the Simulation	71
Monitoring Agents To Measure Number of Visits to Identified Sites and Validate Simulations.....	72

Monitoring Agent at Sensor Placed at Ragged Top.....	72
Discussion.....	74
Scenario Development.....	74
Long Term Monitoring in IFNM.....	75
Monitoring Using Mechanical Counter Pad and Vibration Sensors Technology.....	75
RBSim References and Bibliography.....	77
Appendices.....	79
Appendix 2- Respondent comments.....	95
Appendix 3. Names and addresses for a mailing list.....	96
Appendix 4 - Archives.....	96
Appendix 5 – Detailed Analysis for all Mechanical Counters.....	99
Over the Sampling Period.....	99
Mechanical Counter for Agua Blanca.....	99
Mechanical Counter for the Cemetery.....	101
Mechanical Counter for Mannville Gate.....	103
Mechanical Counter Pad #2.....	105
Mechanical Counter Pad #4.....	108
Mechanical Counter Pad#5.....	110
Mechanical Counter Pad #6.....	114
Mechanical Counter at Pipeline.....	116
Mechanical Counter At Ragged Top #1.....	117
Mechanical Counter at Ragged Rear.....	118
Mechanical Counter at Ragged South.....	120
Mechanical Counter at Red Hill #1.....	121
Mechanical Counter at Red Hill #2.....	123
Mechanical Counter at Red Hill #3.....	125
Mechanical Counter at Samm Hill.....	127
Mechanical Counter at Sasco #1.....	129
Mechanical Counter at Sasco #2.....	131
Mechanical Counter at Sawtooth #1.....	133
Mechanical Counter at Sawtooth #2.....	135
Mechanical Counter at Sawtooth #3.....	137
Mechanical Counter at Sawtooth #4.....	139
Mechanical Counter at Sawtooth #5.....	140
Mechanical Counter at the Silverbell Mine.....	141
Mechanical Counter at Silver Peak.....	142
Mechanical Counter at Silver Peak #2.....	143
Mechanical Counter at West Silver #1.....	144
Mechanical Counter at West Silver #2.....	145
Appendix 6 – Visitor Diary/Survey.....	146
Appendix 7 - Hunter Survey.....	147

List of Figures

- Figure 1 – Context Map of Ironwood Forest National Monument
- Figure 2 - Location and Condition of Access into IFNM
- Figure 3 - Location and Condition of Access into IFNM
- Figure 4 - Legal Status of Routes in IFNM
- Figure 5 - Classification of Routes in IFNM
- Figure 6 - Current Conditions of Routes into IFNM
- Figure 7 - Maintenance Levels Required for Routes in IFNM
- Figure 8 – ROS Classes For Routes in IFNM
- Figure 9 - Recreation Sites in IFNM
- Figure 10 - Impact Assessment for Recreation Sites in IFNM
- Figure 11 - Current Conditions of Recreation Sites in IFNM
- Figure 12 - Location of Survey Stations in IFNM
- Figure 13 - Monthly Arrival Rates from Surveys
- Figure 14 - Hourly Arrivals by Weekday
- Figure 15 - Total Hourly Arrivals at IFNM from Survey
- Figure 16 - Weekly Arrivals
- Figure 17 - Typical Party Size using IFNM
- Figure 18 - First Time Visits to IFNM
- Figure 19 - Reported Visitation to IFNM by Month
- Figure 20 - Total Visitor Days Spent on Recreation Activity
- Figure 21 - Reported Car and Vehicular Use in IFNM
- Figure 22 - Reported Motorcycle and ATV Use in IFNM
- Figure 23 - Reported Foot and Bicycle Use in IFNM
- Figure 24 - Typical Routes of Use in IFNM
- Figure 25 - Location of Counter pads in IFNM
- Figure 26 - Summary of Visitor Counts on pads in IFNM
- Figure 27 - Sampling periods for all Counters Installed throughout 2002-2003
- Figure 28a Summary of total number of visits by counter number
- Figure 28b Total Daily Arrivals in IFNM
- Figure 29 - Weekly arrivals by year
- Figure 30 - Hour arrivals summarized by all counters over the 2002-2003 sampling period
- Figure 31 - Total hours arrivals for all counters by hour of the day
- Figure 32 - Number of arrivals by hour of the day at Ragged Top
- Figure 33 - Number of arrivals by week for 2002-2003 at Ragged Top (summer is not included in this sample)
- Figure 34 - Total weekly arrivals at Pad #3 by hour of the day
- Figure 35 - Hourly Arrivals at Pad #3
- Figure 36 - Total Hourly Arrivals by day for Pad #5 bordering the reservation
- Figure 37 - Monthly Arrivals of visitor for Pad #5

- Figure 38 - Weekly Arrivals by year for counter pad #5
Figure 39 - Location and amount of visitor activity monitored by the counters during the day light hours
Figure 40 - Location and amount of visitor activity monitored by the counters during the night hours activity
Figure 41 - Pad #3 – The Difference Between 2002 and 2003 for Increase nighttime use
Figure 42 - Recreation Impact Condition Class
Figure 43 - Campsite Impacts
Figure 44 - Detail View of Eastside Campsite Impacts
Figure 45 - A View of the Trails Network for IFNM
Figure 46 - Example of a Arrival Curve for Trips Entering IFNM
Figure 47 - Total Hourly Comparison of Arrivals at Ragged Top Between Baseline (Blue) and Simulated Trips (Red)
Figure 48 - Total Monthly Comparison of Arrivals at Ragged Top Between Baseline (Blue) and Simulated Trips (Red)

List of Tables

- Table 1 – Travel Modes in IFNM
Table 2 – Recreation Activities
Table 3 – Respondents evaluation of problems and issues
Table 4 – Identified Reasons for coming to IFNM
Table 5 – Total Number of Counters Installed and Counts Per Sampling Period
Table 6 – Recreation Sites Inventoried

Appendices

- Appendix 1- Access and Transportation Inventory for IFNM
Appendix 2 - Respondent comments
Appendix 3 - Names and addresses for a mailing list
Appendix 4 - Archives
Appendix 5 - Detailed Analysis for all Counters
Appendix 6 - Visitor Diary/Survey
Appendix 7 – Hunter Survey

Executive Summary

This report presents the framework and the inventory and monitoring of visitor use to Ironwood Forest National Monument (IFNM). This cooperative project between the School of Renewable Natural Resources, University of Arizona and the Bureau of Land Management (BLM) was undertaken December 2001 thru December 2003. IFNM is located 25 miles northwest of Tucson, Arizona. The IFNM was declared a national Monument in the year 2000. "President Clinton today signed a proclamation creating the Ironwood Forest National Monument in southern Arizona. The 129,000 acre National Monument contains rich stands of ironwood trees, which can live more than 800 years, and a stunning diversity of bird and animal life and contains a significant system of cultural and historical sites in the Sonoran Desert. The Monument also encompasses several desert mountain ranges including the Silver Bell, Waterman and Sawtooth, with desert valleys in between. Elevation ranges from 1,800 to 4,261 feet. Three areas within the Monument, the Los Robles Archeological District, the Mission of Santa Ana del Chiquiburitac and the Cocoraque Butte Archeological District are listed on the National Register of Historic Places.

What is the Current Level of Visitation at IFNM?

Approximately 12 -15,000 visitors travel through IFNM annually. These estimates are derived from mechanical counter data for twenty-six access points into the National Monument over an eight to fifteen month period.

Where do Visitors Currently Enter and Access the IFNM?

While there are many areas that visitors enter into IFNM, there are some that are more heavily used than others. Those are via the Mannville Gate, the reservation border near the Waterman Mountains, Ragged Top and Avra Valley Road area.

What is the Current Condition of the Access Points into IFNM?

Approximately 70% of gates that provide entry into IFNM are in good condition. There are some broken gates, missing or in only fair condition. For the most part these have been kept in good condition.

What is the Legal Status of these Access areas?

Approximately 65% of the legal access (gates) are located within the jurisdiction of BLM, while an additional 20% provide access to State lands. The remaining entries provide access to private and reservation lands.

What are the Current Types of Routes in IFNM?

Approximately 70% of routes in IFNM are primitive, non4WD roads, 9% light duty but maintained and only 6% primitive 4wd. Primitive, non four wheel drive roads have been constructed or established by use and is generally passable by two wheel drive high clearance vehicle. These routes show no evidence of grading or other travel way maintenance.

What is the Current Status of Legal Access of the Routes in IFNM?

Over 52% of the routes are located on BLM lands, 32% on State Land and approximately 12% on County lands. A very small percentage of routes fall on either private or are not known at the writing of this report. This is important information for the long-term maintenance and management concerns.

What are the Current Conditions of the Routes in IFNM?

Over 90% of the routes are in fair or good condition requiring minor alterations to bring them up to an appropriate safety standard.

What levels of Maintenance are required on Each Route in IFNM?

There is some routine maintenance needed primarily on the primitive, non 4WD roads to bring them up to a road safety standard.

Where are the Existing Recreation Sites?

There are currently 338 recreation sites that have been identified in IFNM. Of these recreation sites 277 are classified as dispersed campsites and some 22 target shooting sites. These sites are located in either the Southeastern section of the Monument, and in the Sawtooth area.

What are their Current Purposes and Level of Impacts?

Over 90% of the recreation sites that were assessed in this study are dispersed campsites. There are a few informal shooting areas and what could be considered larger group sites. A majority of these sites were categorized as impact Class I or II suggesting that they are in good condition. This is probably due to the low use levels. However as evident in the recreation site impact maps, these sites are generally located in the Ragged Top, Waterman and Sawtooth areas and within close proximity of roads. It is apparent that all of these recreation sites are accessible by vehicle. No one in the study reported backpacking into to any recreation sites.

What type of Use is Evident at these Recreation Sites?

Hunting, shooting and camping are the typical recreation use associated with these sites. However, observed and reported trash in some of these sites suggests illegal entrants have been frequenting the area.

How much use do these Recreation Sites currently experience?

The low amount of impact at these sites suggests that these sites are not currently experiencing much use.

What are the Major routes and Destinations that Visitors Use when Traveling Within IFNM?

These recreation activities while dispersed throughout the Monument are most frequently associated with two major routes. The first route starts and/or ends at Mile Wide road, traveling along Cocoraque to Agua Blanca through the Waterman Mountains up to Avra Valley road. The second route starts and/or ends at Silverbell Road, travels along to

Ragged Top and back out Avra Valley road. Of the two, the later route is the more often utilized in the IFNM.

The Sawtooth area, while visited by some ORV and ATV users, does not receive anywhere near as much use as the Ragged Top and Waterman Mountains area.

A majority of visitors come to the area in personal 4WD vehicles. Currently there is low levels of commercial activity in the area

A number of routes that have traditionally been used by locals or those using the area prior to its Monument status are old and infrequently used. However, over 80% of those routes surveyed, are used for 4WD off road driving experiences. These may coincide with driving for pleasure, hunting, shooting or ATV use. A high percentage of those visiting IFNM do so in 4WD vehicles. This is by far the most popular mode of transportation. Since the ATV groups and only a portion of the 4WD community did not respond to this survey it is hard to say. But the routes' conditions and their frequency of use do indicate that these activities are occurring. To what degree, that is still unknown.

When Does Recreation Use Occur?

There is definitely a seasonal nature to visitor use in IFNM. Typically visitation periods range from November through April.

Visitors primarily use the Monument on weekends.

Many visitors indicated that this is their first or second visit to the area.

Where is the majority of Recreation Use Occurring in IFNM?

A majority of the Visitation in IFNM Occurs in the Ragged Top and Waterman Mountains area.

What is the Dominant Recreation Activities Occurring in IFNM?

Of those who travel to the Monument most are either engaged in hiking/walking to observe nature or spend a majority of their time driving around the roads. Hunting and shooting activities are still prevalent and OHV use is increasing.

Most visitors cite experiencing nature, stress release and physical activity as reasons for visiting IFNM. There is a strong sense and need from visitors to the area to find peace and quite/feeling of remoteness as well as strong desire to feel a part of the natural environment. This strong nature theme is apparent in most visitors' responses to the area. The rugged beauty, remoteness, low visitation and encounter rates with other, tends to be a significant reason to visit IFNM.

Ragged Top and the Waterman Mountains are popular destinations for day use activities such as hiking. These areas receive some overnight use as there is access to dispersed camp areas within close proximity. One of the major reasons cited for visiting Ragged Top is to view wildlife. This area is known to be a preferred habitat of desert bighorn

sheep. A study is currently underway to examine the effects of human activity on bighorn sheep habitat in IFNM.

While hunting and shooting was thought to be a high priority in the area, it is apparent from those reporting their recreation activity that driving for pleasure, hiking and nature viewing account for a majority of those who visit IFNM. However one must remember that this assessment is based on those who reported their trips using the survey/diary. It is known that locals still come out to shoot, drive off road and carry on recreation activities that are not so nature friendly. The amount of off-road use, campsite condition, evidence of wash running and shooting sites reveal that these types of uses are occurring and certainly not being reported.

Do Visitors to IFNM Know that they are on Public Lands?

It is also very clear that there is a general lack of understanding by those who visit as to the difference between The Bureau of Land Management (BLM), Arizona State lands and Private land. Seldom do visitors know whether they are on private or public land. This is a concern of private landholders. The lack of attention by visitors to the area with regards to private land postings in IFNM is a significant problem and needs to be addressed. This is a management opportunity to improve communication with the public as to what constitutes a national Monument and those private landholdings and private land signs are important to adhere to.

Are Visitors Aware of Ironwood Forest is a National Monument?

Many visitors have no idea that this is a national Monument or what a national Monument is. Only a very small percentage of respondents indicated that they were attracted to visit the area because it had been designated as a national Monument.

What are the Social and Resource Management Issues that the Visitors Perceive as Critical that Threaten IFNM?

The most serious problems identified by those visiting the area were garbage dumping and illegal immigrant activity. While illegal garbage dumping is evident, trash associated with illegal entrants dominates the sites. Sites containing plastic milk jugs, clothing, feces and other personal items dominate locations in IFNM. These garbage sites coincide with the elevated number of events recorded on the mechanical counters during the evening and throughout the night. While it is impossible to distinguish between border patrol moving through the area, and illegal immigrant activity other clandestine activities, it is apparent that the nighttime use of the area is significant.

Safety for those visiting and living within the boundaries of the National Monument is a major concern. Shooting of water tanks, illegal immigrant activity and drug trafficking have been identified as a threat.

Trash was a significant indicator of illegal immigrant movement.

Lack of Signage and Information for Visitors was frequently reported as a serious management issue.

Is the Visitor Use of IFNM Equally Distributed Throughout the Day and Season?

In some cases, particularly where mechanical counters were placed to record movement patterns of those entering from along the border of the Monument, nighttime activity far exceeds that during the day.

The movement pattern at night is most dominant, along the border of the Monument and concentrated primarily in the Southeastern portion of IFNM.

Established but dispersed campsites utilized by recreation visitors coincide with corridors used by illegal movement of aliens and possible drug trafficking. This has significant health and safety issues for visitors camping in the area.

Other activities that affect recreation use of the area are border patrol moving through the area in search of illegal movement and drug trafficking while necessary have an impact on the nature-loving visitor, as was reported in some of the comments recorded by the surveys.

It is important to distinguish between visitors entering the Monument for some particular outdoor recreation activity and specific destination in mind versus those who illegally move through the Monument on route to some other destination. Evident are those visitors who use the Monument during the daylight hours and those who do not. While the diary/surveys do not acquire this type of information, the counters do so on a 24hr basis.

Has there been an increase in Nighttime use since the onset of the study?

There is an obvious and significant increase in nighttime activity (During the hours of 9:00 PM and 6:00 AM) in some areas of the IRNM.

Nighttime use in the Silver Bell area has nearly doubled between 2002 and 2003, while daytime use has decreased.

Introduction

Ironwood Forest National Monument (IFNM) was formally designated a National Monument by President Clinton in June 9, 2000. This 129,000-acre national Monument contains a significant system of cultural and historical sites. Possessing one of the richest stands of Ironwood trees in the Sonoran Desert, the Monument also encompasses several desert mountain ranges including the Silver Bell, Waterman and Sawtooth, with desert valleys in between. Elevation ranges from 1,800 to 4,261 feet. Three areas within the Monument, the Los Robles Archeological District, the Mission of Santa Ana del Chiquiburitac and the Cocoraque Butte Archeological District are listed on the National Register of Historic Places (BLM 2002). Located east of Tucson, it is accessible by from Interstate 10, Silver Bell and Avra Valley roads (See Figure 1)

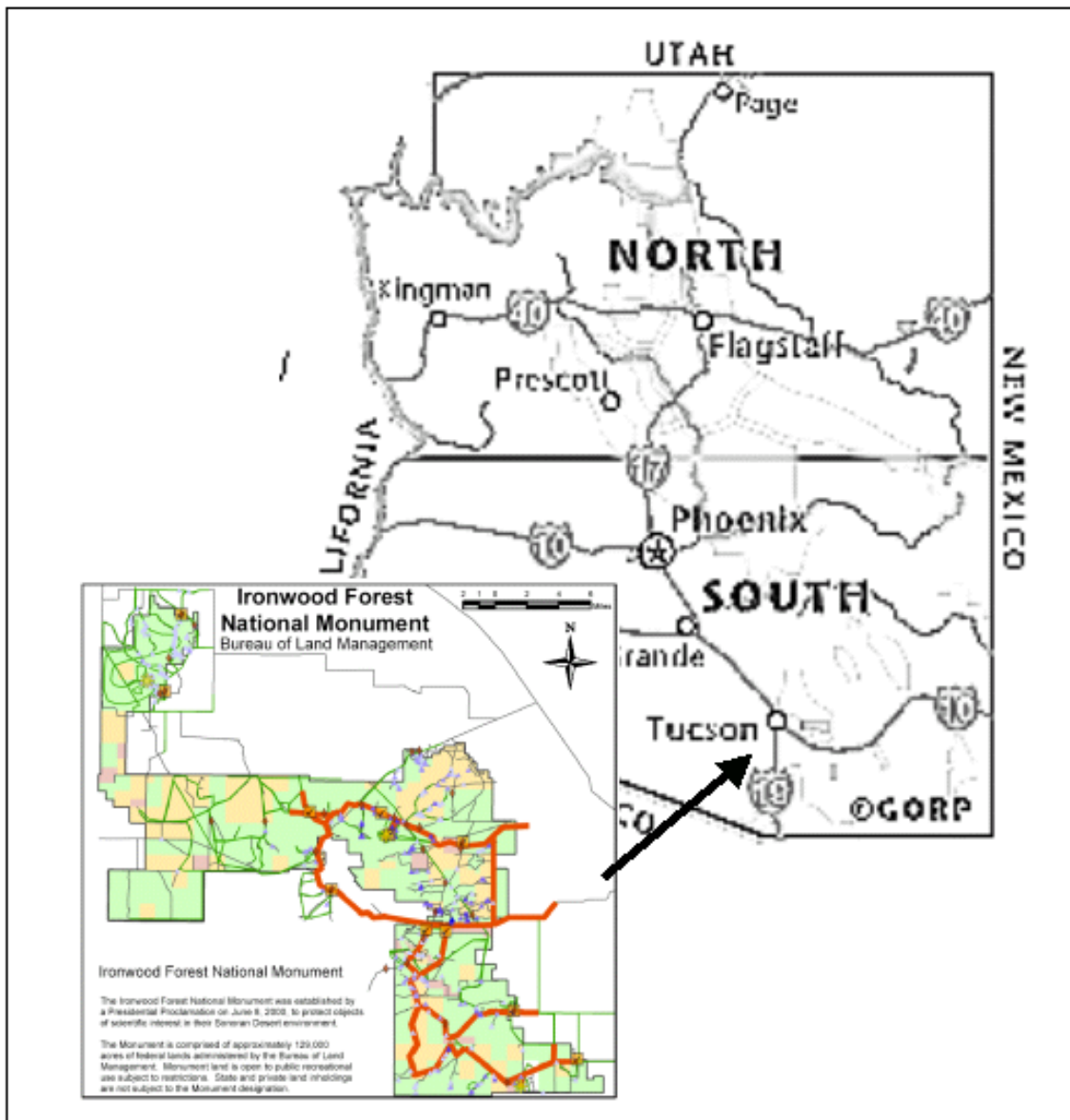


Figure 1 – Context Map of Ironwood Forest National Monument

IFNM is a superb example of the Sonoran Desert ecosystem, featuring exceptional stands of Ironwood trees, important wildlife habitat, associated mountains and significant cultural resources. The Monument has been used for many years for unbridled recreation. Since its recent Monument designation it is becoming a destination for local, national and international visitors, who come to see and experience its natural beauty.

Changes due to illegal alien movement, dumping, drug trafficking, shooting and other recreation uses are having significant impacts on both the social and resource conditions in the Monument. Proliferation of vehicular routes due to off-road vehicular use, wash running and dumping, to name a few, are posing huge challenges to the Monument's interim and long term management. While threats to the unique desert ecosystem are severe within the Monument, forces acting from outside Monument boundaries are equally daunting. Resource management issues related to increasing visitor use include increased fragmentation and isolation of Monument habitats, protection of threatened and endangered species, illegal alien and drug trafficking issues and impacts on cultural resources. These are all of concern to the long-term protection of the IFNM.

While these problems are not insurmountable, the challenge is to develop a more systematic way to understand the dynamics of visitor use patterns throughout the Monument in relation to the increasing use and demand for new access and recreation opportunities. Information that is necessary for managing visitor use in the Monument is currently lacking. Understanding the spatial and temporal distribution of visitor use is of fundamental importance to recreation management in IFNM. The kind and amount of visitor use has profound effects on the quality of the natural resources, visitor experiences and facilities in the Monument. Therefore, it is critically important to be able to monitor the flow of visitation, in space and over time, and to be able to predict how distributions are likely to change in response to both management actions and factors that are not subject to managerial control. In some situations this is easily done. However, the size of the Monument, the complexity of traffic flow, and the amount of uncontrolled access along Monument boundaries makes the monitoring and prediction of use patterns very difficult. Moreover, the importance of being able to monitor and predict visitor flow is particularly pronounced in a place like IFNM, where biophysical conditions and experiential conditions are highly sensitive to the intensity of use.

Minimal work has been undertaken to study both the social and ecological value this Monument brings to the region. Aside from a few anecdotal descriptions of the area, virtually no baseline of existing visitor use conditions has been documented. The purpose of this study is to inventory and monitor existing social and ecological conditions related to the areas transportation system and recreation use in the Monument. The information collected will be used to develop a transportation plan, ORV use designations and recreation management programs through the Monument's management planning.

While documenting and monitoring visitor flow within and outside of the Monument boundaries is critically important, the ability to incorporate this information into long-term decision-making frameworks is of shared importance. Increasingly, travel simulation modeling is gaining recognition as an important tool for natural resource

planning and management. Although travel simulation models for natural resource settings have been experimented with for more than three decades, it is only in the last decade that the cost of modeling has plummeted and capabilities have soared.

The objectives of this study are to:

- Develop a route inventory and document baseline usage patterns, opportunities, and experiences of IFNM visitors.
- Develop a prototype travel simulation model that will replicate baseline visitor use patterns and that could subsequently be used to test the feasibility and effectiveness of planning alternatives.
- Develop a long term visitor use monitoring program for IFNM

Methodology

This report outlines a methodology that uses a combination of techniques to acquire a more thorough understanding of visitor use in IFNM. This report discusses the access, rapid assessment of recreation sites, transportation route mapping and inventory system as well as the work accomplished to monitor visitor flows and patterns of use. Finally a prototype computer simulation tool is presented as a method for replicating spatial and temporal patterns of visitors in the Monument. This simulation tool can alternatively be used to develop, test and evaluate management prescriptions.

Access, Transportation Route Mapping and Recreation Site Inventory

This inventory consisted of mapping all existing road and trail networks, impact areas (grazing sites, campsite locations, drainage areas, etc.), existing gates, fences, trailheads, etc. All data collected will be with the BLM's RMIS, FIMS data needs. All features will be spatially captured and attributed using GPS and converted to GIS inventory maps. In addition, landscape features will be captured using video technology to validate impact areas and to serve as an educational tool for visitors to the Monument. A standard classification system will be developed and used in assessing the current road and trail conditions. The inventory of existing conditions involves recreation visits, permit holders as appropriate and a seamless coordinated effort with the State Land Department and their ongoing route inventory methodology.

The following information provides procedures and guidance for completing the access and transportation route inventory for the Ironwood Forest National Monument. The procedure is designed to collect information necessary for planning and management from various sources, with field information mainly collected using GPS equipment.

1. Initial Route Identification Using Photo Interpretation

A GIS coverage of linear features was created using photo interpretation to capture what appeared to be roads and trails. This initial route system was then used to make field maps for ground verification and GPS mapping. Some of the features captured from aerial photographs were fence lines, pipelines, ditches and old overgrown roadways no longer being used for travel.

2. Digital Orthophotos (DOQs) were used for on-screen digitizing using ArcView. The data capture was done at 1:6000 image scale, with vertices spaced as needed to accurately depict the feature alignment. Arc segments were snapped. The DOQs were produced by the Western Mapping Center, NIES Mapping Group from National Aerial Photography Program (NAPP) color infrared aerial photos taken in 1996. The DOQs used were 1 meter resolution.
3. Field Data Collection
The main objective of this step was to ground check the features identified from the aerial photos and collect positional and descriptive information using GPS and photographic equipment.
4. Global Positioning Systems (GPS)
GPS was used in the field to validate interpreted routes and to capture other significant features as part of the ground inventory. A Trimble Pathfinder GPS receiver with a CMT MC-V with TDC1 data logger were used for this study. The following configuration settings were used:
 - i. Logging Intervals:
 - ii. Point feature: 1 second, minimum 10 positions to determine
 - iii. average position.
 - iv. Line/Area Feature: Positions collected at 5 second interval.
 - v. Coordinate system:
 - vi. UTM, Zone 12, Datum NAD 1927.
 - vii. Travel speed: Because of the road conditions and to ensure fairly
 - viii. consistent resolution, GPS data was collected at a 10-15 miles per hour speed.
5. Field Recording of Features
A data dictionary of descriptive elements for field recording of features was constructed to describe a variety of route conditions necessary for route evaluation and planning (See Appendix I for Description and Evaluation Items description).
6. Photography
Digital photographs were taken of features along routes (gates, use areas, etc.) Digital video was collected for each route at the same time GPS positional data was collected. The time stamp on the video corresponds with the time stamp on the GPS files (See Digital Photography and Video on enclosed CD)
7. Field Notes
A paper worksheet corresponding to the route descriptive elements in GPS data dictionary was filled out in the field to take notes on field observations, supplementing the data logger entries.
8. GPS Data Correction and Cleanup
Differential correction was performed on all GPS field data using local GPS base station data, removing duplicate features (or parts of features) if needed, and

verify data attributes. For this study the Tucson and Scottsdale base stations (COT1, COSA) were primarily used for the differential correction, except for a few instances when data from those stations was unavailable; the Las Vegas Nevada base station was used in those cases. The data was obtained from the National Geodetic Survey's continuously operating reference station website (<http://www.ngs.noaa.gov/cgi-cors/ufcors2.prl>).

9. GPS Data Export

All GPS data was exported to a format useable in the University of Arizona and BLM GIS system using GPS Pathfinder Office 2.7.

- i. Export Settings
- ii. Format: ArcView Shapefile
- iii. Type of Export: Features – Positions and Attributes
- iv. [Generated Attributes: All Features: Date Recorded, Data File Name; Point Features: Height, Position, Point ID; Line Features: Length (2D), Line ID; Area Features: Area (2D).]
- v. Output Option: Create an output folder for each input file
- vi. GIS Coordinate System:
- vii. System: UTM
- viii. Zone: 12 North
- ix. Datum: NAD 1927 (Western US)
- x. Coordinate Units: Meters

10. GIS Data Merge

All GIS data were merged into ArcView shapefiles to create a single file according to feature type. This resulted in a merged file for all linear features, and point files for the various point features.

11. GIS Data Clean Up

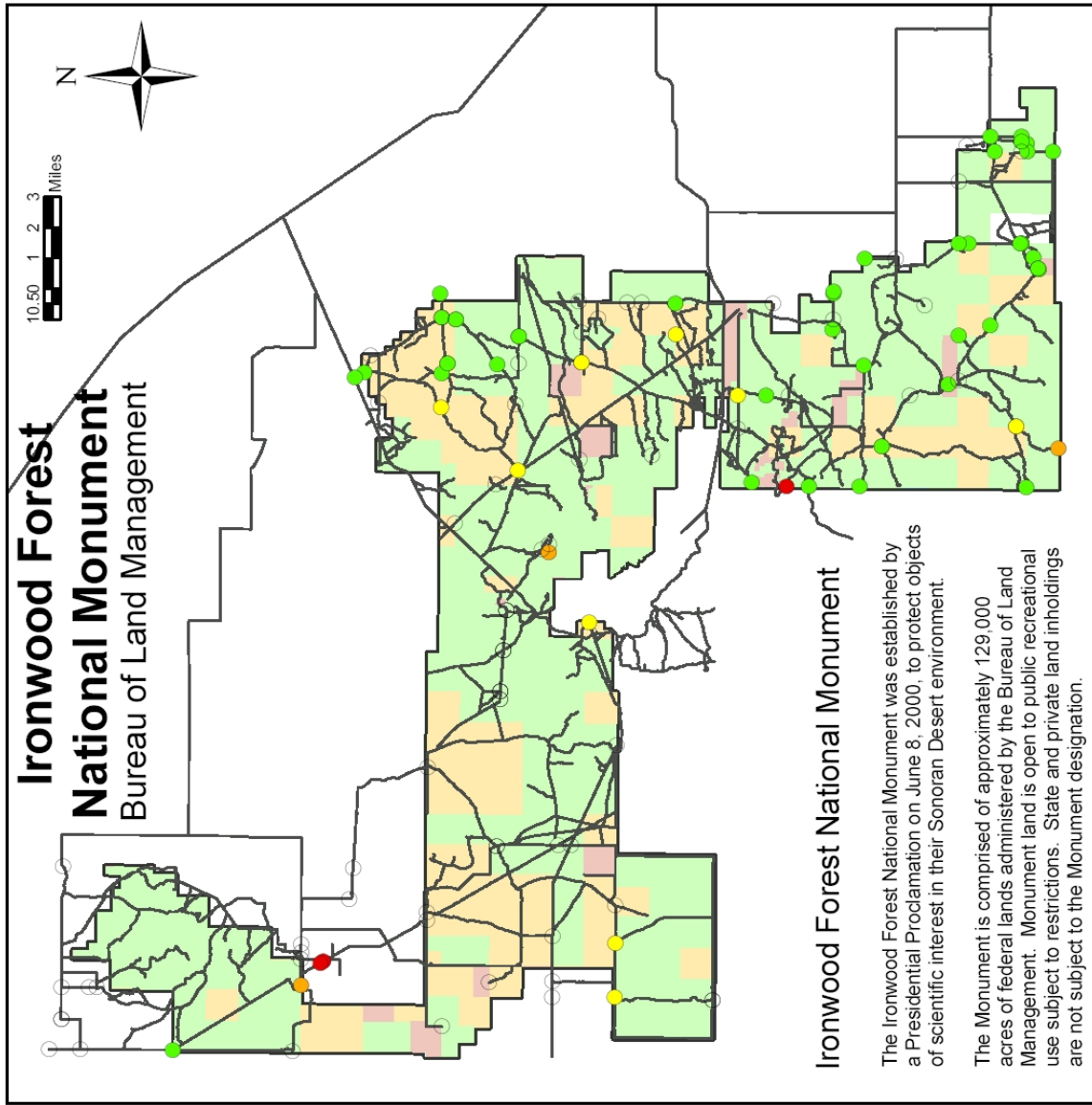
All line features were cleaned to form continuous features and splitting arcs at intersections.

Routes Inventory and Assessment in IFNM

The following is an assessment of the inventory data collected on the routes and access points in IFNM. Maps have been generated displaying entrance areas, legally status of routes, levels of impacts, maintenance levels etc.

Where do Visitors Currently Enter and Access the IFNM?

One of the complexities of working in IFNM is the number of points from which a visitor can enter into the Monument. Figure 2 provides a view of all the access points that were mapped and some indication of what their current condition is. Many of these access points are gates. Many of these gates are old, but in good condition. Figure 2 shows the relative condition of each. Over 90% of the current gates are in good to fair condition. While some require some work, many are in good condition considering the general lack of maintenance.



Federal lands within the Monument are open to recreational use, subject to current regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 2 - Location and Condition of Access into IFNM

Who Currently Owns and Manages the Routes in IFNM?

Over 52% of the routes are located on BLM lands, 32% on State Land and approximately 12% on County lands. A very small percentage of routes fall on either private or are not known at the writing of this report. This is important information for the long-term maintenance and management concerns (See Figure 3).

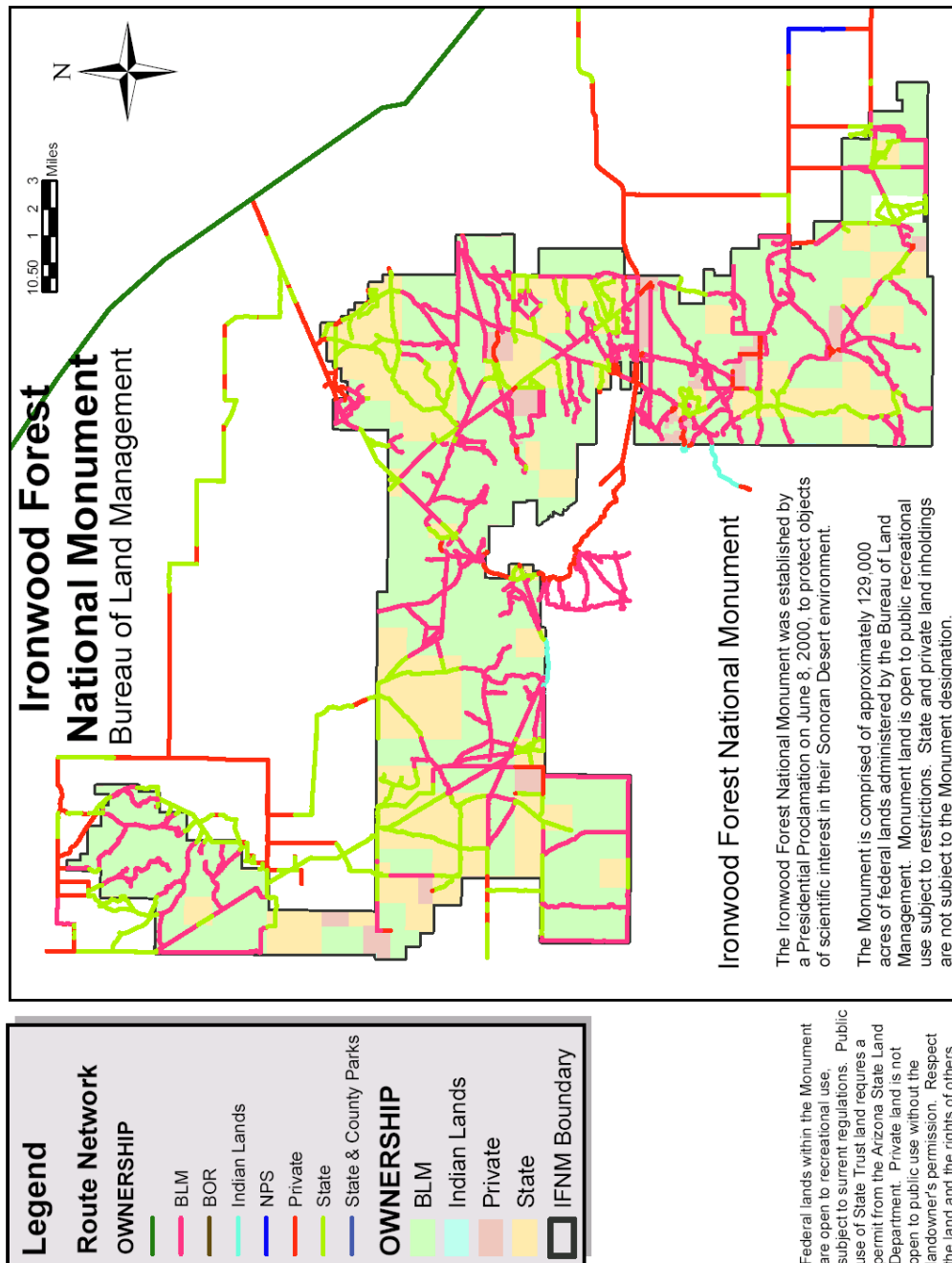


Figure 3 - Location and Condition of Access into IFNM

What is the Current Legal Status of the Routes in IFNM?

Over 70% of the routes in IFNM are classified as allowing legal public access. About 25% of the routes fall on State lands that only allow access with an acquired permit. A very small percent are privately owned roads. These are located within close proximity of the private holdings (See Figure 4).

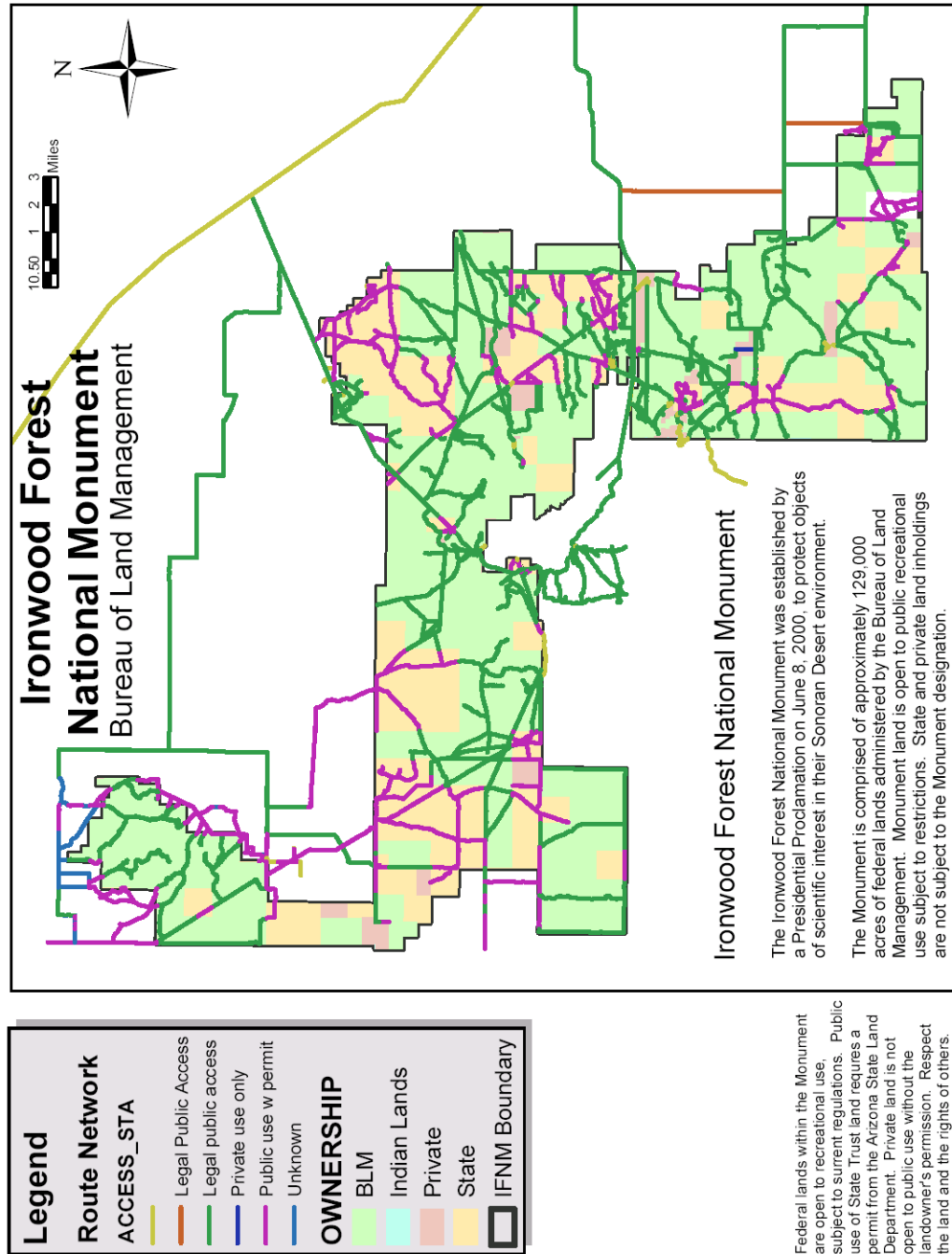


Figure 4 - Legal Status of Routes in IFNM

What are the Current Classes of Routes in IFNM?

80% of those routes surveyed are light duty, maintained suggesting that it is relatively easy for those seeking 4WD off road driving experiences. A high percentage of those visiting IFNM do so in 4WD vehicles. This is by far the most popular mode of transportation. There are some primitive roads in the area but for the most part the ones that seem to get the most use are those that are already lightly maintained (See Figure 5).

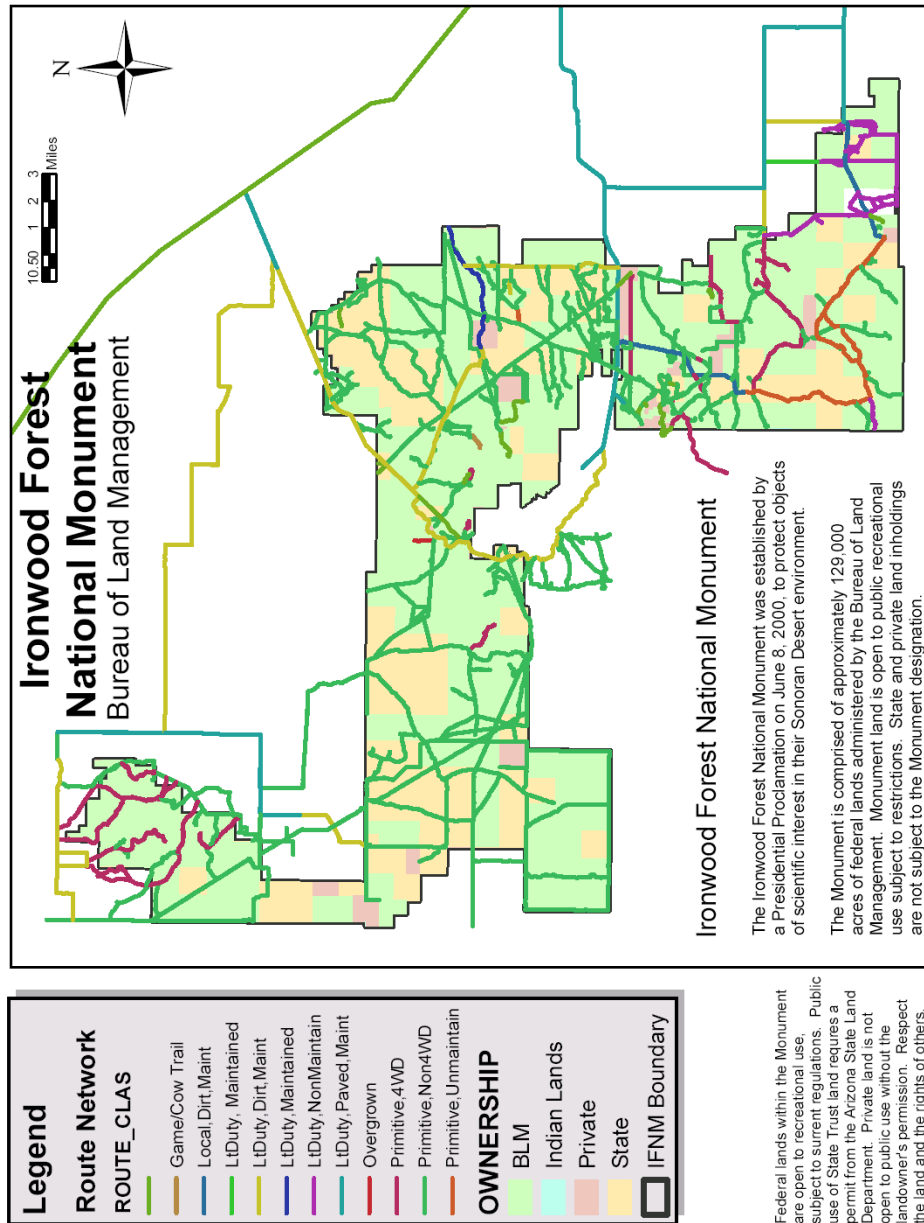


Figure 5 - Classification of Routes in IFNM

What are the Current Conditions of the Routes in IFNM?

Over 90% of the routes are in fair or good condition requiring minor alterations to bring them up to an appropriate safety standard. Only a very small percentage of routes could be considered in poor condition. Those are usually the remote routes not frequently used (See Figure 6).

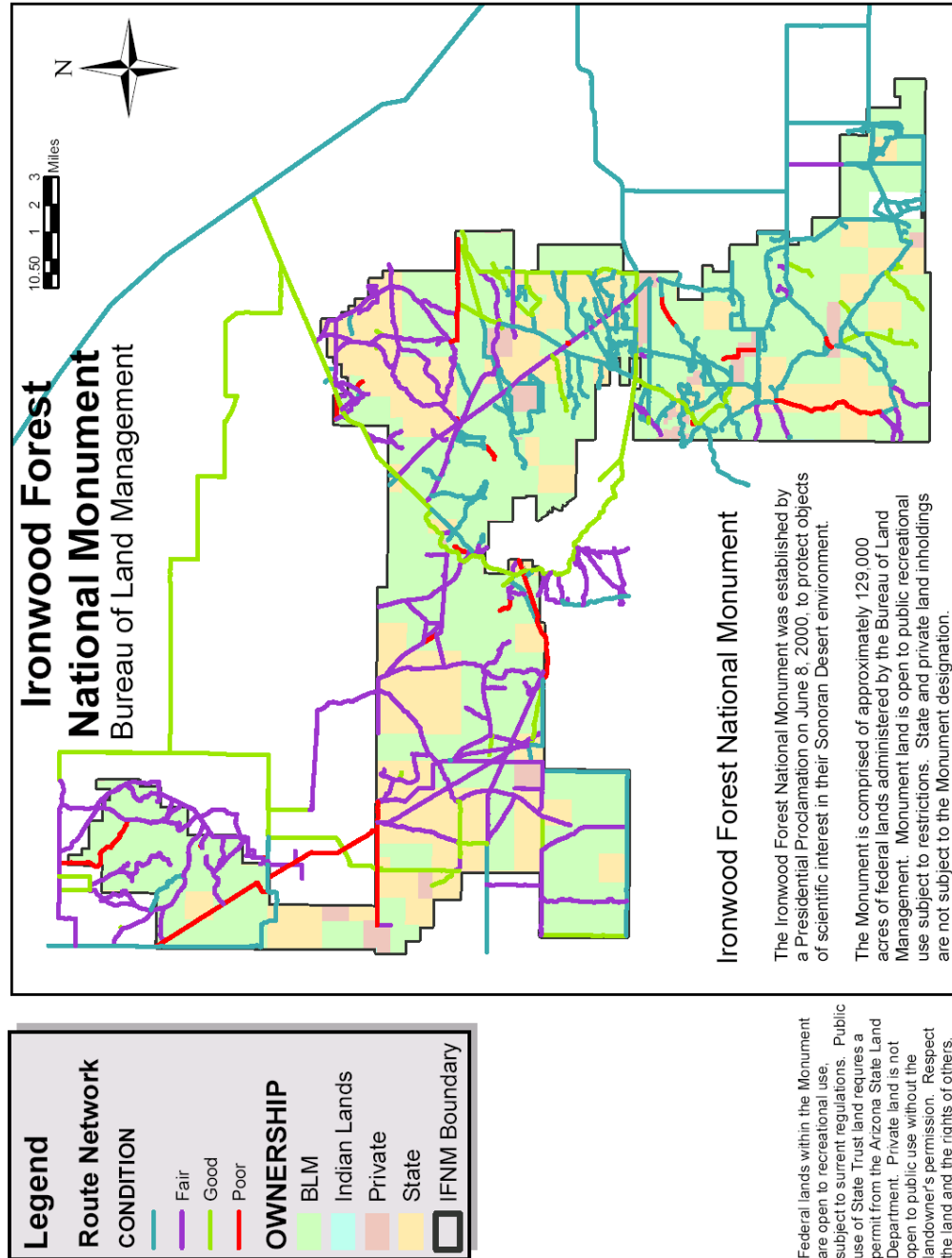


Figure 6 - Current Conditions of Routes into IFNM

What levels of Maintenance are required on Each Route in IFNM?

Over 90% of the roads assessed require level 2 maintenance where management objectives require the road to be opened for limited administrative traffic. Typically, these roads are passable by high clearance vehicles (See Figure 7).

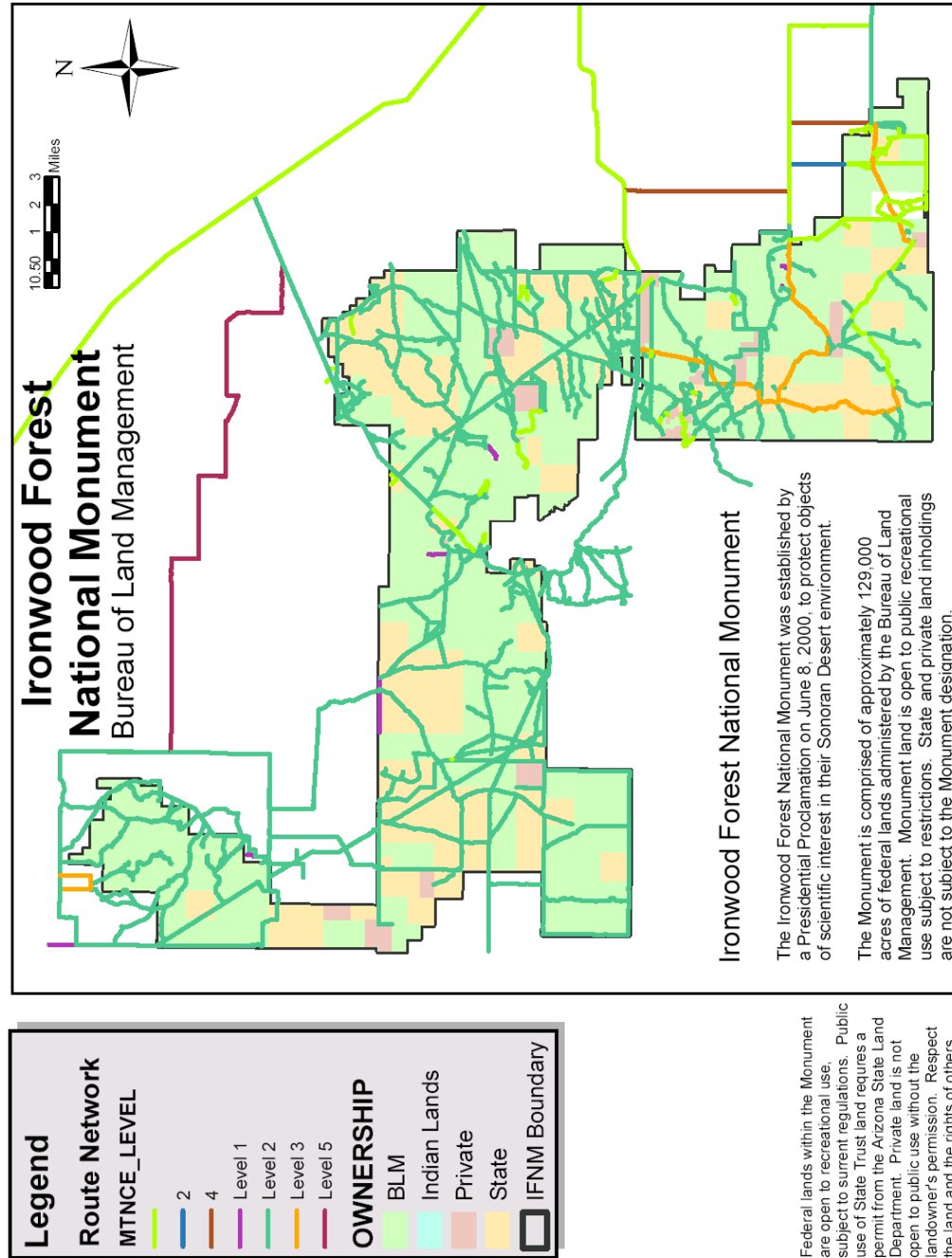


Figure 7 - Maintenance Levels Required for Routes in IFNM

What ROS Class are Associated with Each of the Routes in IFNM?

Over 95% of the routes in IFNM fall within a semi-primitive, motorized recreation opportunities spectrum class. Recreation opportunities in the class are associated with vehicle access and usually coincide with driving for pleasure or drive in hiking or camping experiences.

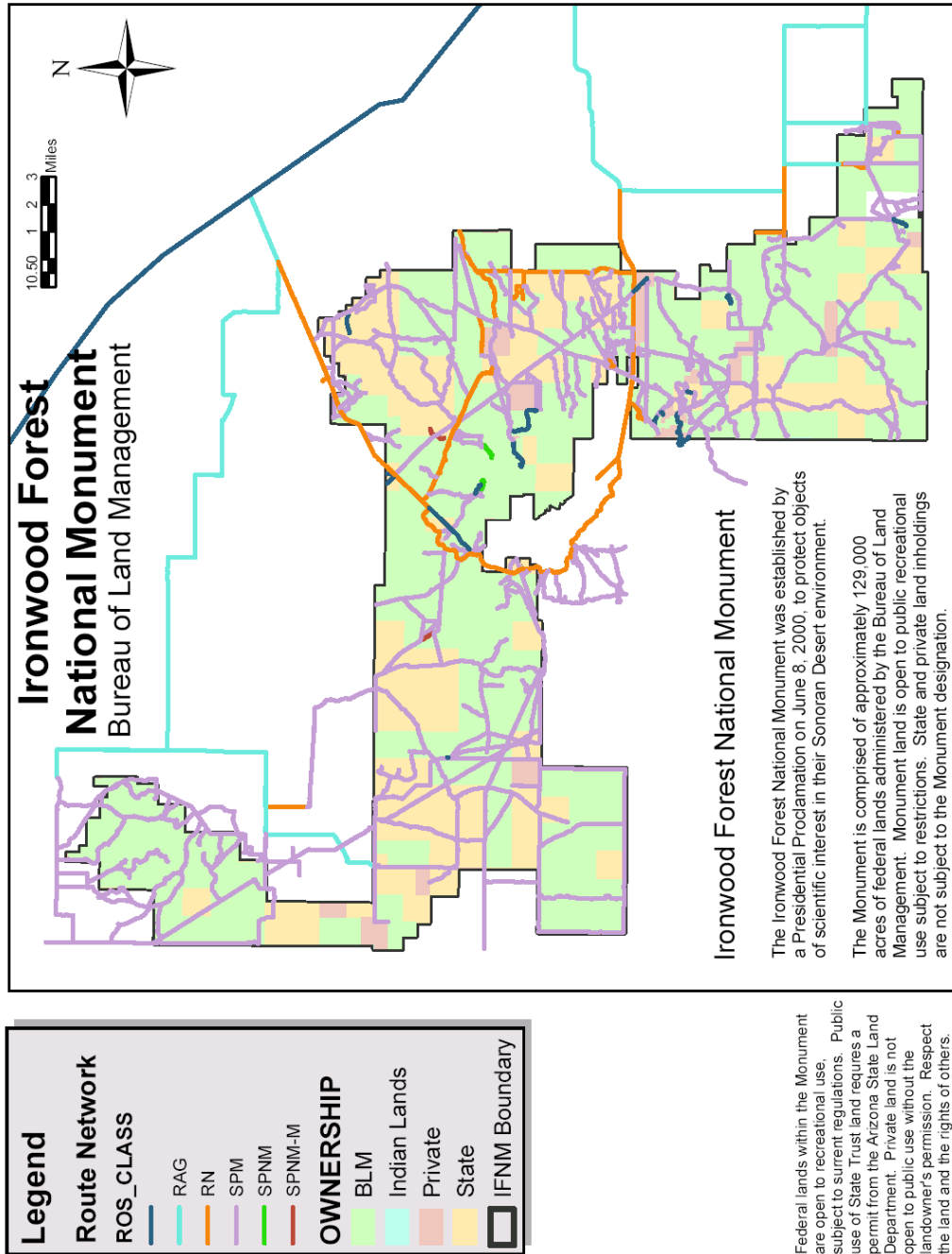


Figure 8 - ROS Classes for Routes in IFNM

After a complete classification of routes within the IFNM our assessment reveals about six different routes classes and associated conditions. They are as follows: Game/Cow Trail, Overgrown., Primitive,4WD, Primitive, Non4WD, Light Duty, Not Maintained. Less than 1% of routes fall into either the game/cow trail or overgrown classification. These routes are basically not drivable and used primarily for hiking or have been overgrown for sometime and are in a natural state of rehabilitation. These routes no longer function as travel ways and should be left to continue on their natural regeneration. The classification reveals that over 80% of the routes fall into the primitive, non4WD class. These routes have been constructed or established by use and is generally passable by two wheel drive high clearance vehicle. There is no evidence of grading or other travel way maintenance. These routes have been created over time by 4WD vehicles. This finding coincides with the assessment of the diary/survey data that reveals the travel routes and type of recreation activity visitors typically follow. Primitive 4WD and LtDuty, Non Maintained routes account for some 14% of the routes inventoried. Figure 5 illustrates the spatial configuration and location of the routes inventories.

It is apparent from this inventory and assessment that these roads are not maintained to any standard. Almost all the routes inventoried are either in some state of rehabilitation or in primitive condition. Routes have been randomly created over time with little concern for the local biological conditions. Virtually no planning has occurred with respect to alignment of routes, to any planned destinations, leaving a spaghetti web of routes leading in and out of dead ends and remote locations. Most routes, other than the light duty roads are passable with a car, leaving a majority of the area available only to 4WD and vehicles with high clearance.

Recreation Site Assessment

The recreation site assessment was undertaken as part of the routes inventory process. This was a rapid assessment with virtually no measurements taken. Sites were examined and classified as to the current recreation use and conditions. There are 338 sites that were inventoried in this fashion. A GPS coordinate and some photos were captured along with the assessment. Figures 9, 10 & 11 illustrate what and where the sites are, their condition and current purpose. Generally, most of the recreation sites are dispersed campsites in relatively good condition. Most would fall into an Impact Class I or II that reveals little to no impact.

Where are the Existing Recreation Sites?

There are n=338 recreation sites inventoried in IFNM. Of these sites, n=277 are dispersed campsites, n=22 are target shooting sites and number of other minor areas such as those used for off road use, group areas and scenic overlooks. Figure 9 illustrates the location of each of these recreation sites. Most of the recreation sites are either in the Southeastern portion of IFNM, located between Avra Valley and south of Silverbell road or in the Sawtooth area.

What type of Use is Evident at these Recreation Sites?

Camping is the primary use at these sites. OHV, Shooting and some signs of illegal trash are evident as a result of the activity occurring at these sites.

How much use do these Recreation Sites currently experience?

Over 36% of the recreation sites have been abandoned and receive no use. Approximately 44% of the sites receive occasional use, while 20% regular use. The sites that receive regular use as located in near major routes.

What are their Current Purposes and Level of Impacts?

Over 90% of the recreation sites that were assessed in this study are dispersed campsites. There are a few informal shooting areas and what could be considered larger group sites. A majority of these sites were categorized as impact Class I or II suggesting that they are in good condition. This is probably due to the low use levels. However as evident in the recreation site impact maps, these sites are generally located in the Ragged Top, Waterman and Sawtooth areas and within close proximity of roads. It is apparent that all of these recreation sites are accessible by vehicle. No one in the study reported backpacking into to any recreation sites.

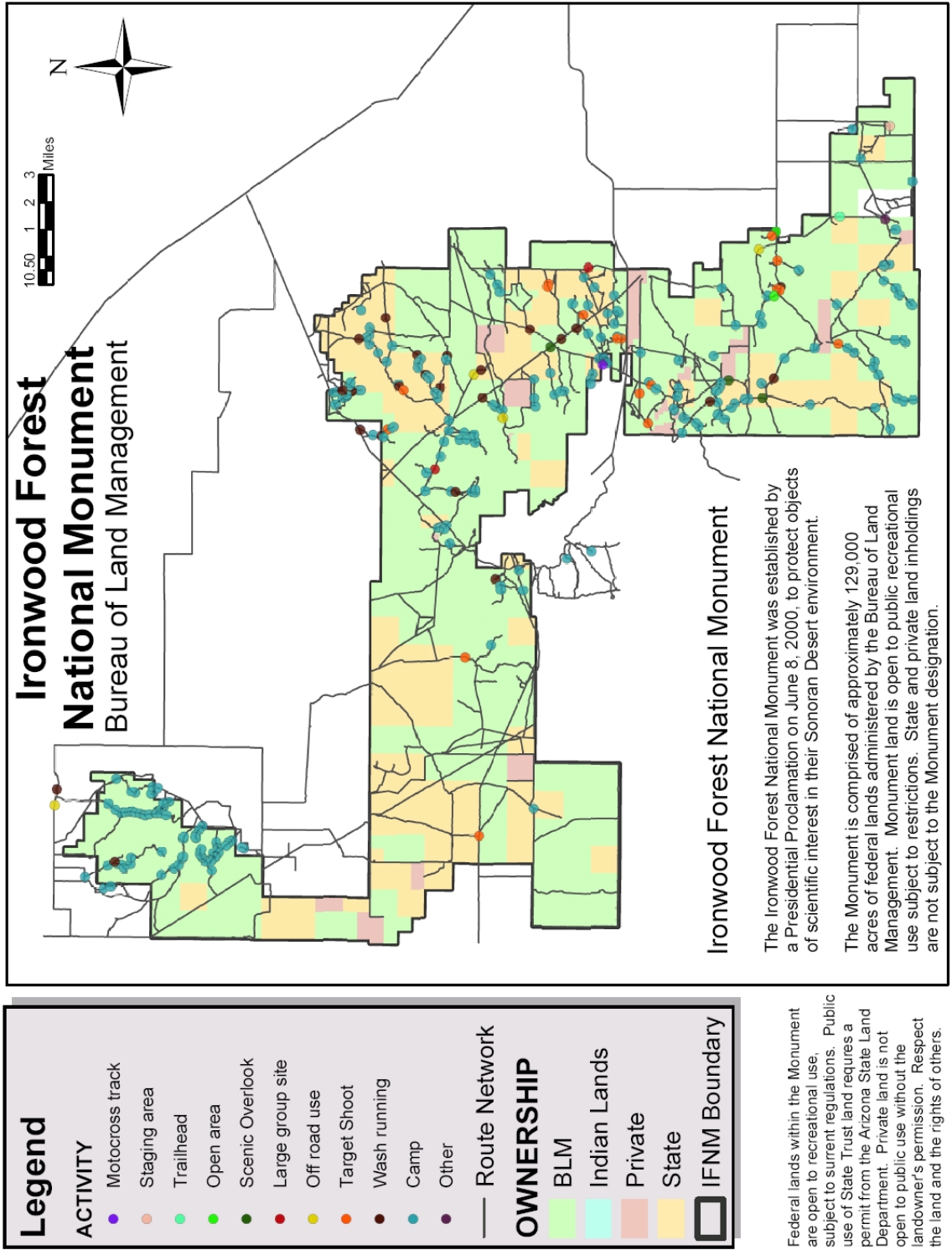
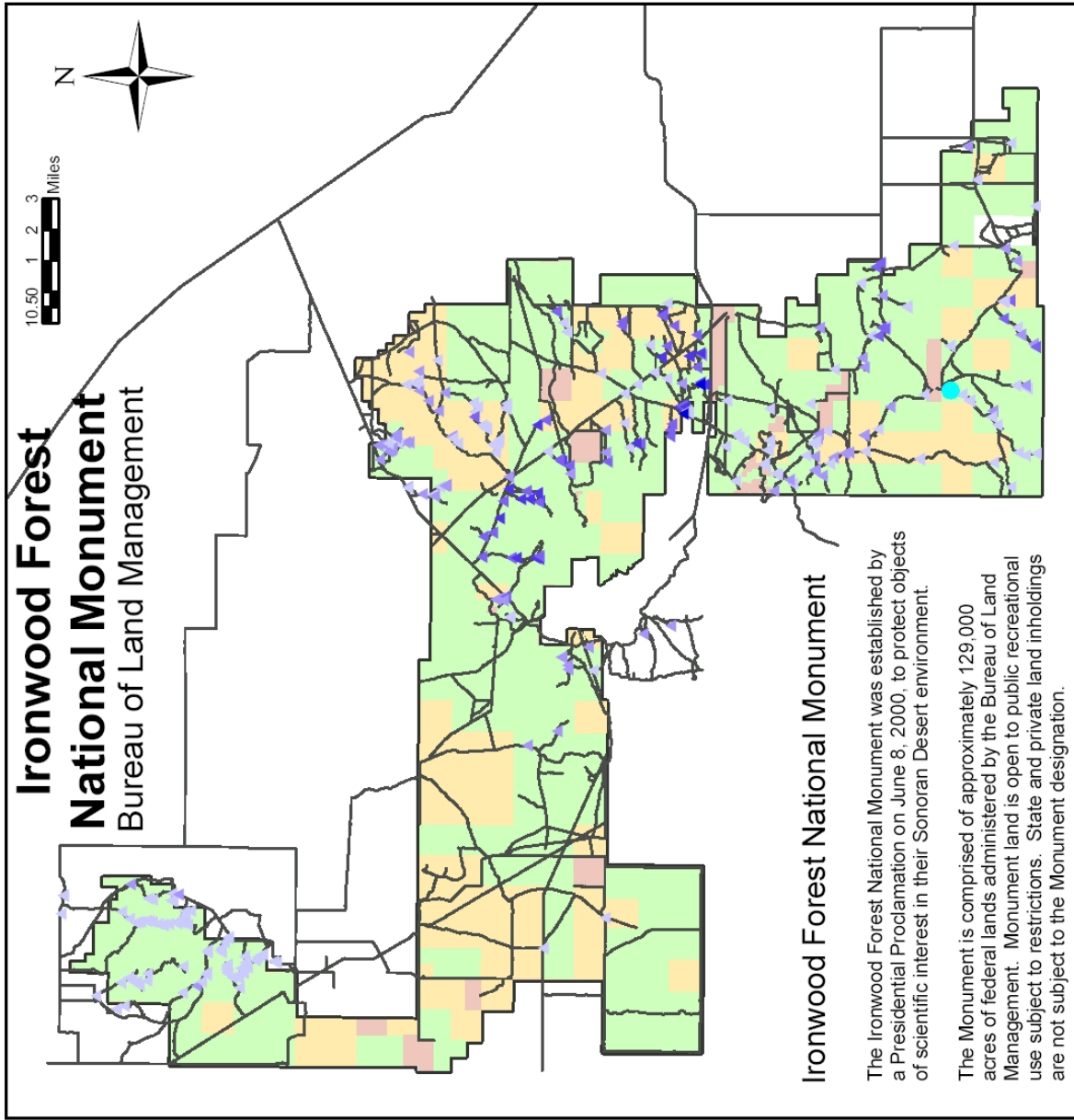


Figure 9 - Recreation Sites in IFNM



Legend

Site Impact Class

- ▲ 0
- ▲ 1
- ▲ 2
- ▲ 3
- ▲ 4 - 5

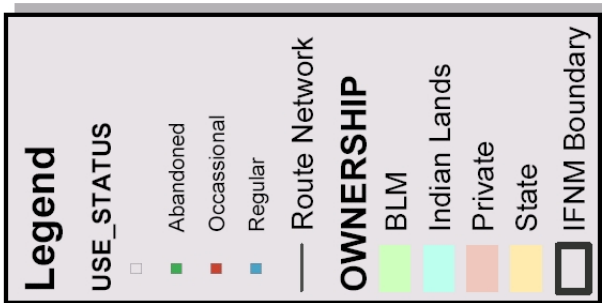
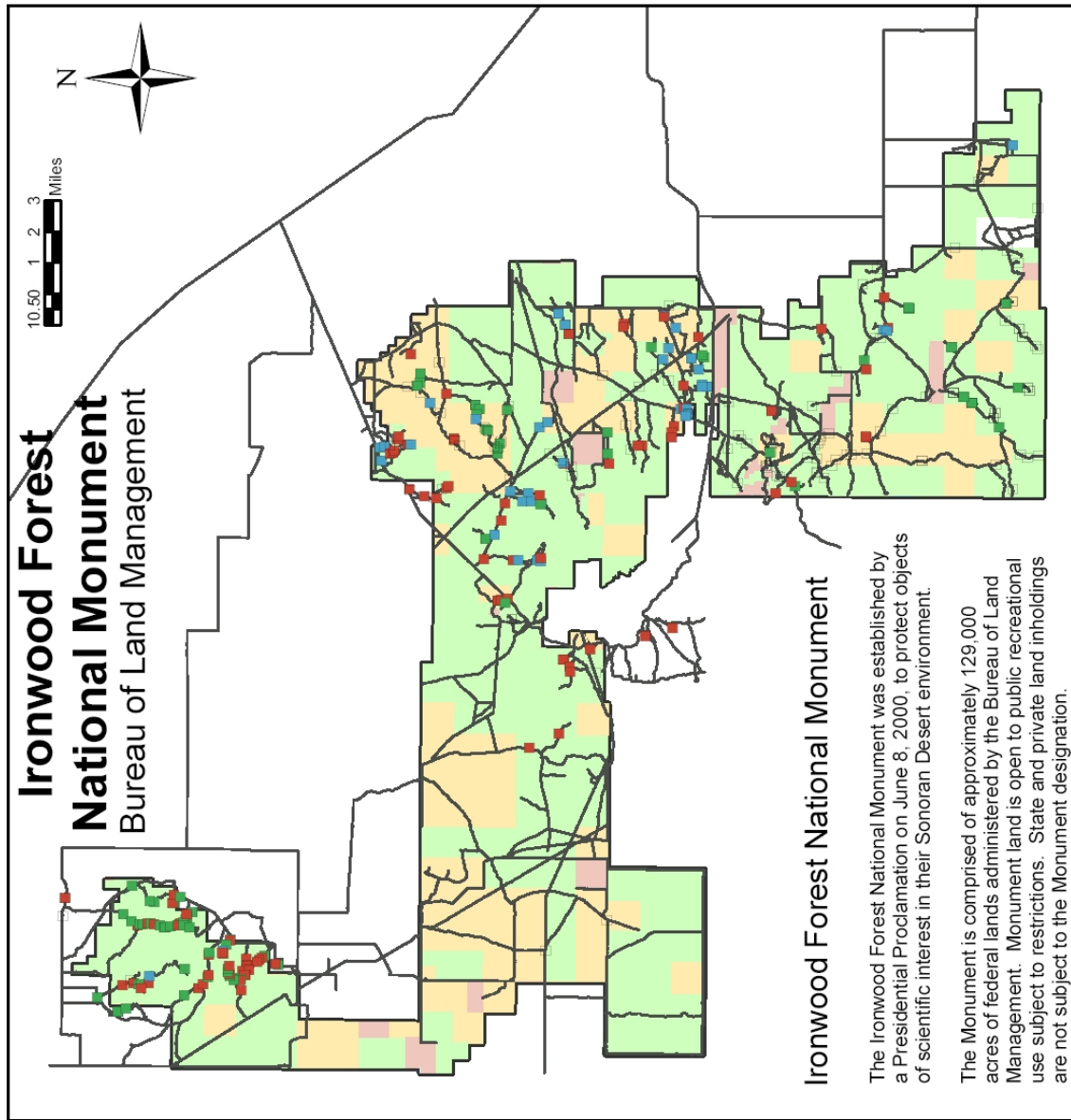
— Route Network

OWNERSHIP

- BLM
- Indian Lands
- Private
- State
- IFNM Boundary

Federal lands within the Monument are open to recreational use, subject to surrrent regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 10 – Impact Assessment for Recreation Sites in IFNM



Federal lands within the Monument are open to recreational use, subject to current regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 11 – Current Conditions of Recreation Sites in IFNM

Monitoring Visitor Flows and Patterns of Use in IFNM

Conventional survey and interview methodologies used to characterize the recreation experience have yielded useful information about the visitor. While this information is important to understanding the general profile of visitors to a region, it does little to enhance our understanding of the spatial/temporal distribution of a visitor and their associated social and ecological impacts in the landscape. Managers require information on the spatial nature of the visitor to adequately manage for both the experience and to protect the recreation setting. This information includes the destination, arrival and departure times, number of visitors in a party, type of activity, nights camping etc. These spatial dynamic parameters likewise are imperative for constructing models to represent current conditions and testing out future management scenarios to reduce social and ecological impacts in a setting.

Some researchers have attempted over the years to collect such data in recreation settings. Some have concluded that the most accurate visitor use data comes from self-issued or mandatory permit systems. This method can be one of the most effective ways for understanding recreational use in most recreation areas. While compliance varies from recreation area to recreation area, mandatory permit systems far outweigh trail registers or other forms of data collection. While observing a sample of trailheads on sample days produces accurate estimates of those entering the area, it is labor and time intensive and tends to lead to a limited sample. Other recreation areas have gone to agency-issued permits. While having some disadvantages such as inconveniencing the visitor and expensive to manage, this system does provide a mechanism for ensuring the visitor comes in to the agency office to pick up the permit and provide information about where they plan to go. While each of these methods has its advantages and disadvantages, the sampling methodology in this study employs a combination of techniques for acquiring an accurate, representative sample of both spatial and temporal use patterns in IFNM.

The methodology for this research utilizes a combination of automated counter pad and traffic count devices in conjunction with visitor diary/surveys and observation to examine visitor flows and patterns of use. Automated technologies used for counting vehicles and visitors provide information on time of arrival at trailheads or key access points and overall numbers of local residents and visitors entering and exiting the Monument. A visitor survey was used to obtain more specific information on the nature of the visit. This information includes characterization of the visitor (i.e. number in party, mode of transportation, identification of destinations visited, duration and preferred travel route to destination). The visitor survey provided attitudinal data on preferences, experiences and satisfaction levels resulting from the visit.

The survey utilized a diary approach that included a map for visitor to record their trips. Visitors were asked to mark the route that they followed on the map. Visitors were instructed to indicate their mode of transportation for each segment of the area they used and indicate direction of travel using arrows. This is critical information to obtain from visitors to the area, as it typifies the way they currently move through the area to their desired destinations. Visitors were also instructed to mark any locations on the map that they stopped at along the routes they traveled. In addition, information was acquired on

any destinations that the visitor traveled to and if it was a campsite to mark it with a 'C' followed by the night to obtain multiple or overnight trips into the area.

Random observation during peak periods will be used to provide verification on traffic and visitor patterns and overall visitor numbers at specific locations. The traffic and visitor flow data in conjunction with the survey data will provide information imperative for planning and management of the Monument. In addition, this same data will be used to characterize travel patterns, visitors and their interactions to build a simulation model that replicates visitor flow patterns in National Monument.

A **Self-Administered Survey** was used to capture visitor use patterns and attitudinal data in IFNM. Sampling was undertaken between October 1, 2002 and June 1, 2003. Nine self-administered survey stations were strategically placed at main entrances and known entry points to the Monument, associated with Bureau of Land Management information signage where maps and location information about the Monument can be found. Where possible, survey stations were placed near trail or traffic counters so that survey responses where could be linked to counter times recorded on the data logger. The counter pads inform the team as to when a party arrived and where they went, and along with associated attitudinal information about their trip. Because of the large number of access points, the potential danger of encountering drug traffickers or coyotes guiding illegal aliens, the anticipated low use levels, visitor contact or interviews were considered a less effective sampling strategy than using a self administered survey. Visitors that stopped at entry points to read informative signage could pick up a survey, read the instructions for filling out the survey and either deposit it in the station when leaving the Monument or mail it back with the contact information provided on the survey. With little known information about how many visitors enter the Monument on an annual basis, the survey stations were kept full and a return rate of 35% was expected (See Appendix 6).

Short **intercept interviews and observations** were undertaken randomly over the duration of the sampling. Twice a month on period days (Saturday or Sunday) during the peak months (October thru May), members of the research team were stationed at access points to the Monument where vehicles had to slow down to enter the area to both count and document time of entry and/or exit and to intercept those who stopped to ask them to complete a survey. These intercepts and observations were done to aid in validating the times and events logged by the trail and traffic counters and to provide and acquire information from the visitor. A detailed **Visitor Use Study** was undertaken in the Ragged Top area to evaluate traces of visitor use patterns. This study was undertaken as a University class project using a trace approach to evaluate the levels of use that aids in understanding more specifically the Ragged Top area.

Trail and traffic counters where used to assess numbers of vehicles entering and exiting the area and at key locations throughout the park. This information is essential for assessing sampling and return rates and understanding visitor volume. Likewise, trail counters were strategically placed to acquire trail use information. Traffic counters were placed in coordination with data being collected for the transportation study.

How Many Visitors Come to IFNM Annually?

Approximately 12 -15,000 visitors travel through IRNM annually. These estimates are derived from mechanical counter data for twenty-six access points into the National Monument over a eight to fifteen month period. These numbers are estimates extrapolated to provide an annual estimate. This study acknowledges that other minor entrances that could provide access to IFNM for visitors, but most do via the areas monitored during the period of time this study was undertaken (See Figure 12).

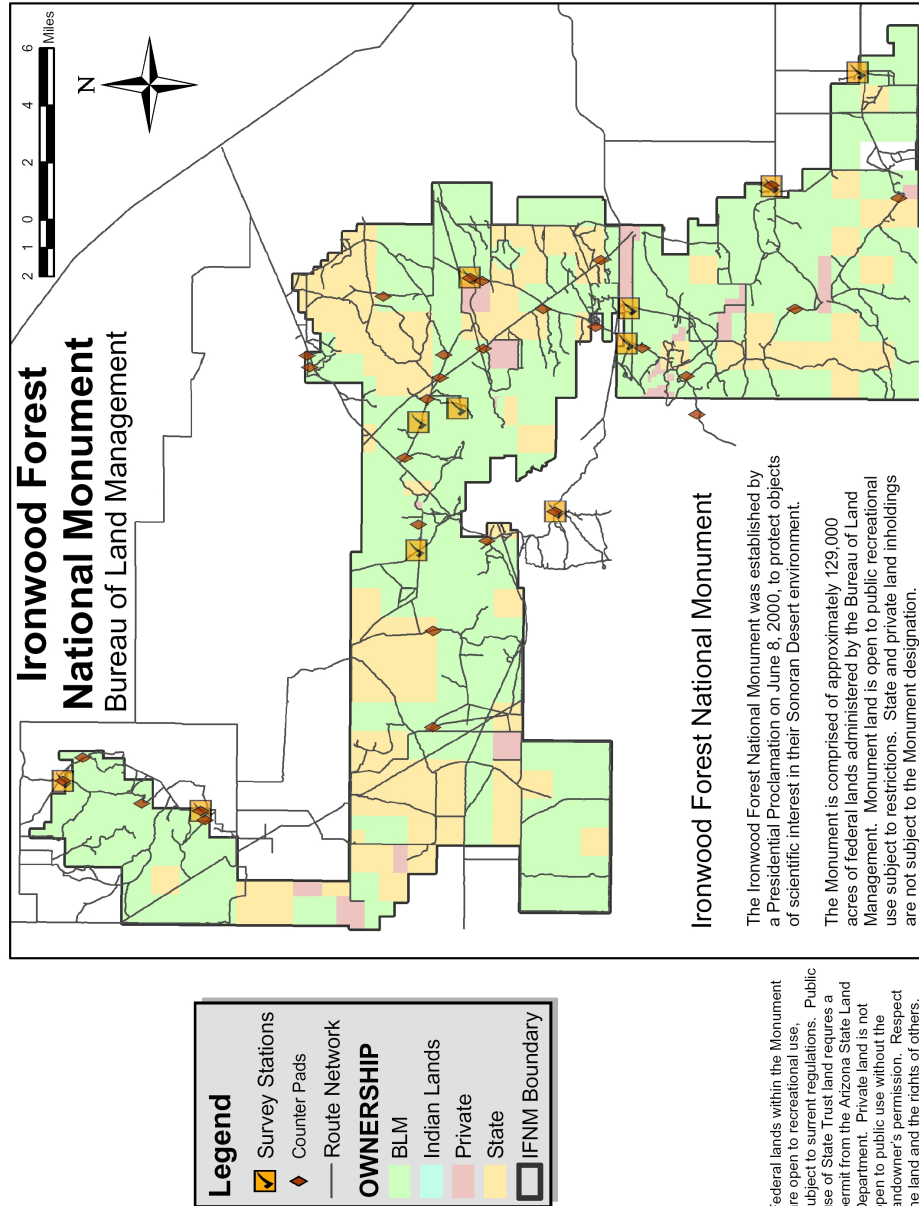


Figure 12 – Location of Survey Stations in IFNM

The estimate number of annual visitors takes into account residents who live and work within the IFNM boundary. Since counters were placed at strategic locations in the IFNM such as along the reservation boundary, it is probable that they are consistently picking up visitors moving on foot as well as in vehicles. Local residents are treated just like other visitors, as they impact the resource and other visitors just like those that visit the area

Results from the Visitor Use Survey for IFNM

The self-administered visitor survey was conducted between October 1, 2002 and June 1, 2003. The peak sampling period in the desert Southwest is January thru May, but in this case, the shoulder seasons were captured to ensure a complete and representative sample. A total of 300 surveys were distributed between nine survey boxes. A total of n=106 surveys were returned. A response rate of 35% that is statistically significant using this type of self-administered system. The following questions were included in the survey and analysis run to answer these questions.

What are the Preferred Times for Visiting IFNM?

Visitor patterns can in part be determined by arrival rates at the Monument. For the sampling period, Figure 13 reveals that the majority of the visitor use in the area occurs in the months of January through April. While data was only collected starting in October 2002, there are no data for the hot summer months in the IFNM. But knowing the patterns of recreation use in the desert throughout the summer in other studies (BLM 2004), use levels are extremely low. While the surveys were not implemented during last summer, the traffic counters should validate the low levels of use in the summer.

Monthly Arrivals by Year

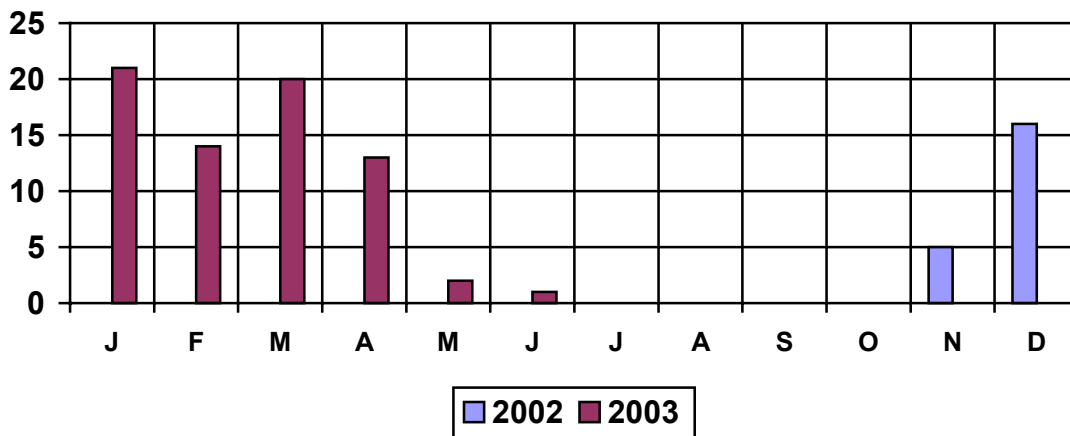


Figure 13– Monthly Arrival Rates from Surveys
(Note that June through September were not part of the Sample Period)

Figure 14 illustrates the hourly arrival rates over weekdays. It is apparent that weekends are the times when visitors are typically using the Monument. Arrival rates occur in a typical pattern from 7:00 AM through 4:00PM.

Hourly Arrivals by Weekday

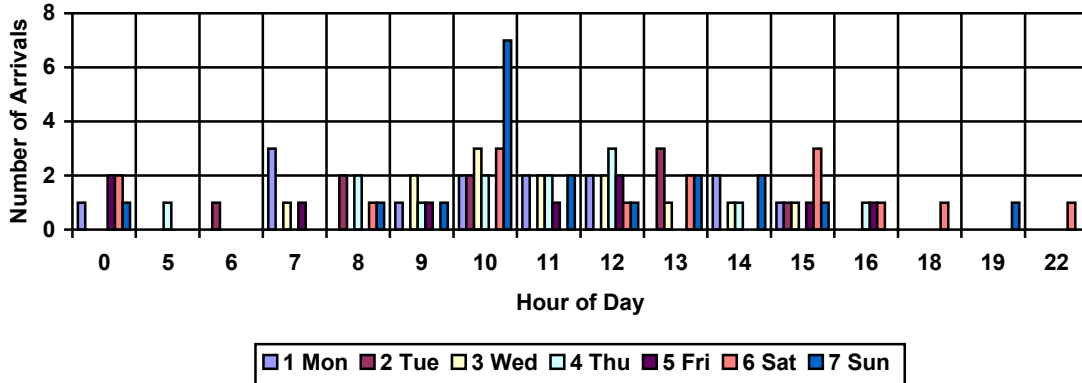


Figure 14 – Hourly Arrivals by Weekday (Units are number of Surveys)

As in the previous summary of hourly arrivals, Figure 15 shows the typical hourly arrivals throughout the sample period. Of the N=106 respondents, they typically arrive and exit IFNM between 7:00 AM and 4:00 PM. The average reported number of parties that filled out surveys, arriving and departing IFNM is about ten, which would be considered to be low use. One interesting result is the number of arrivals at 10:00 AM.

Total Hourly Arrivals

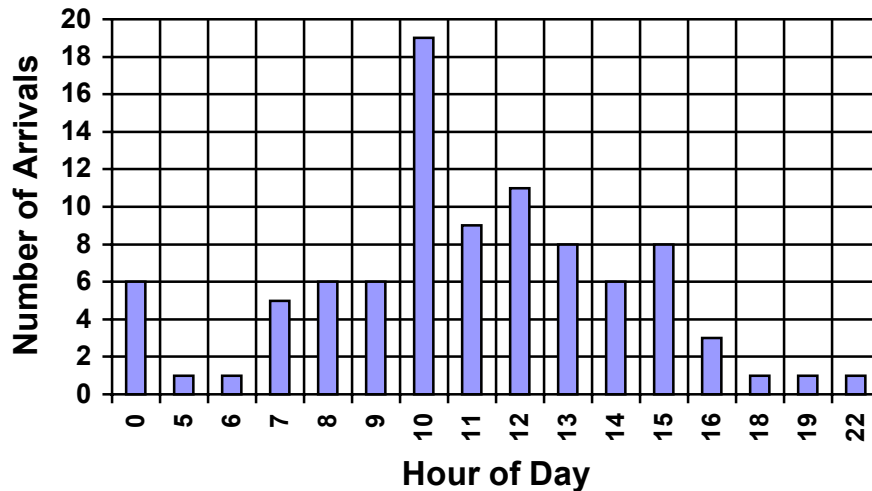


Figure 15 – Total Hourly Arrivals at IFNM from Survey (Units are number of Surveys)

Arrivals by Weekday

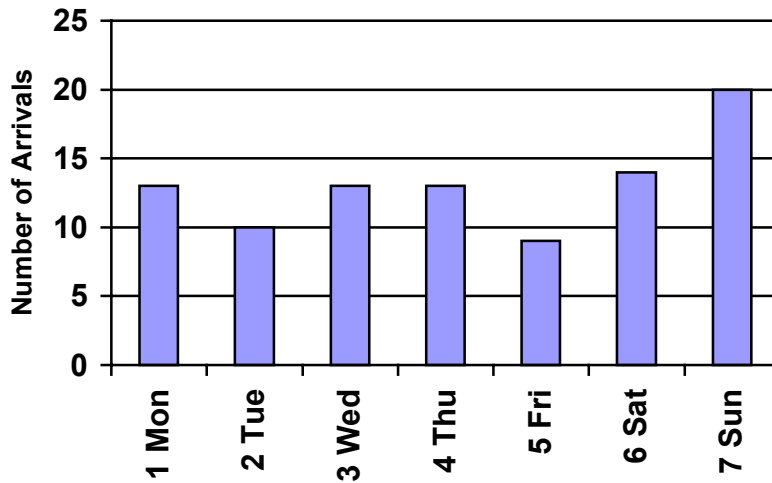


Figure 16 – Weekly Arrivals

Figure 16 provides information on the distribution of visitor use over weekdays. As would be expected, Sundays stand out as an important day of visitation, which is consistent with what is seen in other public land settings in the southwest. The weekdays however in figure 4 are consist but lower than the weekends.

What is the Typical Size of the Parties the Visit IFNM?

Figure 17 illustrates an assessment of the reported party size from the surveys. Party size is relatively small as would be expected in this type of remote setting. Most parties were small, comprised of either one or two visitors. Some of the large party size estimates are due to a group from the Desert Museum of 20-30 people. Four people filled out survey forms in the same group, with different estimates of their group size. The party of about 25 (average reported size) visited on 12/3/02.

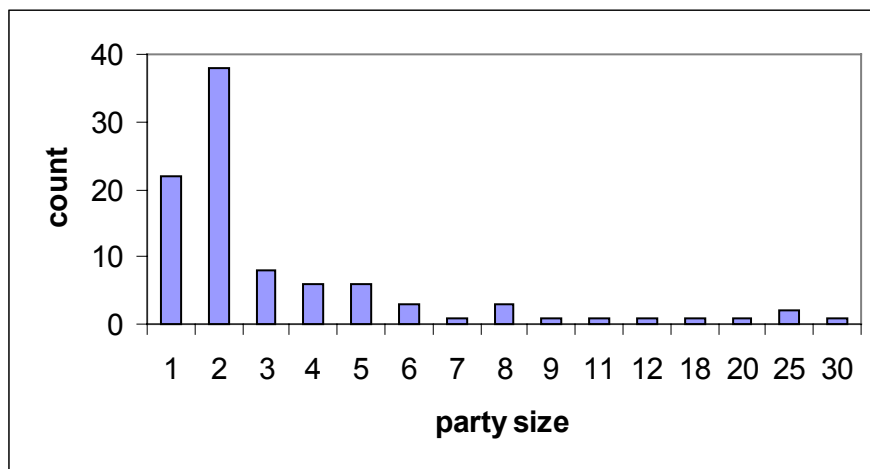


Figure 17 – Typical Party Size using IFNM

Where do those who Visit IFNM Typically Reside?

Most of the respondents of the survey were Arizona residents. Only nine of the 106 respondents reported that they were seasonal visitors to Southern Arizona. It appears that most of the use is coming from those in-state or local visitors who use the area on a more frequent basis.

What is the Frequency of Visits to IFNM?

Frequency of visit per year is a good indicator of the significance of that area as an attractor for recreation purposes. These rates were calculated by multiplying the frequency indicated by the appropriate interval (e.g.: frequency per week x 52 (weeks per year) = visits/year). More than 25% of the visitors to IFNM were first or second time visitors, suggesting they are intrigued with seeing why the national Monument was established. Over 50% of reported visiting many times, even so much as upward of twenty four times per year. These are probably those living within the vicinity of the IFNM that utilize the Monument on a regular basis. One reported using the Monument 365 days of the year, which is someone who obviously lives on within the Monument boundaries.

How Many Visitors Indicated That It Was Their First Visit?

Of the n=76 respondents that completed this question of the survey, many first started using the area after 1970, which may reflect the age structure of the users. Almost half of the respondents (47%), visited the area for the first time in the last 3 years. See Figure 18.

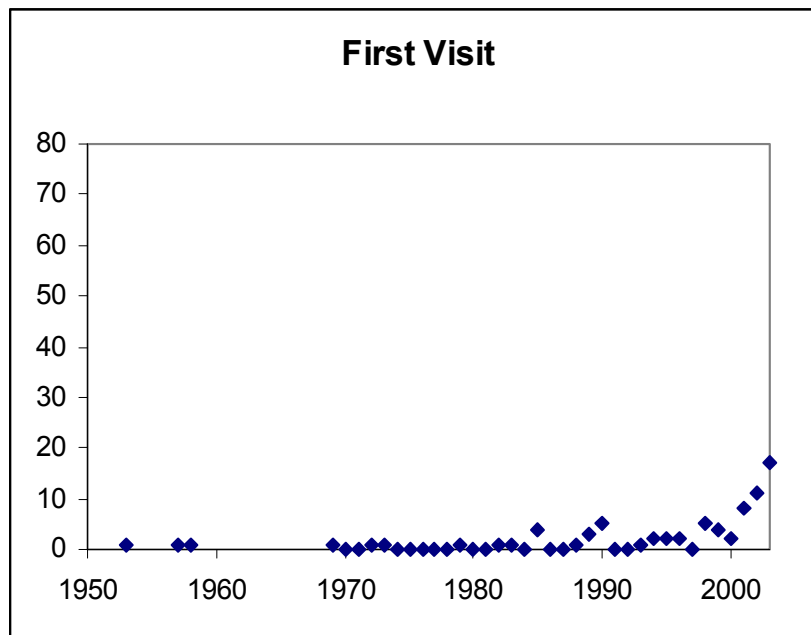


Figure 18 – First Time Visits to IFNM

How Do Visitors Typically Learn About IFNM?

The majority of the respondents learned of IFNM by “word-of-mouth” (46%). 16% of the respondents learned of the area through a newspaper article. 8% learned of the area

through the BLM office and 8% learned of the area through the internet. However, many of the people who responded to the survey indicated that they were exploring the area, driving around, or by looking at a map (about 19%). More than 64% percent of the respondents were attracted to the area because it is a National Monument. Many respondents noted that they were curious to explore the area or decided to take a drive to discover what this area had to offer or heard about it through a local hiking club.

What are the Preferred Months for Visiting IFNM?

As one would expect, the peak seasons in Ironwoods are the fall, winter and spring, with a marked decrease in summer visitation. However, the ranchers and beekeeper that responded to the survey use the area all year. These data reflect the respondents who indicated each month or day that was indicated in their response (See figure 19).

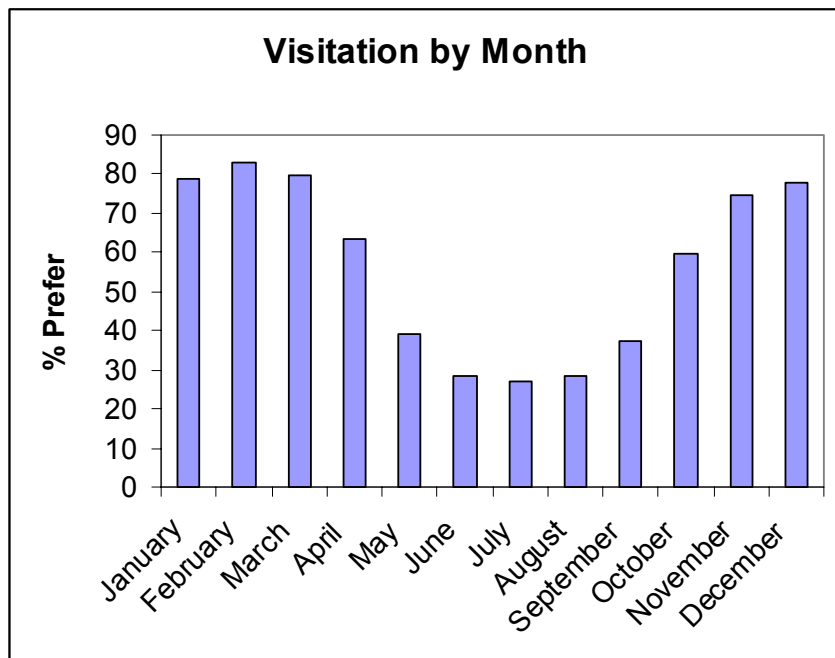


Figure 19 – Reported Visitation to IFNM by Month

How Many Visitors are Typically Encountered During a Visit to IFNM?

68% of the respondents saw other visitors, but only 44 of 68 who did specified how many visitors they saw and reported the activities other visitors were engaged in. It appears that the party size that people report seeing is fairly accurate. Thirty-five of visitors reported seeing other parties of 1-4 people. Another ten parties encountered other parties ranging from 5-10 visitors per party. Of those who reported seeing other visitors the major activities other were engaged in were driving, OHV use or camping with a small number hiking.

How Many Visitors Consider Trash to be a Major Management Issue?

Trash is significant resource issue in IFNM. Trash left by illegal movement through the region included old clothing, water bottles and many other items. The study was

interested in knowing whether visitors to the area were aware that all trash should either be carried or somehow removed from the site when departing the Monument. Over 93% of those who responded to the survey reported that they were aware that this was an issue and they packed their own trash out.

Are Visitors Attracted to IFNM because it is a National Monument?

Of the n=101 respondents who answered this question, 41% indicated that not only did they know it was a national Monument but were attracted by it's Monument status. This is typical of newly established Monuments where there is a direct correlation between Monument creation and increased visitation. The issue that is not apparent from the responses to this question is that policies or regulations set apart Monuments from other public land settings. Unclear from the responses to this question is of the other 59% who were not attracted by what the Monument status brought to the Monument.

How Many Visitors Bring Dogs to IFNM?

18.5% of the respondents reported bringing at least 1 dog with them. 12 of the 17 parties with dogs (who specified their reason for bringing the dog) brought their dogs for "pleasure/companionship." 2 parties brought hunting dogs, and 1 brought a dog to exercise it for hunting. In addition, 2 parties had dogs used for ranching, and 1 brought their dog to "get it out of the house."

What Modes of Transportation Do Visitors Use In IFNM?

A majority of those visitors who come to engage in a recreation activity at IFNM do so using 4WD vehicles. Over 40% of those visitors travel using 4WD vehicles. While very few ATV users filled out the surveys, respondents appear to report seeing an extensive number of ATVs using the area. Table 1 provides a breakdown of the variety of reported travel modes used in the Monument

Mode of Transportation	% of Respondents
Car	9.2%
Van	6%
Bus	0%
Non-4WD SUV	14.8%
4WD	40%
ATV	3.7%
Motorcycle	6%
Bicycle	6%
Horse	1%
Foot	8.3%
Other	4.6%

Table 1 – Travel Modes in IFNM

What Are Preferred Recreation Activities Practiced by Visitors to IFNM?

The results of this survey clearly illustrate that the number of respondents who are engaged in each reported activity parallel the total days that each activity was practiced. From analysis of Table 2, figure 20, the top recreation activities that visitors come to IFNM to do are sightseeing, hiking/walking/running, photography, nature viewing, pleasure driving with a4WD and some reported OHV use.

Recreation Activity	Number of Respondents Who Agree	Total Visitor Days Spent on Activity Respondents
hiking/walking/running	50	90
sightseeing	37	71
viewing- birds/wildlife	35	429
photography	28	54
viewing-flowers	24	402
nature study	22	31
pleasure driving-4wd	19	35
climbing-mountain/rock	16	40
picnicking	15	22
camping-car	13	31
rock hounding/mineral collection	13	27
bicycling-mountain	10	24
pleasure driving-truck	9	12
camping-rv	7	15
archery	7	19
target practice	7	15
hunting-upland birds	7	15
OHV_ motorcycle	7	16
OHV_ ATV	7	16
hunting-javelina	6	23
hunting-mountain lion	6	19
orienteering	4	12
hunting-big game	4	12
hunting-small game	4	8
camp-foot	3	4
hunting-deer	3	9
pleasure driving-car	3	6
social gathering/festival	2	2
hunting-big horn sheep	2	6
horseback riding	1	5
gathering-noncommercial products	1	1
ultralight aircraft flying	1	2

Table 2 – Recreation Activities

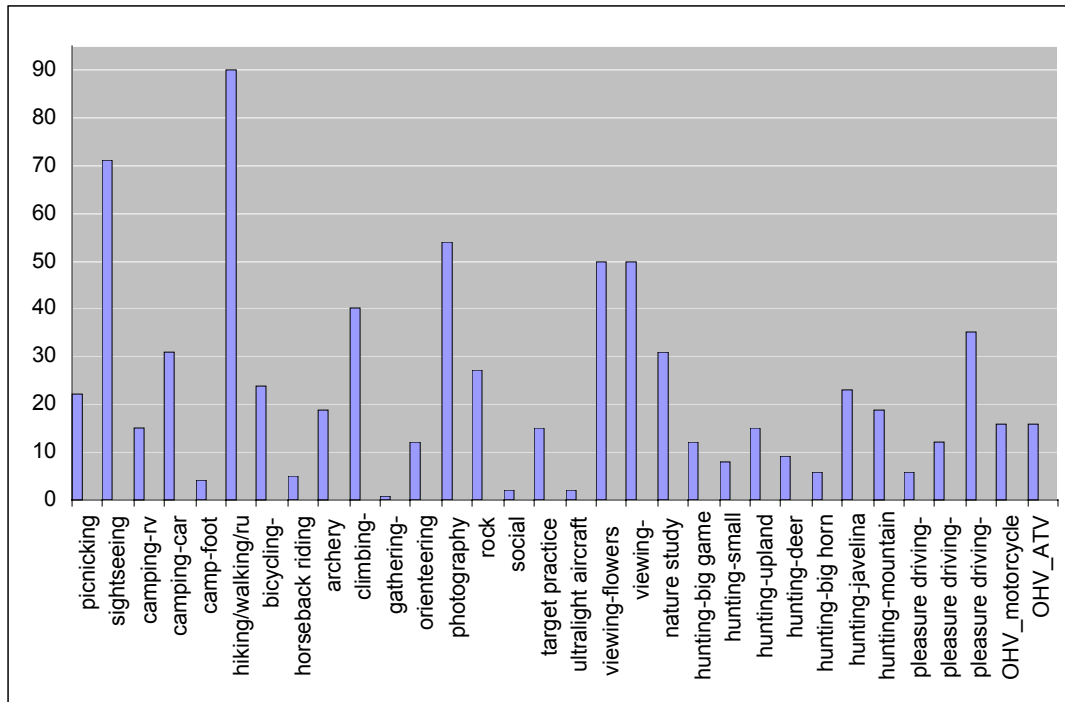


Figure 20 – Total Visitor Days Spent on Recreation Activity

An analysis of the mapped data, in the next section will indicate more about the places these recreation activities currently occur. However, the notable divergence in activities comes from a cattle rancher who visits the area 365 days a year, and views the wildlife and the flowers every day, inflating the count of the days each was practiced. Other activities that were indicated in the survey include ranching (2 respondents; 365 days each), research (1 respondent; 3 days), drawing artwork (1 respondent; 1 day).

What was the Overall Visitor Satisfaction in IFNM?

Since there are few established facilities at IFNM it is hard to have visitor provide some measure of satisfaction. But 95% of those respondents who participated in the survey indicated that they were pleased with their visit. However, many of the respondents did have complaints, which were recorded in the comments section. See the Appendix 2 for comments.

What are the Major Problems Identified by Visitors in IFNM?

Respondents were asked to rate a number of the situations or problems to the extent they felt they were a problem on a scale of 1 to 4 (1= not a problem and 4=serious problem). The most serious problems indicated by the survey data are garbage dumping and illegal immigrant activity (See Table 3). Over thirty six percent of the respondents who scored these problem situations consider these serious, or gave them the highest ranking of 4. Another indication of the seriousness of these situations is the percentage of those who indicate that these are not problematic (scored 1). Garbage dumping and illegal immigrant activity are both considered problematic by over half of the respondents. Measures that help us rank these problematic situations are the mean, median, the sample

size, and standard deviation of the scores. These measures show a good degree of comparability. Both the mean and median of each of these factor scores rank show that garbage dumping, illegal immigrant activity, and lack of visitor information are consistently ranked as most problematic. The sample size shows how many of the respondents felt the situation was important enough to score. Interestingly, the standard deviation and mean scores appear to be correlated. This indicates that those problem situations that are not considered as serious are more consistently ranked lower. The larger standard deviations of the more problematic situations may suggest that there is less comparability in visitor's scales. But this does not suggest that there is less agreement about what are serious problems. Ironically, garbage dumping, illegal immigrant activity and lack of visitor information also the top three problems identified in Las Cienegas Conservation Area in Southern Arizona. The garbage dumping and illegal immigrant activity are serious problems that detract from the recreational experiences of the Ironwood Forest visitors.

Other problems that were identified were: Access road said no trespassing, damage of ranchers, depressed wildlife numbers, lack of designated access signage, few ironwoods, jet noise, lack of signage, need more Border Patrol, the mine operation, too limited access

Situation (1 = not important and 4 = very important)	Mean Score
Garbage dumping	2.5
Illegal immigrant activity	2.3
Lack of visitor information	1.9
Lack of law enforcement	1.7
Unsafe target shooting	1.6
Impacted visual resources	1.6
Damage/collection of vegetation	1.5
Damage/collection of petroglyphs	1.5
Lack of trails for non-motorized activities	1.5
Reckless drivers on or off trails	1.5
Feeling safe	1.5
Lack of camping facilities	1.3
Damage to livestock	1.2
Conflicts with other users	1.2
Noise	1.1

Table 3 – Respondents evaluation of problems and issues on a scale of 1 (minor problem) to 4 (serious problem)

What Factors Do Visitors Cite as Important to the Recreation Experience?

To plan and manage for recreation activities and experiences, it is important to know the reasons visitors seek out places like the IFNM for recreation purposes. Visitors were asked to rate how important certain reasons were to their recreational activities or experiences using a scale of 1 to 4 (1 = not important and 4 = very important). Results

from the survey are summarized below in Table 4. The most important reason come to IFNM is for “*enjoying the scenery*,” which is followed by “*peace and quiet/feeling of remoteness*” and “*feeling a part of the natural environment*.” Other important factors are “*getting away from the demands of day-to-day life*,” and “*getting away from other people*.” The least important factors are “*getting meat for the table*,” and “*collecting plants, rocks, etc.*” In addition, very few people identify *using ATVs, making a campfire, or interacting with other people* as factors that affect their experience in the IFNM. It is clear that some of the activities and recreation groups are underreported or represented. There are few ATV and ORV users included in this sample and yet we have reported contacts from other visitors with these groups.

Factor (1 = not important and 4 = very important)	mean
Enjoying the scenery	3.8
Peace and quiet/feeling of remoteness	3.6
Feeling a part of the natural environment	3.6
Getting away from demands of day-to-day life	3.5
Getting away from other people	3.3
To keep in shape physically	3.3
Releasing tension and anxiety	3.3
Experiencing new challenges	3.0
Being with friends and family	3.0
Getting away from motorized vehicles	2.8
Improving skills	2.8
Testing skills and abilities	2.7
Using motorized vehicles and equipment	2.2
Using primitive outdoor skills	2.1
Taking risks	2.1
Interacting with other people, making friends	1.8
Using All Terrain Vehicles (ATVs)	1.7
Making a campfire	1.6
Getting meat for the table	1.3
Collecting plants, rocks, etc.	1.2

Table 4 – Identified Reasons for coming to IFNM

Summary

- Peak Season through Winter Months
- Excellent distribution of visitors over the month with peak days being weekends
- Many visitors do not have any idea that this is a Monument and however some were attracted by its Monument status
- Many visitors have never been to the Monument before so they are not repeat visitors. For a majority it is their first or second visit

- A majority of visitors come to the area in 4WD personal vehicles. Currently there is virtually no bus tours and very little commercial activity in the area
- Of those to travel to the park most are engaged in either hiking/walking to observe and engage in nature or spend a majority of their time driving around the roads. Hunting and shooting activities are still prevalent and OHV use is increasing
- Most visitors cite reasons for their visit similar to other studies that relate to experiencing nature, stress release and physical activity.

What are the Typical Travel Patterns of Visitors in IFNM?

Capturing descriptive and attitudinal data from visitors provides some beneficial information for managers who are interested in the type of activities visitors engage in, and some basic characteristics and attitudes to management prescriptions. But this information tells us very little about where, when, how long and to what degree visitors move and interact with the landscape. In this study there was an interest to not only understand the characteristics of the visitor but to acquire a more detailed set of information on the visitor use which includes traffic flow patterns, intensity of use at destinations and trails.

In addition to the questions asked in Phase I, visitors were asked to draw on a map the routes they followed, the places they stopped and particularly the destinations they visited. All routes reported by the visitors were digitized in ArcView GIS by mode of transportation to examine the frequency and usage of the routes. These reported routes were compared with the routes that were inventoried. The assumption is that a concentrated amount of use from a variety of modes of transportation necessitates planning and management decisions. If routes had negligible reported use levels and were evaluated in the route inventory as having been abandoned or cow trails, then less priority would be justified for continued use and management.

Figures 21 through 24 illustrate the pattern of use of the reported mode of transportation and frequency. Figure 21 illustrates all visitors that reported using car or van 2WD or 4WD vehicles to travel in the Monument. All of the major routes in the Monument have reported use levels; however, there are many insignificant routes that receive no reported use. The 2WD drive vehicles, as expected, primarily stay on the light duty roads, while the 4WD vehicles traverse many of the primitive routes in the region. However, the most frequently used routes by both modes are the Sasco, Silver Bell, Avra Valley road, Manville, and Mile Wide loops. This is important considering the number of available routes that could be used by these modes of transportation.

Figure 22 illustrates the reported use by motorcycle and ATV. Again the Avra Valley Road, Manville, and Mile wide loop is used by motorcycle groups while the central portion of the area Sasco, power line loop receives the reported ATV use. Figure 23, map 5 reports the foot and bicycle traffic in the Monument. Much of the foot traffic is associated with trail use at ragged top. In fact the Waterman's and Ragged Top are the most popular destinations in the Monument. Figure 24 is a summary of all the routes used, and demarcated by the frequency of use. The most dominant routes and typical trips followed are illustrated in this figure. This is important considering the amount of

primitive roads, spurious routes and washes in the area. There are two distinct routes that are being used by visitors. The first route starts and/or ends at Mile Wide road,

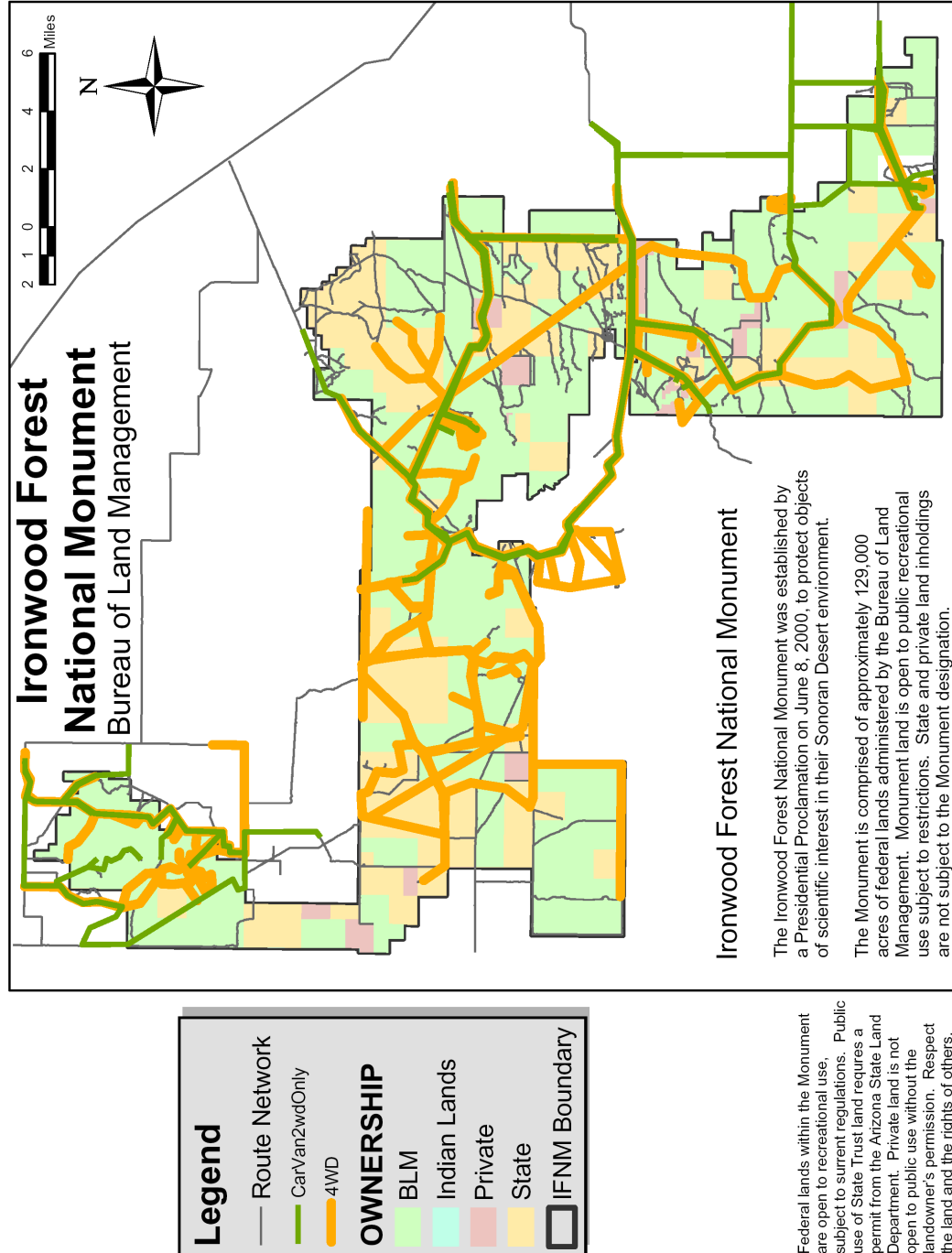
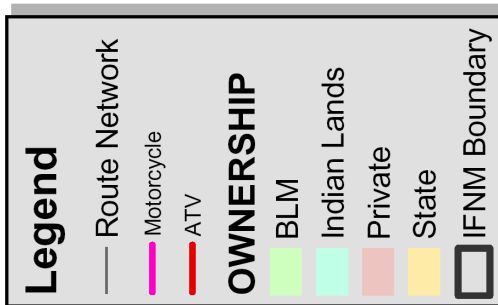
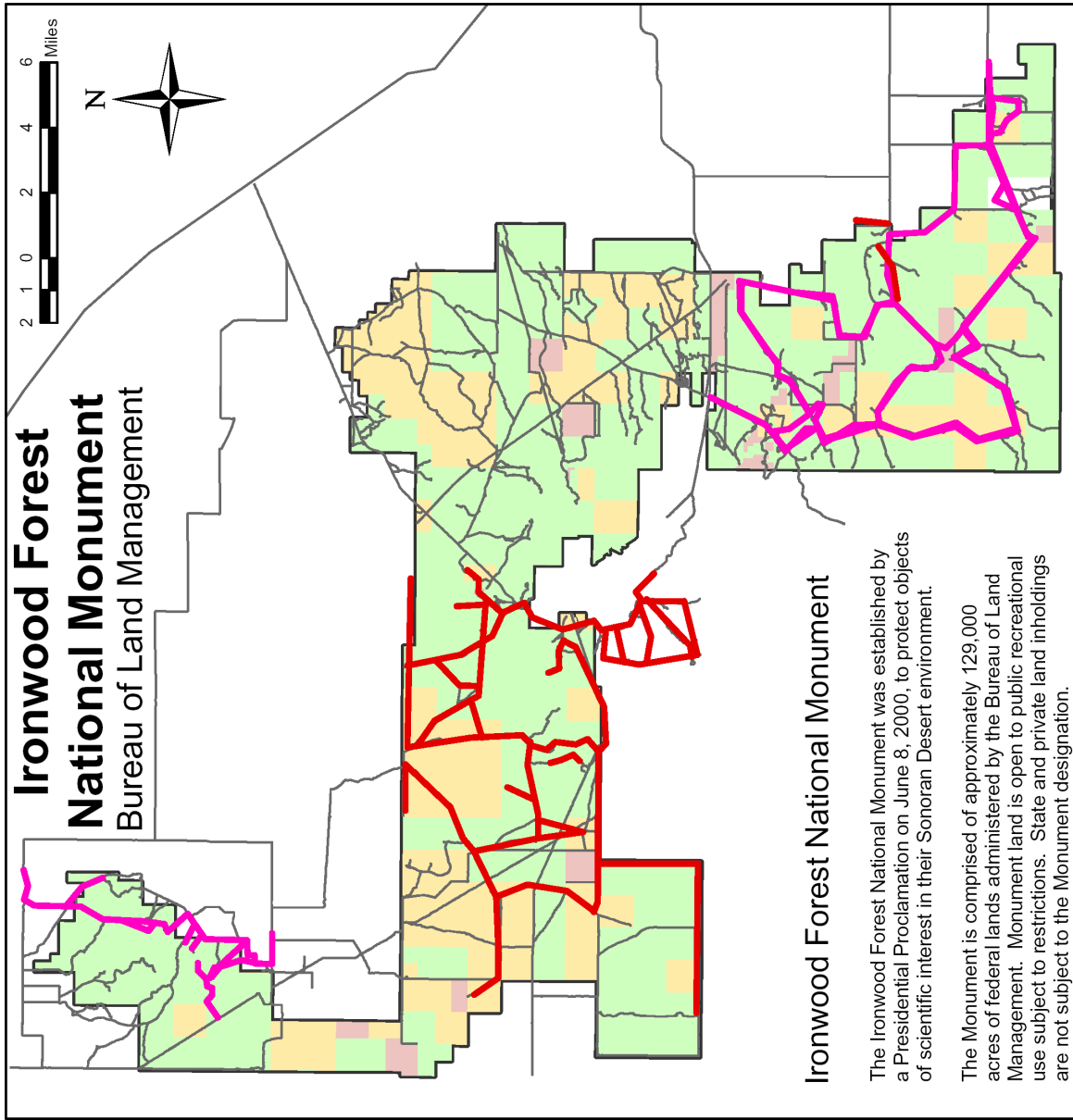


Figure 21 – Reported Car and Vehicular Use in IFNM

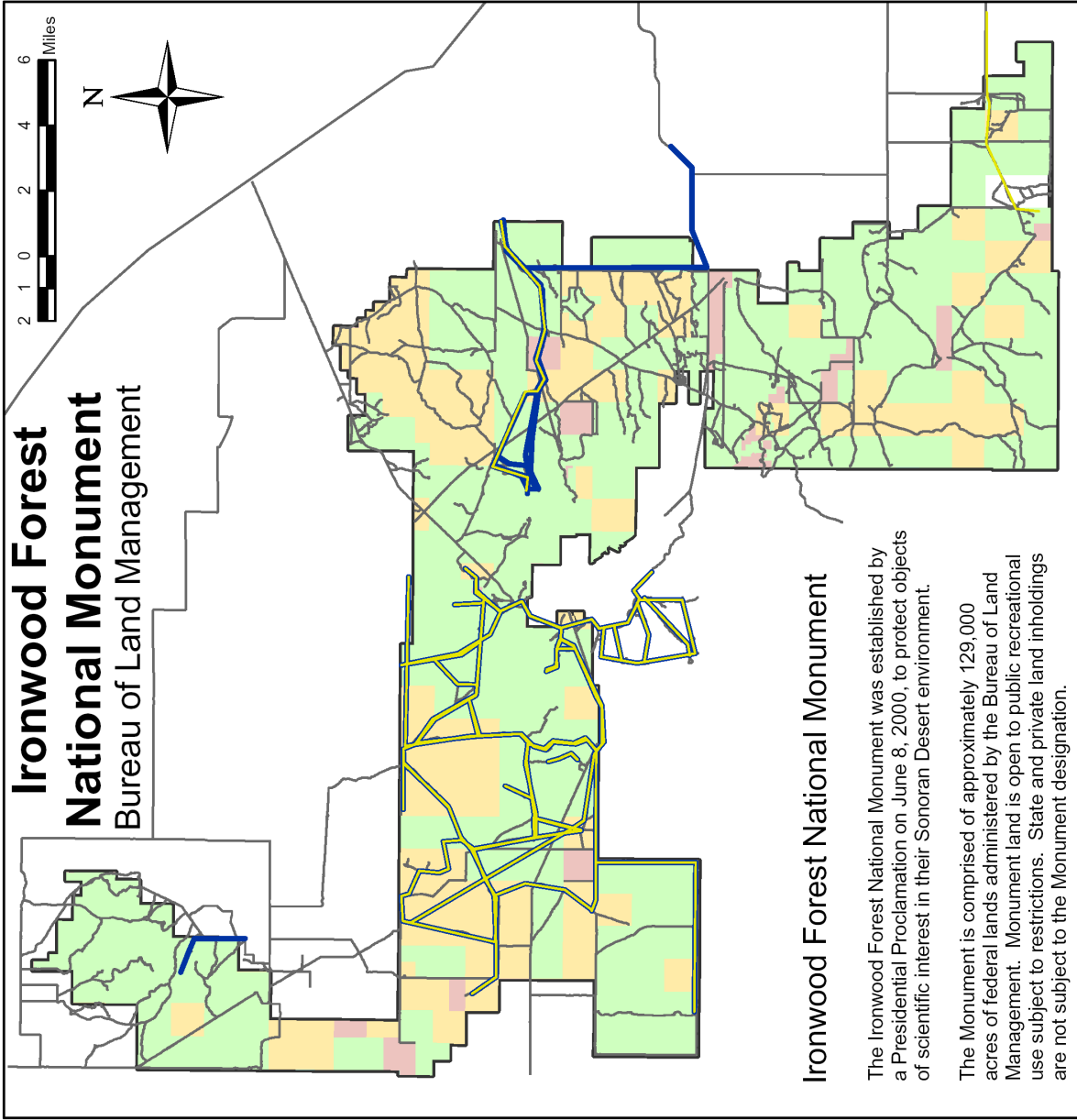


The Ironwood Forest National Monument was established by a Presidential Proclamation on June 8, 2000, to protect objects of scientific interest in their Sonoran Desert environment.

The Monument is comprised of approximately 129,000 acres of federal lands administered by the Bureau of Land Management. Monument land is open to public recreational use subject to restrictions. State and private land inholdings are not subject to the Monument designation.

Federal lands within the Monument are open to recreational use, subject to current regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 22 – Reported Motorcycle and ATV Use in IFNM



Legend

- Route Network
- Foot
- Bicycle

OWNERSHIP

- BLM
- Indian Lands
- Private
- State

IFNM Boundary

Federal lands within the Monument are open to recreational use, subject to current regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 23 – Reported Foot and Bicycle Use in IFNM

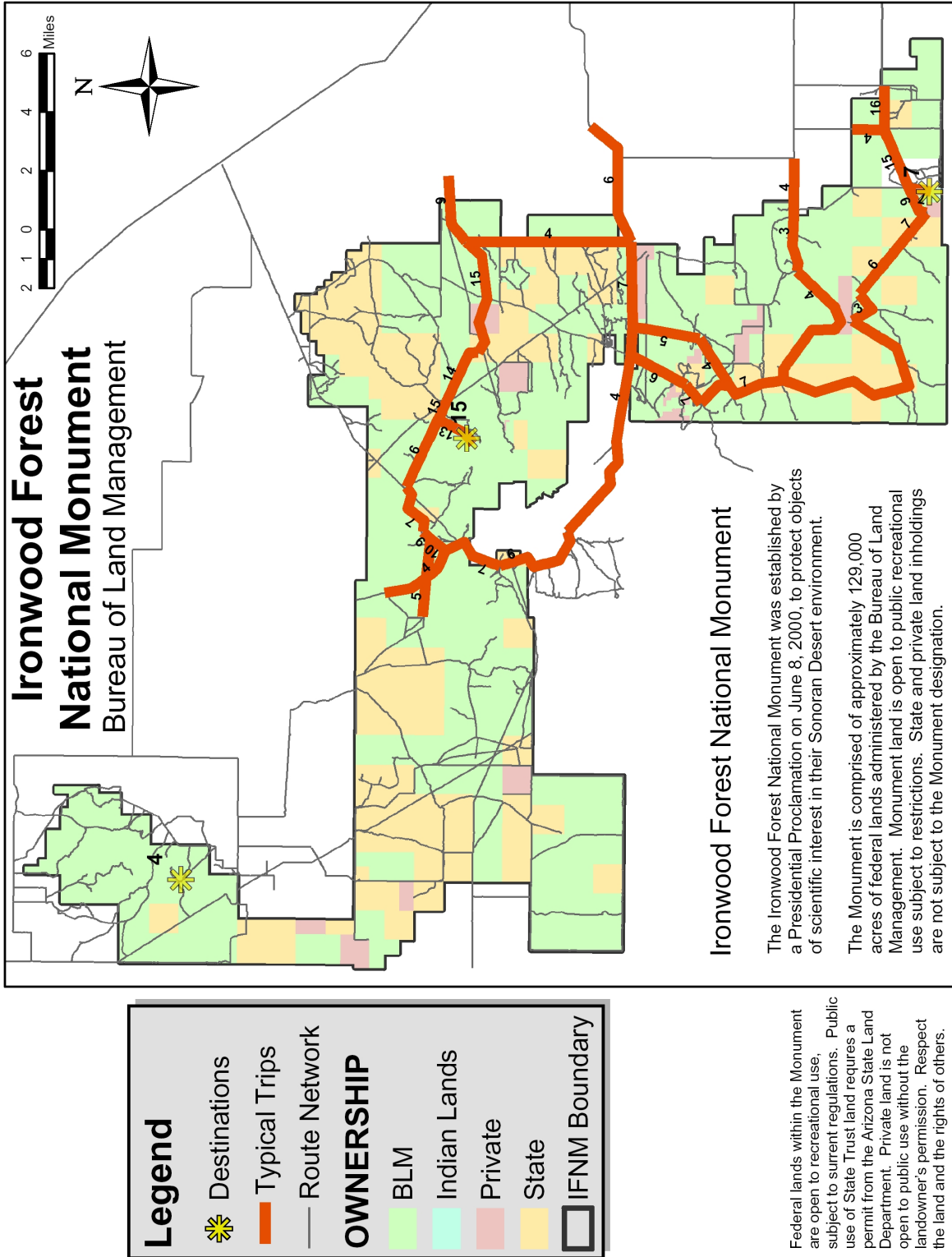


Figure 24 – Typical Routes of Use in IFNM

traveling along Cocoraque to Agua Blanca through the Waterman Mountains up to Avra Valley road. This is clearly a significant and well-traveled route. The second route starts and/or ends at Silverbell road, travels to Ragged Top and back out Avra Valley road. Of the two, this route is the most utilized in the IFNM.

In summary, from those who reported their trips to us and mapped them on the survey, it is readily apparent that trips entering and exiting the Monument are not equally distributed across all transportation routes. There are two preferred routes described above that account for about 90% of all visitor-traveled routes in the Monument. This is significant considering all the routes that were inventoried and reported earlier in this report. While there are random activities occurring throughout the Monument, there are a number of recreation sites or destinations within easy reach of these two major trip routes.

Recreation Visitation in the Ragged Top Mountains

The mapping assessment in the previous section revealed the importance of Ragged Top as a primary destination in the Monument. A team of students was sent out to do some visitor observation during random times during the winter season. However, after several weekends of observing, there were such low numbers of visitors using the area that the team decided to use observation of physical traces as a supporting method. Normally, the trace method is used because of its unobtrusiveness in a popular setting. The observation of traces can be interpreted as being very similar to direct observation with similar advantages and limitations. The analysis of traces provides insight into visitors' actions and environmental impacts in a concrete and quantifiable way. Grouping, quantity, and type of trace can give indication of activities and frequency in a given setting. This information can lead the formation of hypotheses about a setting. But, traces do not test research hypothesis in any meaningful way since they do not provide information on intention or causality. For our hypothesis testing, other methods had to be used, which in turn were supported by the findings from traces.

The method for recording physical traces used a basic combination of satellite technology and existing notation nomenclature. The trace method was used twice during the research phase of this project on April 5th at 10am and again at April 19th at 11am. Prior to the data collection phase the area was cleared of nearly all loose or removable traces on March 18th. The trace data was recorded using a simple log sheet (form 1) and a satellite Global Positioning System (GPS). Each trace encountered at the trailhead was recorded in its location and description and then placed in a trash bag if possible. The GPS used for this process were tandem 12 channel receivers, Garmen Etrex Vistas, and differential correction using the University of Arizona's GPS base station website. The use of GPS rather than paper maps was intended to facilitate greater accuracy in the recording process, as well as enable more analysis options in Geographic Information Systems (GIS) software. The log-sheet was then used to create a database for analysis.

The categorization of traces was a deliberate process based on the apparent proportions of different types of traces. Nearly all traces observed fell into leftovers with a few

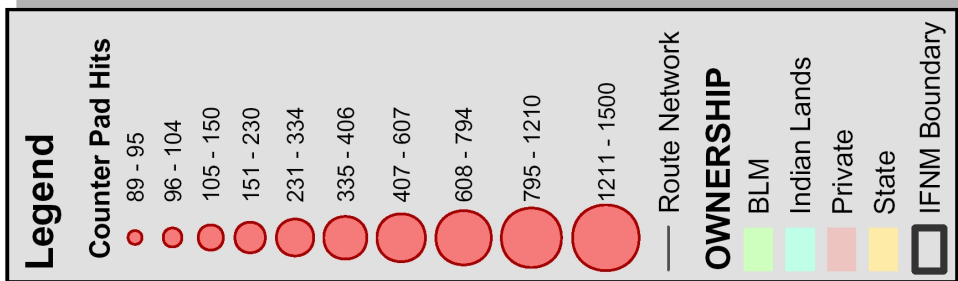
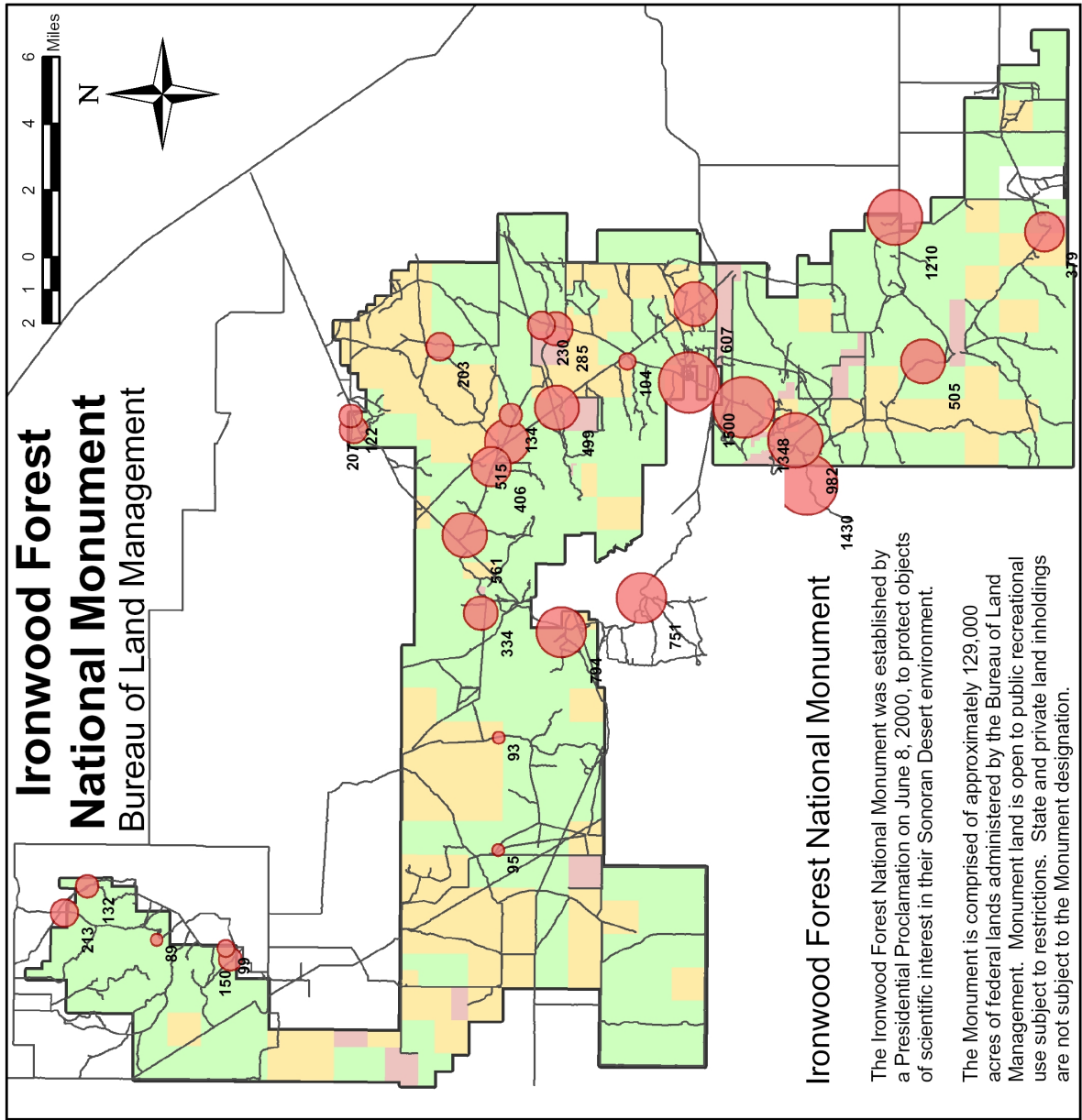
examples of “props”. The leftovers are the residue of different activities at the site: shell casings from all types of guns, food wrappers, and toilet paper. These leftovers were categorized according to the activity they were associated with and tabulated in that form, shooting, camping, or general trash. Props are changes to the environment, added to facilitate activities not already provided in the setting. In a primitive setting props like fire pits and trail extensions stand out distinctly and were recorded for analysis. Many other trace categories were harder to observe or were too similar to natural process to differentiate. Illegitimate use, like shooting saguaros, was apparent but too complex to address, confounded with woodpecker holes and old scars. Erosion was also too difficult to distinguish from natural forces.

Intention and causality as well as an inability to infer missing traces are serious limitations for the trace method. Natural environment processes are regularly affecting the traces left by users. The wind in this open area removes many traces; lighter items are probably underrepresented in the analysis. Some visitors go to great pains to remove all object traces of their use, like, Leave No Trace advocates and some vehicular sightseers. Their tracks cannot be discerned by simple observation. The managing agency, BLM, has provided assurance that no cleanup projects have taken place during the time covered in this method. However, some well-meaning citizen may have removed or altered traces unknowingly during the sampling time.

Monitoring Visitor Flows Using Automated Counters in IFNM

In addition to the map and survey information gathered in this study, additional methods were sought to obtain accurate counts of visitors using IFNM. This study used three different types of mechanical trail/traffic counters. A number of **STIL Trail Counter Pads** (totally hidden in the ground), **Infrared Trail Counters** (located above ground) and **Hobo Vibration Sensors** (Attached to cattle grates) were used to monitor visitor use levels. Each of these mechanical counters records a time and date stamp for each event that occurs over or through the counter device. Events are either vehicles driving along routes or human walking along trails. So anyone driving or walking over them is recorded according to the time and date they stepped on the pad. Mechanical counters were selected depending on how exposed the area was or amount of protective vegetation cover. The more exposed areas would received buried STIL counters, cattle guards, Hobo units; and trails with some vegetative cover, infrared counters.

The sampling period for the mechanical counters started in March 2002 and continued monitoring use levels in IFNM until July 23, 2003. Counter pads were strategically placed at access points to the Monument (See Figures 25 & 26). A total of twenty-nine counters were installed during the sampling period. Since very little was known about how many visitors and locals come and go in the Monument, monitoring locations were selected and moved around to acquire an understanding of which access areas were used and to what degree.



Federal lands within the Monument are open to recreational use, subject to current regulations. Public use of State Trust land requires a permit from the Arizona State Land Department. Private land is not open to public use without the landowner's permission. Respect the land and the rights of others.

Figure 25 – Location of Counter pads in IFNM

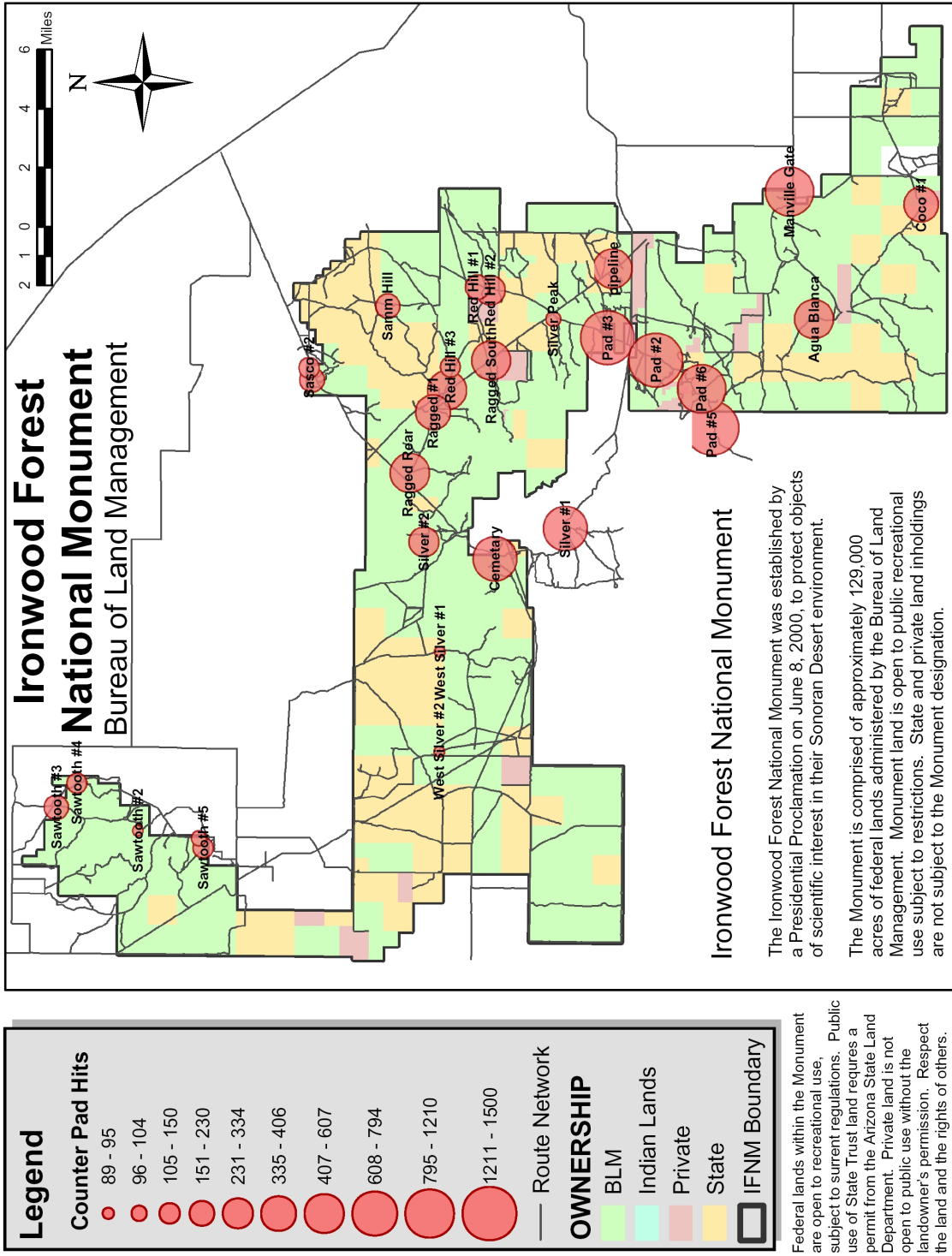


Figure 26 – Summary of Visitor Counts on pads in IFNM

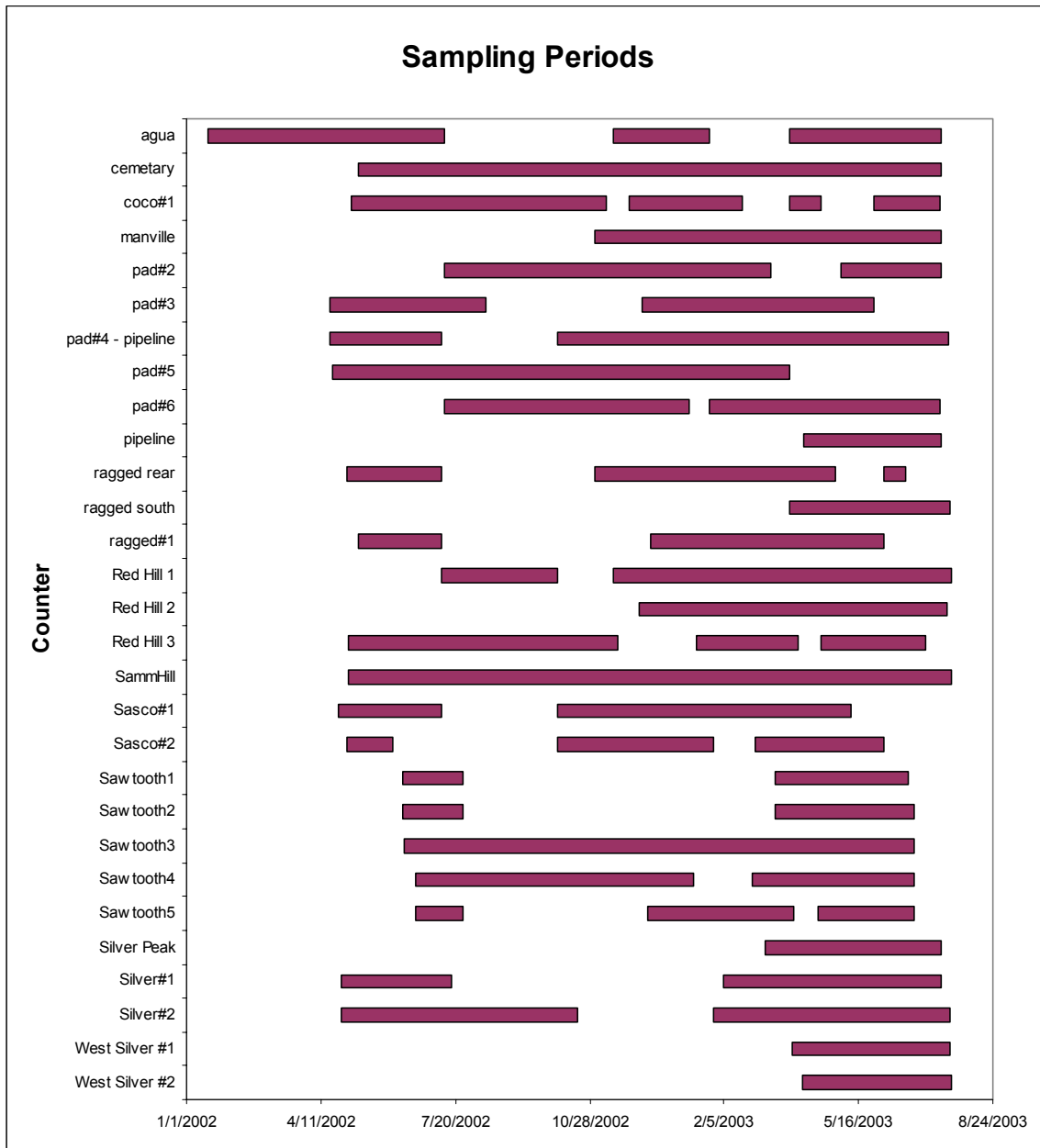


Figure 27 - Sampling periods for all Counters Installed throughout 2002-2003

Figure 27 provides a view of the sampling period and the number of days that the counters were recording data throughout the duration of the study. Data from different pad locations vary widely in their counts. It appears that those in the Saw Tooth area recorded fewer hits during the study period than those in the southeastern portion of the Monument. Table 5, Figure 27, illustrates the total number of events at each of the counters averaged over the sampling period. Counters Pad #3 (n=1500), Pad #2

(n=1348), Pad #5 (n=1430), Manville Gate (n=1210) and Pad #6, (n=982) all represent the counters that received an extensive number of events.

Counter #	Location	Counts	Duration (days)
1	Agua Blanca	505	360.0
2	Cemetery	794	434.1
3	Coco #1	379	346.9
4	Manville Gate	1210	258.1
5	Pad #2	1348	318.0
6	Pad #3	1500	288.6
7	Pad #4 (Pipeline)	515	373.8
8	Pad #5	1430	340.0
9	Pad #6	982	354.4
10	pipeline	607	102.5
11	Ragged Rear	561	265.0
12	Ragged South	499	119.9
13	Ragged #1	406	234.7
14	Red Hill #1	230	337.3
15	Red Hill #2	285	228.9
16	Red Hill #3	134	352.9
17	Samm Hill	203	448.1
18	Sasco #1	207	294.2
19	Sasco #2	122	245.6
20	Sawtooth #1	99	143.9
21	Sawtooth #2	89	148.0
22	Sawtooth #3	213	379.2
23	Sawtooth #4	132	327.4
24	Sawtooth #5	150	215.0
25	Silver Peak	104	131.1
26	Silver #1	751	243.7
27	Silver #2	334	351.2
28	West Silver #1	93	118.3
29	West Silver #2	95	110.0

Table 5 – Total Number of Counters Installed and Counts Per Sampling Period

An analysis of the map and the summary statistics on total number of events per counter, reveal some interesting patterns of visitor use in the area. Most revealing is that most of the recorded activity in the area throughout the year occurred in the southeastern portion of the Monument along reservation border from the Waterman Mountains road up to Avra Valley road. Also, evident is that many of the counters, while being in operation for almost a year are recording very few events, suggesting that the visitor use levels in the Monument might not be as dispersed as originally thought and that use is concentrated in specific areas. Again the Waterman Mountains and surrounding areas are receiving the majority of this attention. We will revisit this finding below in a discussion related to day versus night use of the Monument.

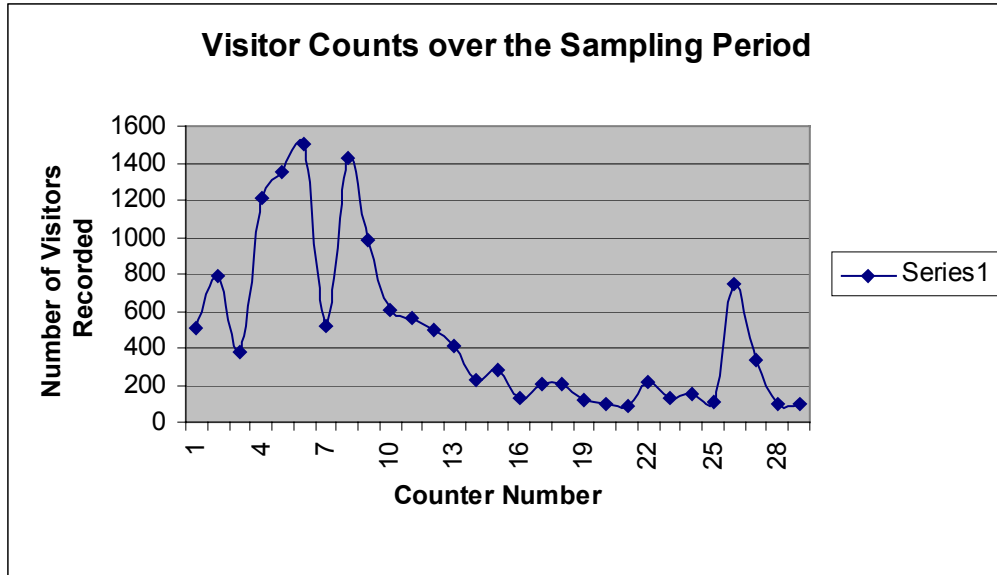


Figure 28A – Summary of total number of visits by counter number (refer to Table 5)

An Assessment of Data from Counters Over the Sampling Period

Figure 28A & B provides a summary of all counter data for each day of the year. What is most revealing about this assessment is that it reaffirms what the visitor indicated on their surveys as to the time of year the Monument is used. It is apparent that peak periods of use are from mid January through May. These arrival patterns illustrate that for planning and management, the targeted times should be during these moderate to high use periods.

Total Daily Arrivals

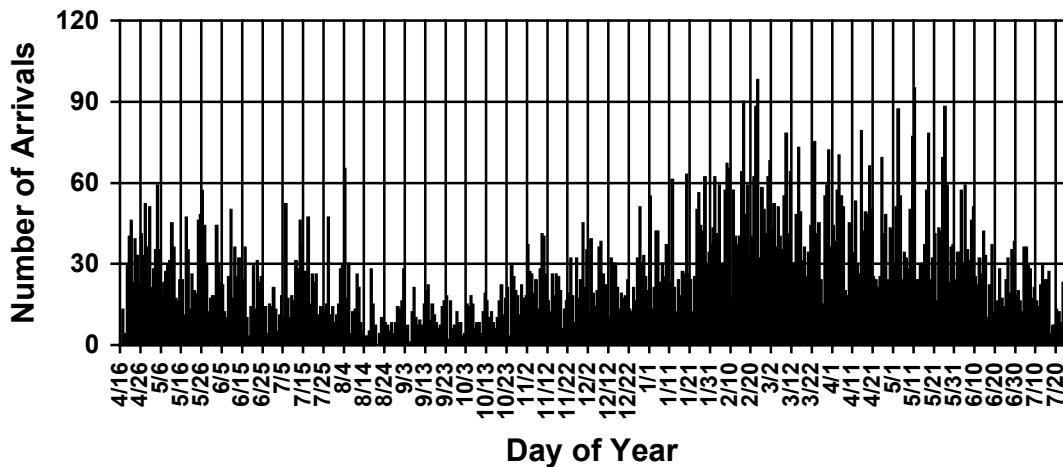


Figure 28B - Total Daily Arrivals in IFNM

Figure 29 reveals overall weekly arrivals throughout the 2002 and 2003 sampling period. Again the peak weeks are from the end of January through May. Figure 30 shows the hourly arrivals. Clearly these are typical patterns for public land settings in the desert Southwest. Typically visitors are arriving at 8:00am and departing by 6:00pm. This pattern is particularly apparent during the winter months. More important is the increase in activity from 9:00 until 1:00am (and continued through the night). This is a good example of how the counter pads can be used to capture overall numbers of visitors to a region, given that only some would respond to the survey. What is interesting is the number of visits that are occurring during the night. Figure 31 illustrates the phenomena.

Weekly Arrivals by Year

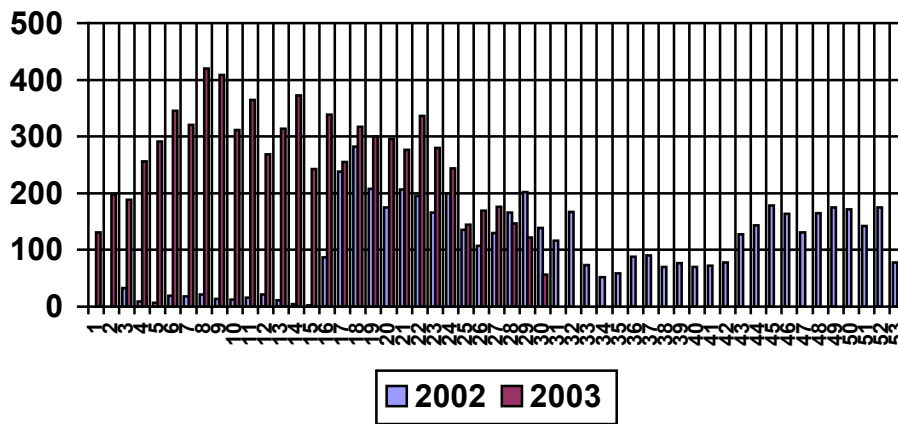


Figure 29 – Weekly arrivals by year

Hourly Arrivals by Year

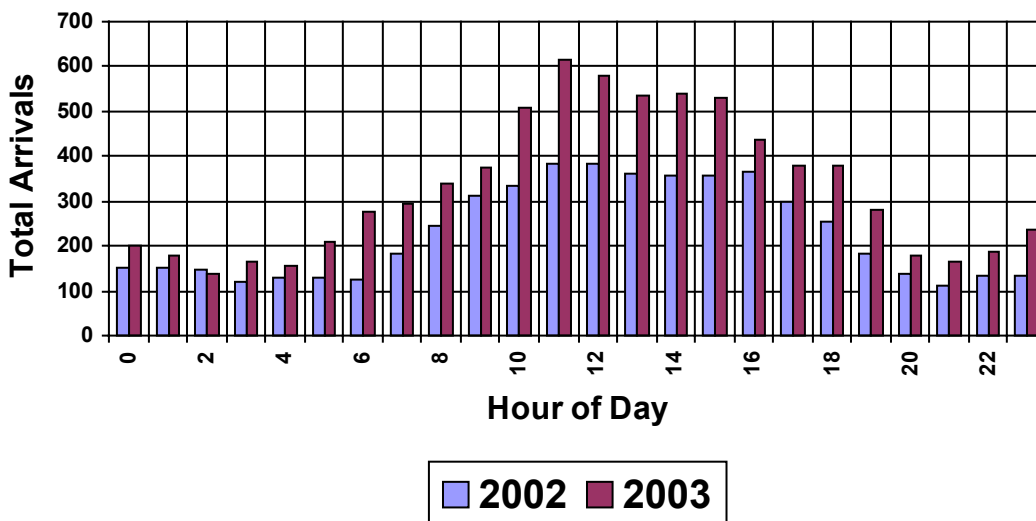


Figure 30 – Hour arrivals summarized by all counters over the 2002-2003 sampling period

Total Hourly Arrivals

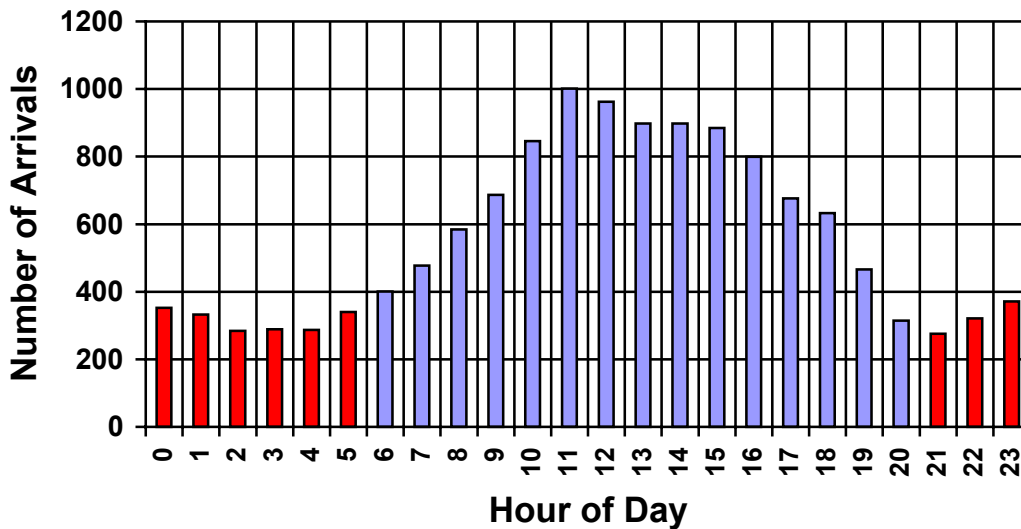


Figure 31 – Total hours arrivals for all counters by hour of the day

Figure 31 shows the number of arrivals across all counters for the entire sampling period by hour of the day. This is quite revealing. While it shows the typical arrival patterns (grey) by visitors during the day to the Monument, it also reveals a significant number of arrival patterns (black) by other visitors during the night.

Summary graphics have been made for each of the individual counters to illustrate total hourly arrivals, hourly arrivals by year and arrivals monthly for the year. Since there are twenty-nine counters that have been analyzed, two have been chosen and discussed. The remaining twenty-seven counters have been analyzed and placed in Appendix 2.

An Assessment of Visitors Using Mechanical Counters at Ragged Rear
 This is an excellent example of day use activity in the Monument. Visitor use levels at the Ragged Top area were monitored using this counter. This counter was installed in May through June 2002 and again November 2002 through May 2003 to capture peak visitation periods in the Monument. Figure 32 and 33 show the results from this counter over the sampling period. Figure 32 illustrates a typical pattern of arrivals for a recreation site through the day. These arrivals are clearly similar to other recreation sites where early morning arrivals (8:00am), peaking by 12:00 or 1:00pm followed by a decline in the evening, tapering off to no visitors after dark. Ragged Top is a commonly used by visitors who prefer to drive to the trailhead and spend a day hiking the trail, departing the area before dark. This is definitely a majority of day use. Figure 33 typically shows the weeks that visitors frequent the area. Again seasonal variation is important here as visitors spent the winter months and cool time climbing and hiking the trails at ragged top.

An Assessment of Visitors Using Mechanical Counters at Pad #3

Of all the mechanical counters that were used at IFNM, Pad #3 placed at the Avra Valley and Silverbell road area (See figures 34 & 35) received the highest number of counts. Pad #3, like the pad at Ragged Top, was installed May through July 2002 and again December 2002 through June 2003 to capture peak visitation periods in the Monument. The data collected at this location is extremely revealing of night usage. While it reveals similar patterns to the counter at Ragged Top from 8:00am through 5:00pm, there is an increase in night activity.

Total Hourly Arrivals

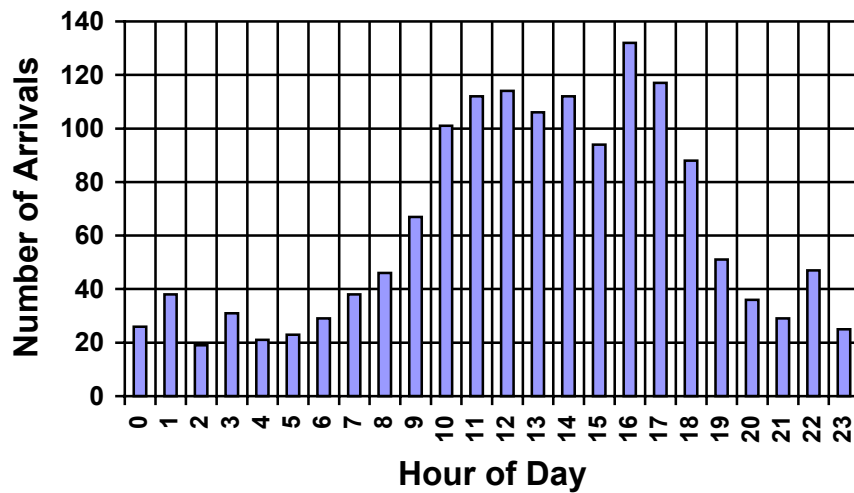


Figure 34 – Total weekly arrivals at Pad #3 by hour of the day

Hourly Arrivals by Year

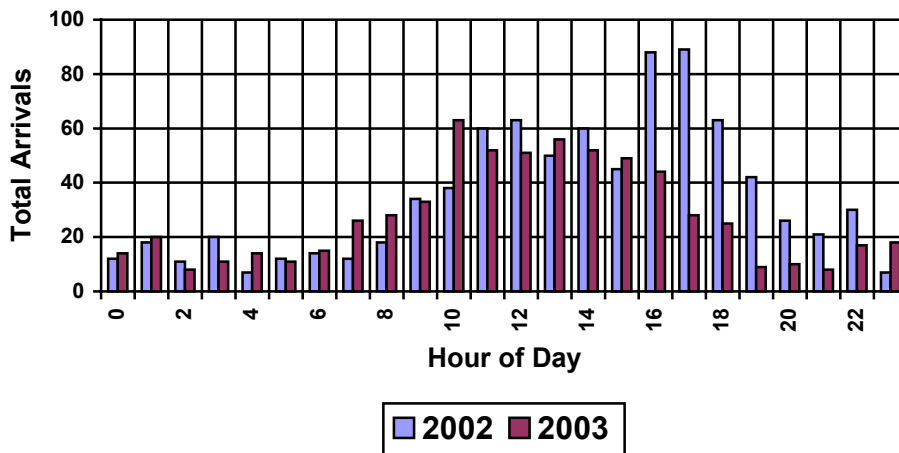


Figure 35 – Hourly Arrivals at Pad #3

An Assessment of Visitors Using Mechanical Counters at Pad #5

Counter pad #5 was placed on the Waterman Mountain road at the border with the reservation. This is a very good example of low visitor use by day but dramatic increases at night. In fact more use occurs through this area during the night than any other counter pad installed. This is also one of the few pads that was in for one full year and has the most consistent arrivals for that period. In fact, the arrival curve for both 2002 and 2003 are similar providing a check on the accuracy of the counts. So what does it mean? It appears that there is a substantial and consistent movement pattern through the area during the night hours. Most of this activity is occurring April and May during the cool evenings. The type of movement and type of group is impossible to discern with the counter data (See Figures 36, 37 & 38).

Total Hourly Arrivals

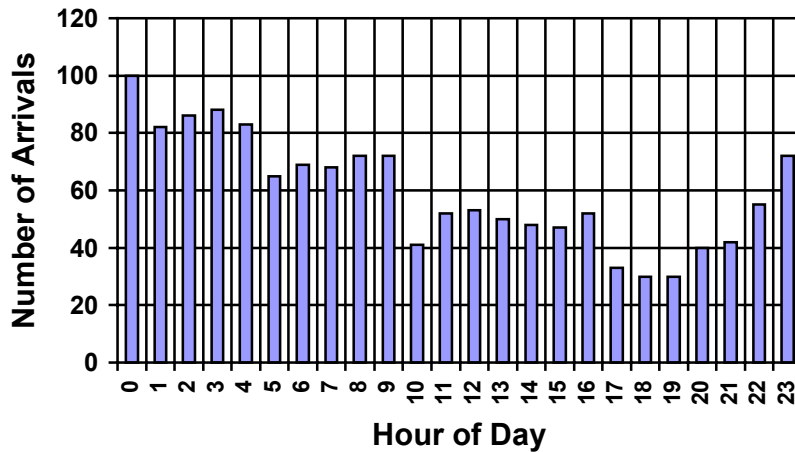


Figure 36– Total Hourly Arrivals by day for Pad #5 bordering the reservation

Monthly Arrivals by Year

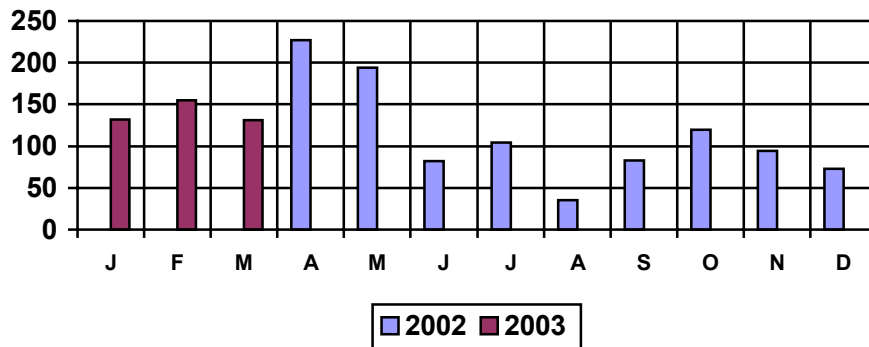


Figure 37 – Monthly Arrivals of visitor for Pad #5

Weekly Arrivals by Year

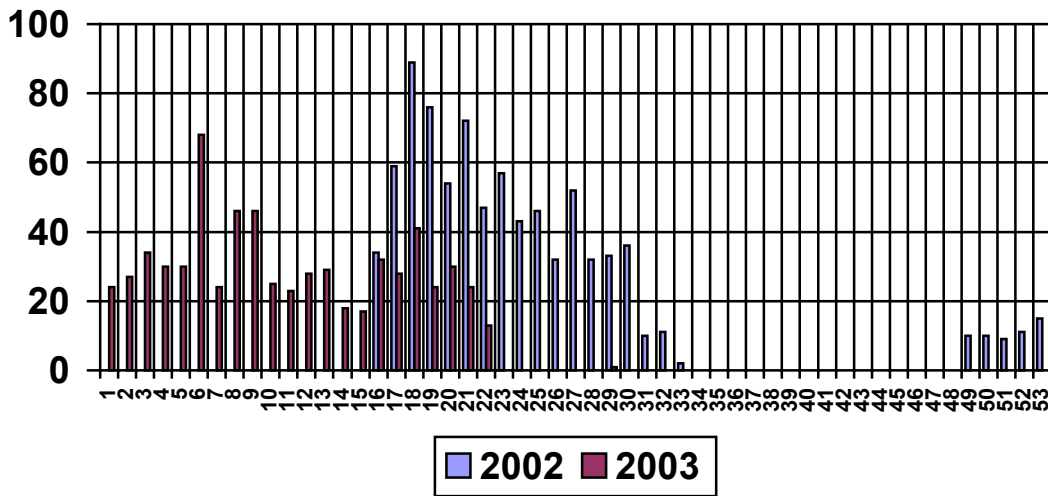


Figure 38 – Weekly Arrivals by year for counter pad #5

Is There Equal Distribution Between Night and Day Visitor Use in IFNM? The amount of night activity in the Monument is an issue that must be addressed in the management plan. To examine the differences between night and day use in the Monument, a separate analysis was performed using the data from all counter devices. Night and day use activity was analyzed separately. Figures 39 and 40 provide a bubble graph of the relationship between night and day use.

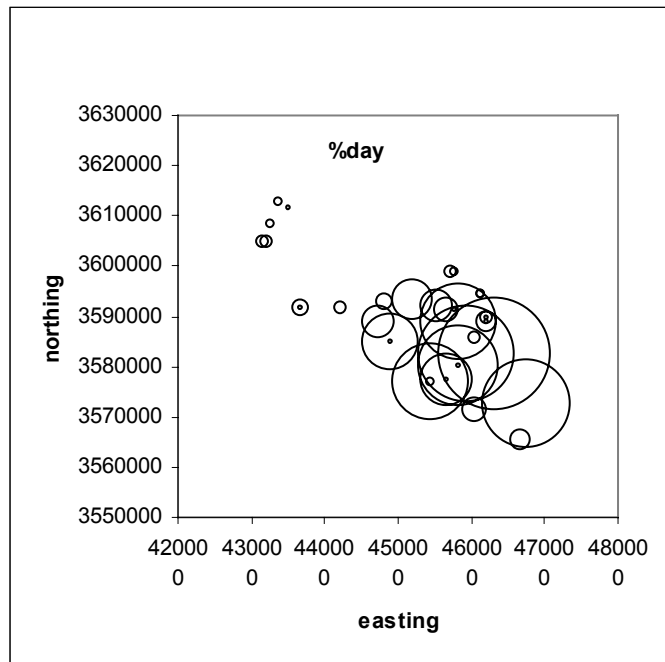


Figure 39 – Location and amount of visitor activity monitored by the Counters during the day light hours

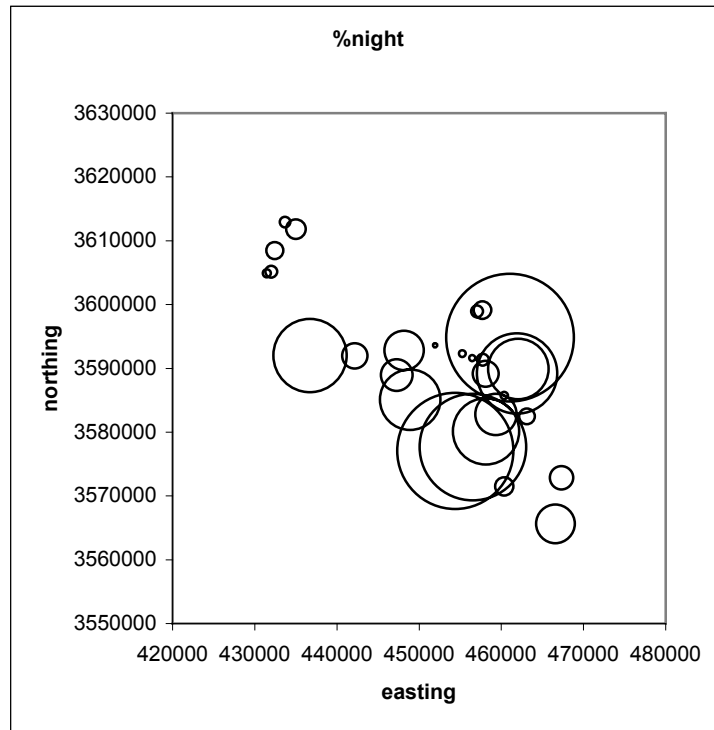


Figure 40 – Location and amount of visitor activity monitored by the Counters during the night hours activity.

Figure 39 illustrates the day activity. The centroid of the circles, represent the coordinates of the counter. The size of the circle is proportional to the amount of activity that is occurring throughout the sampling period. If these circles were laid over a map of the area, the most frequently used areas during the day are those described previously around the Waterman and Ragged Top areas.

The nighttime use is slightly different (Figure 40). It is apparent that a significant amount of users are coming off of the reservation and travel through the heading up to Avra Valley and Silver Bell road area. The other area of concern is in the West Silver Bell area. While directionality was not possible in this initial study, this would provide more revealing information as to where this flow is coming from.

Has there been an increase in Nighttime use since the onset of the study? As evident in Figure 41, there is a significant amount of nighttime movement. These movement patterns have been monitoring in some of the locations for two years. The monitoring counter, Pad #3, located near Silver Bell Road in the Southeast section of the Monument has revealed signs of nighttime movement for nearly two years. Figure xx illustrates the average hourly arrivals for 2002 and 2003.

Hourly Arrivals by Year

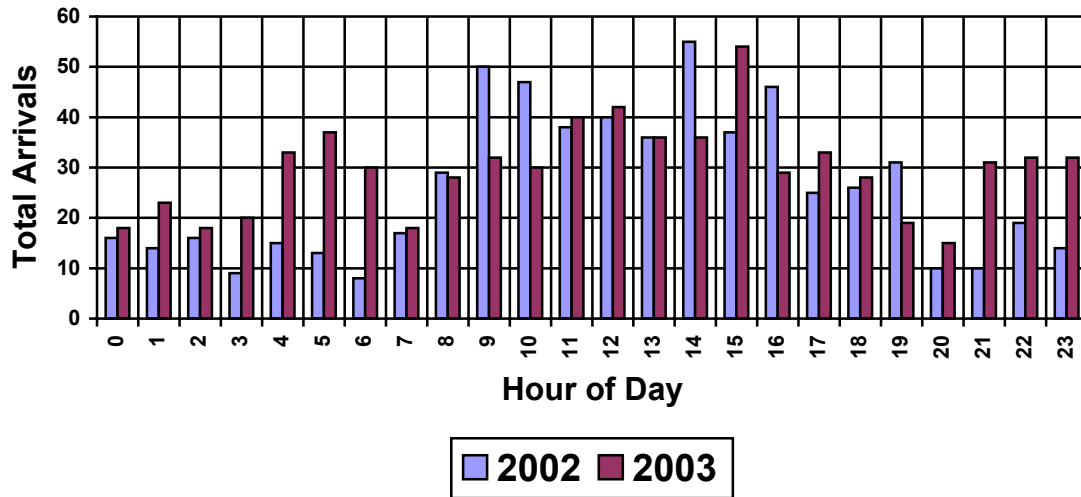


Figure 41- Pad #3 – Difference Between 2002 and 2003 for increase nighttime use

While this is only a summary of data from one counter pad, there is an obvious and significant increase in activity during the hours of 9:00 PM and 6:00 AM. Daytime use has, on the average, decreased between 2002 and 2003, while nighttime use has almost doubled. This is a significant finding, as one would expect visitation to increase as visitors come to experience the Monument’s unique Sonoran Desert character. More critical is the increase in nighttime activity.

What are the Benefits of Using Counters for Acquiring Data on Visitor Use in IFNM?

The mechanical counters strategically placed in the Monument in 2002 and 2003 have provided substantial information on movement patterns of visitors. Aside from providing overall visitor use statistics, these devices have aided in identifying which of the areas is receiving more or less visitor use. Since visitor use is not evenly distributed across the landscape, this assessment aids in understanding the use of different areas. This assessment reveals nothing about the visitors who frequent the area or their activities, but correlated with the map and diary/survey data, it can provide such insights. More revealing, and not captured in the diary/survey data, is the seasonal variation of visitor use patterns but the disparity between patterns of use throughout the day. Day use versus night use is dramatically brought to attention by this data. When compared to the other counters dispersed throughout the Monument, it is apparent that there is a significant amount of night movement occurring in the certain areas identified above. This is important information to consider for planning, for law enforcement of the area, planning facilities and strengthening current opportunities for recreation.

Recreation Site Impact Assessment

The recreation site impact assessment was undertaken at the same time as the routes inventory was being conducted. While in the field, the team was instructed to identify and assess all recreation sites. This assessment consists of mapping all existing visitor impact areas (campsite locations, drainage areas, etc.). All impact areas were spatially captured and attributed using GPS and subsequently converted to GIS inventory maps. In addition, all visitor impact areas will be inventoried using a modified version of the Cole Campsite inventory methodology (Cole 1993). This methodology evaluates each of the impact areas, identifying activity type, condition class, management need, recreation impact class and current use status. This was not a complete inventory but a cursory analysis while in the field to document some features of the sites. Each site could be revisited in subsequent years to undertake a complete inventory establish a long term monitoring plan such as the one being implemented in Las Cienegas Conservation area.

What Type of Recreation Groups Frequent IFNM and Occupy the Campsites?

This measure identifies the type of activity dominantly associated with the area. There are numerous activities occurring in IFNM but the ones identified and inventoried in this study were: Campsite (usually included a fire ring or other evidence of camping), wash running associated with ORV use, target shooting, large group or activity site, areas with impacts indicative of off road vehicle use). Of the 338 sites, 277 sites were identified as camps. Other recreation sites were identified in the inventory, including 22 target shooting and 23 washing running sites (See Table 6). Washing running sites are those sites where ATV or 4WD vehicles leave the primitive road and drive up the washes. A total of 75 acres in IFNM have been impacted with recreation sites.

Activity	No of Sites	Size (Acres)
Camp	277	
Large Group Sites	3	
Motor Cross Track	1	
Off Road Use	4	
Open Area	2	
Other	1	
Scenic Overlook	3	
Staging Area	1	
Target Shooting	22	
Trailhead	1	
Wash running	23	

Table 6 – Recreation Sites Inventoried

What are the Impact Conditions of the Inventoried Campsites in IFNM?

Clearly an important measure is to establish the recreation impact class. This measure determines on a scale to what degree each of the sites is impacted. This is important for further monitoring of conditions so that changes can be identified at the site. If a site continues to decline due to human impact, a drop in the impact class ranking to some undesired condition can provide a warning to managers. For the purposes of this study, five impact classes were identified. They are as follows:

Ranking	Criteria
1 -	No signs of impact
2 -	Minor indication of recreation use
3 -	One fire ring, vegetation removal, compacted soils and trash
4 -	Moderately high degree of impact with (Fire rings, significant trash, vegetation cutting)
5 -	High degree of impact, severe site damage, erosion, compacted soils,

Of the campsites identified, 161 sites were assessed and provided with an impact class condition. Of the 161 sites, only 23 of those sites received a moderate to highly impacted condition class. It appears that most of the dispersed recreation sites are only minimally impacted at this time (See Figure 42).

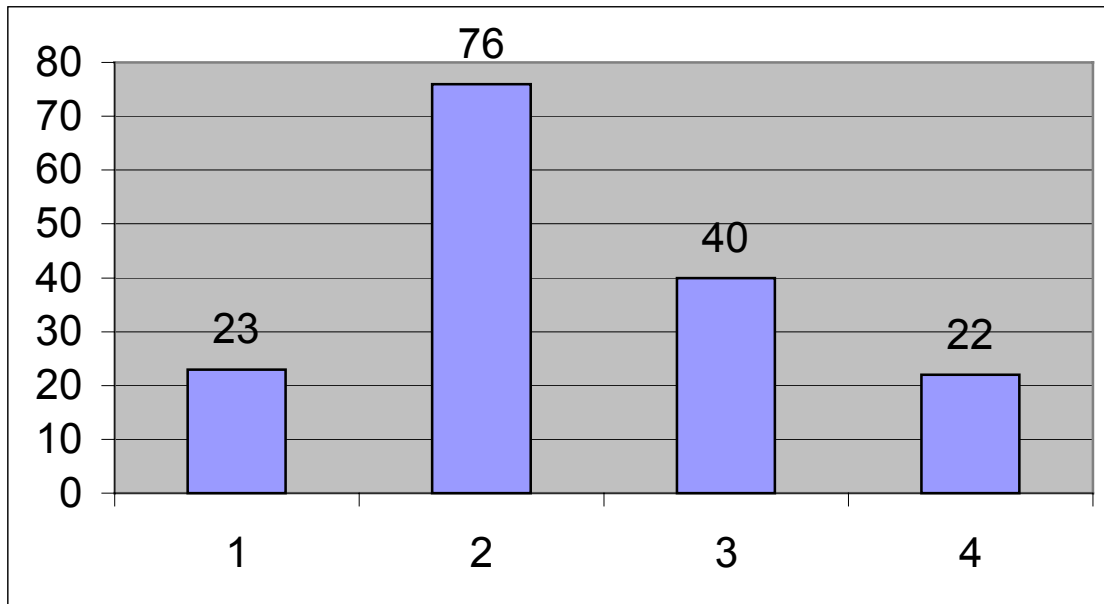


Figure 42 – Recreation Impact Condition Class

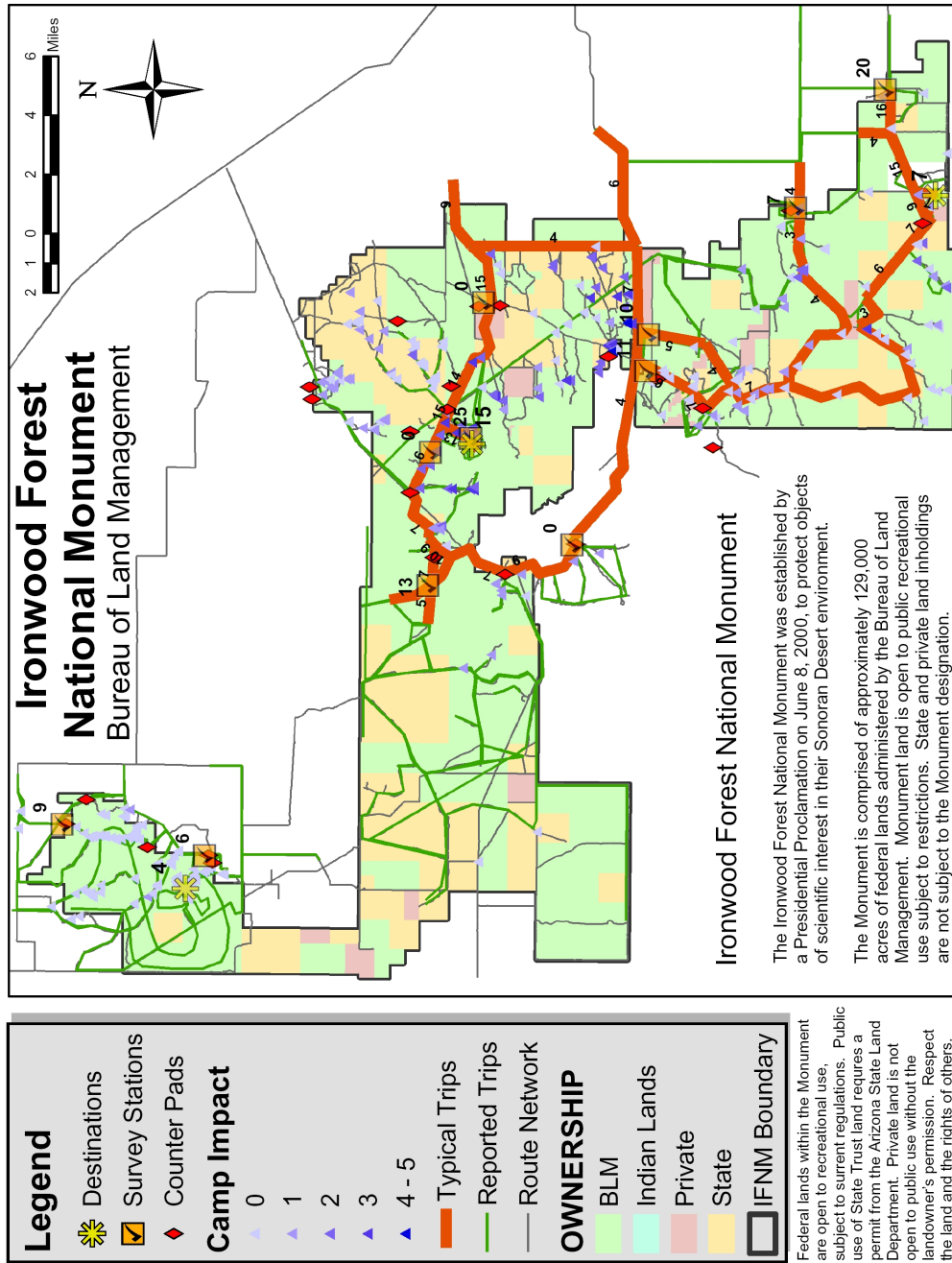


Figure 43 – Campsite Impacts

An examination of Figures 43 and 44, illustrates that most of the camps and more generally the recreation sites reside in the southeastern portion of the Monument. They all coincide with areas that are receiving the vast majority of the recreation use. The moderately to severely impacted sites are those where concentrated use levels occur

throughout periods of the year. Associated with these sites are excessive amounts of trash and vegetation destruction.

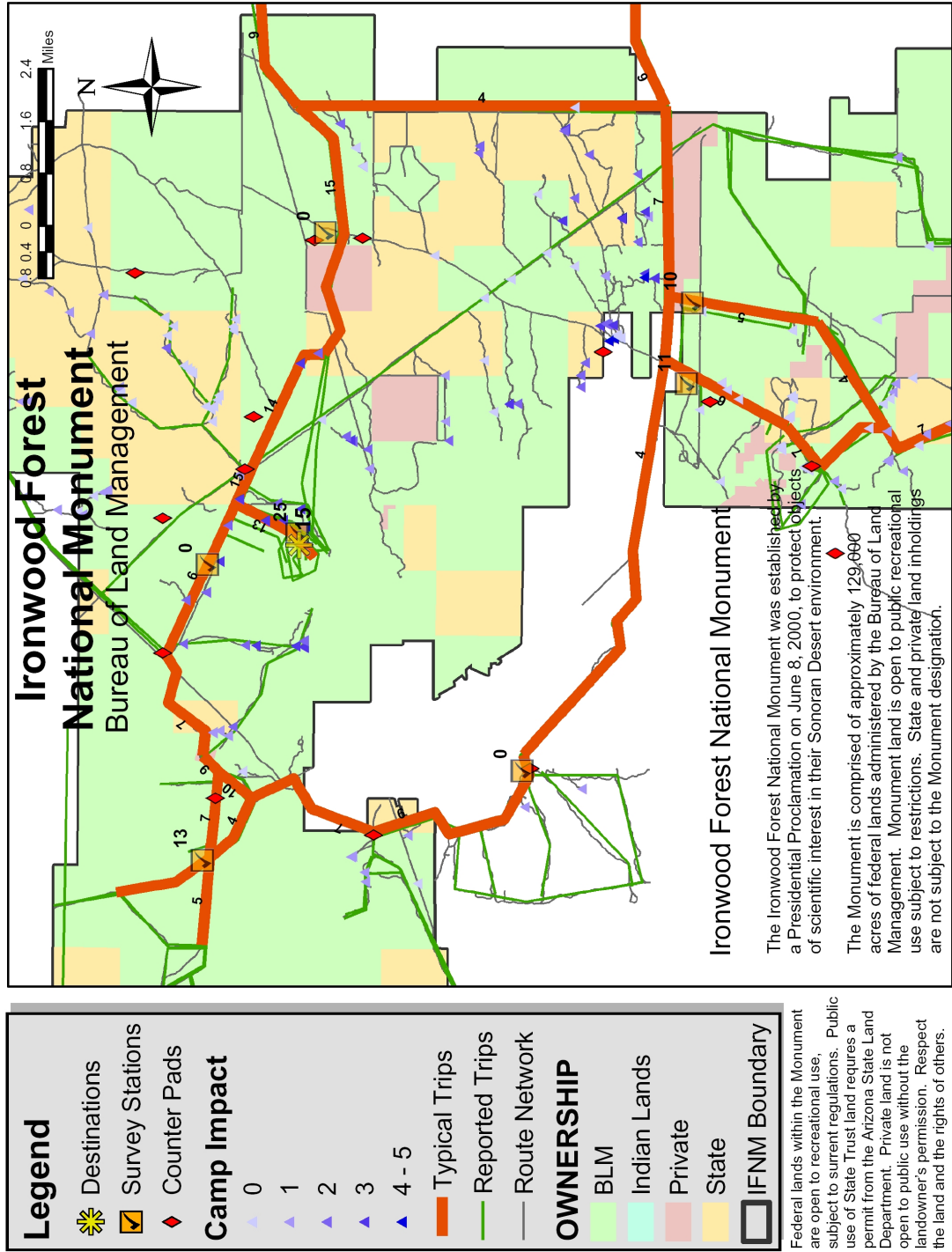


Figure 44 – Detail View of Eastside Campsite Impacts

Survey of Local Hunters in IFNM

A mail back survey was conducted during the fall, 2003 to acquire specific information from the hunting groups applied for tags in IFNM. A comprehensive list of home addresses were obtained from Arizona Game and Fish for those hunters that had applied for a hunting tag for the season in the IFNM area. The survey was mailed to each one with instructions to fill out the map and a set of questions. The survey was constructed to obtain information on when the hunt occurred, the number of hunters in the party, how many months in the year were used for hunting, did they camp while hunting, type of hunting activity they received a tag for, how often they visited the area, typical length of stay and most importantly on a map where they camped and hunted. The research team was particularly interested in frequency of visit, where they hunted and camped. This information was used to augment the campsite inventory carried out during the same period of time. The focus was on which campsite were used by hunting parties versus other recreation groups using the area. A total number of (n=550) surveys were sent out to those hunters who had applied for a hunting tag. A total number of (n=27) complete surveys were returned. For one reason or another the return rate was extremely but provides some insight into hunters behavior in the Monument.

What Type of Game Do Hunters Target in IFNM?

The survey identifies several categories of game on IFNM. They include big game, small game, upland birds, waterfowl, deer, desert bighorn sheep, Javelina and mountain lion. Deer and big game are the most popular for hunters, while considerable numbers hunt Javelina, small game, and upland birds.

What Percentage of the Hunters Camped Over night in IFNM?

The majority of the respondents camped in the area. Of the respondents who camped in the area, 89 nights were spent car or truck camping. Most of the respondents who camped in the area spent 2 nights in the area. Only two parties spent more than 7 days at a time in the area.

What are the most Popular Hunting Times of the Year in IFNM?

Hunting in IFNM varies by month and by day of the week. While there are no months or days of the week without hunting activity, hunting trips are very high during certain times of the year. This has a lot to do with hunting seasons as defined by the Department of Game and Fish. While hunters use the area every day of the week, peak hunting days are Friday through Sunday, with nearly 65% of the respondents reported using the area on a Saturday.

How Often Do Hunters Visit IFNM and what are the Typical Party Sizes?

Although use of the area was reported for all months of the year, most respondents used the area during only one month (43%). In addition, most respondents reported using the area once a year (39%) with only (10%) using the area twice a year. As would be expected hunting seems to be occurring in relatively small parties of 2-3 (78.7%) or 4-5 (9.0%). There is always a question about group size and preferred hunting practices in many recreation settings.

Travel Simulation Modeling for IFNM

Understanding the spatial and temporal distribution of use is of fundamental importance to those who plan for and manage recreation use. The kind and amount of visitor use has profound effects on the quality of the natural resources, visitor experiences and facilities in recreation areas. Therefore, it is critically important to be able to monitor the flow of visitation in space and over time, and to be able to predict how distributions are likely to change in response to both management actions and factors that are not subject to managerial control. In some situations this is easily done. However, the ease of monitoring and predicting use declines as the size of the recreation area increases, the complexity of traffic flow increases, and the degree to which traffic flow is tightly controlled by management decreases. Moreover, the importance of being able to monitor and predict visitor flow is particularly pronounced in places where biophysical conditions and experiential conditions are highly sensitive to intensity of use.

Increasingly, travel simulation modeling is gaining recognition as an important tool for park and wilderness planning and management. Although travel simulation models for parks and recreation have been experimented with for more than three decades, in the last decade the cost of modeling has plummeted and capabilities have soared. Specifically, simulation models can be used to:

- Provide a better understanding of the baseline spatial and temporal patterns of visitor use.
- Help predict how distributions of visitor use are likely to change in response to both management actions and factors not subject to managerial control.
- Allows for testing the feasibility and effectiveness of management plan alternatives.
- Allow for monitoring of hard-to-measure parameters (e.g. people at one time at a certain attraction or walking on particular trails) by using easily measured indicators (e.g. number of cars entering the park or parking at a trailhead).
- Support the planning and management of visitor use in situations where monitoring and predicting visitor flow is difficult.
- Improve communication of implications of management prescriptions to the public. Help with communication of management scenario implications – gives a visual explanation that can be powerful
- Link transportation systems and planning/design
- Support for decisions
- Helps with cost analysis
- Helps evaluate management actions (e.g., implementation of a shuttle system)
- Better understanding of problems and potential casual factors – leads to better solutions
- Testing of management alternatives – better than trial and error on the ground
- Need to ask whether the park is large and complex enough to warrant modeling – the more space in a park, the more need for modeling – but, small, site-specific sites may be good applications if use and/or impacts are complex
- Need validity test on the models – there has been some validation of models on existing conditions, not as much on models of management scenarios – moving in to artificial intelligence applications

- Data that is collected on visitor use is useful with or without modeling
- Data collection should be based on decision making needs
- Should we contract modeling or have in-house? Outsourcing keeps the technology on the cutting edge
- Level of appropriate public access to modeling data
- Modeling helps increase creativity in management scenarios without increasing risks
- Modeling has strong application to site-level design

RBSim Multi-Agent simulation of Visitor Travel Patterns

Both approaches have utility for modeling travel patterns. The prototype developed in this study to examine travel patterns at SCRCA utilizes RBSim RBSim 2 (Recreation Behaviour Simulation) (Gimblett & Itami, 1997; Gimblett, 1998; 1998a; Gimblett et al. 1999; Itami et al., 1999; Itami et al., 2000, Itami and Gimblett, 2000; Itami, in Press) is a computer simulation tool, integrated with a Geographic Information System (GIS) that is designed as a general management evaluation tool for any landscape. This capability is achieved by providing a simple user interface that will import landscape information required for the simulation from a geographic information system. Once the geographic data is imported into RBSim 2, the land manager can change a number of variables. In Misty Fjords for example, variables included the size of vessels, hull designs, and various speeds at which they traveled. Also considered were flight patterns for airplanes or helicopters that were largely dependant on daily weather conditions. In other settings variables could include number and kind of vehicles, the number of visitors, and facilities such as the number of parking spaces, road and trail widths and many other features.

RBSim 2 allows a land management to explore the consequences of change to one or more variables so that the quality of visitor experience is maintained or improved. The simulation model generates statistical measures of visitor experience to document the performance of any given management scenario. Management scenarios are saved in a database so they can be reviewed and revised. In addition, the results of a simulation are stored in a database for further statistical analysis. The software provides tables from the simulation data so land managers can identify points of over crowding, bottlenecks in circulation systems, and conflicts between different user groups.

Specifically RBSim 2 uses concepts from recreation research and artificial intelligence (AI) and combines them in a GIS to produce an integrated system for exploring the complex interactions between humans and the environment (Gimblett et al. 1996a; Gimblett et al. 1996b, Gimblett 1998, Gimblett and Itami, 1997, Itami et al., 1999; Itami et al., 2000; Itami and Gimblett, 2000). RBSim 2 joins two computer technologies:

- Geographic Information Systems to represent the environment
- Autonomous “intelligent” software agents to simulate human behavior within geographic space.

RBSim 2 uses autonomous agents to simulate recreation behavior. An autonomous agent is a computer simulation that is based on concepts from Artificial Life research. Agent simulations are built using object oriented programming technology. The agents are

autonomous because once they are programmed they can move about their environment, gathering information and using it to make decisions and alter their behavior according to specific environmental circumstances generated by the simulation. Each individual agent has its own physical mobility, sensory, and cognitive capabilities. This results in actions that echo the behavior of real animals (in this case, human) in the environment.

The process of building an agent is iterative and combines knowledge derived from empirical data with the intuition of the programmer. By continuing to program knowledge and rules into the agent, watching the behavior resulting from these rules and comparing it to what is known about actual behavior, a rich and complex set of behaviors emerge. What is compelling about this type of simulation is that, although it is impossible to predict the behavior of any single agent in the simulation, it is possible to observe the interactions between agents and draw conclusions that are impossible using any other analytical process or field research.

RBSim 2 simulation model consists of a number of object oriented software technology to model components of the overall simulation system. These software objects include:

- Network Object Model - contains network topology for roads, trails and other linear features organised as a forward star network with associated attributes and methods for calculating travel time and distances across the network.
- Terrain Model - contains elevation data represented as a regular grid of elevations.
- Graphics Engine - provides visualisation of the landscape as a map showing current location of recreation agents.
- Simulation Engine - controls the scheduling of agents, controls simulation events such as weather, road opening and closure, seasonal events and other user-defined events.
- Scenario Builder – for constructing a variety of scenarios to test out design, planning and management options.
- Output Object - stores run-time states for agents and the network.
- Agent object - represents a recreation personality type, mobility characteristics, and reasoning system.

Each of these components allows one to build their own agents, import GIS data to create a travel network, establish arrival times for surrogate visitors to start the simulation, build and test a scenario and derive temporal outputs for any node or linkage in the database.

Developing the Simulation Network for IFNM

Geographic Information Systems (GIS) data was used to build the travel network topology that the agents utilize in the simulation. This involved taking the existing and proposed trail networks and translating the data into a form useful in the simulation. Figure 45 illustrates the trail network used in assessing recreation use in IFNM. The topology consists of lines and nodes that can be attributed with information necessary for the agents to travel along the network.

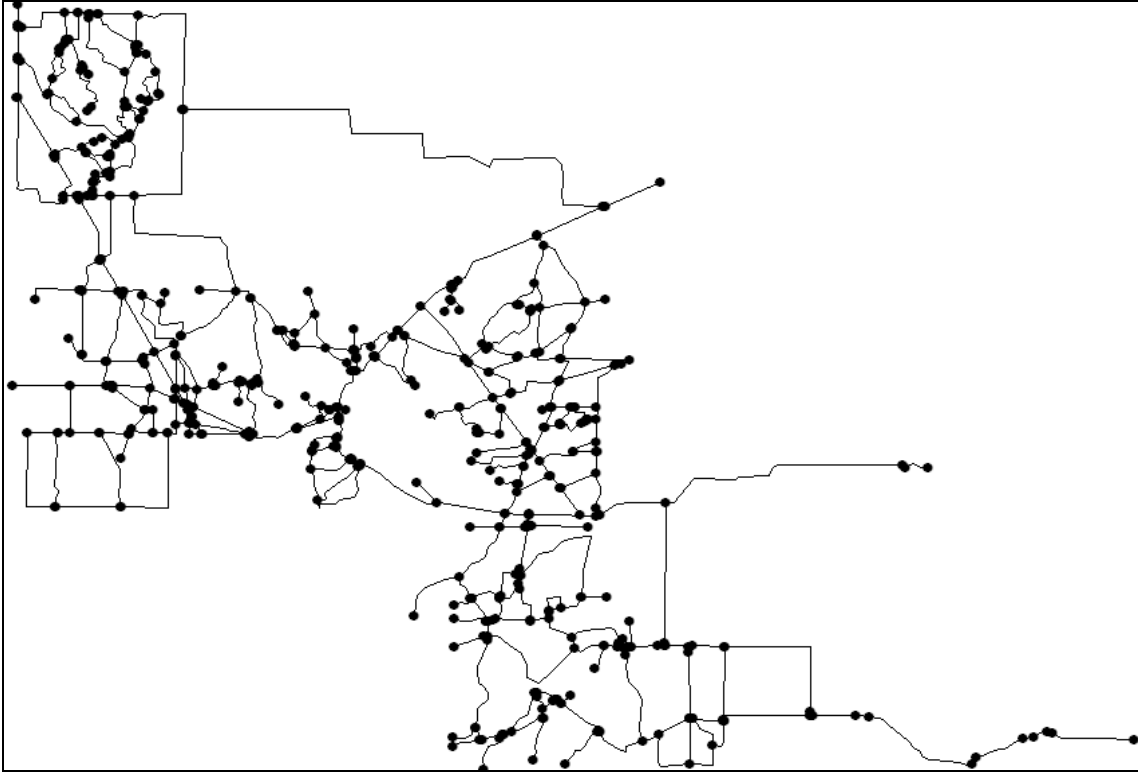


Figure 45 – A View of the Trails Network for IFNM

The nodes either represent intersections of trails, destinations (such as an archeological site) or trailheads or significant access points. Trail speeds, type of trail, condition etc. are important attributes of the trail system that encourage or restrict movement patterns. This information is all encoded into the trail segments and agents in our simulations use this information to navigate along the network. The advantage of using simulation is that if trail conditions change or new trails are proposed, these adjustments can easily be made to the network and the baseline simulation reconstructed to illustrate the effects of these changes. This is anticipated in the future of this project as more concise trail alignments are constructed and recreation use data collected.

Agent Trip Schedules the Represent Expected Visitation Patterns

Quantitative data on visitor use patterns or those currently entering IFNM from various trail entry points were used to develop this prototype. Data for each of the trips was used to create a trip schedule. The simulation works based on simulating individual trips. By simulating all trips over a season it is possible to examine the expected use levels at various sites and provide some feedback to set social and environmental standards as well as monitor for these standards in the future. The trip schedule then in the simulation environment contains information essential for simulating any individual trip. When the simulation begins, each trip then is scheduled for a specified period of time and executes the trip in a sequential fashion. Each individual trip is launched in the simulation and traverses and navigates through the GIS represented landscape as a real trip would in a real landscape. The landscape in this simulation contains popular destinations

(represented as nodes), topography for undertaking visibility analysis to capture information on encounters and visits to a destination and the routes that trips traverse.

In any simulation, many modes of transportation or movement can be simulated. In the prototype developed for IFNM, agent types were constructed to represent recreation use. Remember agents or agent types are simply surrogates for visitors. For this simulation visitors arriving in vehicles in general were simulated. Each trip is assigned an entry and exit node, a network or trail system that the agents will travel on, a trip duration and an arrival/departure curve.

Arrival/Departure Rates for Typical Trips in the Simulation

Arrival/Departure curves provide the departure times of each agent in the simulation. Figure 46 is an example of one of the departure curves used for Trips Entering IFNM. These departure curves were generated using a combination of entry and exit times recorded on the surveys and the counter data captured at the entrances to the IFNM. Trips are required to have destinations and/or routes that they follow. The data for the trips was taken from the surveys and mapped responses visitors provided upon filling out the survey.

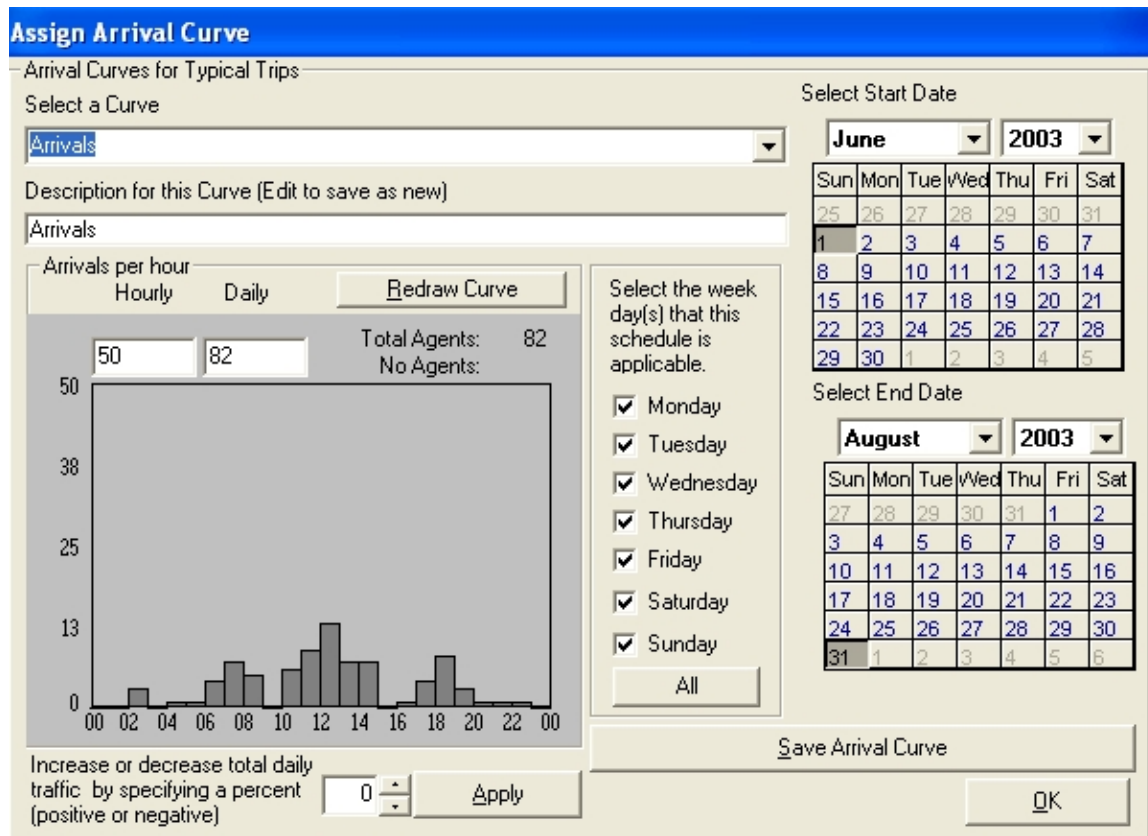


Figure 46 – Example of a Arrival Curve for Trips Entering IFNM

Monitoring Agents To Measure Number of Visits to Identified Sites and Validate Simulations

To better understand the numbers of visitors entering IFNM and traveling to various destinations the simulation environment provides for the use of monitoring agents. A monitoring agent is placed in a fixed location in the simulation to monitor numbers of other agents entering and exiting that location. The only job that these agents have is to keep track of all the visits to the location that they are stationed at over time. They not only count the number of other agents that visit a site, but keep track of who they are, when they visited, number of visitors per mode of transportation and the mode of travel. The data for each of these monitoring agents or sites can be statistically analyzed to determine the volume of visitations, who and in particular when (seasonality) of the visit. It is also possible to speculate on encounter levels and possible conflicts between use levels through this type of analysis. Most importantly as scenarios are developed that relate to management prescriptions, they can be tested and compared to the baseline conditions. These simulated conditions can then be compared to the baseline conditions to determine the effectiveness of the management prescriptions. For example, monitoring visitor use levels at major destinations to derive capacity and determine social and environment impacts. Seasonal data could be collected at that location and a simulation developed to represent the baseline or current conditions. A scenario could then be developed to control the numbers of visitors at particular times of the year by dispersing or reducing use in an effort to maintain a quality recreation experience and protect the natural resource. In this situation a monitoring agent could be placed at that destination, the baseline simulation constructed to represent current conditions. Then the scenario would be constructed, run and a comparison could be made between baseline and proposed/future conditions to determine how effective the management prescription would be in terms of controlling visitor use. The monitoring agent plays a critical role in keeping track of visitor use levels in both situations and provides the basis for comparison.

At this point in the study, no realistic scenarios have been developed so monitoring agents are being used to assist in validating how reliable the simulation is in comparison to the baseline data that was collected. By comparing the two, a certain degree of assurance can be obtained that the simulations can replicate data that has been collected in the field of known conditions. In addition this comparison provides a certain level of confidence that when scenarios are implemented that the outputs of the simulation clearly and accurately reflect what is and could happen in the real world. This is extremely important validation when doing simulation of this type.

This study then takes data that has been collected using. A comparison is then made to the simulation outputs to determine the accuracy of the baseline simulation. For purposes of this study a comparison is done using the total hourly arrivals by day and monthly arrivals by year for one of the areas where a counter was placed in IFNM.

Monitoring Agent at Sensor Placed at Ragged Top

The simulations were run between the months of April and July with the counter data collected during these time periods. This slice of the visitor use during the year provides

an excellent representation of the seasonal patterns of use. A simulation was run using the trips outlined earlier. The outputs for total hourly and month arrivals were summarized and compared to the similar data collected in the field with the mechanical counters. Figures 47 & 48 compare the counter data (blue) with the simulated trips (red) to create baseline conditions. It is clear from Figure 47 that when analyzing total hourly arrivals that the simulation is marginally under predicting the arrivals at the Ragged Top.

An analysis of Figure 48 that examines the monthly comparison the simulated trips for the most part accurately coincide with the counter data and in some situations the arrival rates of simulated visitors is slightly higher. In both of these figures, the simulation is accurately predicting what the mechanical counters are quantitatively providing in terms of arrival numbers of visitors. With the amount of random variability that is built into the simulation in terms of trip departures and travel speeds there is a high amount of correlation between the two. Some statistical comparisons can be done to quantify this association, but that is beyond the scope of this prototype.

Total Hourly Arrivals

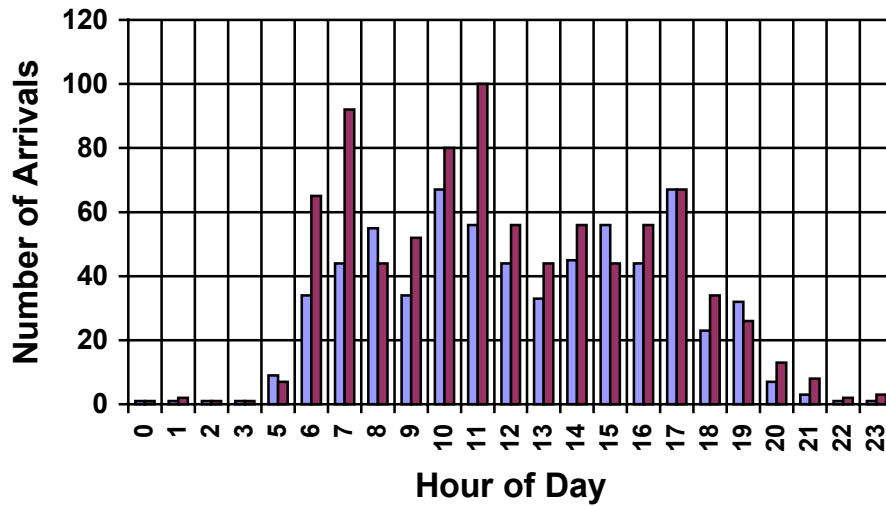


Figure 47- Total Hourly Comparison of Arrivals at Ragged Top Between Baseline (Blue) and Simulated Trips (Red)

Monthly Arrivals by Year

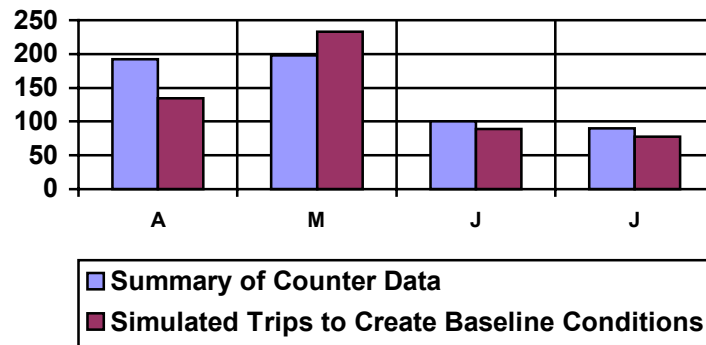


Figure 48 - Total Monthly Comparison of Arrivals at Ragged Top Between Baseline (Blue) and Simulated Trips (Red)

Discussion

After reviewing the comparison of counter data versus the simulations, it can be concluded that the simulations are accurately predicting visit use for the period sampled and simulated. Since the simulations can only be as good as the data collected in the field, with a high degree of replication between the two, it can be concluded that the simulations are working extremely well and would produce accurate simulation results when testing a variable of management prescriptions or scenarios.

As monitoring continues in the future, this data can be used to increase the predictability of the simulations. Rerunning the simulations and refining the parameters with reduce the random variability in the simulations and ultimately improve accuracy and predictability.

An examination of the results of the simulation outputs for all the areas monitoring reveals relatively low levels of use. Recreation use is dispersed evenly across the landscape. But without real data about visitor use levels it is hard to say anything significant about visitor encounters or impacts. However based on the levels of use being simulated, there is potential for a number of encounter interactions between recreation groups to occur. What is required however is to have more accurate data about visitation through inventory and monitoring and to carefully examine the critical sites or destinations that would be anticipated to be visited frequently and monitor use at those sites as well. Both sets of data would provide a much more thorough and substantive set of quantitative information for examining visitor use levels and those associate social and environmental impacts.

Scenario Development

Now that the simulation tool has been constructed and accurately mimics the anticipated use levels, aside from future inventory and monitoring of visitor use a number of realistic scenarios or alternatives need to be careful crafted and tested with local stakeholders. These scenarios should examine and outline appropriate visitor use levels, commercial

and non-commercial use levels for all the destinations in IFNM. It would be very easy to plug in jeep tours or any other commercial activity that might be desirable and evaluate their impacts. How much visitor use is too much, is a question that needs to be examined. What are alternative destinations of similar quality to those currently receiving significant levels of use, but where use could be dispersed. Adversely what would be the consequences of increasing use levels in existing high use areas. Then management objectives or guidelines can be constructed for these areas centered on these types of recreation and volume of use over typical seasons.

Long Term Monitoring in IFNM

A long-term monitoring program needs to be developed to collect data that can be used for model calibration and verification. Since this model will be built on visitor use levels projected from a short season, this is by no means enough data to adequately simulate visitor use patterns. Many years worth of data should be considered essential for having a more accurate, reliable and defensible model. While the data for the 2002-2003 could be considered a benchmark in terms of organizing visitation data, a long term monitoring program needs to be established to systematically collect data on visitor use patterns. One outcome of this project will be to identify where long-term monitoring sampling could be established and protocols for organizing data that could feed directly into the simulation environment. Change detection is an important component of any monitoring program and RBSim could identify where and how much change is occurring in various locations. A combination of automated counter pads, observation and travel dairies would provide a more comprehensive view of visitor flow patterns in IFNM.

Monitoring Using Mechanical Counter Pad and Vibration Sensors Technology

There are a number of technological advancements that are being developed at the time of the writing of this document that provide mechanical ways to count visitors. A number of those technologies have been explored in a variety of research projects. But the STIL Trail Counter Pad /Data logger is an exceptional choice in areas where there is sparse land cover. The Trail Counter Pad is a robust, sensitive, person or vehicle counting system designed for long term, maintenance free operation in rural and park environments. It is a fully sealed system (IP67), maintenance free and made of strong durable materials. Only a minimal deflection of the Counter pad is required to advance the counter. A battery life in excess of 10 years and the full sealing allows this logger and counter system to be completely buried. This subsurface installation makes the unit undetectable and therefore immune to vandalism, environmental damage, and mischievously enhanced counts. It is typically buried beneath 150mm of soil.

Some of the Exceptional Features of the Pads are:

- Detects, verifies and records Counter pad deflections
- Proprietary mechano-acoustic sensing technology
- Can be used to count people or vehicles; thin enough to fit under a doormat
- Records about 160,000 time-linked events before overwriting the oldest stored information. (Larger capacity available on request)
- Single pad, double pad (for wide tracks) or directional mode (two pads)

- LCD Displays total, and two directional totals (directional mode only)
- Data may be downloaded repeatedly without deleting the data loggers memory
- Data can be exported as CSV, Excel or ASCII formats
- Data can be downloaded on site by a laptop computer with infrared capability
- Available with output to trigger camera etc
- Data integrity checking
- Environmentally sealed system (IP67)
- 10 year Battery life

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In a number of research projects currently underway at the University of Arizona, the counter pad technology is being explored. Placement and depth of pad are critically important to capturing accurate data. Pads need to be placed where the width of the trails matches the size of the pad or are narrow either where it is possible to funnel visitors. This is important to ensure that each visitor in a party actually steps on the pad and triggers the receiver. If the pad is buried too deep and/or the soil is too compacted around the pad, it will not work properly making it subject to inaccurate counting. For more information on pad placement please contact the author of this report.

In addition, Scott Technical has entered into a research and development arrangement with the University of Arizona to continue to develop the technology for monitoring visitors or pedestrian traffic. They are currently exploring options to differentiate between recreation user types using some new sensor technology. This is very promising for the understanding not just how many visitors enter into an area but who they are. At the present the only way to differentiate is via travel diaries and observation.

In addition to the counter pads, in areas that area open with little cover, **Hobo Vibration Sensors** (Attached to cattle grates) are an inexpensive solution for monitoring traffic patterns.

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More information on the RBSim approach can be obtained at the following URL:
<http://www.srn.arizona.edu/~gimblett/RBSimBibliography.htm>

Appendices

Appendix 1- Access and Transportation Inventory for IFNM

Appendix 2 - Respondent comments

Appendix 3 - Names and addresses for a mailing list

Appendix 4 - Archives

Appendix 5 - Detailed Analysis for all Counters

Appendix 6 - Visitor Diary/Survey

Appendix 7 – Hunter Survey

Appendix 1 – Access and Transportation Inventory for IFNM

Description and Evaluation Items

Aerial ortho-photo quadrangles were used to identify network of linear features, which appear to be roads or trails. The photo-interpreted network was ground checked to identify if the linear feature is being used for travel related purposes, and to describe their functional and physical characteristics. GPS positional data for was collected for the travel routes and various site features found along the route. Travel routes were filmed in their entirety to record baseline conditions for future reference. Records research and other legwork will be needed to gather some information items.

Based on apparent use, traffic monitoring stations will be set up to monitor traffic volume levels. Monument users will be asked to provide visit/use information to identify use patterns, needs and values. The database will be dynamic during the planning process, with new information added as it becomes available.

Management options identified through the planning process will be used to generate models for different management scenarios and help identify impacts on access, resources and costs.

ITEMS FOR ROUTE FEATURES GROUND CHECKED IN 2001-

Below are the descriptive elements used in the access and travel route inventory for the Ironwood Forest National Monument (access-trn-ifnm.ddf). The travel route attributes describe a comprehensive set of factors, which present resource conditions, and management concerns that may require management action.

Significant factors have a related Comment field. This field will be defined with options for management action to address resource conditions using input from cooperators, users, and public generally.

Date Visited- *Date ground checks completed.*

Examiner Name- *Initials of field crew/team completing the ground check.*

Route #- *Inventory route number, unique identifier for each route described.*

Route Name- *Route name, from County road system data or local tradition.*

Route Class- *menu options.*

Route Class definitions are based on the USGS National Mapping Program Transportation classifications (Roads and Trails) for Class 1 to Class 5. Class 6 through Class 9 are defined to distinguish route types not adequately described in the USGS classes, but which are, or may found in the study area

Primary Hwy, [1]

Class 1, primary road, interstate highway, limited access road. Used by all vehicle types (See AASHTO Vehicle Types, descriptions and criteria).

Secondary Hwy, Paved, [2]

Class 2, secondary road, U.S. highway, state road. Used by all vehicle types.
 LtDuty, Maintained, [3]

Class 3, Connecting road, county road. Light Duty Maintained Road, general class. Regularly maintained. Typically improved and graded travel way. Typically provide reliable access for school bus and passenger car.
 LtDuty, Paved, Maint, [3a]
Subset of Class 3 to distinguish roads with paved surface, typically asphaltic concrete, may include chip-seal treated surface.
 LtDuty, Gravel, Maint, [3b]
Subset of Class 3 to distinguish roads with constructed aggregate surfacing.
 LtDuty, Dirt, Maint, [3c]
Subset of Class 3 to distinguish roads with regularly graded travel way but with natural soil surface.
 LtDuty, NonMaintain, [4]

Class 4, Neighborhood road, city street, unimproved road. Light Duty Non-Maintained Road. No evidence of improvement or regular maintenance. Conditions generally passable during fair weather.
 Primitive, Non4WD, [5]
Primitive, Non Four Wheel Drive Road. May have been constructed or established by use and is generally passable by two wheel drive high clearance vehicle. Shows no evidence of grading or other travelway maintenance. Travelway surface conditions not generally passable by passenger vehicle or larger vehicle types. Typically single lane.
 Primitive, 4WD, [5a]
Subset of Class 5. Travelway surface conditions require 4-wheel drive vehicle due to roughness, grade, or drainage crossings or other obstructions.
 4' ATV Trail, [6]

Class 6. Narrow travel way not generally passable by standard vehicle. Used/passable by All Terrain Vehicle (ATV). Not generally passable by vehicles wider than 48 inches without widening the travelway or side clearance.
 1 Track Gen, [7]

Class 7. Single Track Trail, general class. Travelway width under 36". Used/passable by motorbike, mountain bike, horse, foot travel.
 1 Track Motor, [7a]
Subset of Single Track Trail to distinguish routes by motorbikes.
 1 Track MBike, [7b]
 Subset of Single Track Trail to distinguish non-motorized trails used/passable by mountain bike or horse, foot travel.
 1 Track Foot/Horse, [7c]
Subset of Single Track Trail to distinguish trails only used/passable by foot or horse travel. Travelway/surface conditions not passable by motorbike or mountain bike.
 Game/Cow Trail", [8]

Class 8. Trail established/used by cattle or wildlife.
 Overgrown", [9]

Class 9. Completely overgrown feature. No longer functional as travelway.

Access Vehicle- menu options.

Vehicle type definitions according to the American Association of State Highway and Transportation Officials (AASHTO), 2001 Fourth Edition Green Book. Indicates typical vehicle capable of using a route given the physical characteristics or conditions of the travelway (width, clearance, surface and obstructions) at time of ground check. All are accessible to vehicle type used during ground checking. The standard administrative access vehicle type for current Bureau of Land Management field operations is a full-size 4-wheel drive truck/utility vehicle. For special projects or needs, the vehicle type is a single unit truck, and combination truck and trailer.

Bus/Motorhome- *Vehicle Types S-BUS 11- Conventional School Bus; MH- Motor Home.*

Passenger Car- *Vehicle Type P.*

Non-4WD SUV- *Vehicle Type P, with high clearance, non four-wheel drive.*

4WD SUV Full- *Vehicle Type P, high clearance, four-wheel drive.*

4WD SUV Mid- *Vehicle Type P, high clearance, four-wheel drive, compact (6') width.*

ATV- *All Terrain Vehicle, <48" wheelbase.*

Dirtbike- *Off Road Motorcycle.*

Mtn Bike- *Mountain Bicycle, non-motorized.*

Other- *Other.*

Access Vehicle Comment-

Options for management action to address desired vehicle type, access needs or concerns.

1996 Exist

Does route show on 1996 air photography? Yes/No.

Jurisdiction- Menu options

Owner of land route is on, or agency with legal control, liability or responsibility for access/travel route.

Unknown, [1]- *Undetermined or mixed jurisdiction.*

County, [2]- *County government.*

BLM, [3]- *Bureau of Land Management, US Government.*

Private, [4]- *Private, individual or organization.*

Forest Service, [5]- *National Forest Service, US Government.*

State-DOT, [6]- *State Department of Transportation.*

State-SLD, [7]- *State, State Land Department.*

State-G&F, [8]- *State, Game and Fish Department.*

Federal-DOT, [9]- *Federal Highways Administration. Department of Transportation.*

Indian Nation, [10]- *Indian Nation, Bureau of Indian Affairs.*

Bureau of Reclamation, [11]- *Bureau of Reclamation, US Government.*

Fish & Wildlife, [12]- *Fish and Wildlife Service, US Government.*

City/Town, [13]- *City or Town Government.*

Other, [14]- *Other (Department of Defense).*

Maintenance Responsibility. Menu options

Party responsible for maintenance of travel route, may be different from owner through legal authorization, easement, right of way, or maintenance agreement.

Unknown, [1]- *Undetermined or mixed jurisdiction.*

County, [2]- *County government.*

BLM, [3]- *Bureau of Land Management, US Government.*

Private, [4]- *Private, individual or organization.*

Forest Service, [5]- *National Forest Service, US Government.*

State-DOT, [6]- *State Department of Transportation.*

State-SLD, [7]- *State, State Land Department.*

State-G&F, [8]- *State, Game and Fish Department.*

Federal-DOT, [9]- *Federal Highways Administration. Department of Transportation.*

Indian Nation, [10]- *Indian Nation, Bureau of Indian Affairs.*

Bureau of Reclamation, [11]- *Bureau of Reclamation, US Government.*

Fish & Wildlife, [12]- *Fish and Wildlife Service, US Government.*

City/Town, [13]- *City or Town Government.*

Other, [14]- *Other (Department of Defense).*

Access Status. Menu options

Legal status of access/use of travel route.

Unknown, [1], *Unknown/Undetermined.*

Legal public access, [2]- *Public access available directly from a public road, part of public road, or through easement.*

Public use w permit, [3]- *Public access available, but requires special permission from controlling/jurisdiction agent.*

Private use only, [4]- *No legal public access. Posted and/or blocked by private party.*

Admin Use BLM, [5]- *Administrative access for Bureau of Land Management through agreement or easement.*

Public no easement, [6]- *Traditionally used by the public, not posted or obstructed, but no legal easement or authorization of record.*

Other, [7]- *Other.*

Access Comment-

Options for management action to address legal access related conditions, concerns.

Access Easement-

Reference or serial number of existing access easement or right of way.

Width (Ft)-

Average travelway width, in feet.

Functional Class. Menu options

Functional Classification per Bureau of Land Management Transportation Management guidance; see Bureau Manual 9113- Roads. See also Bureau Facility Inventory Maintenance Management System (FIMMS) definitions.

Collector, [C]-

These Bureau roads normally provide primary access to large blocks of land, and connect with or are extensions of a public road system. Collector roads accommodate mixed traffic and serve many uses. They generally receive the highest volume of traffic of all the roads in the Bureau road system. User cost, safety, comfort, and travel time are primary road management considerations. Collector roads usually require application of the highest standards used by the Bureau. As a result, they have the potential for creating substantial environmental impacts and often require complex mitigation procedures.

Local, [L]-

These Bureau roads normally serve a smaller area than collectors, and connect to collectors or public road systems. Local roads receive lower volumes, carry fewer traffic types, and generally serve fewer uses. User cost, comfort, and travel time are secondary to construction and maintenance cost considerations. Low volume local roads in mountainous terrain, where operating speed is reduced by effort of terrain, may be single lane roads with turnouts. Environmental impacts are reduced as steeper grades, sharper curves, and lower design speeds than would be permissible on collector roads are allowable.

Resource, [R]-

These Bureau roads normally are spur roads that provide point access and connect to local or collector roads. They carry very low volume and accommodate only one or two types of use. Use restrictions are applied to prevent conflicts between users needing the road and users attracted to the road. The location and design of these roads are governed by environmental compatibility and minimizing Bureau costs, with minimal consideration for user cost, comfort, or travel time.

Maintenance Level. Menu options.

Maintenance Level per Bureau of Land Management Transportation Management guidance (BLM Manual 9113; also see Facility Inventory Maintenance Management System (FIMMS) definitions for minimum standards. Existing maintenance level determined based on evidence on the ground, knowledge of area, and consultation.

Level 1-

Roads where minimum maintenance is required to protect adjacent lands and resource values. These roads are no longer needed and are closed to traffic. The objective is to remove these roads from the transportation system. Vegetation is allowed to reclaim the soils naturally, or revegetated through treatment.

Level 2-

Roads where the management objectives require the road to be opened for limited administrative traffic. Typically, these roads are passable by high clearance vehicles.

Level 3-

Roads where management objectives require the road to be open seasonally or year-round for commercial, recreation, or high volume administrative access. Typically, these roads are natural or aggregate surfaced, but may include low use bituminous surfaced

roads. These roads have defined cross section with drainage structures (e.g., rolling dips, culverts, or ditches). These roads may be negotiated by passenger cars traveling at prudent speeds. User comfort and convenience are not considered a high priority.

Level 4-

Roads where management objectives require the road to be open all year (except may be closed or have limited access due to snow conditions) and to connect major administrative features (recreation sites, local road systems, administrative sites, etc.) to County, State, or Federal roads. Typically, these roads are single or double lane, aggregate, or bituminous surface, with a higher volume of commercial and recreational traffic than administrative traffic.

Level 5-

Roads where management objectives require the road to be open all year and are the highest traffic volume roads of the transportation system.

Condition. Menu options

General condition of overall route at time of check, with respect to usability and damage.

Good-

No significant problems with travelway conditions. Usability not impaired and damage not evident.

Fair-

Some but not significant deterioration or damage to adjacent land resources.

Poor-

Obvious or significant damage or deterioration of overall travelway surface, affecting usability and causing damage to adjacent resources. Needs corrective action.

Non-functional-

Conditions make route not useable. Route not functional as a travelway.

Mtnce-Comment

Options for management action to address overall route conditions, maintenance or repairs.

4WD Trail Rating. Menu options

See Arizona State Association of Four Wheel Drive Clubs' (ASA4WDC) difficulty rating classification system. Contact club volunteers to assist with ratings.

0-Easy: *Bus and passenger car, see definitions*

1-Easy All Veh: *High clearance, non 4-wheel drive, see definitions*

2-Easy 4WD: *See definitions*

3-Moderate 4WD: *See definitions*

4-Hard 4WD: *See definitions*

5-Extreme 4WD: *See definitions*

4WD Rating-Comment

Options for management action to address recreational 4 wheel driving related conditions or concerns.

Surface-Tread Type. Menu options

Travelway surface material, treatment type.

Asphalt Concrete- *Asphaltic concrete pavement*

Chip Seal- *Liquid asphalt binder sprayed on the natural dirt or aggregate surface, covered with layer of uniform size crushed gravel.*

Chemical treatment- *Dust abatement chemical spray treatment, such as liquid calcium chloride or similar products.*

Constructed Aggregate- *Constructed aggregate pavement.*

Natural Soil- *Natural soil surface.*

Other- *Other surface material*

Surface-Comment

Options for management action to address surface related conditions or concerns.

Soils. Menu options

General character of soils traversed by route/soil type. Split feature where soil character changes are pronounced. Will correlate by intersecting with Soil Survey Geographic (SSURGO) Data USDA - Natural Resources Conservation (see files AZ659 and AZ669)

Clay, Silt, Sand, Gravel, Stony, Rocky, Bedrock, Caliche

Soils-Comment

Options for management action to address soil related conditions or concerns.

Drainage. Menu options

Travelway storm drainage conditions causing erosion/resource damage problems, affecting usability of route.

None-

No drainage related problems.

Trenched cross sec-

Noticeably entrenched cross section, collects and conveys storm runoff for great distances.

Crowned/ditched-

Improved drainage system, controlled drainage.

Outsloped-

Outsloped cross section drains the travelway, adequate daylight/outlets; requires maintenance.

Other-

Other drainage condition or problem of significance.

Drainage-comment

Options for management action to address drainage related conditions or concerns.

Overgrowth. Menu options

Indicates the character of vegetation growth in the travel way or roadbed. Vegetation cover includes annuals, herbaceous or grasses, perennial and woody plants, young trees and shrubs, and cactus.

None-

No vegetation growth found in travelway. Soil productivity foregone.

Level 1-

Occasional, isolated plants or patches in travelway, predominantly between wheel tracks. Easily driven over without causing any damage to plants.

Level 2-

Noticeable vegetation cover, may be in patches or continuous stretches, but type and size easily driven over without causing any damage to plants.

Level 3-

Significant vegetative ground cover in travel way for extended stretches, brushing vehicle undercarriage but still passable or useable with some, but minimal direct vegetation damage.

Level 4-

Vegetation cover and type and size makes route not passable or useable by standard vehicle (4WD utility truck) without causing noticeable vegetation damage from breakage or crushing.

Overgrowth-comment

Options for management action to address vegetation cover in travelway related conditions or concerns.

Veg-clearance. Menu options

Indicates side clearance conditions encroached or restricted by vegetation growth along the side of the travelway.

None-

No side clearance encroachment by vegetation.

Slight, occasional-

Isolated instances of side clearance encroachment by vegetation.

Frequent-

Sections of restricted side clearance encountered often in isolated plants or clumps, or short continuous segments separated by sparse or open breaks.

Continuous-

Continuous side clearance encroachment by vegetation over the travelway. Constant brushing against vehicle sides, but useable with light damage.

Blocked-

Side clearance encroachment with rigid plants or limbs make it impassable, not useable for travel by standard access vehicle.

Veg-Comment

Options for management action to address vegetation side clearance related conditions, concerns.

ROS-Class. Menu options

Recreation Opportunity Spectrum Class according to the experience, setting and activity opportunities described in Bureau of Land Management Recreation Management guidance (BLM Manual 8320- Planning for Recreation Resources).

P- Primitive Setting

SPNM-NM: Semi-Primitive Non Motorized-Non Mechanized Setting

SPNM-M: Semi-Primitive Non Motorized-Mechanized Setting

SPM: Semi-Primitive Motorized Setting

RN: Roded Natural Setting

RAG: Rural, Agricultural influence.

RRES: Rural, Residential development influence.

RI: Rural, Industrial development influence.

U: Urban.

ROS-Comment

Options for management action to address recreation experience, setting, activity management needs, conditions or concerns.

Scenic-Quality. Menu options.

Scenic quality rating according to Bureau of Land Management's Visual Resource Management guidance and procedures (Manual Handbook 8410-1 Visual Resource Inventory)

A- Scenic Quality Class A, high variety and visual interest in landform, vegetation and other landscape features.

B- Scenic Quality Class B, moderate variety and visual interest.

C- Scenic Quality Class B, Low variety and visual interest.

Viewing-Volume, menu options

Characteristic viewing volume originating from the route, based on the apparent amount of use the route receives, relative to the overall use in the study area. Use volume will be quantified by traffic volume information.

High- High viewing volume.

Mod- Moderate viewing volume.

Low- Low viewing volume.

VRM-Sensitivity. Menu options.

Overall sensitivity about visual quality, changes to the landscape features caused by management activity or uses, and about visual resource protection. Sensitivity levels presumed to be high due to Monument Status regardless of the viewing location, but will be verified through public scoping/planning input. See VRM planning guidance (VRM Manual Handbook 8410)

High- *High sensitivity level.*
Mod- *Moderate sensitivity level.*
Low- *Low sensitivity level.*

VRM-Comment-

Options for management action to address visual resource conditions or concerns. See VRM Management Class definitions. Class I, Class II, Class III, Class IV, Class V (rehab.)

OHV-Designation. Menu options

Existing designations under current management plan pursuant 43CFR8340- Off Road Vehicle use designations.

Closed- Route is closed to all motorized vehicle use under current designations.

Limited- Motorized vehicle traffic is limited to existing road or trail travelway.

Open- Motorized vehicle traffic can go off the existing road or trail travelway.

Seasonal- Seasonal or time of year limitation.

Special- Special designation or restriction.

NA- Designations under 43CFR8340 are not applicable on non-BLM administered land.

OHV-Comment

Options for management action to address motor vehicle use designations, conditions or concerns (See designations in Las Cienegas NCA RMP for example).

Access-Purpose

Primary use(s), activities or management programs which depend on access provided by the route. Check for maintenance and operation of existing and planned facilities or improvements at destination or along the route. Grazing/ranching, State Land and private in holdings, authorized communication sites and utilities, wildlife improvements, water rights, and mining claims are found in the monumen. These uses have particular access needs.

Access Comment

Options for management action to address access needs, conditions or concerns.

Video#

Videotape reference number and counter reading for beginning and end of route filmed.

POINT FEATURE ITEMS

"Milepost", point

"Mile", numeric, 2, 0.00, 9999.00, 0.00, "Mileage, to nearest tenth"

"Item", text, 30, "Description, condition or feature"

"Barrier", point, "Manmade or natural obstruction"

"Type", text, 30, "Brief description "

"Rating", text, 30, "Travel affected, per ASA4WDC class"

"Condition", text, 30, "Description"

"Mtnce Need", text, 30, "Description"

"Comment", text, 30

"Photo", text, 30, "Disk #, frames"

"SoilsP", point, "Route surface soil feature or change"

"Comment", text, 30, "Note feature, changes in soil character"

"Photo", text, 30, "Disk #, frames"

"DrainageP", point, "Drainage problem/feature conditions"

"Type", menu, "Description, feature, structure"

Minor drainage x-ing"

Stabilized Low water"

Major wash crossing"

Basin/ponding area"

Waterbar"

Runout ditch"

Bridge"

Culvert"

Trenched cross sec"

Sheet-cross runoff"

"Condition", text, 30, "Good, fair, poor"

"Mgt Need", text, 30, "Repair, maintenance, replacement, other"

"Comment", text, 30

"Photo", text, 30, "Disk #, frames"

"Erosion Site", point, "Road, side erosion problem conditions"

"Type", menu, "Description"

Cross gully"

Headcut"

Ditch gully"

Impassable washout"

Debris deposit"

Slump"

Washboards"

Rutting"

Pot holes"

Slope"
 Sheet erosion"
 Surface Material"
 Other"
 "Condition", text, 30, "Slight, small, moderate, severe"
 "Mgt Need", text, 30, "Stabilization, restoration , other"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"VegetationP", point, "Location, start/end, of Veg problem condi□ 71"
 "Type", text, 30, "Vegetation feature"
 "Condition", text, 30
 "Mgt Need", text, 30, "Clear, trim, protect growth"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"Hazard Site", point, "Potential hazard, safety risk factor"
 "Type", menu, "potential hazard description"
 Steep grade"
 Steep cross-slope"
 Steep bank/dropoff"
 Slippery when wet"
 Deep mud if saturate"
 Blind curve"
 Deep gully washout"
 Flash-flood"
 Loose sand"
 Rock ledge/dropoff"
 Sharp Rocks"
 Narrow clearance"
 Other"
 "Condition", text, 30
 "Mgt Need", text, 30, "Post sign, barricade, correct/repair"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"Sign", point, "Type and condition"
 "Status", menu, "existing or needed"
 Exst"
 Need"
 "Type", text, 30, "Regulatory, guide, information, other"
 "Condition", text, 30, "good, fair, poor"
 "Mtnce Need", text, 30, "None, repair, replace"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"Cattleguard", point, "Existing cattleguard"
 "Width (Ft)", numeric, 0, 0, 50, 0, required, "Grate width"
 "Condition", text, 30, "Good, fair, poor"
 "Mtnce Need", text, 30, "None, clean, repair, replace"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"Gate", point, "Existing gate"
 "Width (Ft)", numeric, 0, 0, 50, 0, required, "Width of opening"
 "Type", menu, "Gate type"
 Wire",[W]
 Metal Frame",[M]
 Cable",[C]
 Wood/Lumber",[L]
 Other",[O]
 "Condition", text, 30, "Good, fair, poor, damaged"
 "Mtnce Need", text, 30, "None, repair, install closer"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"

"Rec Site", point, "Existing recreation use-activity site"
 "Size (Ac)", numeric, 2, 0.00, 10.00, 0.00, "Acres, in tenths"
 "Activity", menu, "Apparent recreation use/activity"
 Camp", default
 Trailhead"
 Target Shoot"
 Scenic Overlook"
 Large group site"
 Other"
 "Condition", text, 30, "good, fair, poor, degraded"
 "Mgt Need", text, 30, "Monitor, clean up, stabilize, repair"
 "Comment", text, 30
 "Photo", text, 30, "Disk #, frames"
 "Impact-Class", menu, "See definitions"
 0"
 1"
 2"
 3"
 4"
 5"
 "Use Status", menu, "Site presently used"
 Regular"
 Occassional"
 Abandoned"

"Water Facility", point, "Exist water improvement/development"

"Type", menu, "Water facility, improvement, project"
Water Saver"
Pond"
Charco"
Well"
Tank"
Trough"
Dike"
Ditch"
Dam"
Spring"
Other"
"Condition", text, 30, "funct, non-funct, good, fair, obsolete "
"Mgt Need", text, 30, "Maintain, repair, replace, clean out"
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Range Facility", point, "Exst grazing improvement/facility"
"Type", menu, "Grazing improvement, facility, project"
Corral"
Salt"
Water"
Other"
"Condition", text, 30
"Mgt Need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Minerals Site", point, "Exst mineral related site"
"Type", menu, "Minerals related impact, feature"
Adit"
Pit/trench"
Shaft"
Bore hole"
Equipment"
Trash/junk"
Spoils-Waste"
Structure"
Marker-Monument"
Other"
"Condition", text, 30, "Soil, vegetation, structures"
"Mgt Need", text, 30, "reclamation, hazard mitigation, other"
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Wildlife", point, "Wildlife related project-feature"

"Type", text, 30
"Condition", text, 30
"Mgt Need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frame"

"Cultural Site"

Historic/prehistoric feature"
Type of site, menu options
Historic-
Prehistoric-
Recent"
"Desc", text, 30, "Description"
"Condition", text, 30
"Mgt Need", text, 30, "Monitor, study, test, stabilize, protect"
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Residence Site", point, "Exst house/residence structure"

"Desc", text, 30, "Description, owner"
"Condition", text, 30, "Occupied, vacant, abandoned"
"Mgt Need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Other Structure", point, "Other structure/facility"

"Type", text, 30, "Description"
"Condition", text, 30
"Mgt Need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Trash Dump", point

"Type", text, 30, "Description"
"Condition", text, 30
"Mgt Need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

"Other Site", point

"Description", text, 30
"Mgt need", text, 30
"Comment", text, 30
"Photo", text, 30, "Disk #, frames"

Appendix 2- Respondent comments.

satisfied	satisfaction comments
Yes	Good weather. Some dust and exhaust and noise fro
Yes	To many illegal aliens
Yes	Beautiful place!!
Yes	beautiful
Yes	beautiful, pristine desert; hope to visit again so
Yes	would prefer no one brings dogs
Yes	best ocean of cacti in world [sic]
Yes	I love it how it is, but lacks trails
Yes	newly enacted preservation is most appreciated
Yes	really pretty good hike up Ragged Top
Yes	beautiful; uncrowded
Yes	I usually bring more empty bottles and cans home w
Yes	access too limited
Yes	very scenic
Yes	did not like airplane noise
Yes	needs cleaning up
Yes	beautiful! Too bad about private/state inholdings.
Yes	illegal alien and hunter trash!
Yes	The Monument should not exist!
Yes	always. Trash is a problem. Border patrol and hunt
Yes	but roads need to be marked, signage + maps not adequate!
Yes	beautiful and remote
Yes	the fewer people, the better
Yes	Please keep management to a minimum!
Yes	Lots of trash - we cleaned 1.5 mi. of roadside
Yes	trash from undocumented aliens
Yes	Too much U.D.A. trash
Yes	Very few ironwoods - should relocate park to Thorn
Yes	beautiful area
Yes	please leave it like it is, it's not nature with a
Yes	Would like to see more maps of the whole terrain
Yes	too much trash
No	I'm sick of the fucking trash left by illegals [sic]
	The multiple use aspect allows for recreational diversity and personal freedom!
Yes	Would like to see more literature on the Monument, i.e. location of mission and petroglyphs. Would also like to see protection for same.
Yes	Other than migrant trash I didn't see anything that looked like a problem, but I've only been there once.
Yes	very natural and beautiful
Yes	Excellent for 4WD exploring
Yes	Mike Adler was a wonderful guide. So knowledgeable.
Yes	petroglyph theft in 60's through 90's

Yes	I'm glad the BLM closed the road to the petroglyph butte. Now they need to close it more, to the ATV's.
satisfied	satisfaction comments
Yes	More garbage than there used to be
Yes	hedgehog in bloom
No	It will ruin my area should not be a Monument
Yes	Very pretty area!

Appendix 3. Names and addresses for a mailing list

name_first	name_last	street	city	state	zip	phone
W. G.	Alverson	9572 N. Desert Mist Ln	Tucson	AZ	85743	
Norm	Haase	P.O. Box 2319	Arizona City	AZ	82904	520-466-4501
Thomas	Konczal	P.O. Box 492	Arizona City	AZ	85223	
Glen	Cyphers	812 W 6 PMB 8251	The Dalles	OR	97058	
Warren	Cooper	3656 N. Trilby Wash CT	Tucson	AZ	85745	
Brian	Dolay	511 E. Robesta Circle	Tucson	AZ	85704	
Nancy	Favour	1921 E. Hawthorne St.	Tucson	AZ	80784	
Bill and Dana	Bishop	P.O. Box 454	Marana	AZ	85653	520-891-9696

Appendix 4 - Archives

Archives were used as a method in studying the Ragged Top area which is located near the Silverbell Mountains. It is also part of the Ironwood Forest National Monument (IFNM). The archival information came from different types of archives used for the Ragged Top area. This included The White House Press, The Wilderness Society, The Bureau of Land Management, The Arizona Republic, Arizona Daily Star, and the Tucson Weekly. All the information found for the purpose of the Ragged Top area overlaps in information and many types of pictures of the Ragged Top Mountain area.

The IFNM is located 25 miles northwest of Tucson, Arizona. The Ragged Top Mountain is located approximately in the middle of the IFNM. The IFNM was declared a national Monument in the year 2000. "President Clinton today signed a proclamation creating the Ironwood Forest National Monument in southern Arizona. The 129,000 acre Monument contains rich stands of ironwood trees, which can live more than 800 years, and a stunning diversity of bird and animal life (White House Press 2000)." The area of the IFNM that this research project is concerned with is Ragged Top Mountain and the different types of uses for this land.

Ragged Top Mountain is home to the bighorn sheep as well as other native wildlife. The University of Arizona has had an ongoing study relating to bighorn sheep. Bighorn sheep were protected in the Arizona territory as early as 1887. From 1887 through 1930 bighorn sheep were protected by the fish and game departments of each state. In 1930 the bighorn sheep became protected in Arizona by the Arizona Fish and Game Department according to (Bighorn Arizona). The protection of the bighorn sheep started back in the 1800's and the bighorn are still protected today. The bighorn sheep on Ragged Top Mountain are a

protected species even though they can be hunted under stringent regulations. The research on the bighorn sheep continues at the current time.

The Bureau of Land Management has a listing of the activities that are most common to this area. These activities include hunting, Off Highway Vehicle Management, target shooting, transportation system, mountain bicycles, camping and picnicking. These activities are why many people come to the Ragged Top area for recreation and leisure time activities (Pre-Plan Analysis).

The IFNM has other activities that are as popular as the previously mentioned ones. The popularity of the mountain has grown as the local and out-of-staters have shown up with dirt bikes and All Terrain Vehicles (ATV's). According to the Arizona Daily Star (2003), the environmentalists are unhappy with this situation. The article states that the desert plants which are rare, native and specific to this area of the Sonoran Desert are being harmed.

The plants are being harmed and destroyed by OHV's. They run over small plants that are just beginning to grow and the soil is packed down by these vehicles. As a result, the soil has a difficult time breathing and letting new desert foliage grow.

Gary Paul Nabham writes in the Tucson Weekly. Ironwood trees which are located around Ragged Top are important for more than 500 species of plants and animals living in the Ragged Top Mountain area in order to provide them with shade. The ironwood trees can live for more than 800 years. The ironwood trees are a hard wood and will easily dull saw blades, and if you put the chunks of ironwood in water, they will sink. The wood is dense and heavy. Wildlife is also endangered by the ATV's. Because of all the wildlife and plants that exist in IFNM, the area has been compared to the Saguaro National Monument.

According to the Historical Research Guide, the description of the Saguaro National Monument before it was designated a public use area, it was very much like the Ironwood currently is. The Saguaro National Monument is 30% smaller than the IFNM. According to the Arizona Daily Star, the concern of making the 129,000 acres into a public use recreational area has similar challenges like the Saguaro National Monument had to deal with in the beginning of turning Saguaro National Monument into a public use area.

Saguaro National Monument had problems with mining, cattle grazing, the use of off-highway-vehicles, and target shooting. These same concerns face the IFNM. OHV's destroy the natural landscape. They do not stay on the roads that are provided for public use.

ASARCO, a copper mine company, has a mine that is surrounded by the IFNM. According to the National Wilderness Society, ASARCO would like to start operating this mine and removing the copper and other minerals. This would be hazardous to the IFNM because of the close proximity of the circumference to the borders of the IFNM. The cattle grazing issue also presents a problem. The cattle eat the new foliage. Thus, the desert area where grazing takes place continuously stays bare.

The Bureau of Land Management has plans to make the area more user friendly to the public. The problems BLM face are with environmentalists and the problem of urban growth moving closer to the area. This makes it difficult to maintain and keep IFNM.

The environmentalist groups such as the Sierra Club, Audubon Society, and the Sonoran Desert Conservation Group are insisting on keeping Ragged Top Mountain the way it is. If there are any changes that take place in the environment, they do not want the wildlife and plants disturbed any more than necessary.

The issue of drug smuggling is also a concern in the IFNM. An article in the Arizona Republic (2002) stated, "This is the tough one, says Mike Taylor, Deputy Site Director for Resources at the Bureau of Land Management. This is the agency charged with developing the plans for the state's five new Monuments." Another issue is that of illegal aliens. "Our ability to control it is minimal." Because this is one of the problems the BLM is faced with, it makes it even more difficult for them to develop the plan to enable the general public to safely enjoy the Monument.

The Ironwood is full of spectacular natural beauty, but the human element has had, and will continue to have, a significant impact on this magnificent desert area. Our research confirmed the findings of the article in the Tucson Weekly and the Arizona Daily Star. The traces we found were everything from toilet paper to shotgun shells and broken glass bottles. Everything was left as litter on the beautiful terrain of Ragged Top.

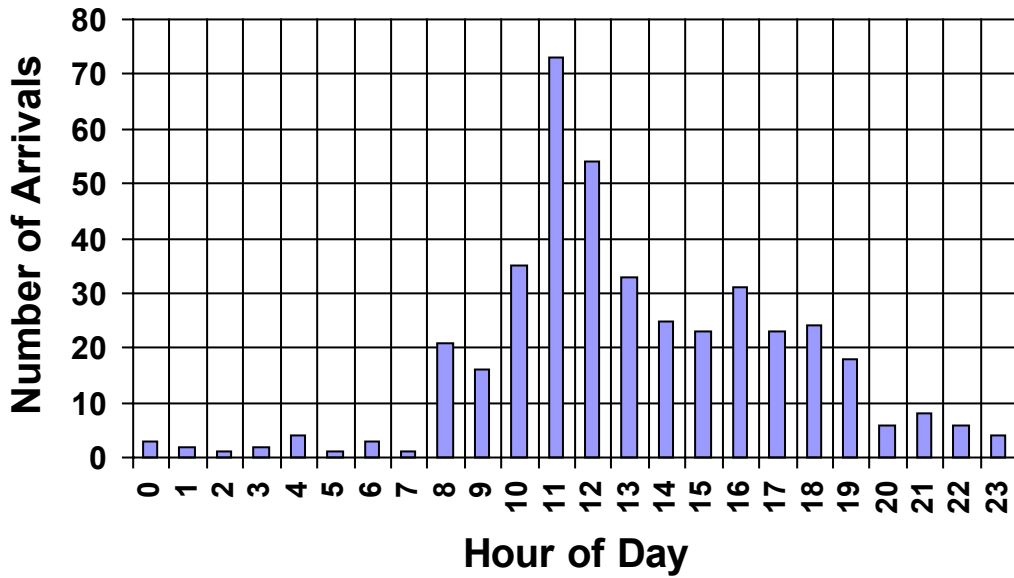
With all the previous issues previously discussed, other issues are also paramount when our research revealed parties had taken place in the more secluded area of the mountain. The parties that take place often have a number of underage drinkers, due to the fact the area is remote to public access. The evidence left behind included beer cans and bottles, cigarette butts, and a campfire ring. These are also factors that are valid concerns of making this a popular and much used national Monument.

However, these are all issues that BLM is currently studying and looking at before Ragged Top Mountain is made more accessible to the general public.

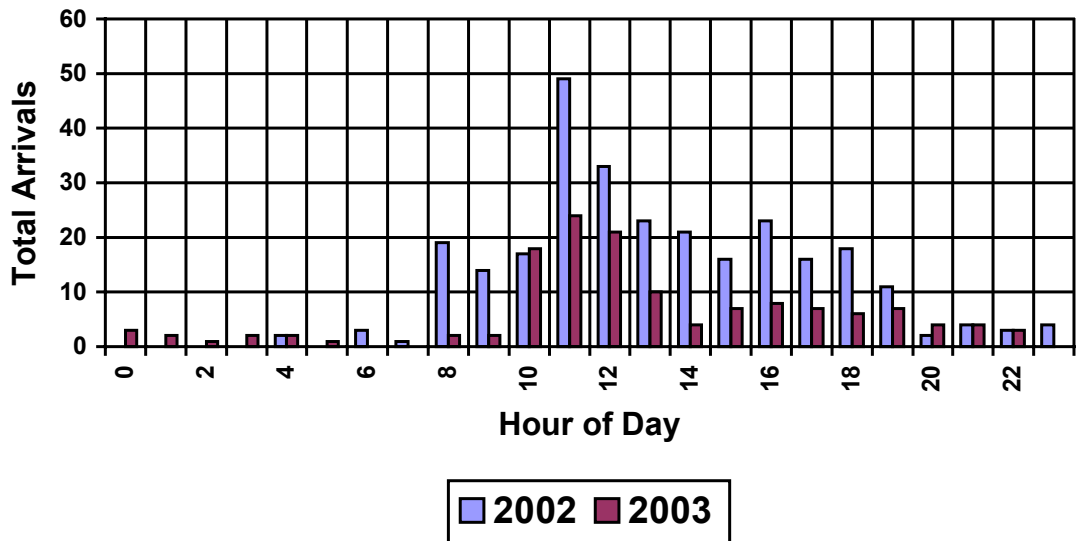
Appendix 5 – Detailed Analysis for all Mechanical Counters
Over the Sampling Period

Mechanical Counter for Agua Blanca

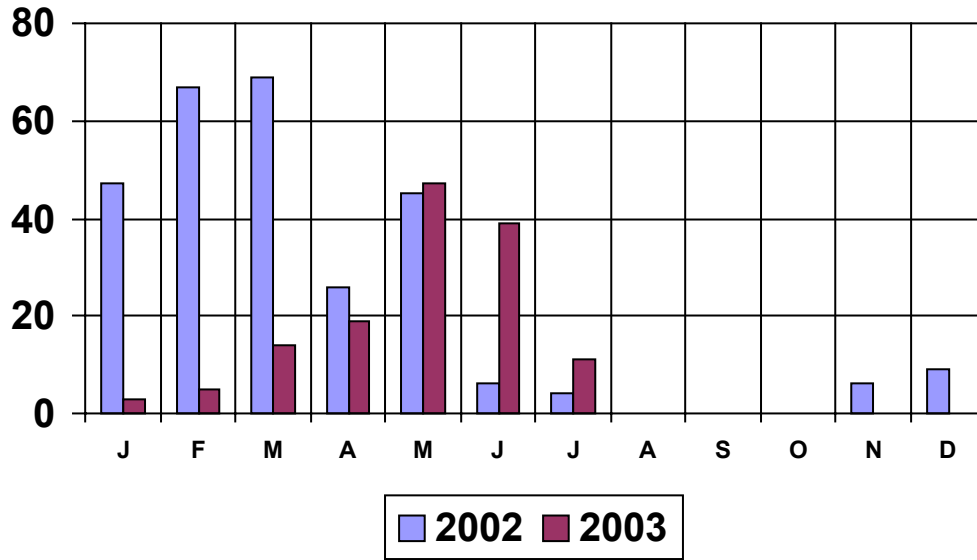
Total Hourly Arrivals



Hourly Arrivals by Year

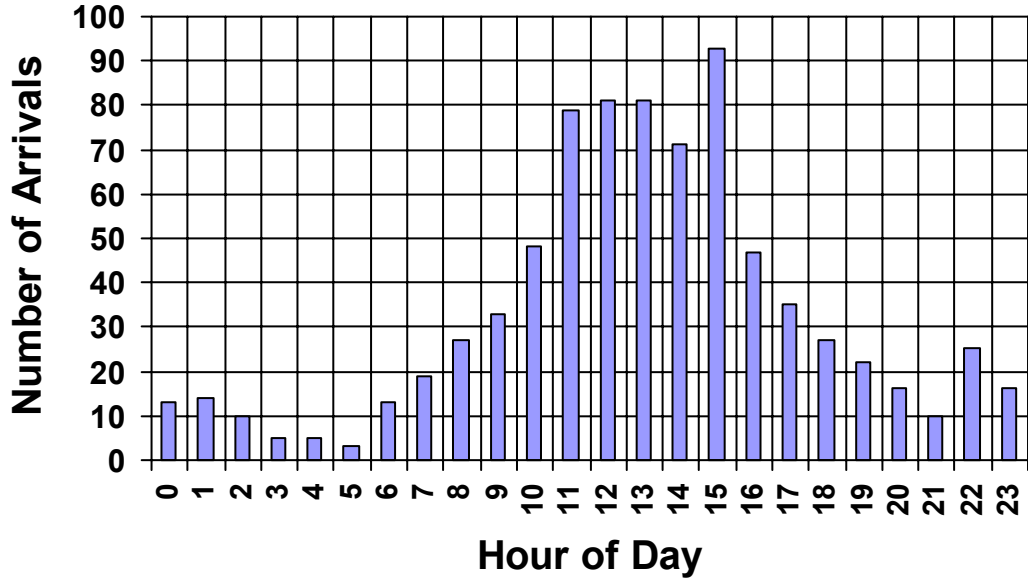


Monthly Arrivals by Year

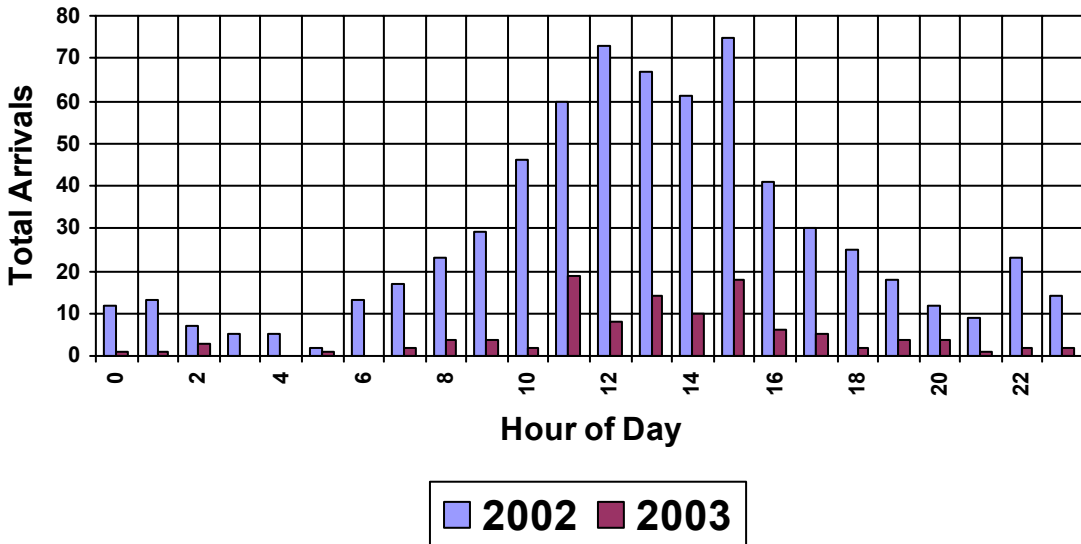


Mechanical Counter for the Cemetery

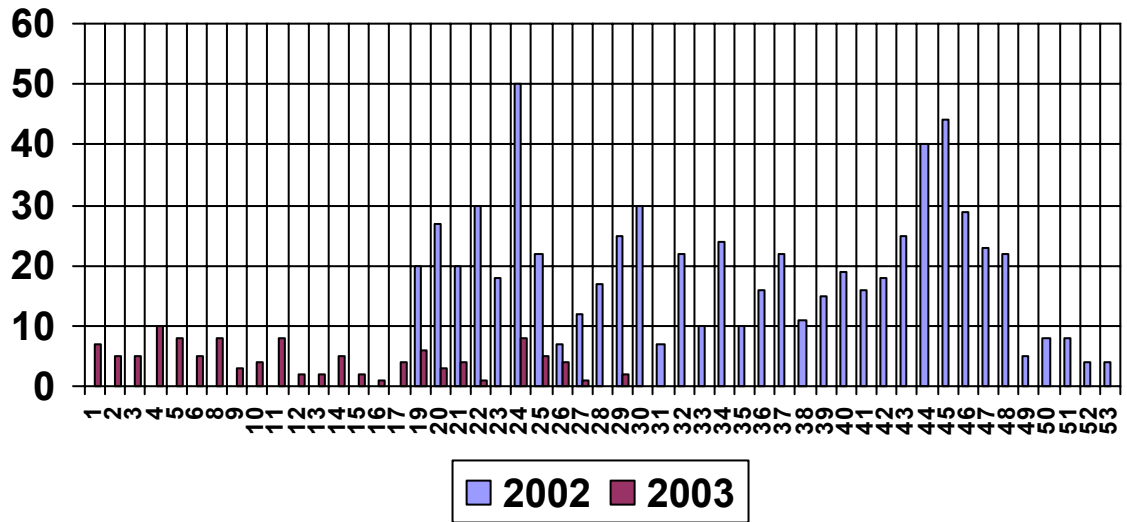
Total Hourly Arrivals



Hourly Arrivals by Year

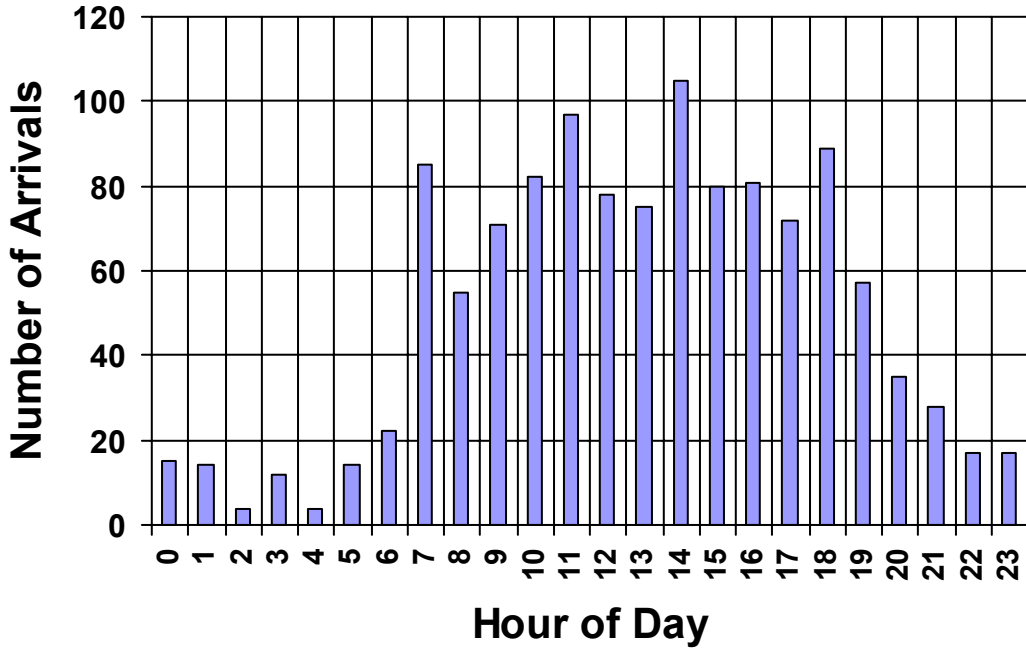


Weekly Arrivals by Year

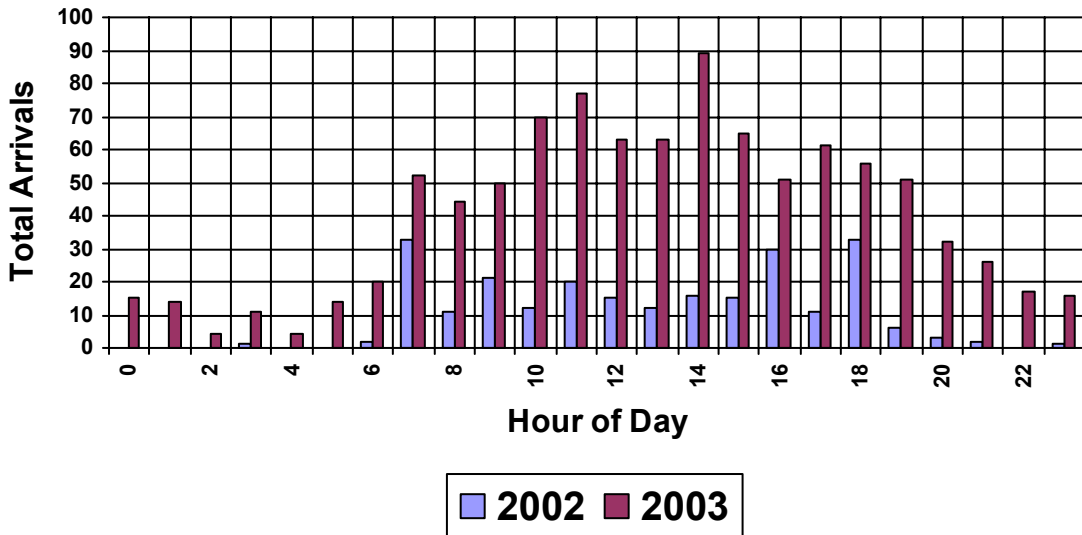


Mechanical Counter for Mannville Gate

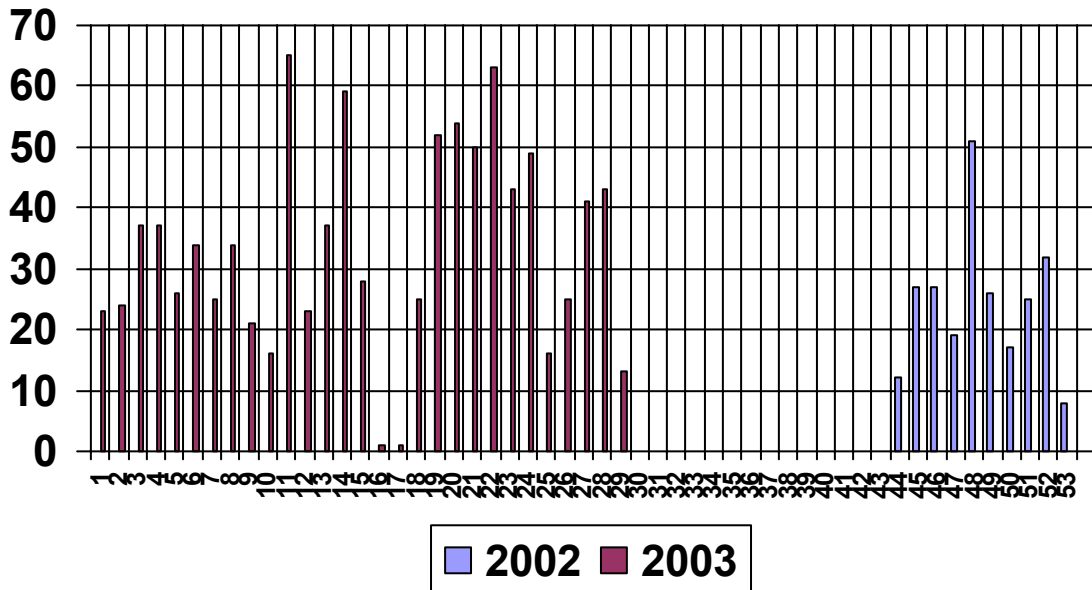
Total Hourly Arrivals



Hourly Arrivals by Year

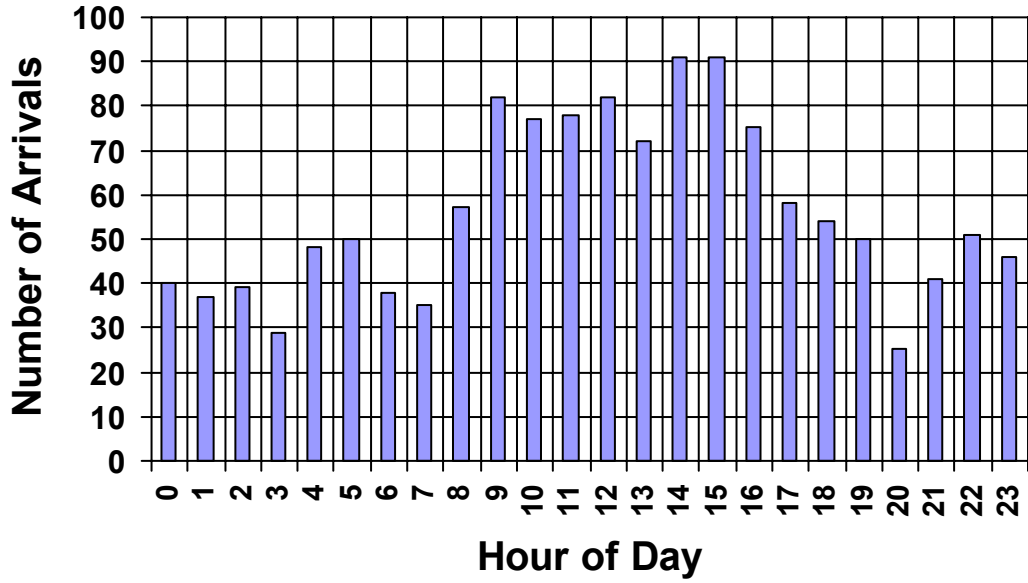


Weekly Arrivals by Year

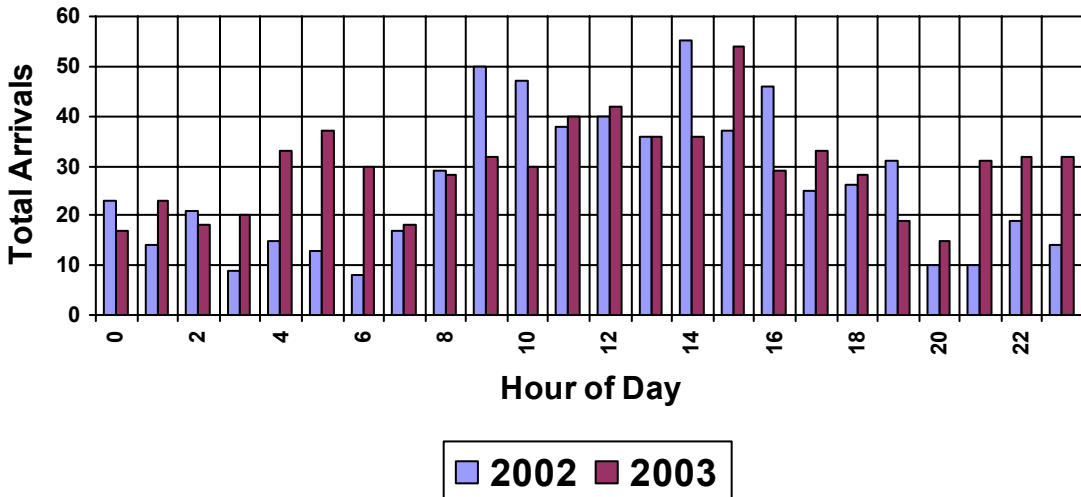


Mechanical Counter Pad #2

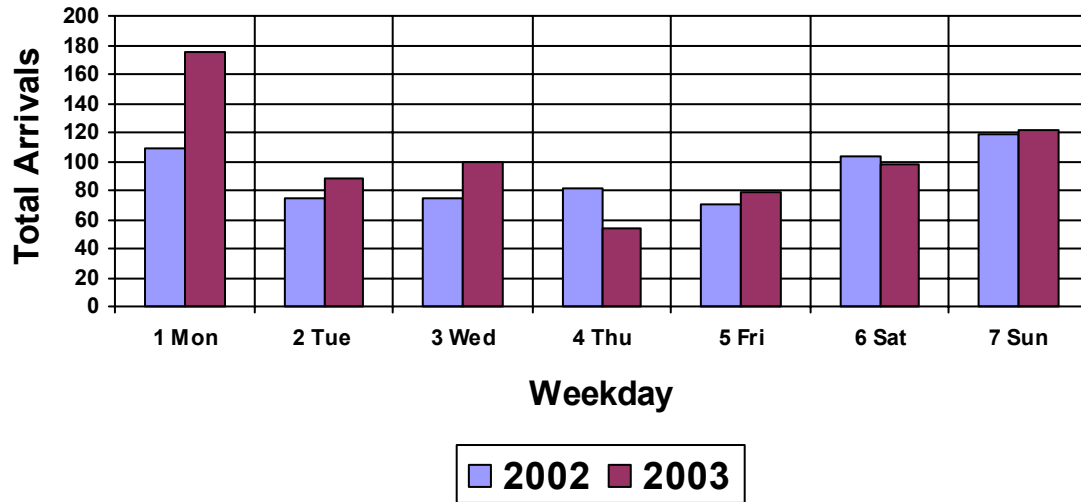
Total Hourly Arrivals



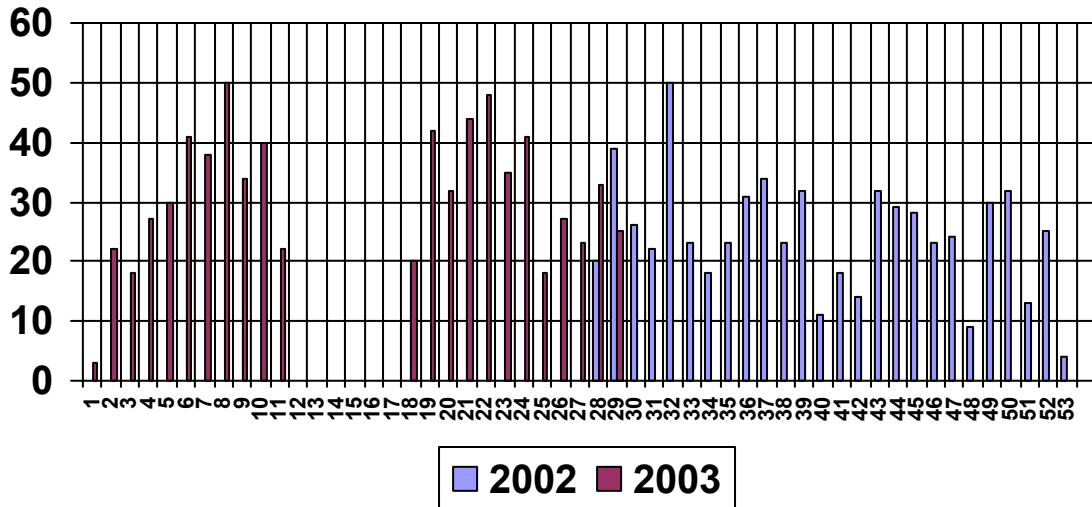
Hourly Arrivals by Year



Weekday Arrivals by Year

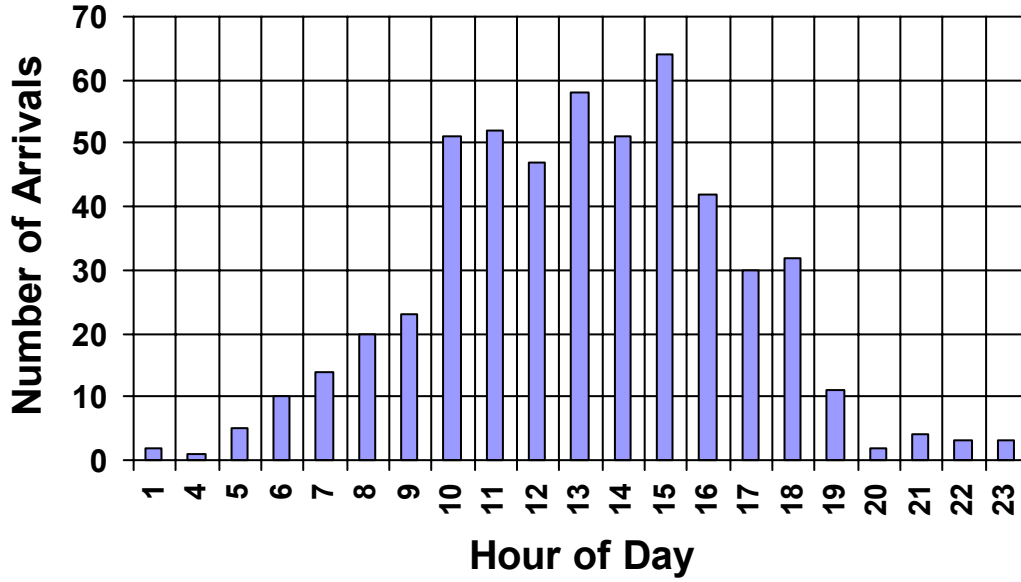


Weekly Arrivals by Year

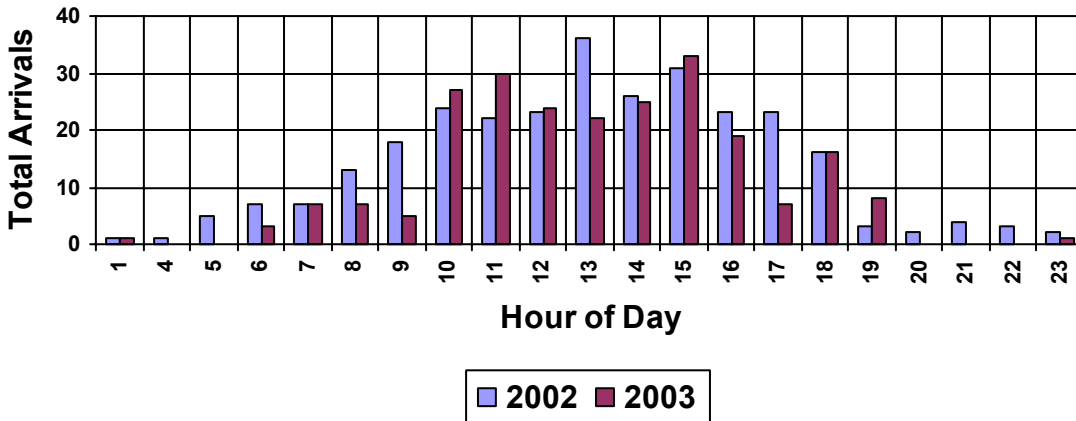


Mechanical Counter Pad #4

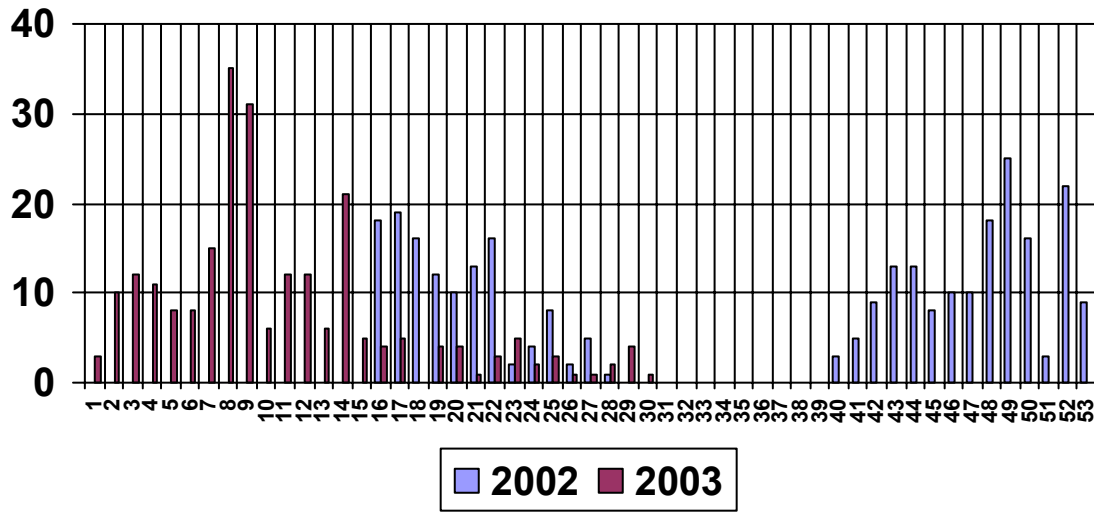
Total Hourly Arrivals



Hourly Arrivals by Year

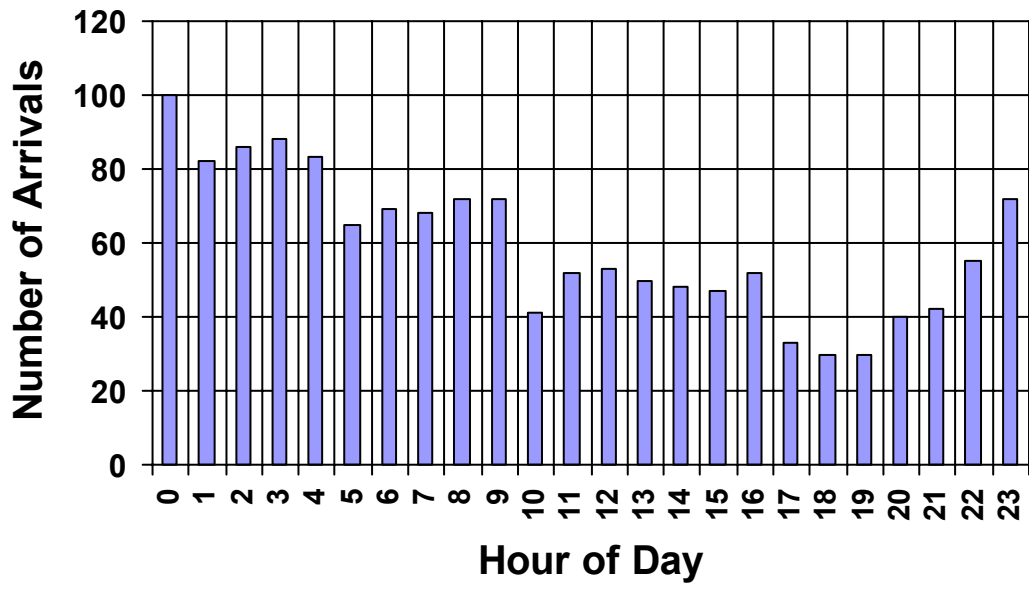


Weekly Arrivals by Year

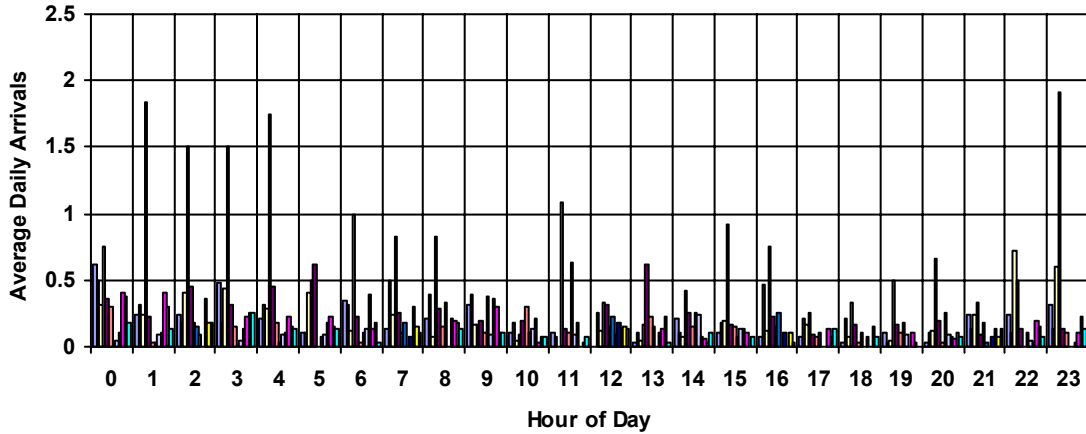


Mechanical Counter Pad#5

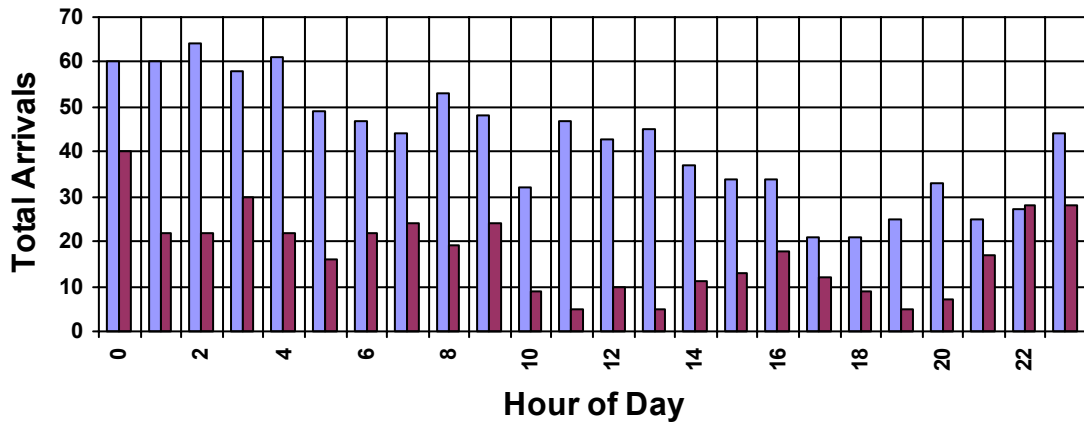
Total Hourly Arrivals



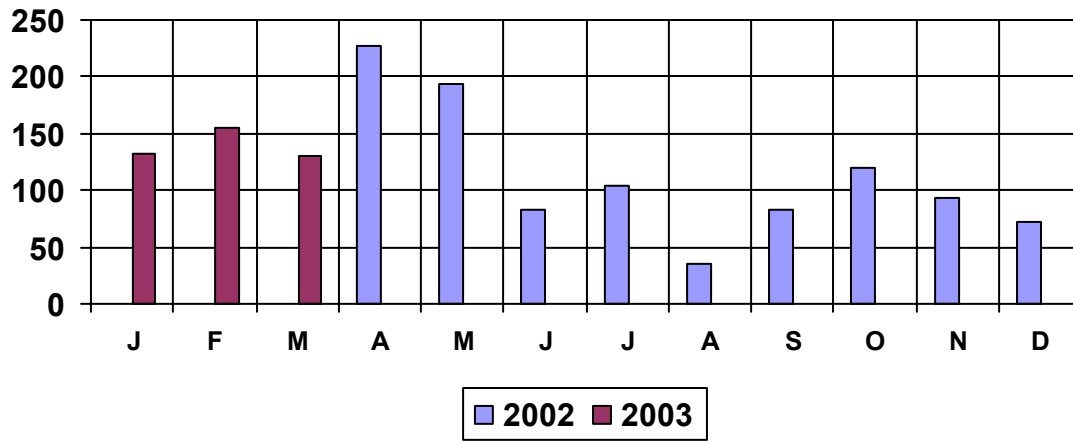
Average Hourly Arrivals by Month



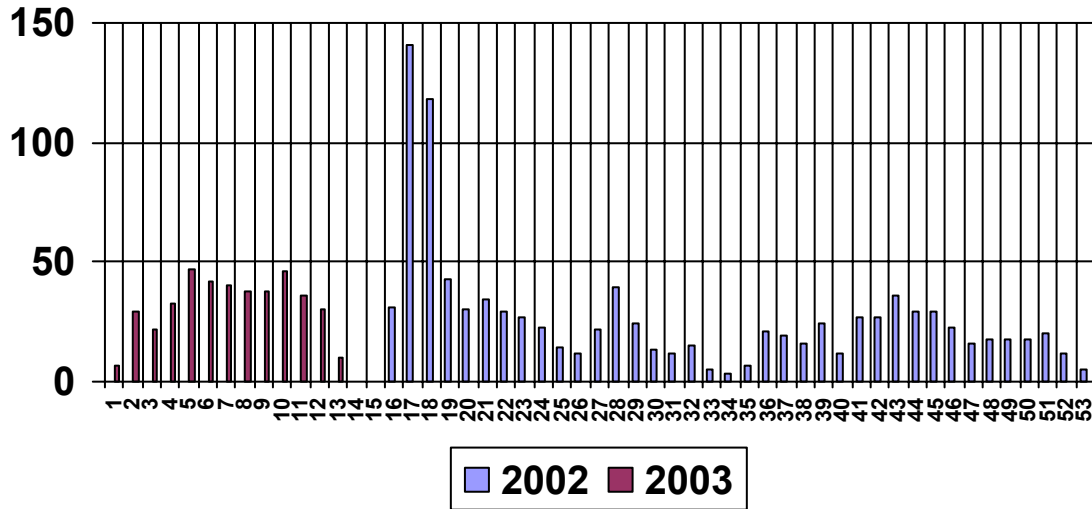
Hourly Arrivals by Year



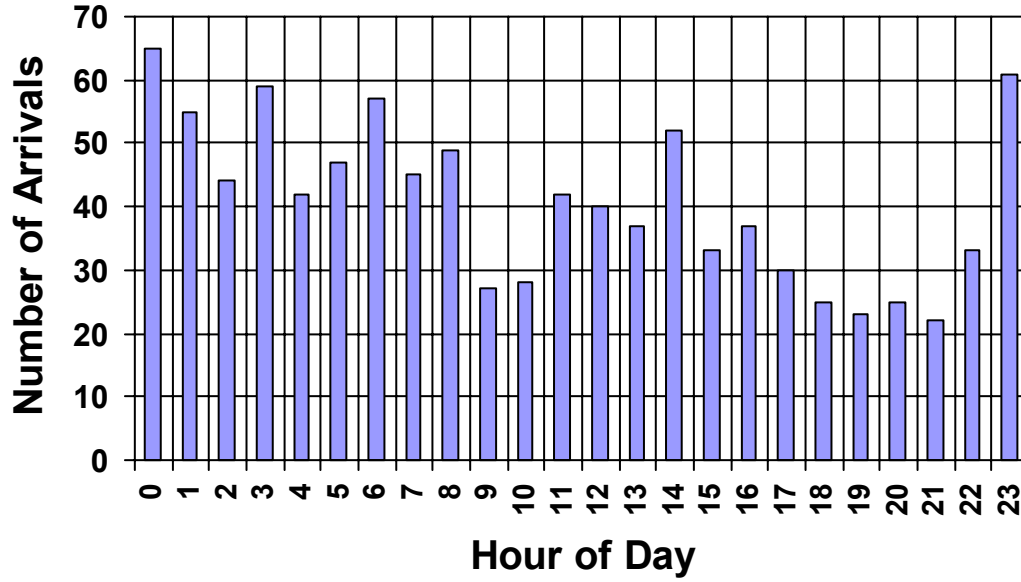
Monthly Arrivals by Year



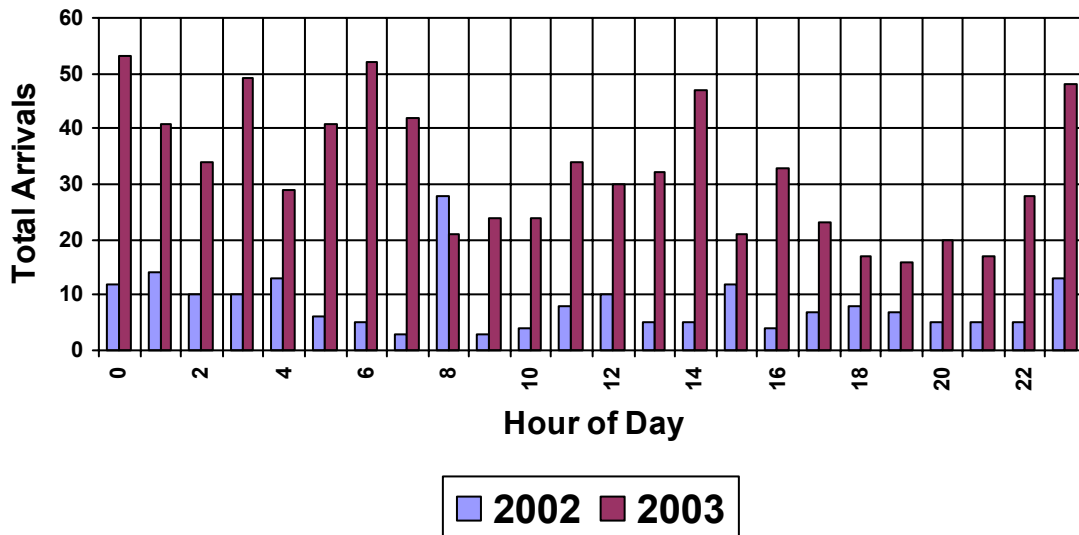
Weekly Arrivals by Year



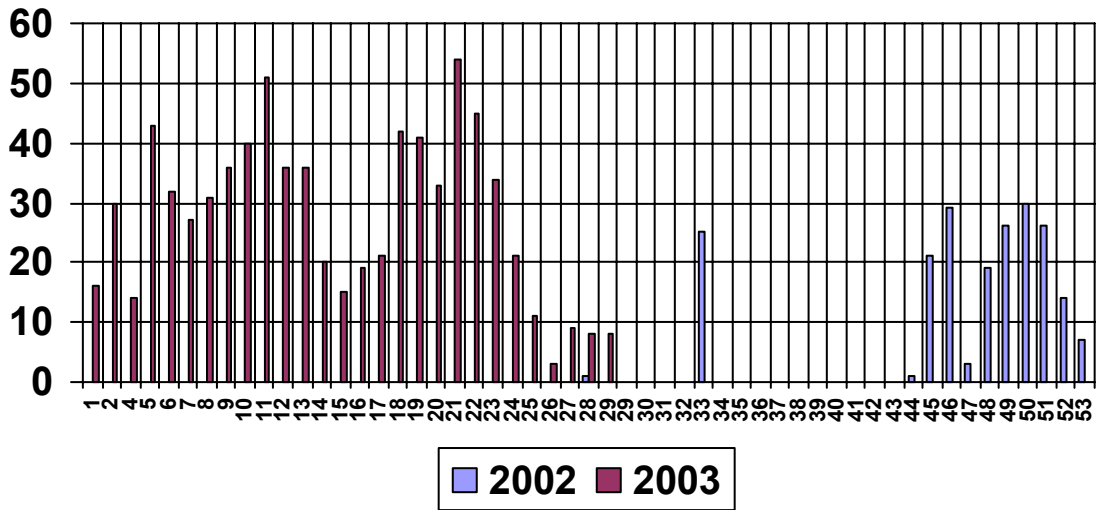
Total Hourly Arrivals



Hourly Arrivals by Year

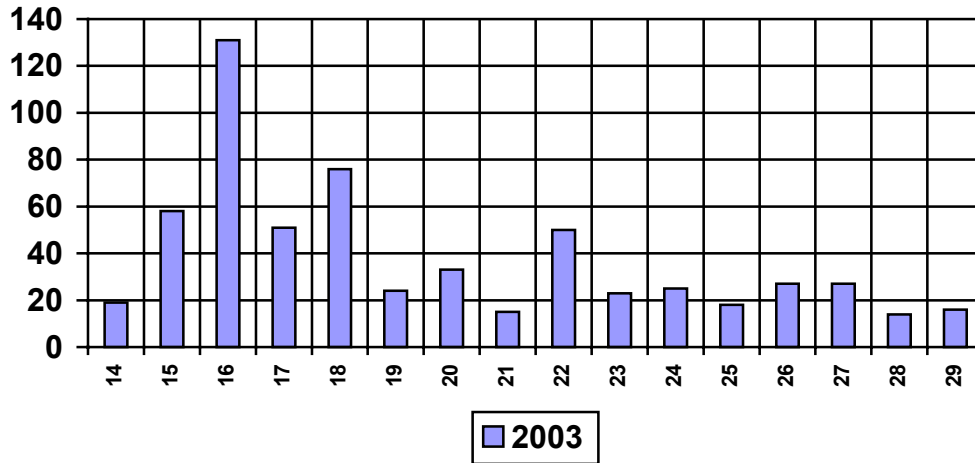


Weekly Arrivals by Year

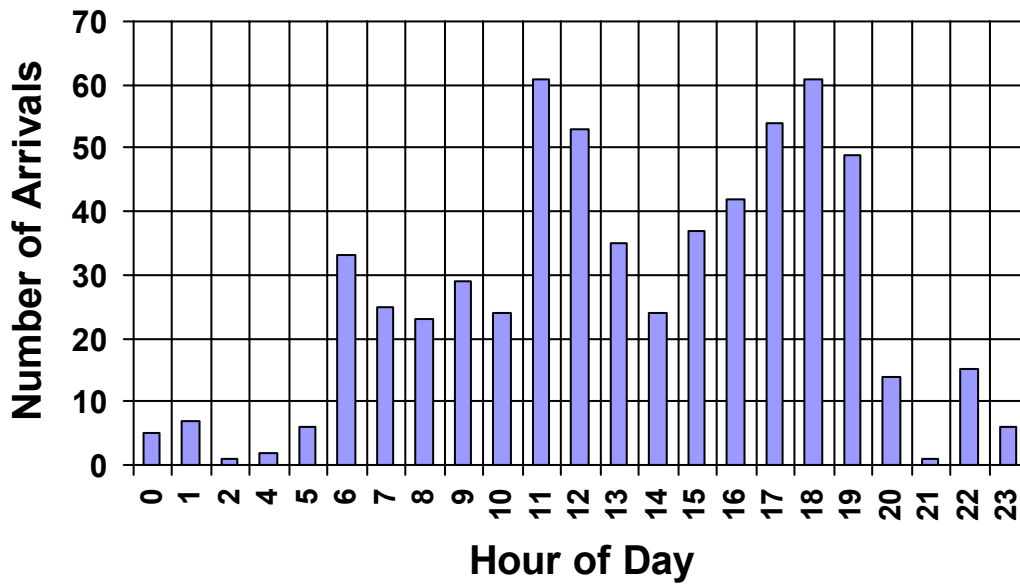


Mechanical Counter at Pipeline

Weekly Arrivals by Year

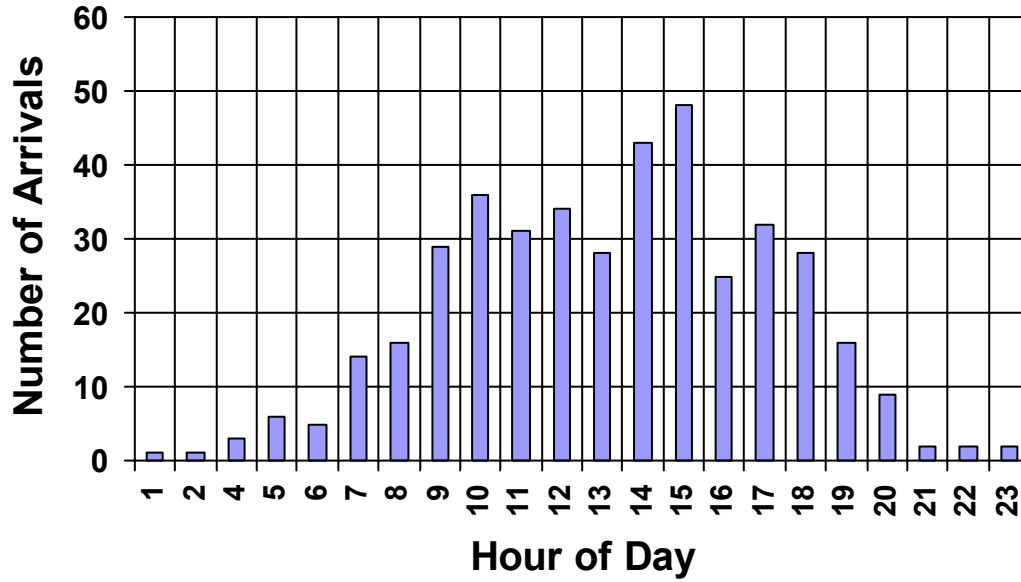


Total Hourly Arrivals

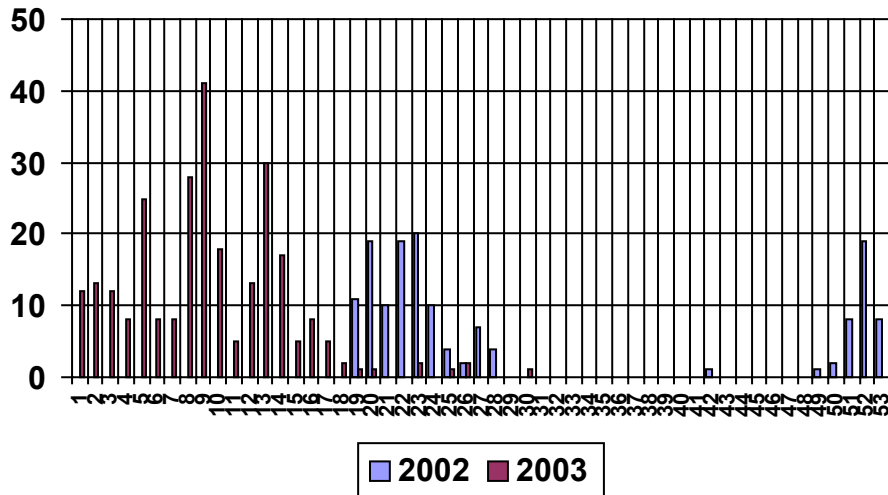


Mechanical Counter At Ragged Top #1

Total Hourly Arrivals

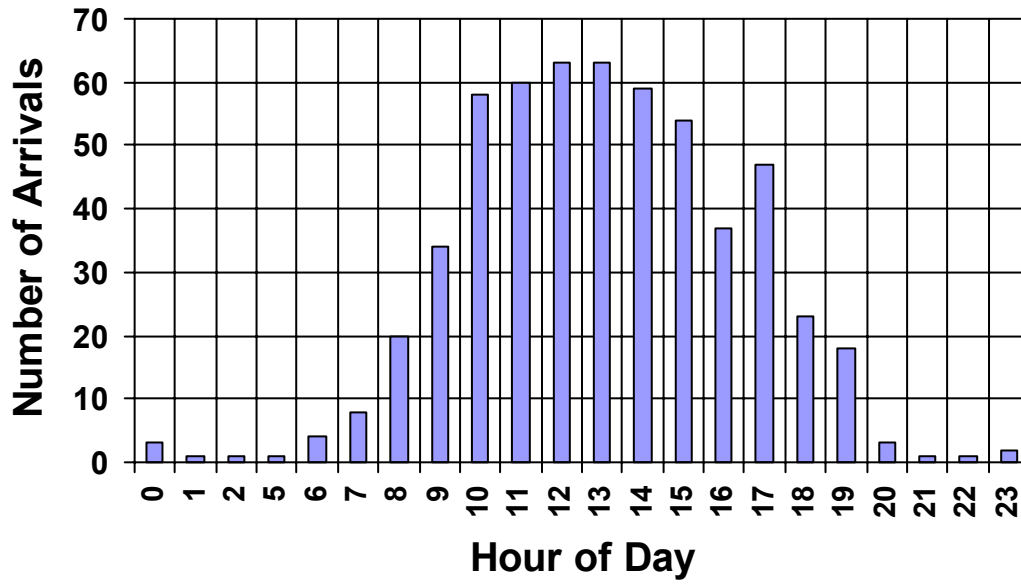


Weekly Arrivals by Year

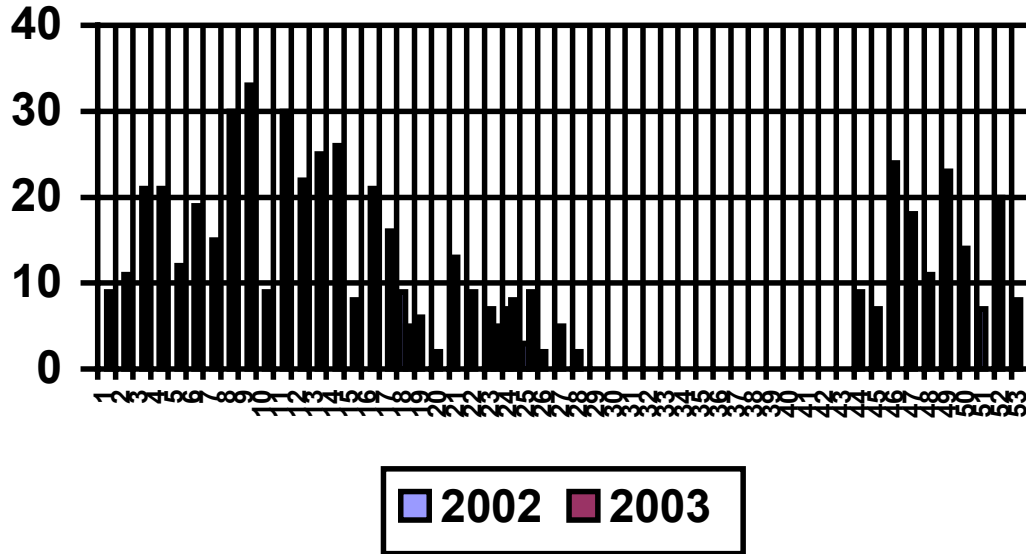


Mechanical Counter at Ragged Rear

Total Hourly Arrivals

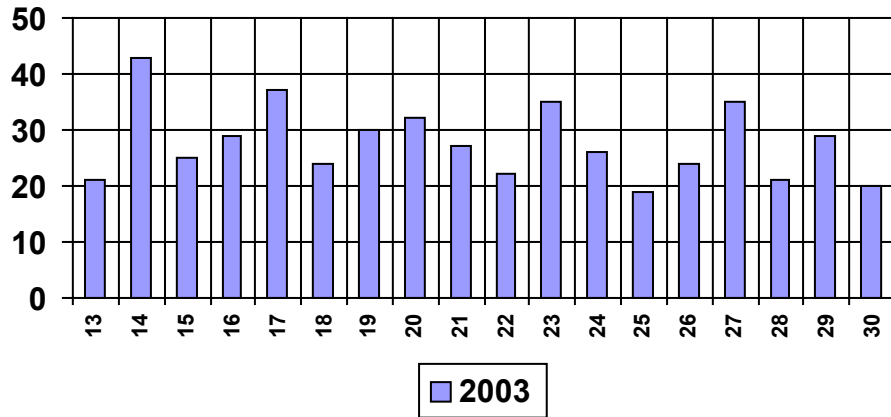


Weekly Arrivals by Year

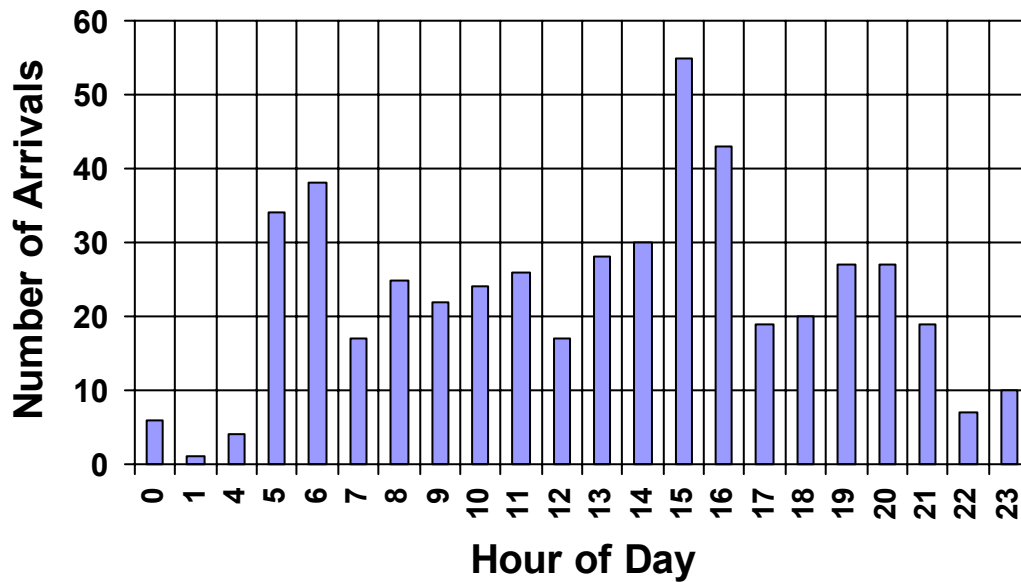


Mechanical Counter at Ragged South

Weekly Arrivals by Year

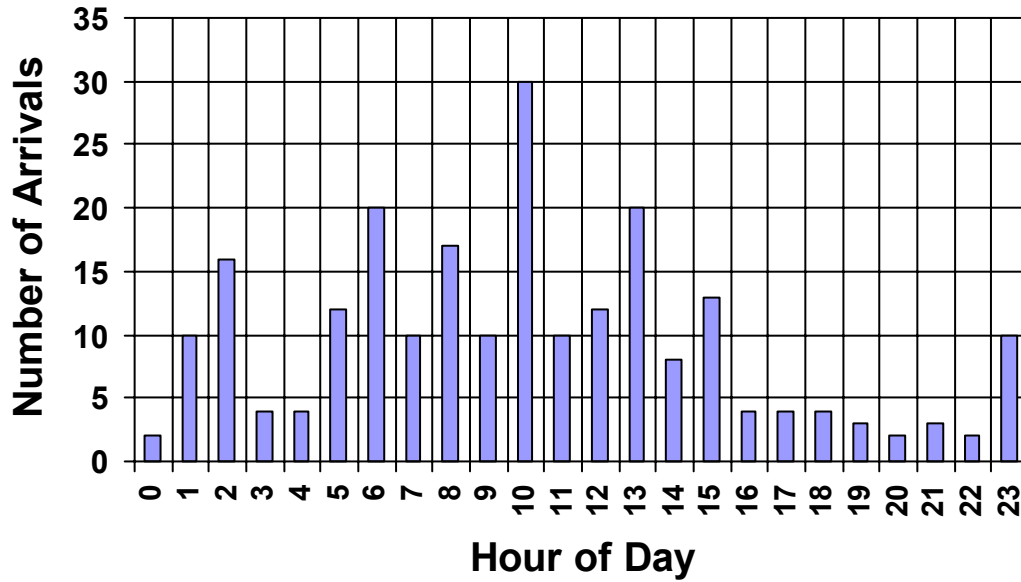


Total Hourly Arrivals

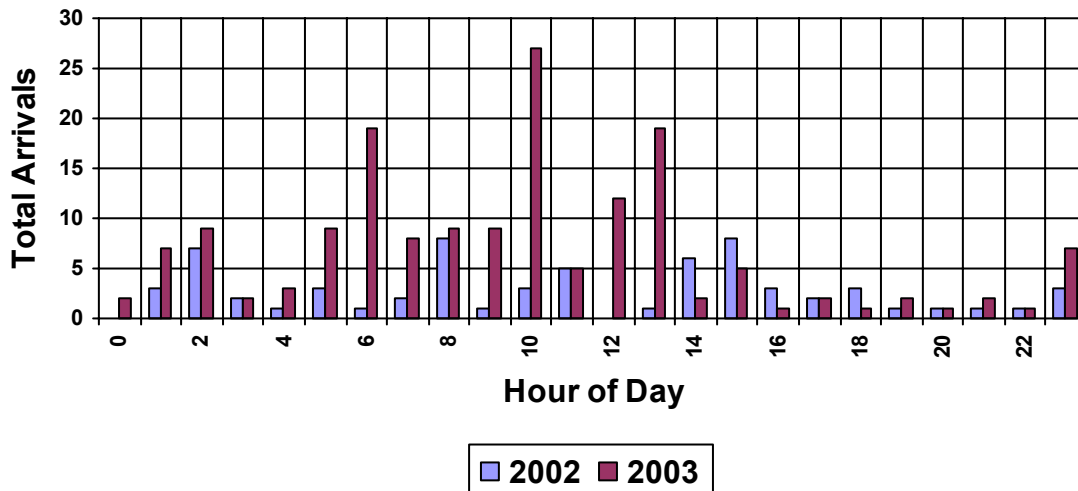


Mechanical Counter at Red Hill #1

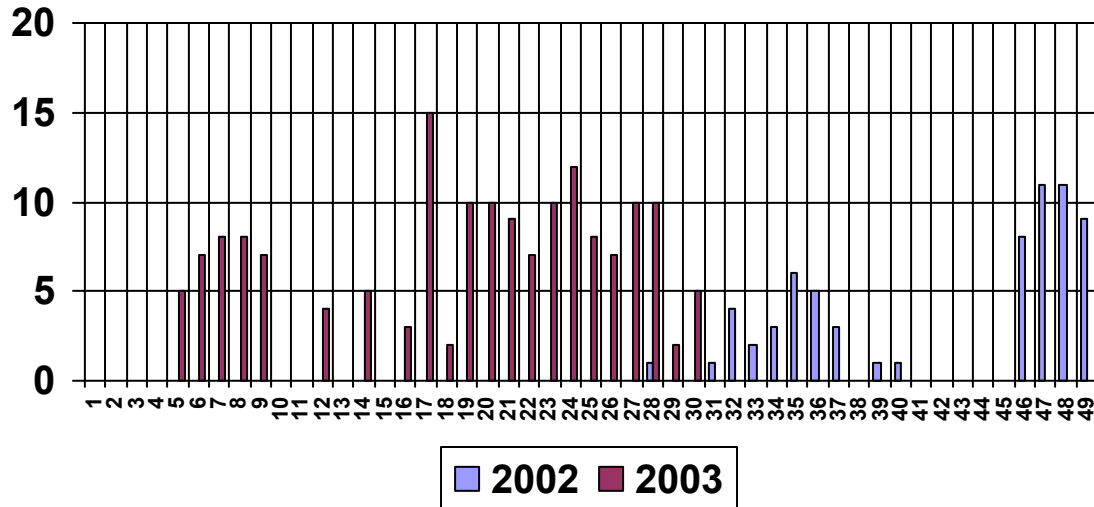
Total Hourly Arrivals



Hourly Arrivals by Year

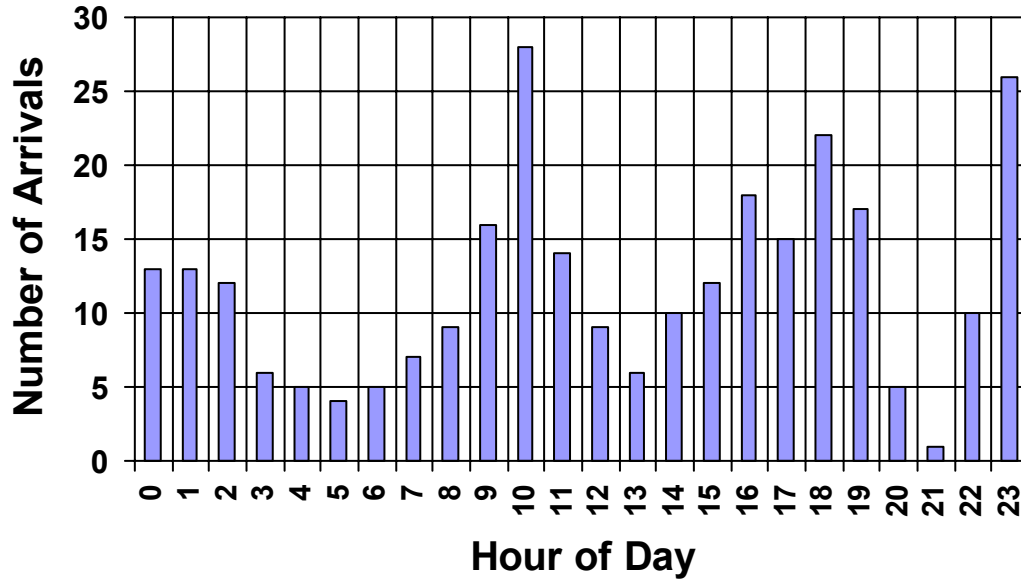


Weekly Arrivals by Year

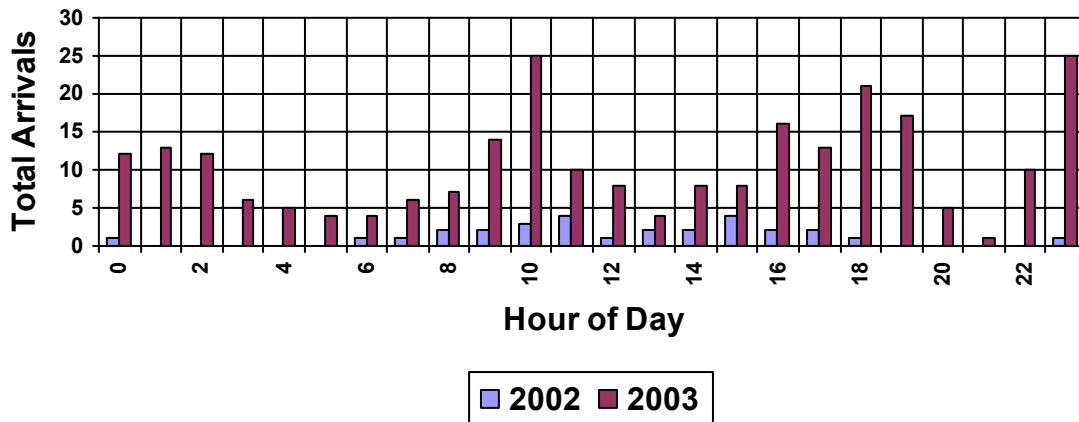


Mechanical Counter at Red Hill #2

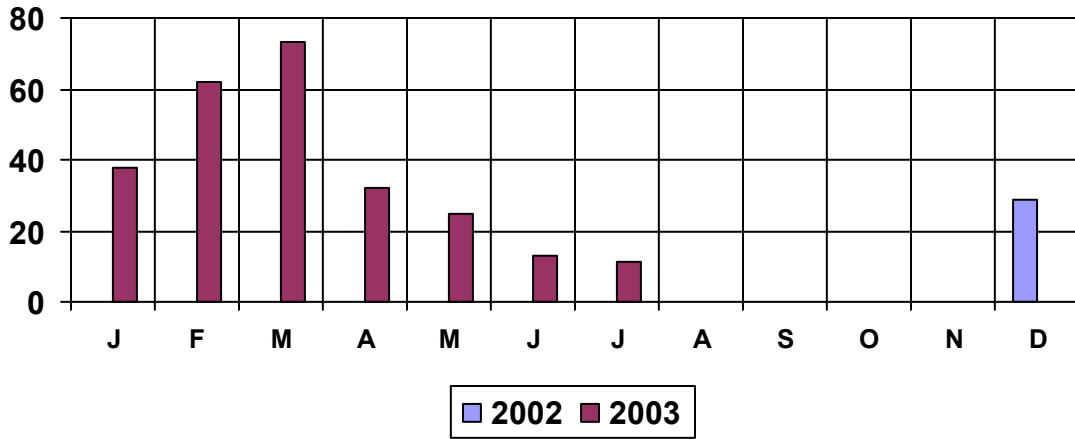
Total Hourly Arrivals



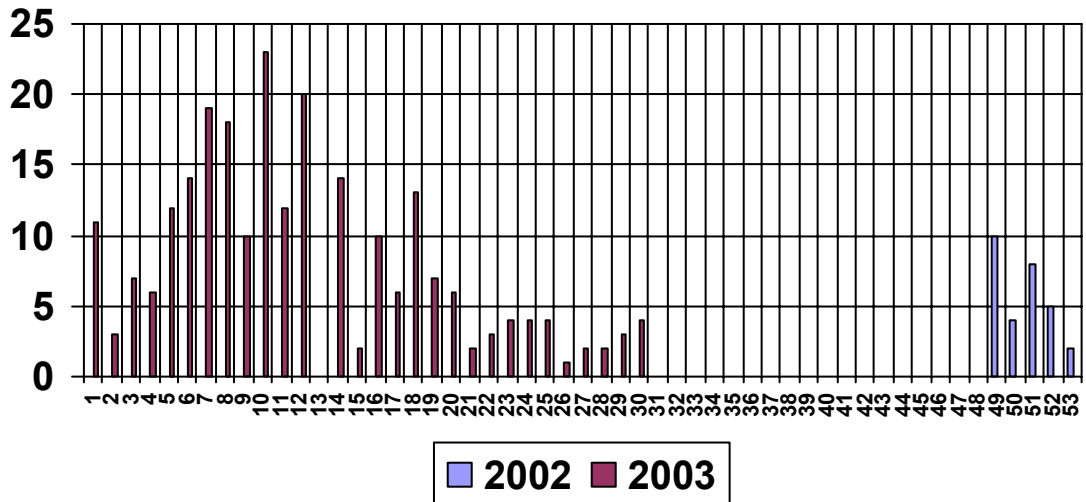
Hourly Arrivals by Year



Monthly Arrivals by Year

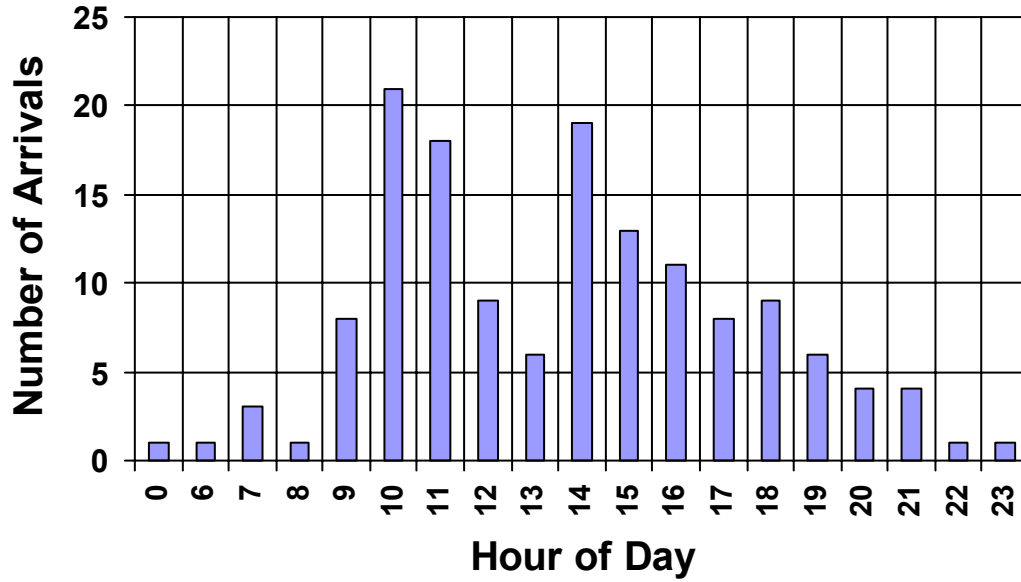


Weekly Arrivals by Year

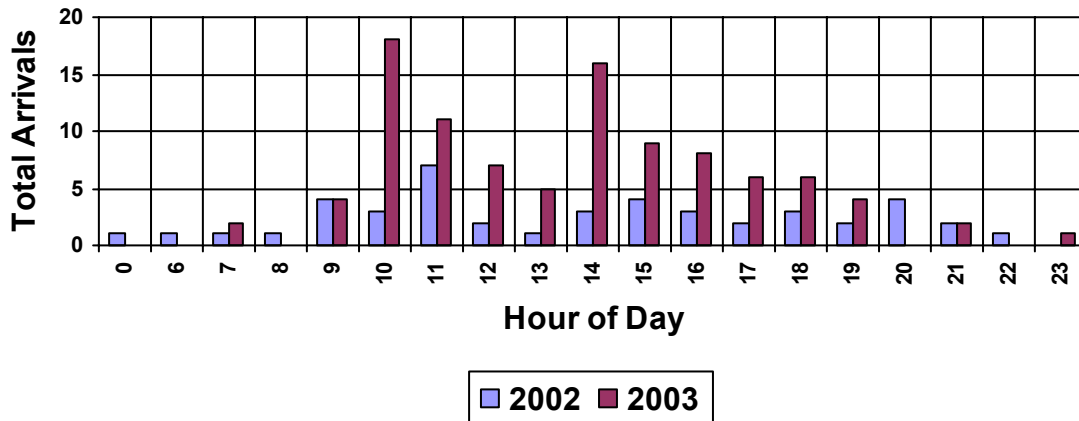


Mechanical Counter at Red Hill #3

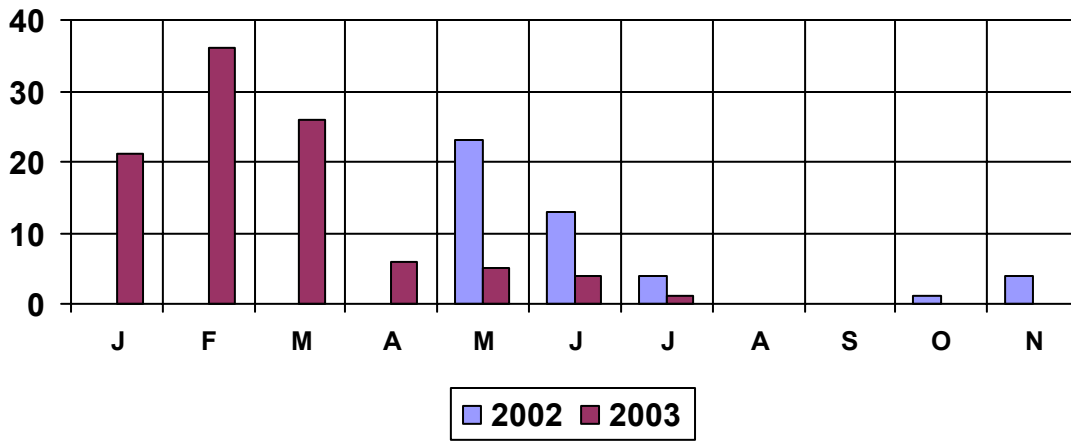
Total Hourly Arrivals



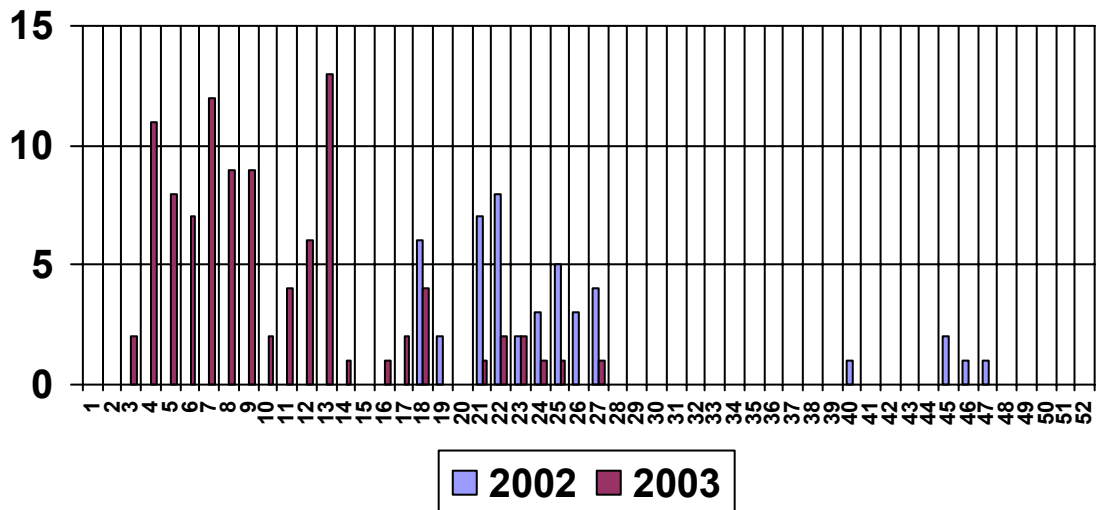
Hourly Arrivals by Year



Monthly Arrivals by Year

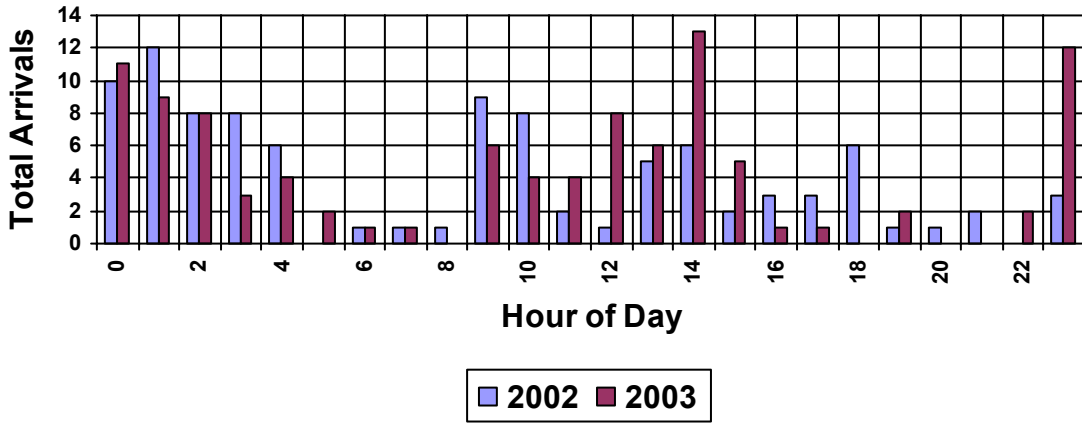


Weekly Arrivals by Year

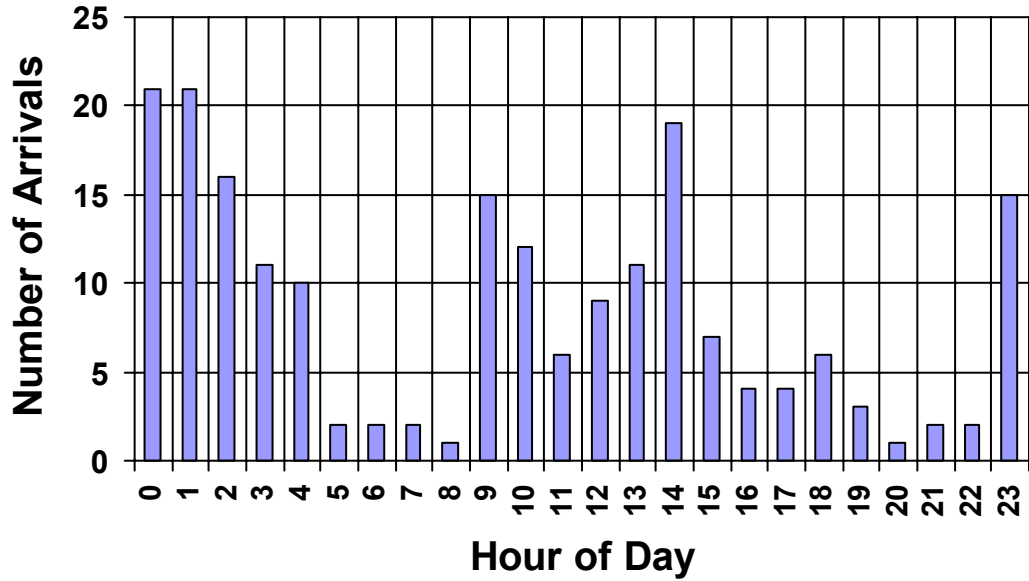


Mechanical Counter at Samm Hill

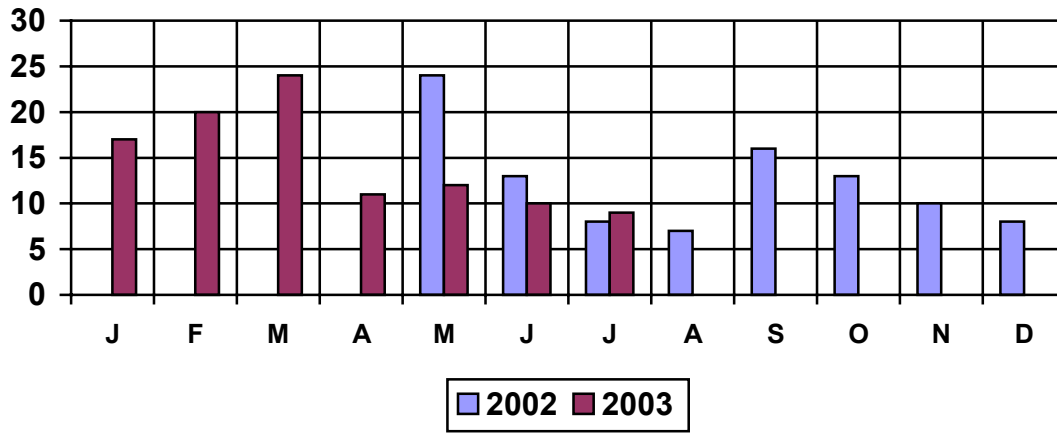
Hourly Arrivals by Year



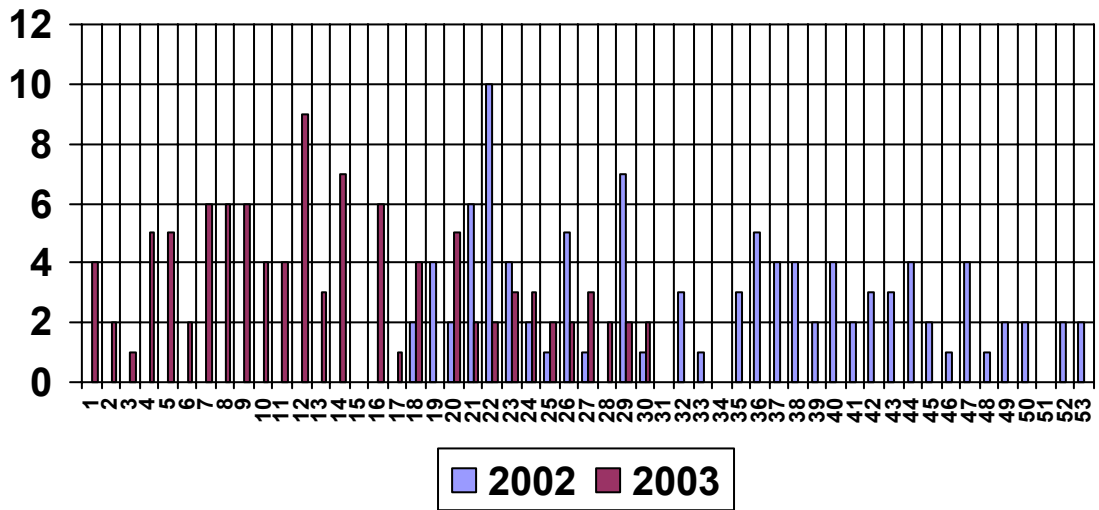
Total Hourly Arrivals



Monthly Arrivals by Year

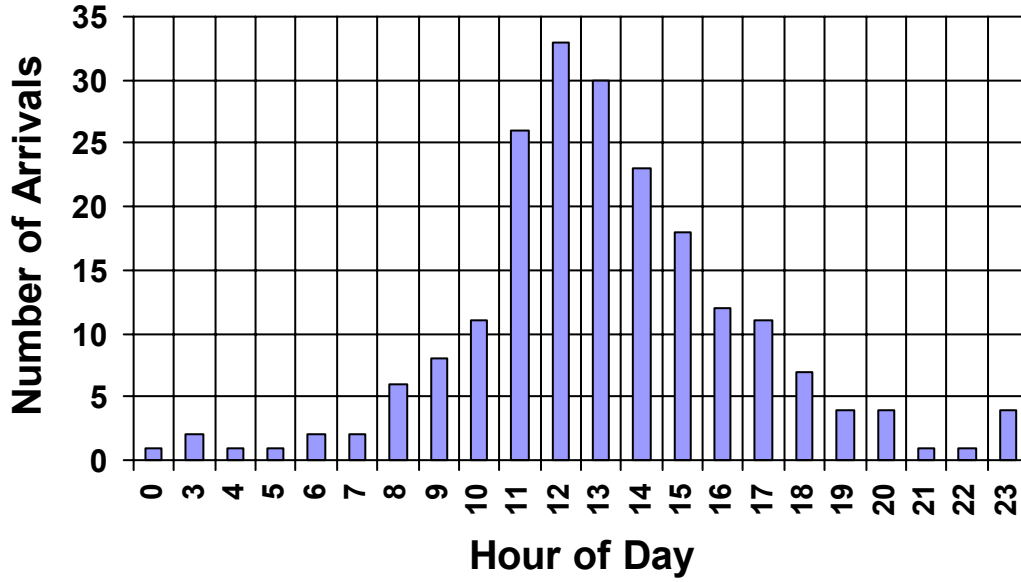


Weekly Arrivals by Year

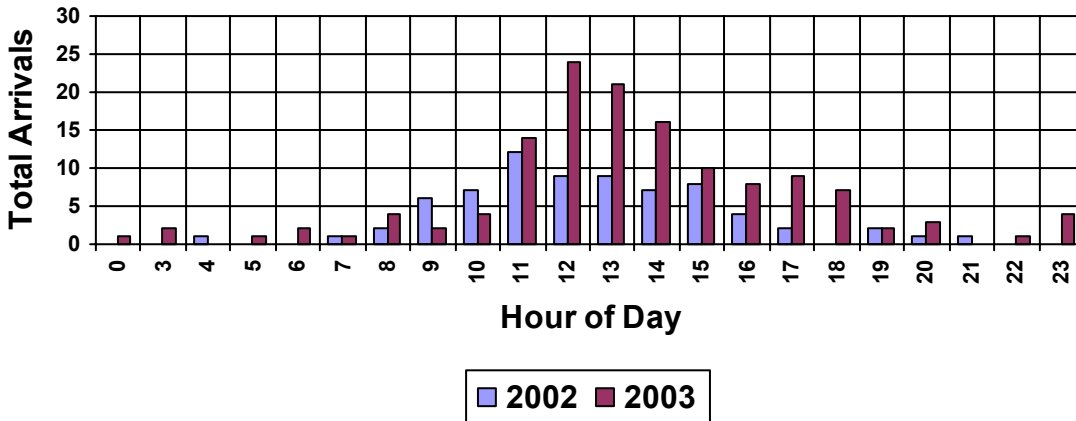


Mechanical Counter at Sasco #1

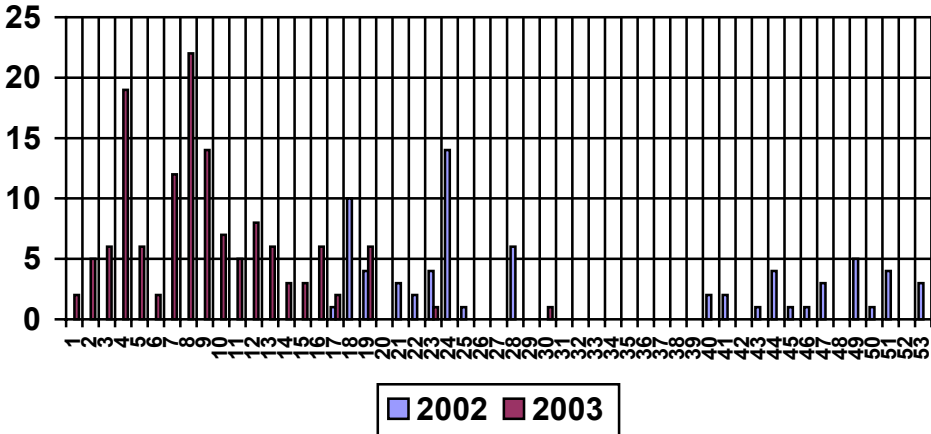
Total Hourly Arrivals



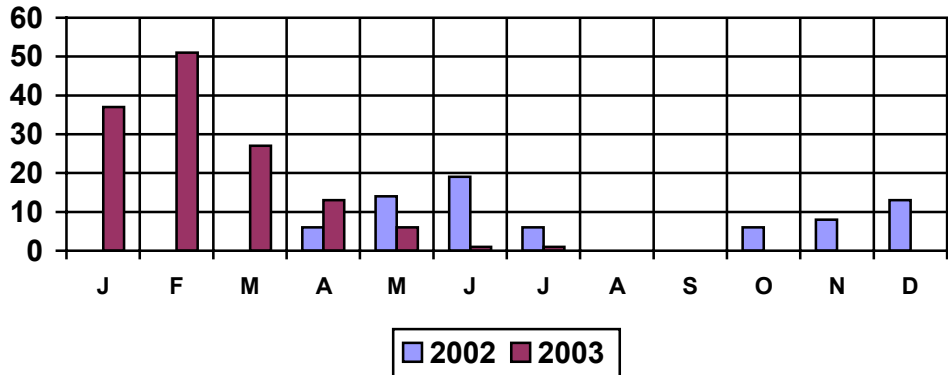
Hourly Arrivals by Year



Weekly Arrivals by Year

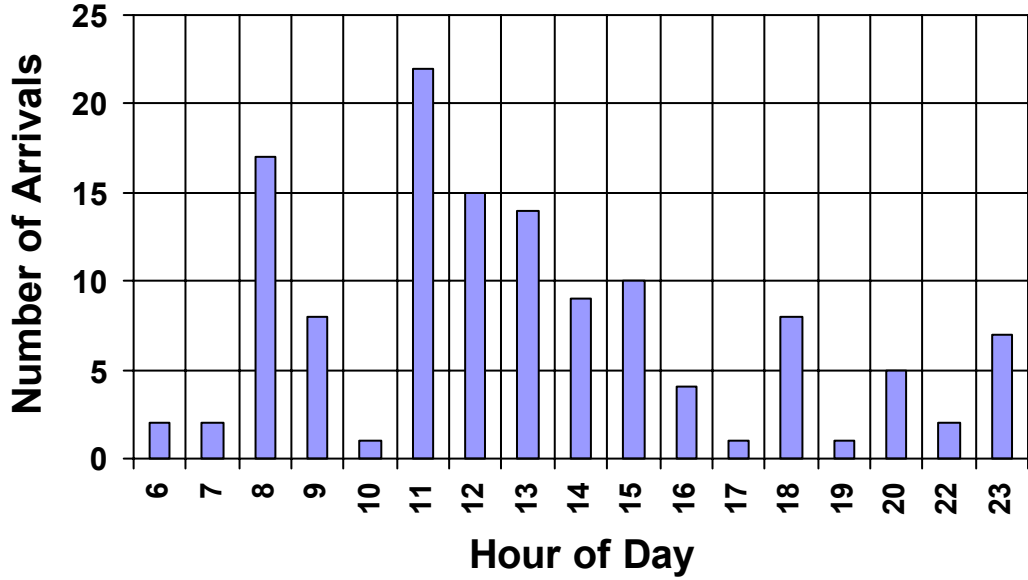


Monthly Arrivals by Year

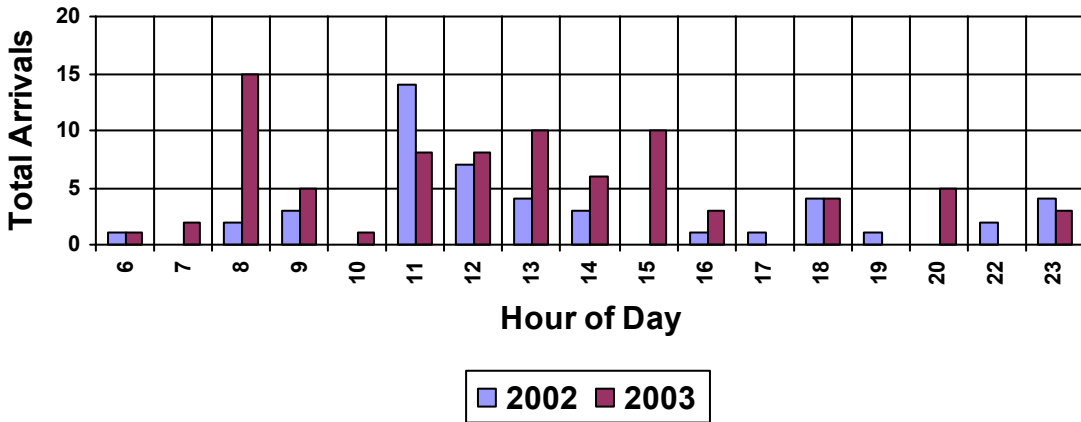


Mechanical Counter at Sasco #2

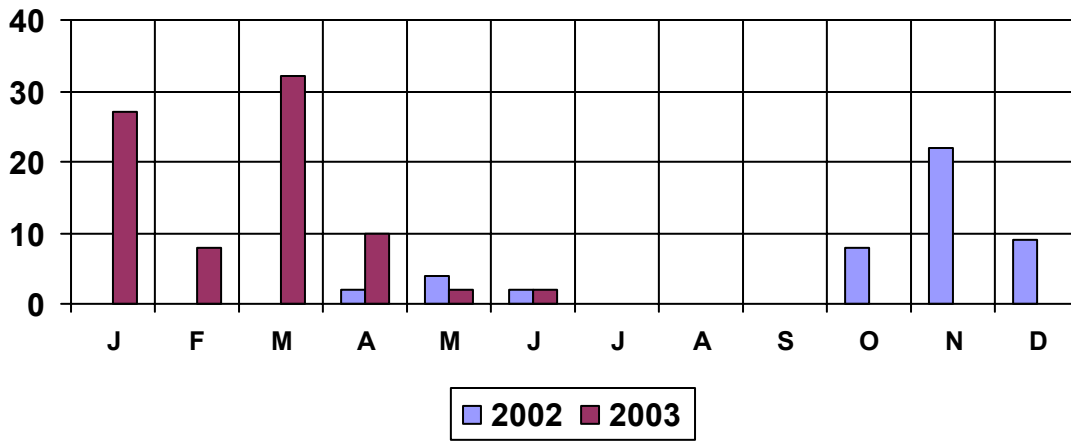
Total Hourly Arrivals



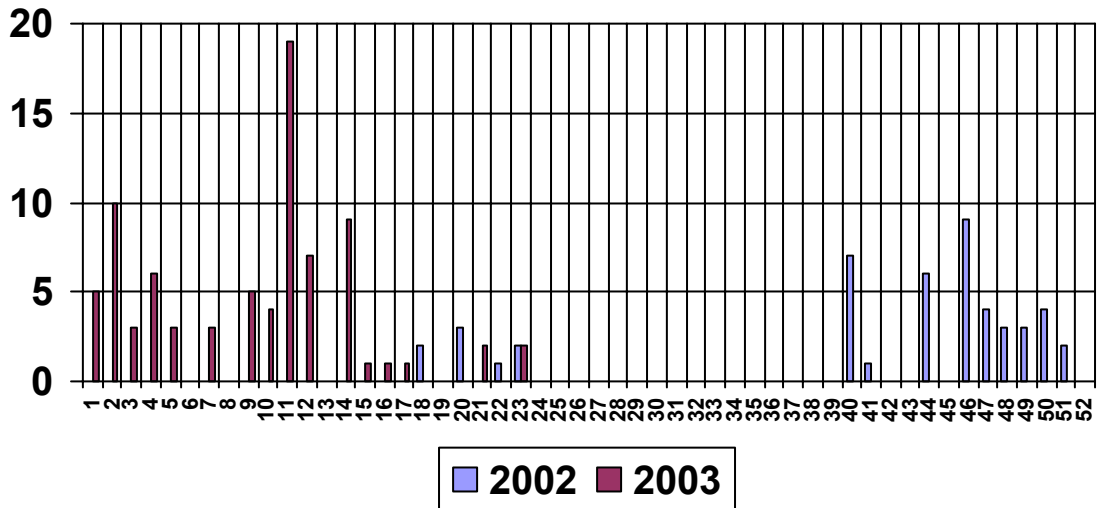
Hourly Arrivals by Year



Monthly Arrivals by Year

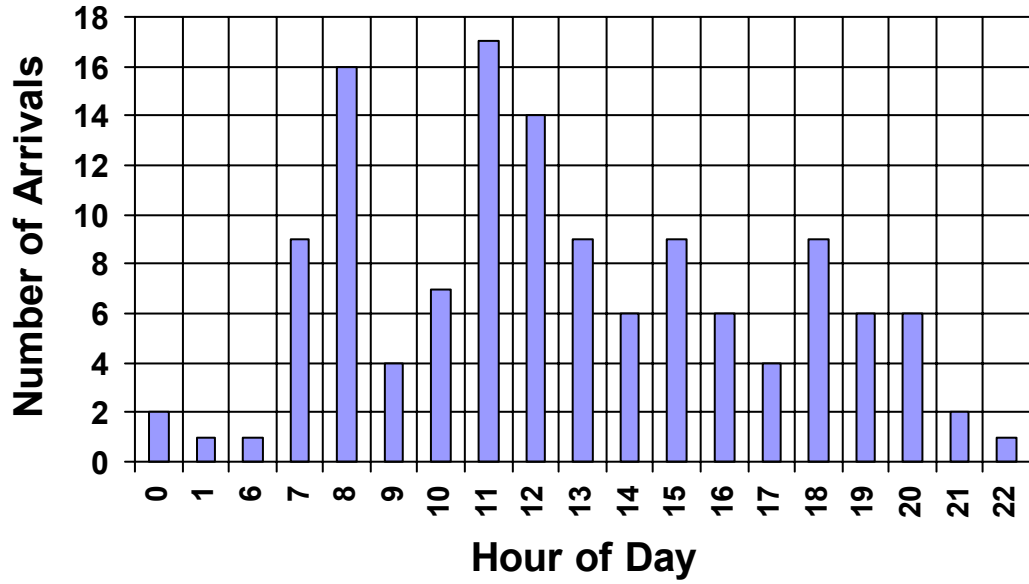


Weekly Arrivals by Year

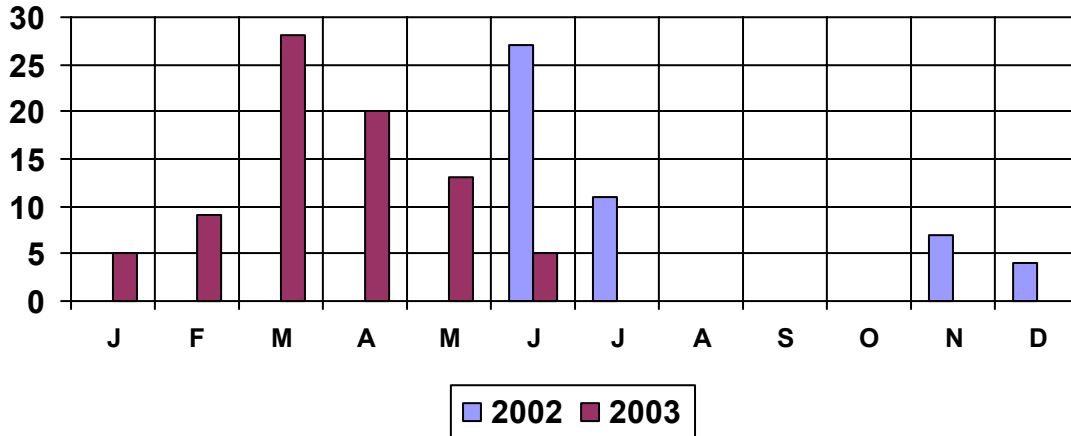


Mechanical Counter at Sawtooth #1

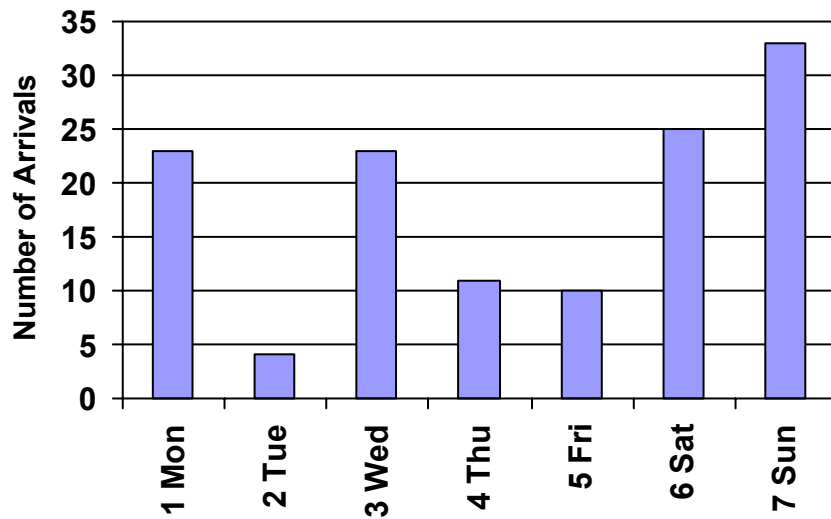
Total Hourly Arrivals



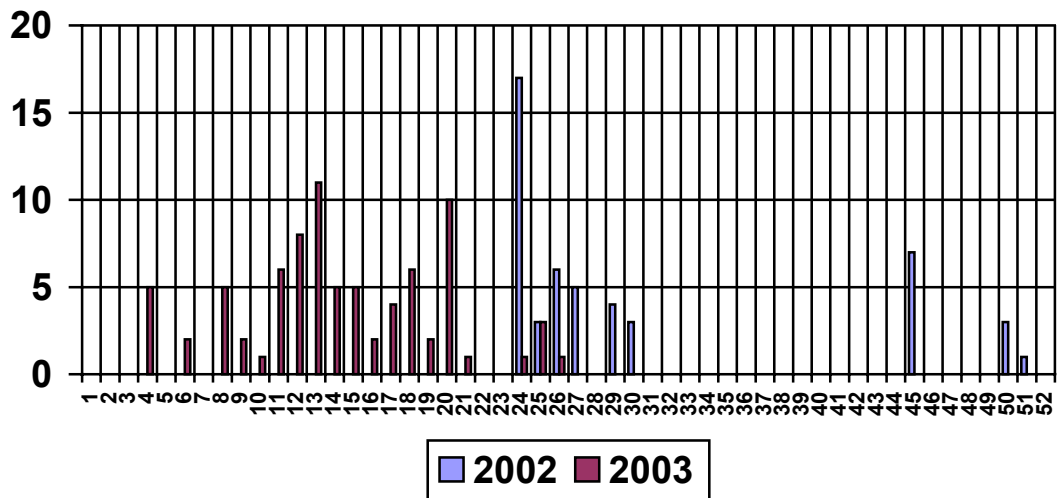
Monthly Arrivals by Year



Arrivals by Weekday

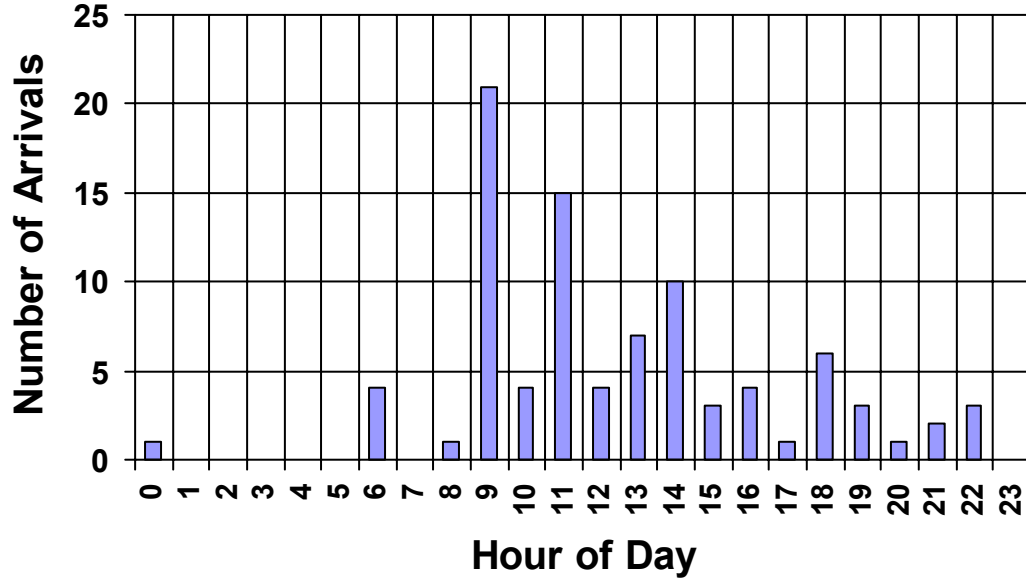


Weekly Arrivals by Year

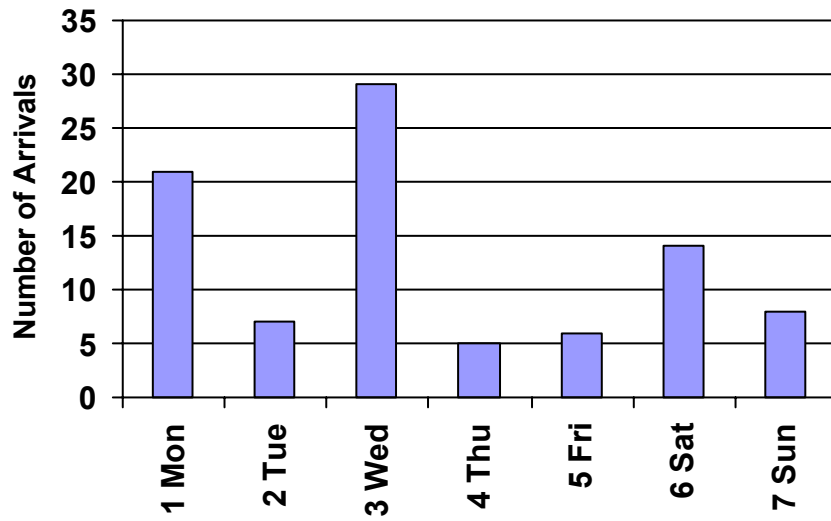


Mechanical Counter at Sawtooth #2

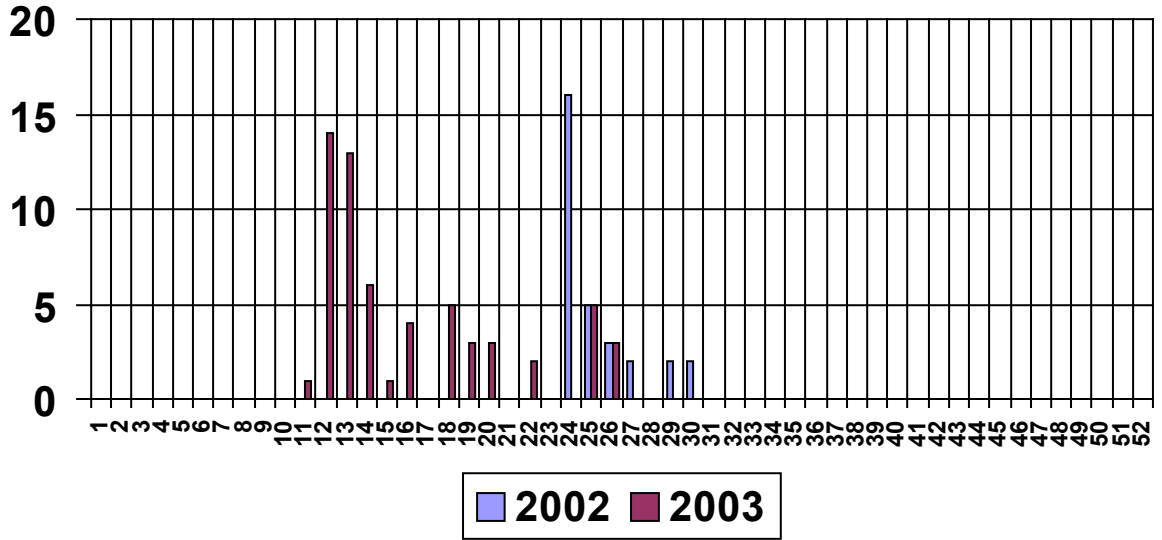
Total Hourly Arrivals



Arrivals by Weekday

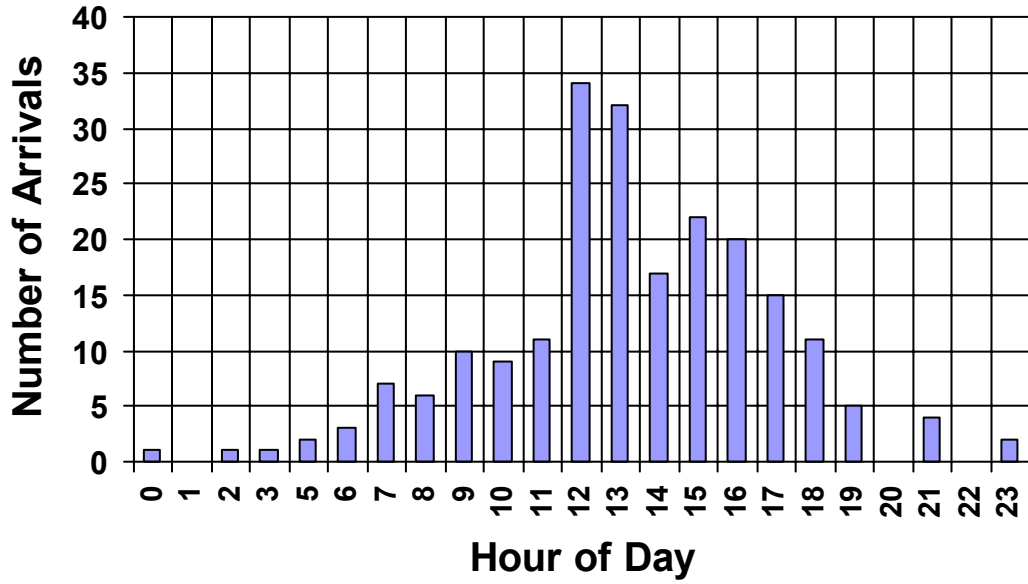


Weekly Arrivals by Year

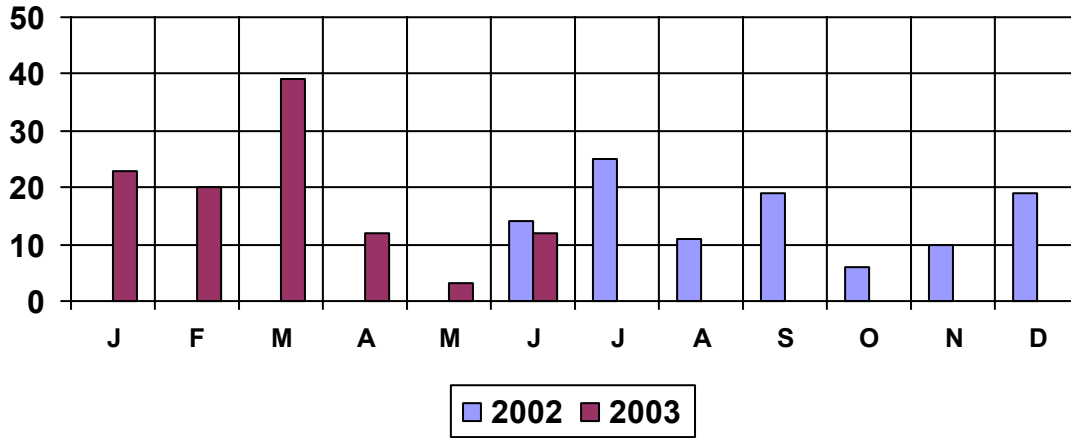


Mechanical Counter at Sawtooth #3

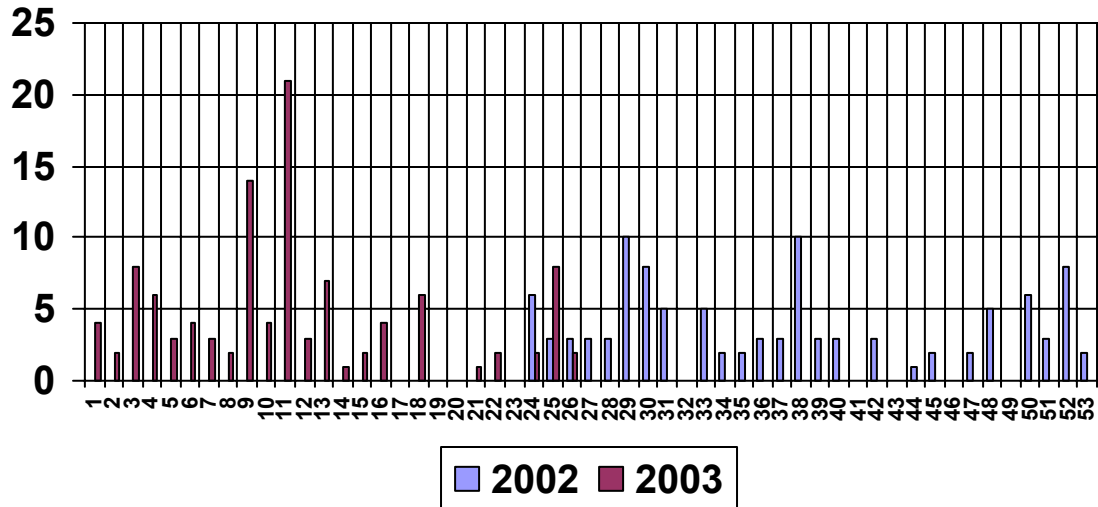
Total Hourly Arrivals



Monthly Arrivals by Year

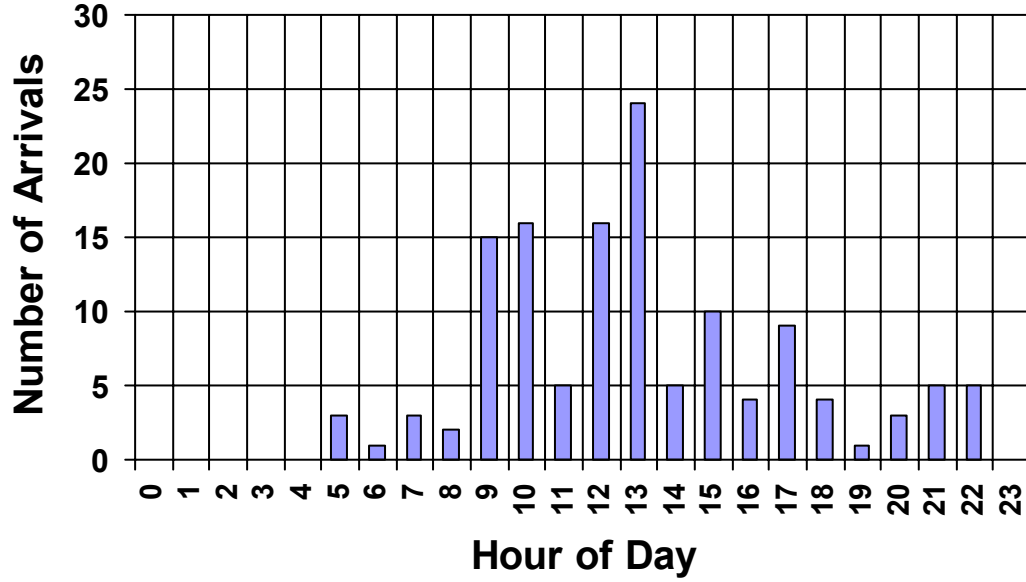


Weekly Arrivals by Year

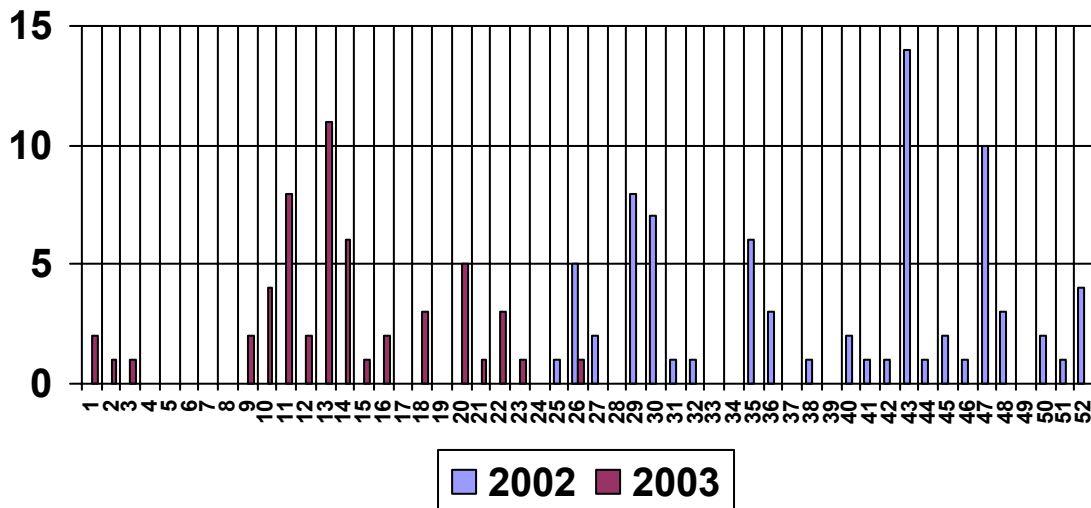


Mechanical Counter at Sawtooth #4

Total Hourly Arrivals

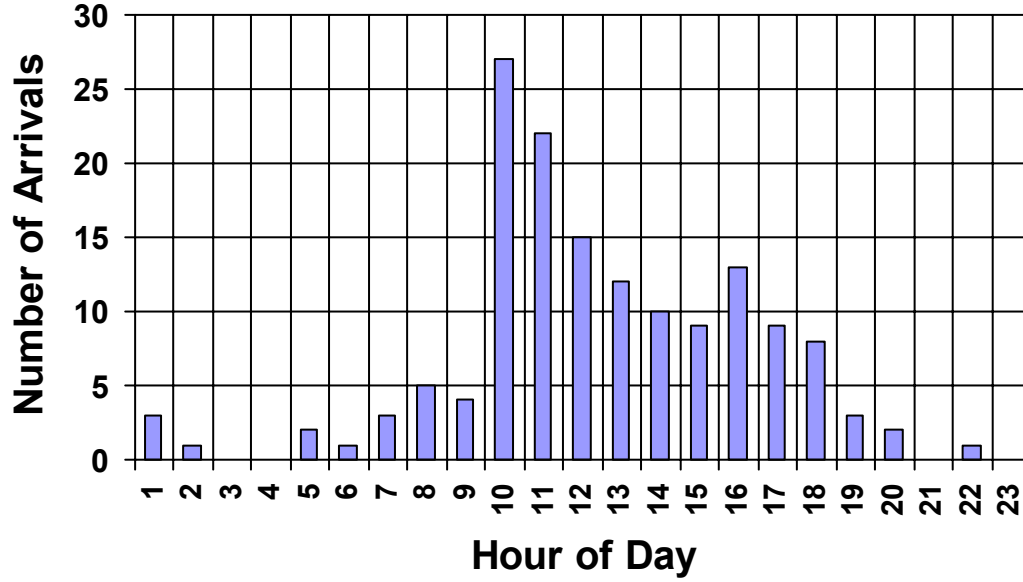


Weekly Arrivals by Year

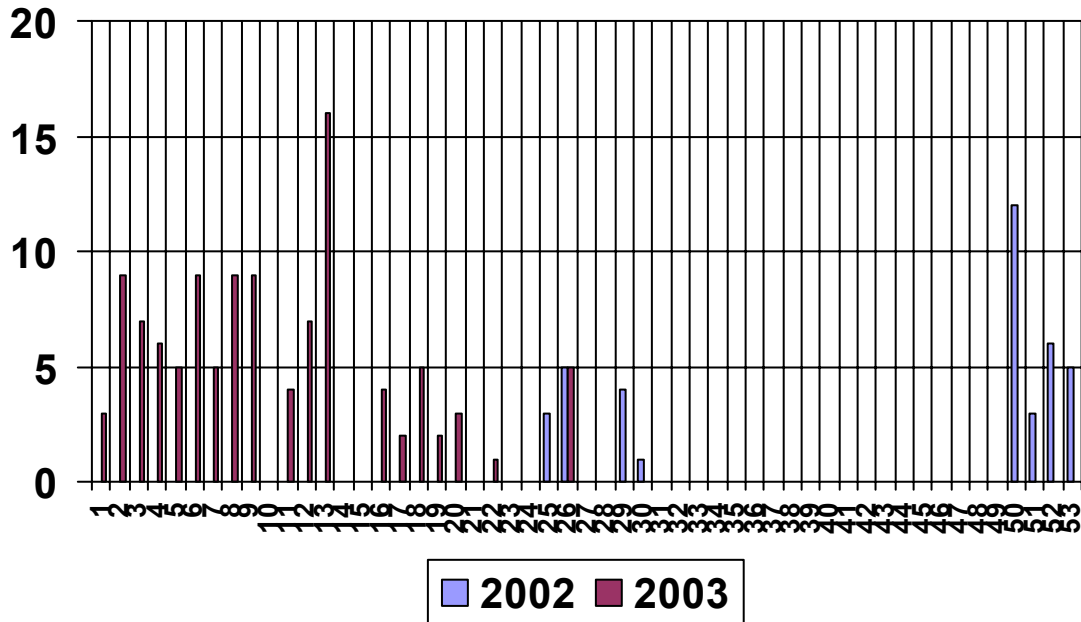


Mechanical Counter at Sawtooth #5

Total Hourly Arrivals

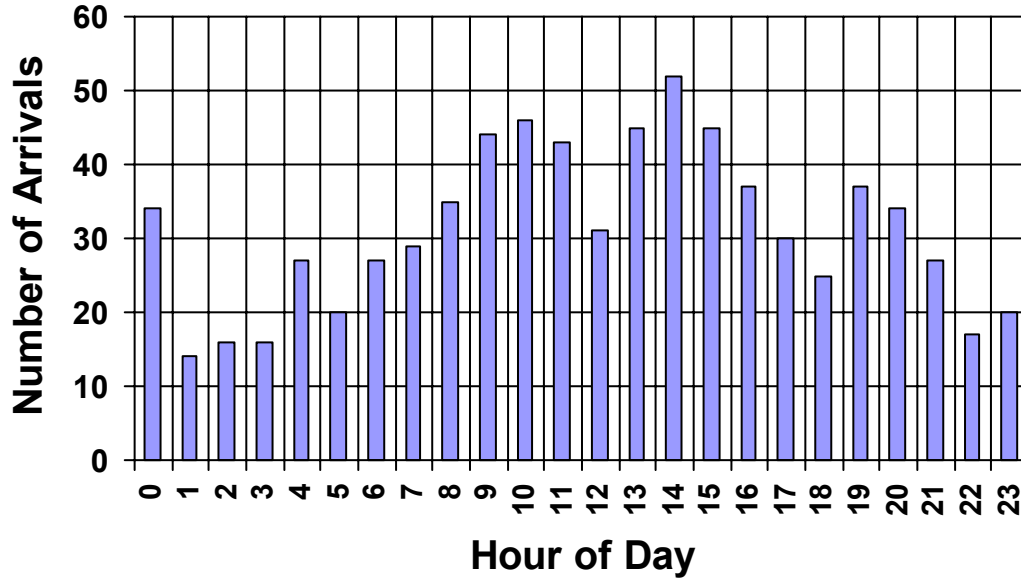


Weekly Arrivals by Year

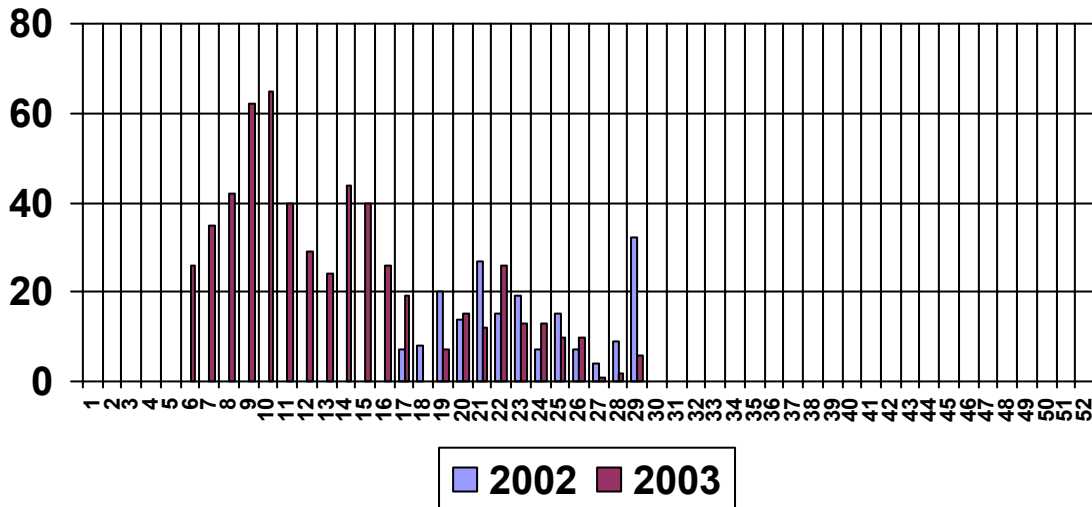


Mechanical Counter at the Silverbell Mine

Total Hourly Arrivals

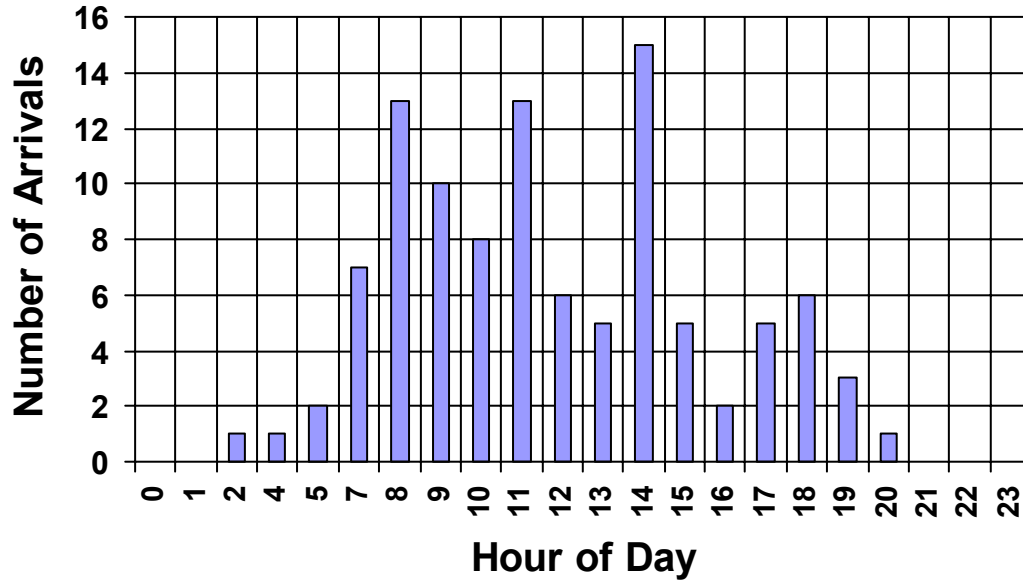


Weekly Arrivals by Year

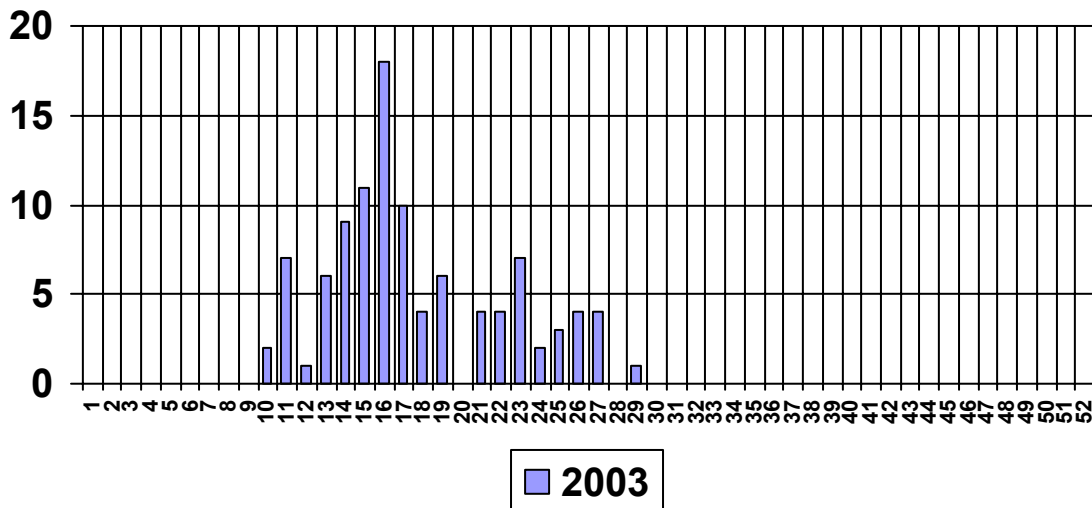


Mechanical Counter at Silver Peak

Total Hourly Arrivals

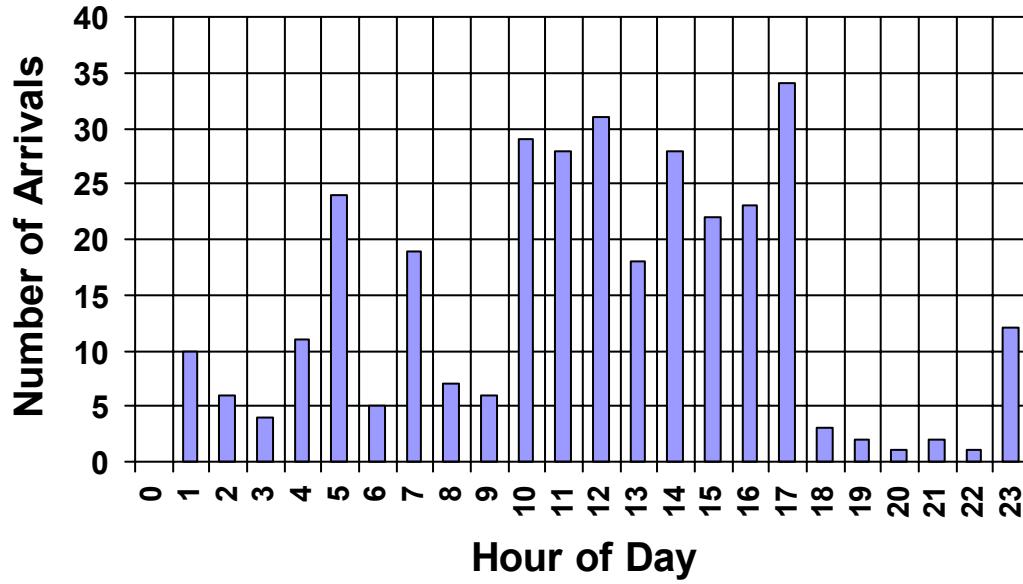


Weekly Arrivals by Year



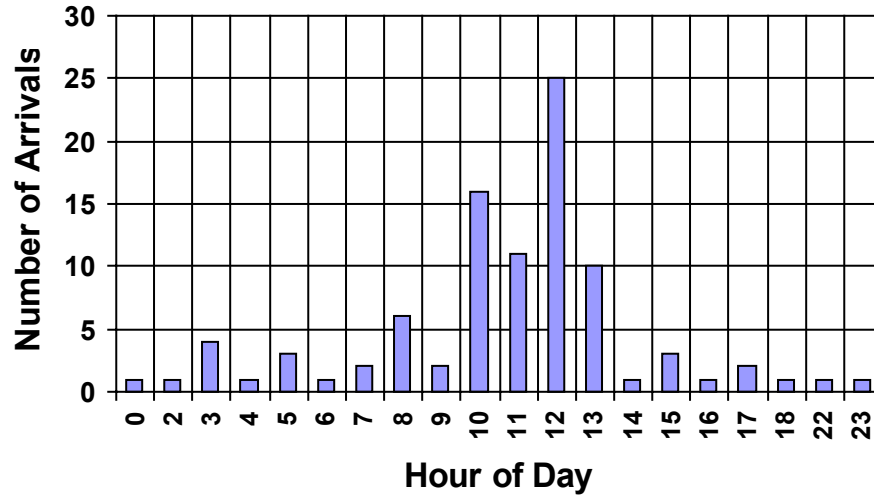
Mechanical Counter at Silver Peak #2

Total Hourly Arrivals

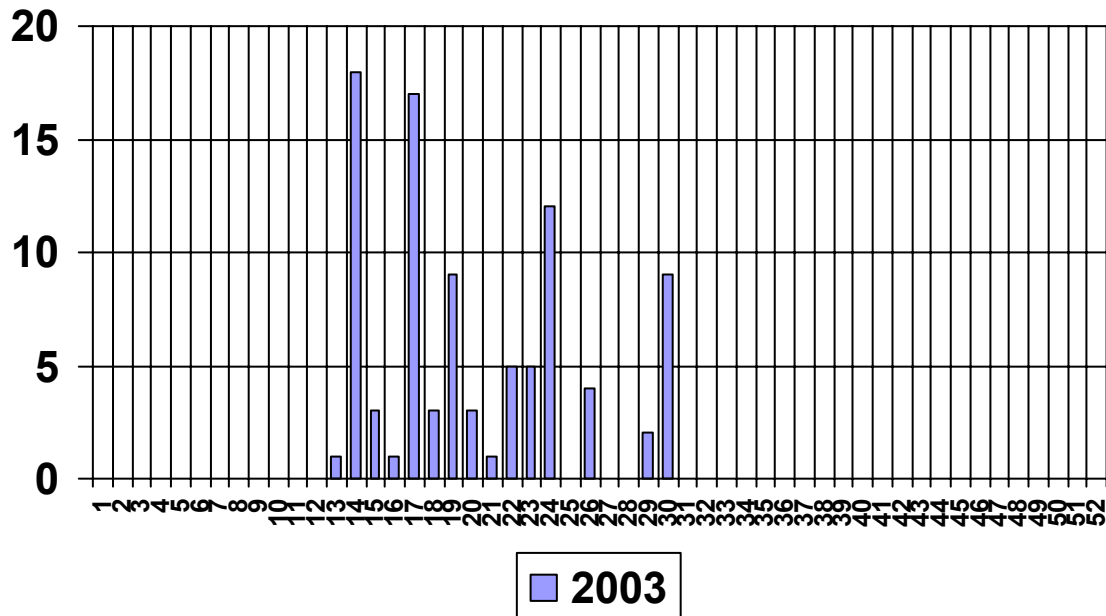


Mechanical Counter at West Silver #1

Total Hourly Arrivals

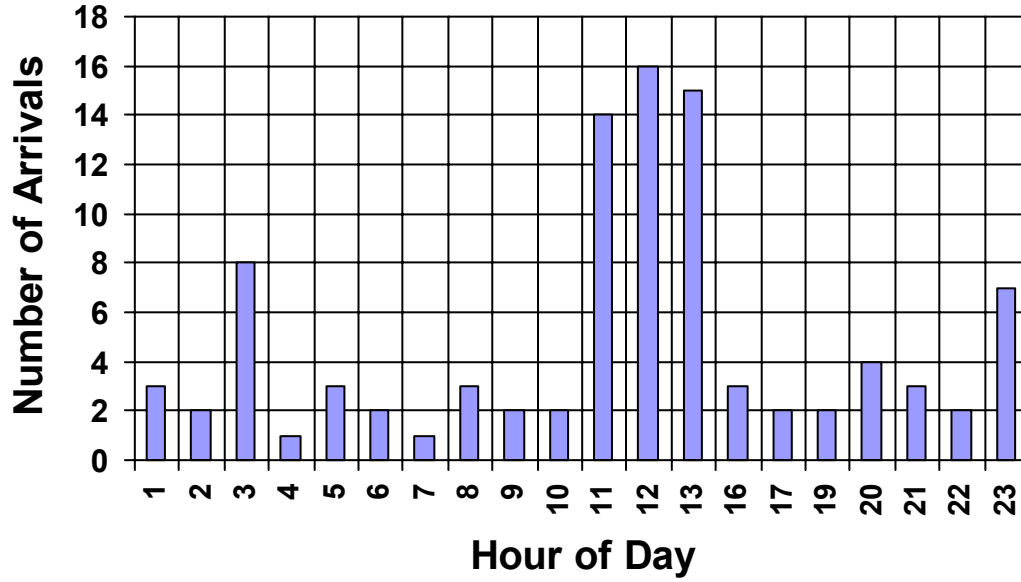


Weekly Arrivals by Year

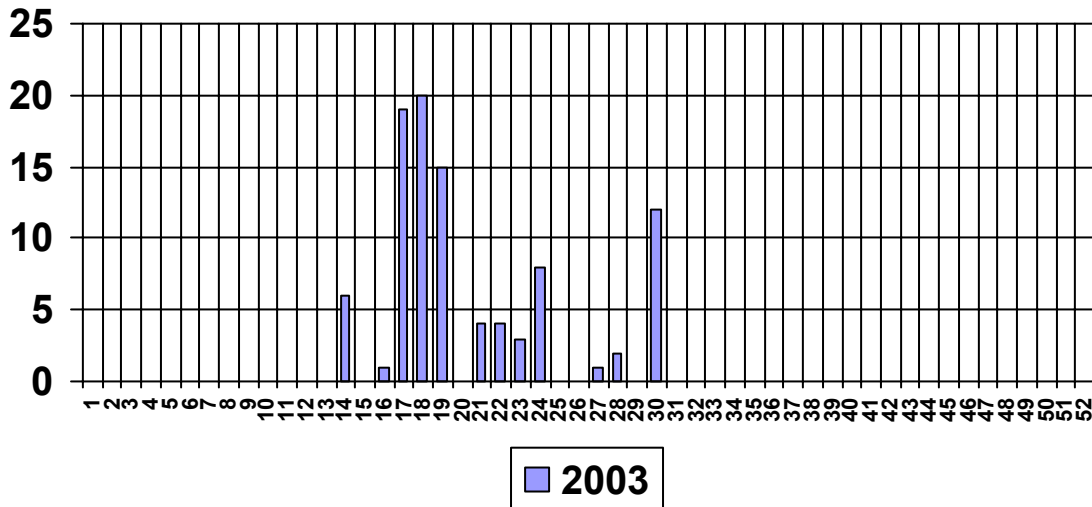


Mechanical Counter at West Silver #2

Total Hourly Arrivals



Weekly Arrivals by Year



Appendix 7 - Hunter Survey

Ironwood Forest National Monument Hunter Survey

Thank you for taking time to fill out this survey regarding your use of the Ironwood Forest National Monument. This survey is part of our effort to involve visitors in the management decisions for this special area. You have been selected for this survey because you applied for a hunting permit for this area over the past year. The University of Arizona School of Renewable Natural Resources is conducting this project in collaboration with the Bureau of Land Management.

The map is a representation of the area you visited for the purpose of hunting. Please mark on the map where you hunted, how you used the area and any other information according to the notations on the map itself. You are welcome to make any other notations that you feel will assist us in understanding more about your recreational outing(s) and your needs.

Please return this survey in the envelope provided. Thank you for your participation!

1. What months did you use this area for hunting in the past year? (check all that apply)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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2. How many people were typically in your party?

1 2-3 4-5 6-10 over 10

3. Did you most often:

- Arrive alone, hunt alone
- Arrive with a small group, hunt alone
- Arrive with a small group, hunt as a group
- Arrive with a large group, hunt alone
- Arrive with a large group, hunt as a group

4. Did you typically camp? ____ yes; ____ no

5. If so, how many nights did you typically stay?

1 2 3 4-5 more

6. Which days of the week do you typically visit the area? (check all that apply)

S	M	T	W	T	F	S
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7. How often do you visit this area for hunting?

____ times a week; ____ once a year; ____ other

8. If you saw other visitors while you were using the Monument, what were they doing?

Activity	Number of days in the last year
Planishing	
Sightseeing	
Camping/Motorcamps/RV	
Camping-Car/Truck	
Camping-Backpacking	
Hiking/Walking/Running	
Bicycling-Mountain	
Horseback Riding	
Pack Trips	
Archery Target Practice	
Archery Hunting	
Climbing-Mountain/Cliff	
Dog Trials	
Gathering Non-commercial Products	
Hang gliding/Parasailing	
Model Airplane/Rockets	
Orienteering	
Photography	
Racing-Horse Endurance	
Racing-Foot	
Rock Hounding/Mineral Collection	
Social Gathering/Festival	
Specialized Sport/Event	
Target Practice	
Ultralight Aircraft Flying	
Viewing-Wildflowers	
Viewing-Birds	
Hunting-UPland Birds	
Hunting-Waterfowl	
Hunting-Other Small Game	
Hunting-Deer	
Hunting-Desert big/born sheep	
Hunting-Axolotls	
Hunting-Mountain lion	
Hunting-Other Big Game	
Fishing	
Pleasure driving - passenger car	
Pleasure driving - high clearance vehicle	
Pleasure driving - four wheel drive	
Pleasure driving - extreme four wheel drive	
OHV/Dunebuggy	
OHV/Motorcycle	
OHV - All terrain vehicle	

9. Do you use the Monument for other activities? If so, what are they?

Activity	Number of days in the last year
Planishing	
Sightseeing	
Camping/Motorcamps/RV	
Camping-Car/Truck	
Camping-Backpacking	
Hiking/Walking/Running	
Bicycling-Mountain	
Horseback Riding	
Pack Trips	
Archery Target Practice	
Archery Hunting	
Climbing-Mountain/Cliff	
Dog Trials	
Gathering Non-commercial Products	
Hang gliding/Parasailing	
Model Airplane/Rockets	
Orienteering	
Photography	
Racing-Horse Endurance	
Racing-Foot	
Rock Hounding/Mineral Collection	
Social Gathering/Festival	
Specialized Sport/Event	
Target Practice	
Ultralight Aircraft Flying	
Viewing-Wildflowers	
Viewing-Birds	
Hunting-UPland Birds	
Hunting-Waterfowl	
Hunting-Other Small Game	
Hunting-Deer	
Hunting-Desert big/born sheep	
Hunting-Axolotls	
Hunting-Mountain lion	
Hunting-Other Big Game	
Fishing	
Pleasure driving - passenger car	
Pleasure driving - high clearance vehicle	
Pleasure driving - four wheel drive	
Pleasure driving - extreme four wheel drive	
OHV/Dunebuggy	
OHV/Motorcycle	
OHV - All terrain vehicle	