# Social and Economic Values of Caves on National Forest Lands: The Case of the Monongahela National Forest

**September 2012**

This research was funded through a cost share agreement between

the USDA Forest Service and Christensen Research

Neal Christensen
Social Scientist
Christensen Research
Missoula, Montana
neal@ChristensenResearch.com

and

Cynthia Sandeno
USDA Forest Service National Cave and Karst Coordinator
Monongahela National Forest
Elkins, West Virginia
cmsandeno@fs.fed.us

## Executive Summary

White-nose Syndrome (WNS) is killing vast numbers of bats in the US while they hibernate. A fungus, *Geomyces destructans,* has been shown to be the primary cause of WNS. Spores transferred from one cave to another may spread the fungus and people are a possible vector for that transfer. This possibility has brought emergency closures of access to caves on public lands across the US. The purpose of this case study is to develop knowledge about the social and economic values associated with public wildland caves and their closure. This case study focused on the Monongahela National Forest (MNF) located in north central West Virginia. All caves on the Forest have been closed to public access since 2009 in response to the spread of WNS. The case study considered the views of the mainstream caving community who utilize the caves for recreation, exploration, and research. This report describes the social and economic aspects of cave closure impacts. The description is based on findings obtained from a qualitative research case study that included interviews with nine key informants from the caving community. This report also describes the economic interests of the community-of-place related to local caving activities.

### Caving Community

The key informants described the mainstream caving community as being composed of a diverse group of individuals interested in cave and karst ecosystems. The reasons given for being involved in the caving community were also diverse, ranging from recreational and social to scientific and the thrill of discovery. Underlying most of the descriptions of the caving community was a general appreciation for the natural qualities of cave environments and the overarching priority to protect those places in their natural condition. Most of the respondents described the caving community as being centered around individuals affiliated with organized clubs, but that the community also embraces unaffiliated individuals that adhere to accepted cave ecosystem conservation values and behavioral norms. The organized caving community in the United States is described as mostly being under the umbrella organization of the National Speleological Society (NSS). Belonging to the NSS, cave conservancies, and local caving clubs (referred to as 'grottos') is an important part of identifying with the caving community for many of the respondents. The NSS, in particular, is described as a leader in promoting cave stewardship. The NSS also develops and promotes caving safety practices. Cavers not associated with a local grotto or the NSS were described as independent, unaffiliated, or unorganized cavers. It was common for the affiliated respondents to attribute independents with having a more casual connection to caves and caving. Affiliated cavers may be only a small fraction of the people involved in caving, as many people use relatively unknown caves in their local area.

### Other Stakeholders

Respondents described two specific non-caving stakeholder groups that focus on bat conservation that are concerned about the spread of WNS: Bat Conservation International (BCI) and the Center for Biological Diversity (CDB). Bat Conservation International was described as an ally of the caving community. The primary reason that BCI was seen as an ally of the caving

community was the perception that they favored a case-by-case policy on cave closures rather than supporting a blanket-closure policy. Environmental groups that favor blanket cave closures as a response to WNS were portrayed by respondents as conflicting with the views and interests of the caving community. The Center for Biological Diversity's views were described as being bio-centric and their portrayal of issues as being in absolutes with little room for compromise. Unlike the stewardship approaches advocated by the caving community respondents, the CBD was described as being overly focused on litigation rather than on science, education, or direct forms of conservation. A second type of stakeholder portrayed by respondents as opposed to the mainstream caving community, though still interested in caving, are the unorganized cavers who are careless, unprepared, or engaged in depreciative behavior in the cave environment. These cavers were described as outcasts of the caving community because they were seen as a threat to cave environments and to the caving community's ability to continue to participate in caving activities. Respondents attributed the problems caused by the 'spelunker crowd' to a lack of education and to a lack of the type of behavioral norms that would be instilled by the organized caving community.

## Caving Activities

The mainstream caving community participates in a diverse set of related activities that occur both on and off-site and inside and outside of the cave environment. One respondent described caving activities as belonging to four general types: 1) recreation, 2) conservation, 3) mapping, and 4) cave science. These general categories would overlap for many people. Caving was often described as vital to the well-being and identity of the respondents. A number of respondents described their participation in conservation activities aimed at improving the protection and habitat for bats in the caves. With their personal identities as cavers influenced by their focus on conservation, most of the respondents felt that they actively supported the bats in their fight for survival from the threat of WNS. Geology, hydrology, biology, and mapping were among the science-based caving activities commonly mentioned by respondents. Respondents often described their activities as long-term projects that mutually benefit the caving community, science, and land managers. Several of the respondents described the effect of the MNF cave closures as a lost opportunity for science and for research partnerships. Respondents described the caving community as supportive, both financially and through caving activities, of the advancement of bat science. Some respondents described caving activities either centered on or beneficial to the advancement of knowledge related to bats and WNS. One respondent described cavers as the eyes of bat science, while another described their own increased interest in the science of bats that has resulted from concern about WNS.

## Cave Closure Social Impacts

A number of different types of impacts were attributed to the current MNF cave closures. Respondents reported that specific MNF caves were important to them for reasons including recreation, sharing with and educating others, introducing young people to caves and caving, as laboratories for science, and as sources of inspiration. As public places, the MNF caves were described as serving important unique functions in terms of access, land owner relations, and

wildland experiences. The direct effect of the MNF cave closures is the displacement of cavers from the underground places that they used in the past. The MNF was described as offering a variety of caving opportunities prior to the closure. Some of the caves on the forest were described as very accessible, some more wild, and many not easily substitutable. Local landowners have responded in different ways to the Forest Service cave closures - some following the lead of the agency and some going against it. However, public lands offer a level of access and a sense of belonging generally unavailable on the private landscape. A critical aspect of the role of the caves on the MNF is the level of access they offer to the local and regional public. The public will not wear out their welcome through continued use of their own national forest lands.

Monongahela National Forest Cave Management

The closures have resulted in dissatisfaction among the caving community, but all of the respondents expressed their desire to work with the USFS in the future to improve relationships between managers and cavers. The cave closure policy on the MNF was not popular among the respondents. However, they were all in favor of taking steps to protect the bats. They were likely to prefer policies that were more targeted at specific caves with critical bat habitat. They also pointed out that there are tradeoffs with the closure policy that should be acknowledged - excluding people to protect bats negatively affects the caving community, and possibly the caves themselves. The caving community has historically been involved in conservation of cave environments. Most of the respondents described their long-term commitment to conservation in general and also to the protection of specific caves. With the closure of access to public caves comes a sense of a loss of connection to the places targeted for conservation. Respondents described one of their roles in conservation as providing protection to the caves that they visit. Without the presence of the caving community, caves can be vulnerable to trespass and damage from less conservation-minded members of the public. The caving community feels that the cave closures have resulted in a loss of protection, as the stewardship and protective role formally filled by the caving community has been put on hold. Vandalism is increasing and is a real concern.

Perceptions of a heavy-handed approach to protection of bats through blanket closures can discourage the public's trust and willingness to cooperation in conservation. The closures are described by some as a lost opportunity to educate the public about cave conservation. Education makes caves and bats relevant to people. First-hand experience leads to more loyal conservationists. Dissatisfaction with the approach taken by Forest Service managers can have lasting effects on attitudes toward the agency. Long-term public trust suffers from dissatisfaction with relatively short-term policy decisions and that trust is slow to return and relatively difficult to rebuild. Many of the respondents described a desire to improve relationships with the agency. They are dissatisfied with the current policy because they were not asked for their input earlier. Others described dissatisfaction with being excluded from the solution as well as the decision-making process. The caving community considers its members to be among the experts in cave and bat sciences. Respondents described cavers as the segment of the public most involved with, and most sincere about, cave and bat conservation. They would like to be involved in the solution.

## Economic Values of Caving

Caving-related activities contribute to the economy in several different ways; from the purchase of equipment and clothing, to travel-related purchases of gas, food, and lodging, and to in-kind labor contributions for on-the-ground cave science and conservation efforts. As caving comprises a diverse set of activities and participants, spending patterns and related impacts also vary considerably. In estimating the economic costs of cave closures on the MNF, it is important to understand the characteristics of expenditures related to caving, the overall amount of caving in the area, and the change in caving-related behaviors that resulted from the implementation of the management policy.

The greatest amount of money attributable to caving for many people, particularly as they become more specialized, is likely to be spent on equipment and clothing. Other individuals, especially those starting out, may use club equipment to cut costs; the greatest expenditures for groups of this type are more likely to be related to travel - which could be considerable given long distance and large group sizes associated with some club weekend outings. While most equipment purchases are made in the home community or through mail order / on-line shopping, travel expenditures are made in numerous places along the way, with communities closest to the destination most likely to receive these types of purchases. Cave closures have influenced the patterns of equipment purchases in two contrasting ways: first, some individuals are spending less on equipment for caving because they are going underground less; second, some individuals are spending more on equipment as they are purchasing separate gear for different areas so as not to transport *Geomyces destructans* spores to uninfected hibernacula.

Respondents described how many cavers travel considerable distance to caves in West Virginia and the area around the MNF. Travel behavior of cavers often resembles the activity and expenditure patterns of typical national forest wildland recreation visitors. Many respondents described camping, rather than hotel stays, as typical of their more distant caving trips. Most respondents reported eating along the way in restaurants, and frequently reported using local restaurants while camping on the national forest. The frequent descriptions of traveling long distance and staying overnight suggest the high value of the area as a regional (not just local) caving opportunity. The economic effect of caving on the MNF and the effect of the cave closures have certainly been felt by individual local businesses.

## Local Economic Impacts of Cave Closures on the Monongahela National Forest

Information from the economic impact analysis combined with knowledge from the qualitative interviews provides economic perspective to the MNF cave closure policy. The key informants from the caving community characterized their nonlocal travel behavior in ways that are typical of nonlocal visitors to the MNF described in the National Visitor Use Monitoring Program (NVUM) report. The cavers described a variety of caving trip types, including overnight campouts on the forest, stays in local motels, and some that were based at the homes of friends (or the local grotto bunkhouse). A few described coming to the area on long day trips. The key informants also described expenditures for gas, food, groceries, retail, and other expenses, that are typical of those reported in the NVUM visitor expenditure profiles. In the absence of primary quantitative cave visitor survey data, the characteristics of recreation forest visitors reported by

the NVUM system provide reasonable estimates of travel characteristics of cavers for use in economic impact analysis.

Evidence presented in this study suggests that there are likely to have been negative impacts resulting from the ongoing MNF cave closures that can be estimated in terms of income, jobs, and value added to the local economy surrounding the forest. Referring to Table 4 and using the NSS national convention attendance of about 1,000 as a lower bound for annual wildland caving visits to the MNF and the NSS national membership as an upper bound of visits (about 10,000 after discounting for local members), the potential economic impact from the cave closures on the MNF would range between 1 and 12 jobs, distributed across all involved industrial sectors. Given current knowledge, there is no way to know the actual wildland caving use of the MNF prior to cave closures, or the actual impacts that the closures have had on the local economy. The estimates provided here seem reasonable and give a good sense of the types and numbers of jobs and income at stake.

## Conclusions

The research participants described a wide range of types and intensities of involvement in caving activities. They described some aspects of their connections to MNF caves as not being substitutable, and all of the key informants described a sense of loss from the closures. They felt that opportunities for wildland recreation, stewardship, and science have been lost. They described a sense of belonging offered by caves on public lands that cannot be found elsewhere. Because of the specialized nature of caving. the cave closure policy on the MNF has resulted in social impacts that are particularly concentrated within this mainstream caving community. Other observations include:

- Economic impacts of cave closures on the MNF are likely small, but not insignificant
- Some of the local negative economic impacts of the cave closures are concentrated in a few businesses; for example, lodges that have lost bookings from annual grotto caving trips and locally owned restaurants. Most of the impacts are spread throughout the local economy.
- Caves and bats may be more vulnerable to human caused negative impacts, such as vandalism, because the caves are closed to the mainstream caving community.
- There are costs associated with the cave closures on the MNF that go beyond reduced revenues related to equipment and travel-related expenditures by caving participants. Costs that were mentioned include lost opportunities to introduce people to nature, reduction of progress in science, less volunteer stewardship work, less variety of recreation opportunities, a loss of protection of caves, and a decline in interest in caving activities.

This report suggested a genuine passion and concern for the health of the cave environment among the mainstream caving community. While respondents described a sense of loss from the cave closure policy on the MNF, they also described concerns for the well-being of these public

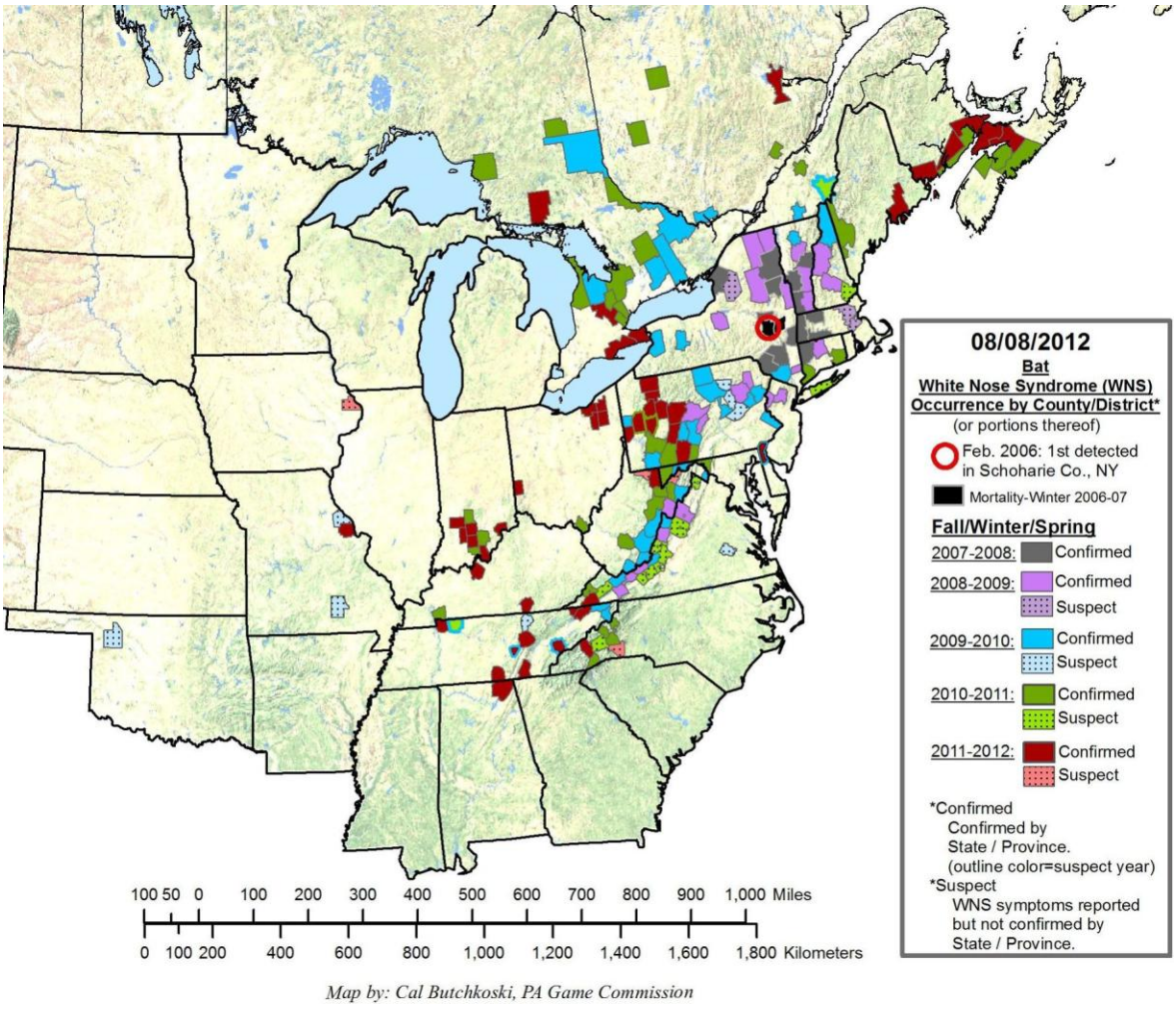
lands and their wild inhabitants, as well as an attitude reflecting the importance of being good stewards of these places. In making decisions about the protection of these resources, managers should be aware of the social and economic values at stake that are described in this report. Informed decisions that acknowledge and consider the importance of these public places to the caving community will enhance the acceptance of management policies. Relationships between the agency and the caving community could be enhanced by further engagement with these stakeholders in planning and implementation of stewardship efforts to provide the best management for the caves and bats.

## Table of Contents

## Cave Closure Background

Federal land managers across the United States are faced with controversial decisions about how to address a lethal epidemic among bats. Little is known about White-nose Syndrome (WNS), except that it can kill entire colonies of bats while they hibernate. A fungus, *Geomyces destructans*, has been shown to be the primary cause of WNS. The fungal spores can be spread through bat-to-bat and bat-to-cave transmission, but may also be spread by humans and other animals. This possibility has brought emergency closures of access to caves on public lands across the US, especially in the East where the fungus first appeared. Figure 1 shows the current extent of WNS occurrences in the United States and Canada as of August 8, 2012. There is a lack of knowledge about the social and economic impacts of cave closures on federal public lands. While many people are concerned about the imperiled bats, Americans also greatly value access to public lands. Members of the public advocating for more consideration of their interests that are at risk in closure decisions are asking for federal land managers to re-evaluate this policy.

Figure 1: Current extent of WNS in the US; http://www.caves.org/WNS/; accessed 9/19/2012.



The purpose of this case study is to develop knowledge about the social and economic values associated with public wildland caves and their closure. This research addresses the need for information about the values at risk from wildland cave closures through a case study investigation focused on the Monongahela National Forest (MNF). The MNF is located in north central West Virginia. All caves on the forest have been closed to public access since 2009 in response to the spread of WNS. The current management policy regarding cave closures on the MNF started when the Eastern Region of the US Forest Service closed all caves on National Forest System lands in the region to try to slow the spread of WNS. In 2010, the decision to retain or remove the cave closures was delegated from the regional to the forest level. At that time, all of the Forest Supervisors in the Eastern Region that have cave resources continued the closures. The cave closures on the MNF will expire on June 30th, 2013 unless terminated earlier by the Forest Supervisor (Order Number 09-21-12-08).

## Stakeholders

There are a number of potential interests in the caves on the MNF. Seiser and Schuett (2006) identified four general types of wildland cave community-of-interest stakeholders, including: 1) individuals who utilize caves for recreation, exploration, and/or research; 2) individuals engaged in cave-based commercial activities; 3) state and federal government officials responsible for decisions impacting caves or cave management; and 4) special interest organizations that have an interest in cave and karst environments. This case study focused on the views of individuals who utilize the caves for recreation, exploration, and research. These stakeholders are referred to in this research as the 'mainstream caving community.' Concerns of other community-of-interest stakeholder groups were evaluated in this case study only from the perspective of the caving community.

A second general type of interest group, consisting of community-of-place stakeholders, was identified by Seiser and Schuett (2006) to include: 1) local individuals who earn a living via a non-resource extraction business; 2) local individuals who earn a living via a natural resource extraction industry; 3) local government officials who may have an impact on cave stewardship activities; and 4) local residents. While the current case study does not represent these place-based stakeholders, a number of insights have been identified about the effects of MNF cave management policy on local citizens. Following the assessment of social characteristics, this case study describes travel and economic characteristics of caving that are of primary interest to community-of-place stakeholders.

## Case Study Methods

This report describes findings obtained from a qualitative research case study. The qualitative findings were developed through the identification of themes during analysis of key informant interview transcripts. The themes that emerged from the interviews represent the perspective of mainstream caving stakeholders and provide insight about the social impacts to this group from cave closures on the MNF.

### Key Informant Interviews

Interviews with nine key informants from the caving community were used to develop deeper understanding of the MNF caving stakeholder group in this case study. All of the informants described themselves as having many years of experience in caving and all had at least some familiarity with the caves and cave closures on the MNF. The key informants were identified by the US Forest Service National Cave and Karst Coordinator, Cynthia Sandeno, who also works on the Monongahela National Forest. The interviews were conducted and recorded by Cynthia following a semi-structured interview guide that was standardized across all interviews. The recorded interviews were later transcribed by a volunteer to facilitate analysis. The analysis was conducted by Neal Christensen and then the findings were reviewed, edited, and supplemented by Cynthia Sandeno.

### Qualitative Data Analysis

The purpose of the qualitative data analysis was to develop understanding of the importance that the caving community places on the cave resources found on the MNF. The interviews were analyzed to explore the key informants' history of use and advocacy for the wildland caves located on the MNF. The analysis was facilitated by the use of QSR NVIVO qualitative analysis software. Understanding of caving stakeholder issues was gained by the identification of important topics as they emerged during analysis of interview transcripts. Identification of topic areas and caving values at risk were informed by general outdoor recreation theory and by the more specific findings of Seiser and Schuett (2006). Topics were catalogued and later summarized with the aid of the NVIVO qualitative analysis software.

## Qualitative Findings

Qualitative research produces *findings* that can lead to insight about a phenomenon being studied. Findings are generalizable to a topic of interest. The objective of this approach is to identify the range of knowledge, opinions, and experiences of a particular group of people. This is somewhat different from the more familiar quantitative research approach that produces statistical *results* that are generalizable to a population of interest and provide insight about the prevalence of specific knowledge, opinions, and experiences. Qualitative findings provide a deeper insight about a topic; they reveal the range, rather than the prevalence, of phenomena.

The findings of this case study were developed through coding of topics as they emerged from the caving community interviews. This process initially identified 54 topics. Some of the interview references were coded under more than one topic. Analysis across the interviews identified a range of 26 to 38 topics per interview, with an average of 31 topics per interview. The number of individual references to each topic ranged from 63 to 158, and averaged 98 references per interview. Topics of periphery relevance were filtered and those remaining were combined in a hierarchical structure before being summarized in this report. The following tree structure outlines the topics of the findings described here. The findings are divided into three major headings - 1. Stakeholders, 2. Cave-Related Activities, and 3. Cave Closures on the Monongahela National Forest. The three major subject areas are further subdivided to reflect the emerging understanding of the topics:

1. Stakeholders
    - 1.1. The Caving Community
        - 1.1.1. Organized Cavers and the National Speleological Society
        - 1.1.2. Independent and Unaffiliated Cavers
        - 1.1.3. Environmental Organizations that Support Caving
    - 1.2. Caving Community Out-Groups
        - 1.2.1. Environmental Organizations that Oppose Caving
        - 1.2.2. Unaffiliated Casual Cavers
2. Cave-Related Activities
    - 2.1. Recreation
        - 2.1.1. Commercially-Guided Caving
        - 2.1.2. Commercial Show Caves
    - 2.2. Conservation Activity
    - 2.3. Cave Science and Mapping
        - 2.3.1. Bat Science

3. Cave Closures on the Monongahela National Forest
    3.1. The Importance of Access to MNF Caves
        3.1.1. Place Dependence
        3.1.2. Substitutability, Local Alternatives
    3.2. Priority: Bats / Humans
    3.3. Conservation
        3.3.1. Protection
        3.3.2. Cooperation
        3.3.3. Education
    3.4. Management Views
        3.4.1. Relationship with the Agency
        3.4.2. Partnership with Stakeholders
4. Economics of Cave Closures on the Monongahela National Forest
    4.1. Equipment Expenditures
    4.2. Caving Travel Expenditures
    4.3. Caving Activities Associated with the Monongahela National Forest
    4.4. Change in Caving Behaviors
    4.5. Local Economies
    4.6. Additional Costs

The qualitative research approach was employed in this case study to develop deeper insight about MNF caving community stakeholders, the nature of caving activities historically associated with the MNF, the effects the cave closures have had on stakeholders and their activities, and views about MNF management held by the mainstream caving community. Each of the topics in the tree structure is described in depth in this section using text from the interview transcripts for illustration. Qualitative analysis methods produce findings that are somewhat subjective; the reported findings reflect the opinions of the authors about the range of views and behaviors found among the mainstream caving community.

## 1. Stakeholders

All citizens of the United States have stakeholder interest in the management of caves on the MNF. Stakeholders who actively use the forest caves and who take time to volunteer or provide

input to management are often the most familiar with, and the most affected by, MNF cave resource management decisions. This case study research focused on understanding the perspective of one particular type of community-of-interest stakeholder in the cave resources on the MNF - that of the mainstream caving community. From the perspective of the caving community, the findings also provide insight about several other primary types of community-of-interest and community-of-place stakeholders, including casual recreational cavers, cave resource managers, environmental organizations concerned about bat conservation, and local businesses frequented by cavers.

## 1.1. The Caving Community

All nine of the key informants in this case study described themselves as members of the mainstream caving community. They described the caving community as being composed of a diverse group of individuals interested in cave and karst ecosystems. As a group, they described many different ways that they interact with the cave environment - directly in underground activities, and also above-ground through on and off-site cave related activities. The reasons given for being involved in the caving community were also diverse, ranging from recreational and social to scientific and the thrill of discovery. Underlying most of the descriptions of the community was a general appreciation for the natural qualities of cave environments and the overarching priority to protect those places in their natural condition. Most of the respondents described the caving community as being centered around individuals affiliated with organized clubs, but that the community also embraces unaffiliated individuals that adhere to accepted cave environment conservation values and behavioral norms. The organized caving community in the United States was described as mostly being under the umbrella organization of the National Speleological Society (NSS).

The following quotes illustrate positive views about the caving community to which the respondents identified themselves as members. A relatively large amount of text is presented to illustrate this topic - both reflecting its complexity, and also as an opportunity to introduce many of the respondents to the reader. The respondents' identities are kept confidential in this report, but individuals can be tracked in the analysis through their ID numbers that are referenced at the end of each quote (R#1 through R#9).

> "There are people who are not in the organized caving community and there are people who are very much into the organized caving community, which in this country means the NSS. There are people who like to do vertical and there are people who like to do surveying, such as myself. There are people who like to take photographs, people who spend very little time underground but like to look for new caves. Of course, there are people who like very short trips and people who

like very long trips and expeditions. There are people who like water. It is a very diverse community, but then again, every sport has this." R#2

"...caving is fun, but for me it is just as much the community as it is the active exploring the caves.... It is very allusive, but at the same time it is very welcoming." R#3

"I could not pick another community that won't do more for their hobby than the caving community... I can organize a larger group of cavers to get something accomplished...Many activities like bird watching and hiking, they are more solo activities and not group activities." R#4

"I would describe the caving community as a group of individuals that are drawn together by their common love and appreciation of caves and cave ecosystems and going into caves...But, they are a very diverse group..." R#5

" There is the organized caving community and there's the, I would call, the incidental caving community. The organized caving community would include folks like NSS, cave conservancies, and folks whose profession takes them into caves. And, I would include cave managers for state, federal, local agencies, as well as research scientists who's work necessitates they be dealing with caves." R#6

"...They are very adventurous. They tend to be fairly liberal. They are very passionate about the environment…ecological issues, particularly those involving caves, karst, ground water...Cavers tend to be very much more of a family unit as a whole..." R#8

"Surprisingly, there is a lot of knowledge in the caving community. A lot of people are interested in geology and conservation. … It is a pretty well-rounded group and there is a lot of technical expertise there. We have a couple of people with Master's degrees in Information Technology...We have a number of geologists, biologists…the annual NSS convention...has presentations of scientific papers…and they publish a journal of scientific papers and there is a monthly newsletter that has scientific papers. So, cavers…I don't know how to describe them…they are a good group of people who are conscientious and conservation minded." R#9

### 1.1.1. Organized Cavers and the National Speleological Society

Belonging to the NSS, cave conservancies, and local caving clubs (referred to as 'grottos') is an important part of identifying with the caving community for many of the respondents. The NSS, in particular, was described as a leader in promoting cave environment stewardship. The NSS also develops and promotes caving safety practices.

"One of the things the society (NSS) has taken on as one of its responsibilities is conveying and perpetuating a conservation ethic for caves. Valuing the resource and the things within that resource teaching people safe caving techniques, proper gear…" R#6

"The NSS is…because we want to promote more professional image of caving, very safety conscious…the NSS even has a National Cave Rescue Commission. They teach cave rescue techniques." R#8

" I began caving in 1966...I have been caving on and off all of those years and I've been a continuous member of the NSS for all of that time. I was awarded a Fellow of the Society and got a certificate of merit from the Society for changing West Virginia's quarry laws." R#9

### 1.1.2. Independent and Unaffiliated Cavers

Cavers not associated with a local grotto or the NSS were described as independent, unaffiliated, or unorganized cavers. One respondent (R#4) began caving (and still refers to himself) as an 'independent' caver, but he also considers himself a member in good standing of the mainstream caving community. Likewise, some of the affiliated respondents consider many independent cavers to be members of the mainstream caving community; though it was common for the affiliated respondents to attribute independents with having a more casual connection to caves and caving.

"There is another group of cavers, the unaffiliated cavers. These people are essentially independent, some of which are very responsible cavers, some of which are very irresponsible cavers, and for various reasons they have chosen not to be involved in the relatively formal caving community. NSS membership, grotto membership and so forth, they tend to just go out on their own. There are very active and very good cavers in that group that choose to be independent but it also includes a lot of the locals that choose to go out on occasional trips and are sometimes problematic in the caves." R#1

"Unorganized caving could be very sophisticated and it does have a wealth of knowledge, at least locally. I find that most unorganized cavers, or spelunkers, tend to be locals. They tend to have a store of knowledge that sometimes the organized caving people do not have. Furthermore, a lot of unorganized cavers…once they discover that the NSS exists, they immediately join. So, there is sort of a give and take between the two." R#3

"An independent caver is someone who started caving and was not affiliated with national grottos...I think outside the box... As an independent caver, I had my own group of friends...an independent caver is not tapped into that...network of information." R#4

One respondent suggested that affiliated cavers are only a small fraction of the people involved in caving.

"...I would say the unaffiliated caving community is perhaps quite a bit larger...the NSS estimated that NSS members probably make up 5% of cave visitors. Now, that includes forests to show caves but you also have tons of other people who go into caves…Scout groups, camp groups, locals…Any local, rural kid who grows up in a caving area probably knows every hole in the county." R#6

### 1.1.3. Environmental Organizations that Support Caving

Respondents described two specific non-caving stakeholder groups that focus on bat conservation and are concerned about the spread of WNS: Bat Conservation International (BCI) and the Center for Biological Diversity (CDB). Bat Conservation International was described as an ally of the caving community. The primary reason that BCI was seen as an ally of the caving community was the perception that they favore a case-by-case policy on cave closures rather than supporting the current blanket-closure policy (views about the CBD are described within section 1.2).

"I think the NSS and Bat Conservation International have a lot of things in common. I think they are shooting towards common goals." R#2

"They (BCI) focus on bats. We focus on caves...They understand, as we do, the various roles that people play here. Because they understand more about bats, they understand that not every bat is in danger to WNS, that there are species-specific differences, and that bats don't like all caves. And so, for example, they support a targeted approach to cave closure as does the NSS; and that is very different than CBD...I think they feel really good about the NSS...We work together often." R#6

## 1.2. Caving Community Out-Groups

There are two primary types of stakeholders in MNF cave management that were identified by the respondents as having opposing interests to the organized and independent members of the mainstream caving community. These two caving 'out-groups' include 1) certain non-caving environmental groups, and 2) certain unaffiliated cavers.

### 1.2.1. Environmental Organizations that Oppose Caving

Environmental groups that favor blanket cave closures as a response to WNS were portrayed by respondents as conflicting with the views and interests of the caving community. The Center for Biological Diversity's views were described as being bio-centric and their portrayal of issues as being in absolutes with little room for compromise. Unlike the stewardship approaches advocated by the caving community respondents, the CBD was described as being overly focused on litigation rather than on science, education, or direct forms of conservation.

> "They (the CBD) do not have a concept of multiple-use. Their concept is that wildlife is the ultimate goal and the fact that we humans want to use an area is irrelevant. The wildlife has absolute priority...when someone comes out of their law offices or wherever they are without any scientific knowledge or proof, and says 'close everything, no matter what.' That is not very productive." R#1

> "I think they are a bunch of lawyers...people who would actually want to abuse something like the Endangered Species Act to make money...they put absolutely zero money towards research and conservation. They just funnel it back in for more legislation." R#3

### 1.2.2. Unaffiliated Casual Cavers

A second type of stakeholders portrayed by respondents as having interests opposed to those of the mainstream caving community, though still involved in caving, are the unaffiliated cavers who are careless, unprepared, or engaged in depreciative behavior in the cave environment. These cavers were described as outcasts of the caving community because they are seen as a threat to cave environments and to the caving community's ability to continue to participate in caving activities.

> "It is those unaffiliated people, those guys that are going out there and skipping classes and getting into their 4x4 to raise some hell." R#8

The term 'spelunker' was sometimes reserved by the caving community to refer to this out-group of casual or vandal cavers.

> "...just recently, some independent spelunkers…unprepared cavers became overdue and the local mothers and fathers all called 9-1-1, who was smart enough to call the cave rescue guys in the neighborhood" R#4

Respondents described a negative association of caving and the caving community with the undesirable behaviors of the caving out-group. This association harms the image of the caving community with managers and the public.

"…most agencies do not differentiate between cavers and spelunkers. They don't differentiate between the safe conservation oriented cavers and every other person that wanders into a cave with a spray paint can and a six pack in hand." R#8

Respondents attributed the problems caused by the 'spelunker crowd' to a lack of education and to a lack of the type of behavioral norms that are normally instilled by the organized caving community.

"Organized cavers of course respect those closures. Now, unless there was a gate to enforce it the spelunker crowd usually ignored those...there is no communication network. And what about Scout groups, college outing clubs, youth groups..." R#8

## 2. Cave-Related Activities

The mainstream caving community participates in a diverse set of related activities that occur both inside and outside of the cave environment. One respondent described caving activities as belonging to four general types: 1) recreation, 2) conservation, 3) mapping, and 4) cave science. These general categories would overlap for many people. Ridge walking, for example, was described as an activity that provides recreation, entails discovering and mapping new cave entrances, and also encourages conservation by respecting cave closures. However, it may be hard to categorize the meanings associated with participation in these activities for many people; caving was often described as vital to the well-being and identity of the respondents.

"...caves are an integral part of who I am. I find the cave environment one of the most unique and fascinating places on Earth and I have had the pleasure of more than 40 years of caving in different places on the planet. I would say I am one of those who caving borders on religion." R#6

### 2.1. Recreation

Recreational caving activities were described as a casual form of caving. Although, recreational caving was recognized as the primary activity usually associated with the caving community, it was also described as an introductory and transitional activity that often leads to more specialized forms of caving and a greater focus on conservation. The respondents mostly described their own careers in caving as starting with and progressing from a general recreation orientation to a more varied and specialized set of activities and reasons for participating.

"...right now, they (younger grotto members) seem more interested in recreational caving. But, I anticipate that if they stay with caving for a significant period, they

will eventually become involved in various projects. Like I said, clean-ups, bat counts, surveys and that sort of thing." R#1

"There is the purely recreational people…where their primary interest is going into caves and exploring them. They usually go into known caves, usually the larger ones... I got interested in surveying and prior to that I was an occasional caver. That is, a recreational caver…I would go in the larger and better known caves for fun...I saw it as a recreational thing…like how climbers see walls or something like that. My attitude started changing and I quit doing it as a recreational…well, I still enjoy it, but I do not do it as a purely recreational thing anymore." R#7

### 2.1.1. Commercially-Guided Caving

One of the more visible aspects of caving is the commercial development of visitor opportunities. Seiser and Schuett (2006) described a distinct community-of-interest stakeholder group to include individuals engaged in cave-based commercial activities. Respondents in this study identified two particular types of commercial enterprises - guided caving and show caves, and tended to distance the mainstream caving community from these commercial enterprises. Respondents described professionally-guided caving as being similar to other wildland recreation activities where the public may hire a commercial guide. Common examples of guided recreation activities on national forest lands include big game hunting, mountain climbing, sport fishing, and white-water rafting. Commercially-guided wildland caving was not generally portrayed positively by the respondents, though it was acknowledged that guided caving provides an opportunity to introduce casual cave visitors to experiences they might not otherwise get. The primary objections to guided caving included the perception that it commercializes a wildland setting and the concern that large commercial groups may jeopardize sensitive cave environments.

" I am not an advocate for cave for pay...Do I approve of somebody taking $50 from you to take a group of 40 rafters into a cave that I consider of biological significance...No."R#4

"...you have got geocachers, rock hounds, adventure clubs…you know cave for pay, you have all of these profit making organizations that do adventure tours - 'What do you want to do?....You want to go into a cave?'" R#6

### 2.1.2. Commercial Show Caves

Respondents also talked about commercial show caves as providing a distinct recreational caving opportunity. The guided tours provided in the commercial show caves differ from the concept of

guided wildland caving described in section 2.1.1. While commercial show caves may occur on public lands, they have largely been exempt from closures (for example, Mammoth Cave National Park in Kentucky, which receives nearly a half million visitors per year; *Smithsonian Magazine, August 2011*). The reason for these exemptions is perceived to be due to the high economic value of tourism generated from the show caves.

> "...we also have show caves, some of which are important bat caves as well, which are wide open. There is absolutely no control or regulation; and once they touch that 100 pound gorilla, because that is somebody's livelihood… it is easy to close caves that nobody is making money on, but if it is somebody's business then no one is going to say, 'you cannot let people in here anymore,' because there would be all types of uproar from that." R#8

## 2.2. Conservation Activities

All of the respondents described their own orientation toward caving as being dominated by the goal of protecting the cave environment. A number of respondents described their participation in conservation activities aimed at improving the protection and habitat for bats in the caves. With their personal identities as cavers influenced by their focus on conservation, most of the respondents feel that they are allies of the bats in their fight for survival from the threat of WNS.

> "I started out as a recreational caver in the late 70's and got more into it in the early 80's. I turned to cave conservation in the mid 90's and concentrated most of my efforts there...The defining factor was that I wanted to give something back to something I loved, which was the actual cave environment. " R#4

> "...another specific group('s)...primary interest in caves is conservation. So, they focus on clean-ups, they focus on gating caves when it is necessary, they focus on evaluating bat populations..." R#7

> "I am working on trying to further some protection and look at possibly getting some cave gates on to help prevent some of the inadvertent winter disturbance." R#8

## 2.3. Cave Science and Mapping

Geology, hydrology, biology, and mapping are among the science-based caving activities commonly mentioned by respondents. Respondents often described their activities as long-term projects that mutually benefit the caving community, science, and land managers.

"My primary interest in caving is the science and especially mapping the caves. I am a project caver. I tend to go to the caves over and over and work on the maps and so forth. I have been involved in several mapping projects in and around the (MNF) forest." R#1

"I helped at the end with the Tucker County cave survey. That was a project to map all the caves in Tucker County, a fair percentage of which are on MNF land. And, the project could not have been completed without the cooperation of the Forest. That represents a resource both to the forest and to the caving community." R#3

"I like to spend a lot of time ridge walking and finding where the geologic formations outcrop and then where you find caves and holes. And why? I just kind of lean to the geology." R#5

"(There are) people interested in mapping caves and understanding the hydrology of an area...finding new caves, surveying them, and frequently doing dye traces to try and figure out where the water is and what the water is doing." R#7

Several of the respondents described the effect of the MNF cave closures as a lost opportunity for science and for research partnerships, for example, with the local university.

"In the forest (MNF) there is still stuff we just do not understand about what is going on there. We have a great university nearby and a chance for partnerships between the university and the MNF that would be mutually beneficial. And, they are being put on hold for the foreseeable future." R#3

"I think the caving community had been at the ready to gather data on caves before WNS hit. And then when WNS hit, it was like now they cannot even do that." R#5

"I am very environmentally oriented but I am also very practical. I just do not think that keeping everyone out of the caves is going to be a cost-benefit thing for them. While the caves are shut down, you are losing all the research that we could have been doing…and I am not getting any younger. If we still had this year's mountain project, we could have been able to find more caves, done more surveying and dye testing…and you are missing out on that." R#9

One respondent was frustrated with scientists for exhibiting a sense of hubris about honoring the cave closures.

"...that is a real particular bone of contention because I, as a caver, have observed that many in the scientific community did not stop what they were doing. I watched them go in and take their biological samples and I watched them go in and take their core samples...they still trespass without asking the landowner, but that is a

whole other bone of contention that I have with the scientific community...I think that they feel like they are above the rules." R#4

### 2.3.1. Bat Science

Respondents described the caving community as supportive, both financially and through caving activities, of the advancement of bat science. Some respondents described caving activities either centered on or beneficial to the advancement of knowledge related to bats and the WNS. One respondent described cavers as the eyes of bat science, while another described their own increased interest in the science of bats that has resulted from their concern about WNS.

> "I have done the bat counts in Trout Rock Caves for 25 years now, and that data has been made available to anybody interested, including the West Virginia Department of Natural Resources, the Forest Service, and those who are doing various studies. So, any data we do is always given to the appropriate landowner, whether it is the Forest Service or a private landowner." R#1

> "...we probably are helping the bats…if it was not for cavers we would not have known about WNS in a lot of places...Saving the bats is the name of the game. We are the eyes of the scientific community. I might go in a cave that a scientist never saw before because it is a new cave and I might discover a hibernaculum or something." R#4

> "...with WNS hitting the bats I have to say…over the past four years, I have become pretty knowledgeable about bats and specifically all the research that is going on with WNS." R#6

> "...most bat biologists did not really know where the little browns or the big browns were...They were interested in the endangered bats. The cavers knew where the little browns were and still do. So, that is kind of a way…the information gets shared...Most of the caves are known…on the national forest are known, because of people like me…because of cavers. " R#7

> "Most of the research has been done on WNS and has been privately funded. It is money the NSS is raising, it is money being donated by cavers to try to find some answers to these questions." R#8

## 3. Cave Closures on the Monongahela National Forest

A number of different types of impacts were attributed to the current MNF cave closures. Respondents reported that specific MNF caves were important to them for reasons including

recreation, sharing with and educating others, introducing young people to caves and caving, as laboratories for science, and as sources of inspiration. As public places, the MNF caves were described as serving important unique functions in terms of access, land owner relations, and wildland experiences. According to respondents, the cave closures have resulted in a loss of protection, as the stewardship and protective role formally filled by the caving community has been put on hold. The closures have resulted in dissatisfaction among the caving community, but all of the respondents expressed their desire to work with the agency in the future to improve relationships between managers and cavers.

### 3.1. The Importance of Access to Monongahela National Forest Caves

The direct effect of the MNF cave closures is the displacement of cavers from the places that they used in the past. The MNF was described as offering a variety of caving opportunities prior to the closure. Some of the caves on the forest were described as very accessible, some more wild, and many not easily substitutable.

> "...there are actually two caves that are very important to me (on the MNF). One is Bowden...The other cave that affects me a lot is the Cave Mountain cave...The D.C. Grotto would typically run one or two tourist trips a year there to introduce new cavers and so forth. The loss of those two caves has hurt because they were both popular caves and fun caves for introducing people to caving..." R#1

> "I know people are going caving less each year and people are being more careful with where they go caving. The richness of the variety of going caving has suffered. The few caves that are still opened have suffered from increased use...The student grotto used to use Bowden cave as it is beginner cave trip every start of September. It was a great cave because it is close to the camp, which was at Stuart Recreation Area, and it was a really safe cave to bring brand new people to...Bowden cave was also used for class…WVU has a karst class that teaches senior local geology students and grad students about karst." R#3

#### 3.1.1. Place Dependence

One respondent provided a good description of the effects that cave closures have had on them, personally. They described their activities as being particularly dependent on specific MNF caves.

> "So, the caves on the national forest land are definitely important to me and to what I do. Not being able to go into them has definitely negatively affected what I do...speleology...It is new knowledge…it is finding something nobody has known before...There are many

opportunities in the national forest for doing that…I and the people I do this with are closed off...I have this drive to discover new things and to understand puzzles...On private land, that is very hard to do because of the permissions that you have to get from one property owner to the next…unless a property owns some huge piece of land...That is how the national forest is really great because we can see where the water goes in underground and we can see where the water comes out…which may be 600 feet away or 1,000 feet away. On private land we cannot do that." R#7

### 3.1.2. Substitutability, Local Alternatives

The closure of MNF caves has had effects beyond the forest. While cavers have modified their activities in response to the threat of spreading WNS, many of them continue to seek opportunities to go underground. West Virginia is widely known for its caving opportunities, both on and off public lands. Local landowners have responded in different ways to the Forest Service cave closures - some following the lead of the agency and some going against it. However, public lands offer a level of access and a sense of belonging generally unavailable on the private landscape (for example, the ability to hike cross-country and camp). A critical aspect of the role of the caves on the MNF is the level of access they offer to the local and regional public. The public will not wear out their welcome through continued use of their own national forest lands.

"Other caves are taking the slack to some extent. But, a fair number of them have been closed due to WNS or landowners. Yes, you can find alternatives, but they are not as popular; and you do not want to wear out your welcome with landowners and go up to them every day and bang on the door and ask the farmer to go into his cave and things like that." R#1

"If you think about caving, especially in this day and age, you are essentially asking a random stranger to go onto their property and do some things, in their point of view, as dangerous...The closure of those caves puts a strain on other caves. I am from the Northeast, and the change in access in West Virginia is something I am very familiar with... The few caves that are still open have suffered from increased use...One of things that totally blew my mind was the idea of being able to camp for free in parts of the MNF. I am from New Jersey. The idea of camping free anywhere is incredible..." R#3

## 3.2. Priority: Bats / Humans

The closure of caves on the MNF was not popular among the respondents. However, they were all in favor of taking steps to protect the bats. They were likely to prefer policies that are more

targeted at specific caves with critical bat habitat. They also pointed out that there are tradeoffs with the closure policy that should be acknowledged - excluding people to protect bats negatively effects the caving community, and possibly the caves themselves.

> "I think it is still appropriate to have closures on significantly large bat colonies in the forest (MNF); but on the same token, closing caves where there are no bats or very few bats is not going to make a difference when cavers…or people who visit caves decon (decontaminate equipment)...And, in terms of the caves that have very few bats, are the caves that have a lot of human visitation. So, you are really looking at two different populations that is there…of caves. I think that with the additional information, hopefully the forest will make an informed decision...Each cave is different as to which side you lean on." R#3

> "The bats in my mind come first...Even though I would like to have caves opened, if it jeopardized the bats, then I want it closed tighter than a drum. The only thing I could request is that the MNF…certain caves on an individual basis are recreational in nature and if you do not allow these recreational caves to be open, the non-conservation types of people are going to find another cave that may or may not be sensitive to utilize. " R#4

> "I think (we need) a hard look at whether the closures are actually having the desired effect on bat protection or reducing risks to bats compared to the effect they are having by people not going in at all." R#5

### 3.3. Conservation

The caving community has historically been involved in conservation of cave environments. Most of the respondents described their long-term commitment to cave conservation in general and also to the protection of specific caves. With the closure of access to public caves comes a sense of a loss of connection to the places targeted for conservation.

> "Conservation through prohibiting access all around is not really conservation. That is not what Teddy Roosevelt had in mind when he started the National Park System. He wanted something people could enjoy in perpetuity. Not something that was locked away that no one could ever see." R#3

### 3.3.1. Protection

Respondents described one of their roles in conservation as providing protection to the caves that they visit. Without the presence of the caving community, caves can be vulnerable to trespass and damage from less conservation-minded members of the public.

> "I am sure for some people keeping them closed feels like a way to keep the caves safe, but it is actually, in my opinion, counterproductive because it keeps people who are interested in caves away from those areas. People who are interested in the conservation of caves...cavers actually reduce vandalism because of our presence…because people will not spray paint caves when cavers are around...It is a crazy catch-22 where the people who do not care go into the caves because it is not well enforced. And the people who would never violate that will not go into the caves to clean them up." R#7

> "It kind of bothers me because while I am staying out of caves, people still go in caves...I believe that if I had been caving along with other responsible cavers, instead of staying out like we were requested, that the vandals would not have been there because of our presence." R#4

### 3.3.2. Cooperation

Perceptions of a heavy-handed approach to protection of bats through blanket closures can discourage the public's trust and willingness to cooperation in conservation. Respondents expressed a concern that landowners and members of the caving community will not cooperate with conservation efforts out of fear of loss of control of places and activities that are important to them.

> "...many cavers are afraid to tell…because of the CBD (Center for Biological Diversity) and people like that…they are afraid to tell anybody where the bats are because they are afraid that there will be some sort of violent reaction against…you know, close the caves down...the landowner let us go in to survey the cave under the condition that we not tell anybody about any bat we found because they are afraid that if there are endangered bats found in their caves that the caves will be confiscated or forced off their land." R#7

### 3.3.3. Education

The closures were described by some as a lost opportunity to educate the public about cave conservation. Education makes caves and bats relevant to people. First-hand experiences can lead to more dedicated conservationists.

> "...we had a lot of people who would have never really gotten into caving without those weeknight trips. And that kind of represents a lost opportunity from our point of view. The more people you get educated about caves, the easier it becomes to sell the idea that caves are worth protecting and caves are worth conserving." R#3

> "... the actual loss of the educational ability to get this younger generation to respect caves and our natural resources is lost...losing the ability to show them even one limits my ability to instill my conservation ethic." R#4

> "There is a spectrum and the person who gets introduced and sees things and experiences that nature first hand is always going to have a higher value and be more committed to protecting it than someone who just saw it on TV, for example..." R#6

## 3.4. Management Views

The relatively recent involvement of the Forest Service in major policies influencing the caving community has brought the agency to a new level of awareness among cavers.

> "It was not until WNS hit that I sort of became cognizant and aware of the Forest Service as a cave agency." R#6

However, cavers are accustomed to being on public lands and they seem to have a realistic understanding of the obligations of land managers to protect the public good.

> "...managers have to make these kinds of decisions. Sometimes I agree with them and sometimes I don't." R#5

While the respondents all described the caving community as very supportive of bat conservation, the blanket closure policy on the MNF has resulted in dissatisfaction with management. Some of that dissatisfaction can be characterized as cynicism about the motives for the blanket closure on the forest.

> "...it is a whole lot easier to say that everything is closed. There is no issue with having to worry about which cave is open and which cave is closed." R#1

> "I think there are some people in Forest Service units that are like…it is an easy administrative thing to do to close because I do not have to go into the field and

check. I would say that is less than sincere...I think the blanket orders and the orders coming out of Washington D.C. have struck me as being taken by people who did not really know the caves and the bats. " R#6

### 3.4.1. Relationship with the Agency

Dissatisfaction with the approach taken by Forest Service managers can have lasting effects on attitudes toward the agency. Long-term public trust can suffer from dissatisfaction with relatively short-term policy decisions, and that trust is slow to return and relatively difficult to rebuild. Some respondents recognized the difficulty that managers are faced with in providing for public access while protecting the resource, and they seem more likely to maintain trust in the agency over the long term. Other respondents described growing distrust among a few cavers that is likely to remain in the caving community for a long time.

"I do not think that blanket closure is helping the caving community with the caves and it is alienating people from the Forest Service and government too...The Forest Service in the ninety's and in this century has come a long way from where they were...I am starting to think that they are drifting back to where they used to be. " R#2

"There is always going to be some people that just hold a grudge and (say) 'well, I am never going to work with the Forest Service again.' But, I do not think it is the majority…I think it is very few." R#5

"...cavers are an easy target. And they feel much put upon because of that. There is a great deal of disparity in the closures right now. That is part of the problem...It is going to take someone...going to meetings, bringing cavers into your office for meetings, working very closely to rebuild those relationships." R#8

"I would probably do the same thing and close them…especially if I were not a caver. If I were the person in charge, it is a safe approach to take. I do not agree with it...I would have closed them at first, but now I think I would start opening them back up. And I am not saying that to be selfish, but I do not think keeping the caves closed is doing any good as far as protecting the bats...I think I would limit it to organized caving." R#9

### 3.4.2. Partnership with Stakeholders

While the caving community may be dissatisfied with the Forest Service's forest-wide cave closures, many of the respondents described a desire to improve relationships with the agency.

One respondent described being more motivated to become involved in the public participation process. They are dissatisfied with the current policy because they were not asked for their input earlier. Others described dissatisfaction with being excluded from the solution as well as the decision process. The caving community considers its members to be among the experts in cave and bat sciences. Respondents described cavers as the segment of the public most involved with, and most sincere about, cave and bat conservation. They would like to be involved in the solution.

> "...it probably means that I will participate more, and this interview is a prime example. Did the federal government ask me ever my opinion in the past? No. Unfortunately, WNS came along and as a conservationist I would like to think that my opinion is highly respected, if not agreed to, on issues such as this." R#4

> "...there is a very large and passionate group of volunteer expertise out there and people who would like to help and be part of the solution and like to come to some collaborative management; and right now, that group is feeling extremely alienated. They would like to do something but are pretty much shoved into the corner and asked to shut up. That is not very productive for anybody. I think there needs to be some way to engage both the agency managers and some of the users…particularly the knowledgeable users, not the spelunkers…I am not talking about the beer drinking, spray painting kind of guys…there is help available that is not being taken advantage of." R#8

## 4. Economic Values of Caving

Caving-related activities contribute to the economy in several different ways; from the purchase of equipment and clothing, to travel-related purchases of gas, food, and lodging, and to in-kind labor contributions for on-the-ground cave science and conservation efforts. As caving comprises a diverse set of activities and participants, spending patterns and related impacts also vary considerably. In estimating the economic costs of cave closures on the MNF, it is important to understand the characteristics of expenditures related to caving, the overall amount of caving in the area, and the change in caving-related behaviors that resulted from the implementation of the management policy.

The greatest amount of money spent on caving for many people, particularly as they become more specialized, is likely to be for equipment and clothing. Other individuals, especially those starting out, may use club equipment to cut costs; expenditures by this type of caver are more likely to be related to travel - which could be considerable on a per-group-per-trip basis, given long distance and large group sizes associated with some club weekend outings. While most equipment purchases are made in the home community or through mail order / on-line shopping, travel expenditures are made in numerous places along the way, with communities closest to the

destination most likely to receive these types of purchases. Cavers also reported volunteering significant amounts of effort to cave-related projects on the national forest. The cost of hiring the labor contributed by cavers would be prohibitively expensive for managers; and yet, most of this type of volunteer work is no longer being done on the forest.

> " I cannot afford to hire people to get that kind of cave research information (provided by volunteer cavers). There is just not that kind of funding that comes to Minerals and Geology." R#5

4.1. Equipment Expenditures

For cavers who are not members of student-type clubs that provide specialized equipment, the cost of purchasing gear can be substantial. Cave closures have influenced the patterns of equipment purchases in two contrasting ways: first, some individuals are spending less on equipment for caving because they are going underground less; second, some individuals are spending more on equipment as they are purchasing separate gear for different areas so as not to transport *Geomyces destructans* spores to uninfected hibernacula. As much of the equipment is specialized for caving, typical purchases likely occur at businesses that cater to the sport. These types of businesses are not likely to be located in small communities near the MNF. However, equipment purchases can also include common items, like batteries and gloves, that are more likely to be purchased locally as needed.

> "...most of our caving equipment is bought locally (at home). Or it is going to be bought on the Internet or whatever, so we are not spending that kind of money...I am going to guess what I spend on lights, batteries, coveralls, boots, and survey gear because it gets worn out… I am going to say $250-$300 a year on tangible gear. And yes, that has dropped over the past couple of years because I hav been doing less caving...I am not trashing as much gear." R#1

> "Well, one of the benefits of being in an organization like the grotto, especially a student grotto, is that college students tend to be poor and the grotto provides a lot of the expensive equipment. We provide licensed helmets, vertical gear…that is about it. That is a lot of money for a college kid. To be able to do that without the start up is a great benefit. A lot do not buy cave gear until they are done with college. They continue to use the gear for four years. And, that is fine. They pay $15 a year in dues and we get a bit of money from the student organization that we use to buy gear." R#3

> "Well, we are pretty simple cavers since we are not vertical cavers, so we do not really have very much stuff that we buy. I would say $100 or less for me, per person." R#5

"I probably spend $500 a year anyway (on equipment)...I have got sets that I use in WNS areas and sets that I use in non-WNS area. So, I have had to double." R#6

"…what we normally do requires cave suits, but it is really hard on those. Most of us will go through one of those cave suits every two years or so and they cost $100-$120...the average caver I would say…they usually spend a good $500 on equipment... with a vertical caver who does surveying…I would say the average person spends about $1,000. Some of that, you keep it for years and years, but other people go through it fairly quickly and replace it gradually; so they are not spending $1,000 at one time, but they definitely spend a lot of money." R#7

"I have got a helmet that probably costs around $85…a light for $250…a back-up light for $50…packs that range anywhere from $50 - $100…ropes which are hundreds of dollars…wear and tear on the vehicle and gasoline…Vertical gear is expensive…I have got a rope walking system and other repelling devices. For a year...typically I spend at least…$500 a year." R#9

## 4.2. Caving Travel Expenditures

Many cavers travel considerable distance to caves in West Virginia and the area around the MNF. One respondent jokingly pointed out that West Virginia is very familiar to cavers in the Northeast, where it is referred to as the 'holey' land. Other respondents live close to West Virginia caves that they frequent, and so tend to travel less and spend little compared to more distant visitors. Travel behavior of cavers often resembles the activity and expenditure patterns of typical national forest wildland recreation visitors. Many respondents described camping, rather than hotel stays, as typical of their more distant caving trips. Most respondents reported eating along the way in restaurants, and frequently reported using local restaurants while camping on the national forest.

"You leave Friday night, so you have gasoline to get to the cave and you have got food for Friday night. Of course, you have food for the cave that needs to be bought ahead of time...you may have to pay to spend the night somewhere Friday night. On Saturday, you have got food, gasoline, another night staying somewhere, and then Sunday you come home. So, with today's gas prices, gas is the biggest factor...my hours on the ground on the MNF are relatively few, but the hours getting there and doing ridge walking and literature searches…boy, those really add up." R#2

"Obviously gas, and batteries for your headlamp. Usually, especially if it is a day trip, whichever town is near us...if we are in West Virginia then Elkins, and we would have dinner there...If it is down in southern West Virginia we would probably stay at WVACC (a grotto-owned bunkhouse) then get breakfast on the

way home; or if we camped then we would go to the local grocery store and purchase food." R#3

"In terms of economic impact, you can talk to Mark Burke at the Alpine Lodge…we spent a large amount of money. We would eat breakfast there. We would usually go and eat supper there when we got out of the cave or we would go into Elkins and eat supper. We would buy our supplies at the local Krogers in Elkins or occasionally Wal-Mart, but usually Krogers. And of course we bought gas at those places as well…both Parsons and Elkins. Now, we definitely spent money, but we did not usually spend the night in hotels or anything…although, there was at least one night that I did. I spent the night at a motel in Elkins because of the weather. So, we are not a major economic factor, but we definitely end up spending money in the local communities...Groceries, mostly groceries. We will occasionally buy a piece of equipment…I bought a shovel once at Wal-Mart. I forgot my jacket once and ran to Wal-Mart and bought a jacket just so I'd have a jacket. We used to frequent the Army Navy Store that is now closed. I would buy coveralls, socks, and all kinds of stuff there. Occasionally, we will buy knee pads from Wal-Mart or leather gloves." R#7

"We always ate somewhere. Gas or sometimes you had to go buy supplies like batteries or propane fuel or things of that nature. It depends. One of the reason we made so many trips was it was not a very expensive activity. Cavers are notoriously cheap. And so, it is one of those appeals - that counter culture kind of thing, because you don't need a lot of stuff. Once you have your basic gear (your helmet, your lights, your pack, your kneepads, your vertical gear and so on) pretty much all you need then is your travel money." R#8

### 4.3. Caving Activities Associated with the Monongahela National Forest

Respondents described their typical caving activities in the area around the MNF - both before and during the cave closures. Many of the caving trips occurred over weekends and included camping. Those living outside the area had stories about periodic organized trips to the MNF for caving. Others described local student trips from the university, or trips with groups like the Scouts. Most of the respondents also had a history of going on less organized and more personal trips to the area for caving activities. The frequent descriptions of traveling long distance and staying overnight suggest the high value of the area as a regional (not just local) caving asset.

"...it is about a three and one-half to four hour drive for me to get to West Virginia to the MNF caves. So, typically we do not do it on day trips, we sometimes do, but it is a pretty long day. When we come out, depending on where we are going, for example if we are going to Bowden, we end up staying in a motel in the area.

If we come in Friday night, eat dinner on the way, stay in a motel on Friday night and go caving on Saturday and either come back Saturday night or maybe stay another night. For the Cave Mountain cave in Pendleton County, the Potomac Speleological Club has a little farm house they lease, and so it is available for cavers. And so, again, we would typically get in on Friday night, stay in the PSC field house on Friday night, go caving on Saturday, come back to the house on Saturday night, and then head home on Sunday... we try to limit the trips to a dozen or 15 people...If we are doing mapping trips and so forth, the teams are typically three or four people. We may have multiple teams, but typically each team is made up of three or four people" R#1

"They are usually one-day trips and usually horizontal trips. Most of my trips usually have some sort of educational aspect to them and that gets divided into three categories. One, it is research; two, it is education - bringing people who want to know about caves; or three, I am leading beginners through a cave and having them get a feel... If we stay overnight it is usually camping...Although, we have had trips where we have been snowed in, so we would go to a movie or go bowling. We are most likely camping out, enjoying nature and coming back a few days later. " R#3

"My husband and I, maybe a couple more people...A day trip. From the house to go to the cave…you know, an hour or two drive wherever we are going. Do our thing…you know walking…at this point...otherwise it would have been be going into a cave and coming back out. And then, we will often stop and get something to eat on the way back home somewhere out there wherever we are. So, it is a day trip...We can go home when it is going to rain...We will take our own stuff for snacks, but we almost always eat on the way home." R#5

"...these are annual pilgrimages (to the MNF) and they are on extended Memorial Day weekends…On average, 12-18 people stay for five days and four evenings...The one I was on, there was 26 of us...Cave all day and soak all night. There is an outdoor hot tub...Well, I am coming from Vermont. And, I meet with a couple of the folks in the Albany area and we go there…so, probably 14 hours one way... There is so much there that you can spend a lifetime caving in that region (the MNF). And it is why it is such a Mecca for cavers." R#6

"... we would drive down, camp out, and in terms of the local economics of the area we would go to restaurants... with Shavers Mountain and Tucker County… Most of us would come down Friday night and leave on Sunday...it was about at least six people usually." R#7

"Most of them were weekend trips. It was still a four or five hour drive from

Pennsylvania where I lived. So, day trips were not really feasible. Normally, we would come down and stay either in the Elkins area or Marlinton or somewhere in between depending on what area we were going to...in Elkins, we had friends and could stay at their house but most of the time we would stay in a motel...Three or four people. Occasionally, we would have seven or eight people...Mostly it was strictly a caving trip. You get off work Friday, drive down Friday night, cave and hike all day Saturday and drive back Sunday. Sometimes we would do touristy things but they tended to be outdoors touristy things like hiking around Spruce Knob." R#8

## 4.4. Change in Caving Behaviors

Concern about contributing to the spread of WNS along with the cave closure policy on the MNF have influenced respondents to modify their caving activities both on and off the forest. Many respondents reported caving less because of WNS and the closures, some said they were more likely to access caves on private lands, and others have changed their focus to above-ground activities. There is concern among some respondents that reduced opportunities are contributing to reduced interest in caving - both among those already caving, and among a new generation that is not being introduced to caving.

"... until the last couple of years, I typically went caving twice a month and the average trip in the cave was about five or six hours. Since WNS hit and since I have gotten a little older, my caving has dropped down to every couple of months, plus I do a lot of bureaucratic things at home. But, as far as active caving, I would say an average of every two months." R#1

"...prior to WNS, I would try and go twice a month... Ideally, I would like to go caving once a month at this point... For people living in the Morgantown area, Bowden cave, in particular, was a very useful cave... The closure of those caves puts a strain on other caves." R#3

"I personally have been staying out of caves on a recreational basis since WNS came into our neck of the woods, which has greatly reduced my conservation capabilities... I do not take any Scouts caving. That means I do not take any beginners caving and teaching them the conservation aspects of caving... The MNF closing caves prevents me from showing…I am not going caving, so I am not teaching these kids. It is a trickle effect...When it first came out, what did I do? I organized ridge walking and sinkhole clean-ups. And as the Common Wealth of Virginia has eased their restrictions, I then started caving in one specific Virginia cave...We have lost some of our caving community. They have gone from being active to arm chair." R#4

"I am not an every weekend caver devoted to caving. I like to do the ridge walking part as my bones have gotten older. So, less and less underground till the cave closures, and then I kind of stopped going underground... I think people are caving and getting access to caves on private land, and there are a lot of caves on private land." R#5

"It has limited, for example in Randolph County, it has limited what we can do to what is on private land so it has significantly reduced the number of days I cave." R#7

## 4.5. Local Economies

The economic effect of a loss of caving opportunities on the MNF and the effect of the cave closures have certainly been felt by specific local businesses.

"Elkins is the closest to Bowden and it is a pretty good size town, so my guess is the impact on Elkins economically is pretty small. The Cave Mountain cave is near Franklin, West Virginia, frankly Pendleton County only has eight or nine thousand people, and Franklin is probably only several hundred. So, the fact that there are lots of caves in that area, including Cave Mountain, and many of those were closed for WNS. There has been a precipitous problem, I believe, in cave visitation to the town. The town is very caver friendly. They know cavers, and they like them..." R#1

Though not typical of most caving trips, the following description provides a good indication of the potential caving-related economic impacts for particular local businesses.

"Another example of the impact (to the town of Franklin and Pendleton County) would be Slygo Grotto, the social club in the D.C. area. They use to run a winter trip to Franklin, sometime in January or February every winter. They had a fairly good number of people and would rent six to eight motel rooms in Franklin for two nights; Friday and Saturday night. They would go caving on Saturday then go to dinner, and stuff like that. And because the caves have been closed for a couple years, they have not had their event in Franklin. So again, I would assume that the motel noticed that they were not there and would probably welcome them back. One of the caves they went to was Cave Mountain Cave." R#1

While it is difficult to quantify total economic activity associated with caving in the area surrounding the MNF, the stories told by the respondents provide insight about travel characteristics and the nature of local economic impacts.

## 4.6. Additional Values

There are costs associated with the cave closures on the MNF that go beyond reduced revenues related to equipment and travel-related expenditures by caving participants. Additional costs that were mentioned include lost opportunities to introduce people to nature, reduction of progress in science, less volunteer stewardship work, less variety of recreation opportunities, a loss of protection of caves, and a decline in interest in caving activities.

> "...there are lost opportunities for kids to have an enjoyable day - seeing an environment they have never seen. There are lost opportunities for novices to learn about the caves and the groundwater that goes through the caves. There are lost opportunities for people to do research, and the people that come out of the blue and become good cavers - they are losing that opportunity." R#2

> "I know people are going caving less each year and people are being more careful with where they go caving. The richness of the variety of going caving has suffered. The few caves that are still open have suffered from increased use regardless of the vandalism issue... It puts a strain on the caves that are left. It puts a strain on landowners that are on the fence of letting people cave and it just makes everything generally all around more difficult. I do not think it is actually helping the caves that are being left open or the ones being closed." R#3

> "...when I say a cave's recreational value, that is a range from the person who thinks 'Wow this is really fun' to the kind of caver that actually caving is pretty much a religion. It is almost like a religion. It is something they need for their own self health." R#5

> "...it stopped the Shavers Mountain karst survey in its tracks because that was all on national forest land... in Tucker County for example, we found numerous potential caves... but we could not go in to check them out. So, it did impact that and it has... limited...what we can do to what is on private land, so it has significantly reduced the number of days I cave... I used to frequently take groups into Bowden Cave and that was recreational. And I mean like church groups or occasionally Scout groups. While that was recreational, it was educational as well. I had a certain route I would follow and we would discuss bats and discuss the hydrology of the system and why it occurred, the history of the cave. I sort of acted as a tour guide. So, that has been lost.... So, the caves on the national forest land are definitely important to me and to what I do. Not being able to go into them has definitely negatively affected what I do." R#7

> "We had done some restoration work in West Virginia where we visited 20 caves or something like that…quite a few of them on the MNF...Then WNS came along and the agencies got very nervous about people going into caves…particularly in

hibernacula and pretty much shut down that whole project, which was unfortunate because we had quite a few successes." R#8

## Local Economic Impacts of Cave Closures on the Monongahela National Forest

Consideration of caving values summed across the local region provides an idea of how the cave closures on the MNF could influence the economy of the area surrounding the forest. Because little is known about the amount of past use of wildland caves on the MNF the following analysis first assesses overall wildland recreation use of the forest and then describes potential impacts of the cave closure policy in terms of incremental change in overall use. The information obtained from the interviews in this case study along with consideration of membership participation levels in the National Speleological Society provides context for the analysis. However, a lack of historic wildland cave use figures prevents accurate estimation of the overall economic impacts resulting from the cave closures on the MNF.

If a particular policy changes the amount or type of visitation to an area, the change in associated spending in the local economy results in an economic impact attributable to that policy. Economic impacts are usually described in terms of total value added, income, and jobs; with these measures typically reported by industrial sectors like services, retail sales, wholesale, transportation, and manufacturing. Different activities on a national forest can impact the local economy in different ways. For example, comparing economic activity in the local area resulting from timber sales and recreation visitation would show differences in the types of jobs supported by each across different industrial sectors; timber related employment would be more concentrated in transportation and manufacturing sectors while wildland recreation related employment would be more concentrated in services and retail sales. This section of the report considers the information provided by the key informant interviews described in section 4 along with additional indicators to provide a local economic context for the impact of the cave closure policy on the MNF.

The focus of this section is on economic impacts to a local region resulting from recreation visitor activity on a national forest. To understand impacts of cave closures, it is necessary to define the local economic region, assess caving-related activities and expenditures in that region, and then use an input/output model of the economic activity to estimate impacts. The economic analysis in this report considers local caving expenditures and their potential impacts using two tools: 1) the National Visitor Use Monitoring Program (NVUM) visitor statistics reports; and, 2) the Money Generation Model (MGM) input/output economic impact modeling software. These tools are briefly described in the following sections. In this case study, they are used in combination with the interview data to describe the local economic context of the cave closure policy on the MNF.

Caving-Related Expenditures and Values in Impact Analysis

There are several ways that caving-related activities can contribute value to a local economy. Section four describes three types of economic values associated with caving: 1) in-kind contributions to stewardship and science; 2) purchases of specialized equipment; and, 3) travel-related expenditures. Ultimately, only a subset of these values are suitable for consideration in this local economic impact analysis.

Of the potential sources of caving-related economic impacts, in-kind contributions of the caving community to further public goals are the most difficult to quantify; and these activities are likely to represent substantial potential benefits (or potential lost opportunities) to management and science. As described in section 4, some of the stewardship activities of the caving community have continued on the MNF (aboveground) during cave closures. However, key informants described a number of lost opportunities and costs as projects have been halted and caves have suffered from a lack of protection. Our understanding of these potential benefits from in-kind contributions is currently limited to the qualitative descriptions from the caving community and the first-hand knowledge of managers about the value of past cave stewardship projects in which the caving community voluntarily participated.

As with in-kind contributions, expenditures by the caving community on specialized equipment are mostly excluded from the economic impact analysis in this section. Equipment expenditures are excluded for two reasons. First, there is conflicting evidence as to whether or not closures on the MNF have reduced or increased overall equipment expenditures by cavers. Evidence presented in section 4 suggests equipment purchases by the caving community have declined in some cases but have increased in others. Some cavers have reduced their caving activities (and their corresponding need for equipment) as a result of the cave closures on the MNF. However, other respondents reported that they continue to participate in caving off the forest. They described the need for additional equipment rather than less because they now need more sets of gear to avoid cross-contamination between caves, and because decontamination procedures contribute to increased wear, resulting in the need for more frequent replacement of equipment. The second reason that equipment purchases are excluded from consideration in this section on local economic impacts is because the purchases for specialized gear are more likely to occur on-line, in specialized retail outlets located in larger cities, or in the home community of visiting cavers, than in the more rural local economy immediately surrounding the MNF. Incidental purchases of equipment made while traveling to caves (like gloves and batteries) are included in this economic impact analysis, but only if those purchases are made in the local economy by nonlocal visitors.

*Visitor Expenditures and the Local Economy*

The primary data used for economic impact analysis of wildland recreation activities are the travel-related expenditures made in the local economy by nonlocal visitors. Expenditures made by local residents are generally excluded from this type of impact analysis because they do not represent the introduction of new money to the local economy. According to convention in regional economic studies, a particular expenditure by a resident represents a choice among local alternatives that 'rearranges' existing monetary resources but does not generate new wealth. Unless the local person is forced to go outside of the local economy for an alternative purchase, there is no impact to the local economy from a loss of a particular expenditure opportunity. In contrast, the same expenditure made in the local area by a nonresident brings new resources into the area, and therefore, represents an impact or change to the economy. The stories told in the qualitative interviews suggest that local cavers have greater knowledge and access to local caving alternatives off the forest. Because they have more local alternatives than visiting cavers, residents are more likely to continue to recreate and spend money in the local economy in the face of MNF cave closures.

The definition of a local economy is somewhat arbitrary, as functional economies are more like ever-expanding networks of connected transactions rather than isolated islands of local economic activity. Many economic impact studies define local economies along municipal or county boundaries. As the MNF spans a number of county boundaries, a more suitable definition of the local economy may be found in the guidelines of the US Forest Service's National Visitor Use Monitoring Program (NVUM). The National Visitor Use Monitoring Program defines local visitors as those living within 30 straight-line miles of the forest visited. Applying this distance standard to the current impact analysis results in a local economy extending approximately 30 miles in a band around the national forest. Applying the 30-mile radius definition to the local economy of the MNF describes an area that is intuitively identifiable as local and also provides a convenient way to tie the visitor expenditure information from NVUM to this economic impact analysis.

Economic Impact Analysis Informed by the National Visitor Use Monitoring Program

The US Forest Service's National Visitor Use Monitoring Program provides estimates of visitor characteristics and use across the entire National Forest System. Since 2001, NVUM data have been systematically collected on every national forest in five-year cycles, with results from the second cycle - representing visitor use data through 2009, now available online at (http://www.fs.fed.us/recreation/programs/nvum/, accessed 05/06/2012). The NVUM program provides information about visitor use volume and visitor characteristics that can be used in economic impact analysis, including trip purpose, length of stay, group size, travel patterns, and expenditures by type. As a large national program, NVUM provides the best available data on

use levels and visitor characteristics for most National Forest System (NFS) lands. However, as a national program, NVUM has limitations when applied at the local forest level and it cannot be applied at the local site or district level or to specific local activities. In addition to geographic scale limitations, NVUM data cannot be compared between the first and second rounds, as the methods were adjusted based on the experience of the first cycle. Future NVUM data should be more directly comparable to the second round results.

## Economic Impact Analysis Using the Money Generation Model

The Money Generation Model (MGM), developed primarily by Daniel Stynes at Michigan State University, is used nationwide to model economic impacts to local areas adjacent to units of the National Park Service. The MGM model was developed to estimate the impacts that national park visitors have on local economies in terms of their contribution to sales, income, and jobs in the area. The MGM estimates an input / output economic model to calculate industry multipliers in the local economy. Documentation and software for the Money Generation Model are available free of charge at the Michigan State University website (http://web4.msue.msu.edu/mgm2/, accessed 05/06/2012). The model can be used to estimate impacts of recreation on public lands other than national parks. Although developed for use at national parks, the MGM model can be used for any activity involving visitor spending (Dr. Daniel Stynes, personal communication, 09/12/2011). It is well suited to assess recreation-related impacts around national forests using NVUM data. The NVUM program collects expenditure data in categories that are compatible with MGM, and NVUM distinguishes local, nonlocal, overnight, and day use visits with definitions similar to those in the MGM model. The primary constraint to applying the MGM modeling approach to impacts generated on NFS lands is that it does not account for outputs typical of multiple-use national forest lands, and therefore, is not suitable for comparing policy tradeoffs that have influence beyond the recreation resource. While this limited impact focus would be a constraint in using MGM to model tradeoffs, the model is appropriate for an analysis of specific policies primarily influencing visitor use, like that of the current cave closures.

## National Visitor Use Monitoring Results for the Monongahela National Forest

The NVUM program was primarily designed for accurate assessment of visitor activities at the NFS level. At the individual forest level, sampling can be somewhat sparse and this can cause results to vary from sample to sample and between similar forests. Aggregating data and using national averages can improve the reliability of the data, but this also makes the application of results more abstract. This analysis follows NVUM guidelines and uses national four-year spending profiles from round one to calculate total local expenditures by MNF visitors. The spending profiles are matched with the number of visits of each visit type to calculate total local

expenditures. The visit type and volume estimates for this analysis are calculated directly from MNF NVUM results. The analysis considers the range of results from the two rounds of NVUM in modeling visitor types and numbers for the MNF.

The NVUM program reported a total of one million forest visits and 1.3 million site visits per year for the MNF from the first round of results in 2004. The second round of results (released in 2010) reported 618 thousand forest visits and 714 thousand site visits. The drop in estimated annual visitation to the MNF between the two rounds of NVUM reporting is not an indicator of an actual drop in visitation, but rather, reflects an adjustment in methods and the inherent variability of small samples.

Of particular interest to this economic impact analysis is the portion of MNF visits that are categorized within three trip-types: nonlocal visitors on day use recreation trips, nonlocal visitors staying overnight away from home to recreate on the forest, and nonlocal recreation visitors staying the previous night on the forest. Spending in the local area by these three forest visit segments brings new money into the local area that can be attributable to recreation activity on the forest. Other types of visits, including those by local residents and those primarily for reasons other than recreation, are not of interest to this recreation visitor economic impact analysis. Across the three nonlocal recreation visitation categories, NVUM estimated a total of 562 thousand annual forest visits by nonlocal people using first-round results and 377 thousand with second-round results. Round 2 results show the total nonlocal visits broken out into 49,455 day use visits (8% of all forest visits), 179,275 overnight off the forest visits (29% of all visits), and 148,366 overnight visits with the previous night on the forest (24% of all visits). Following NVUM user guidelines, the number of travel groups is calculated using group size estimates for each travel group type reported in the MNF-specific NVUM results. Overall, there are an average of 145 thousand annual nonlocal group visits to the MNF according to round two results (232 thousand according to round one). The weighted average travel-group size is 2.6 for these nonlocal visits.

Modeling Impacts of Recreation on the Monongahela National Forest

The MGM estimates impacts across major industrial sectors resulting from visitation to a local area. The model uses estimates of the number of visits and average expenditure profiles by type of travel group as inputs. MGM developers have found that the greatest variation in recreation visitor expenditures is explained by trip type (for example, day use compared to overnight use) rather than by activity type or other categorization. Besides distinguishing between trip types, modelers have found that it is important to consider expenditures at the group level rather than those made by individual travelers. This is primarily because recreation travelers tend to have many shared purchases within travel groups and their reported expenditures are usually conceptualized by respondents in the original aggregate form. In family groups, in particular, it is

common for one group member to keep track of major purchases for the group (like gas and lodging) rather than for individuals in the group. NVUM four-year-average expenditure profiles are reported on a per-group basis that is directly compatible with MGM modeling assumptions.

Table 1 shows the nonlocal travel group spending profiles reported by NVUM that are used in the impact model for this report. These profiles, reported in 2011 dollars, show the differences in types of expenditures and the total amount spent in the local area by trip type. Nonlocal day trips accounted for the lowest trip expenditures of the three segments, and those including a stay overnight away from home (and off the forest the previous night) resulted in the highest expenditures per trip in the 30-mile local area.

Table 1. National forest visit spending profiles by trip type and spending category per party per trip within 30 miles of the forest, NVUM 4-year report, p. 11. This table reports spending profiles in 2011 dollars that were adjusted from original NVUM 2003 dollars using MGM sector-specific deflators.

| | Non-Local Segments | | |
|---|---|---|---|
| Spending category | Day | OVN-NF | OVN |
| Lodging | $0.00 | $28.83 | $73.90 |
| Restaurant | 17.28 | 32.10 | 74.86 |
| Groceries | 9.60 | 46.08 | 39.44 |
| Gas & oil | 35.71 | 83.25 | 79.92 |
| Other transp. | 1.20 | 3.67 | 9.22 |
| Activities | 6.47 | 12.63 | 11.14 |
| Admissions/fees | 6.47 | 12.63 | 11.14 |
| Souvenirs/other | 2.93 | 10.59 | 15.19 |
| Total | 79.65 | 229.79 | 314.81 |

This MGM economic analysis combines the NVUM recreation visit estimates described in the previous section with the expenditure profiles presented in table 1 to derive estimates of total expenditures in the local economy. Table 2 shows the results of the MGM analysis of MNF annual nonlocal visitor expenditures. The table shows the number of annual nonlocal group visits by type of trip along with associated average and total spending. The modeling results, reported in 2011 dollars, estimate total spending in the local economy resulting from the 145,000 nonlocal recreation group visits to the MNF to exceed $36 million annually.

Table 2. Average annual nonlocal recreation visits and expenditures by trip type to the Monongahela National Forest. Expenditures are reported in 2011 dollars that were adjusted from NVUM data using MGM sector-specific deflators. Segments include nonlocal day visits, nonlocal visits with the previous night on the forest, and other nonlocal visits with a night away from home.

| Segment | Group Visits | Avg Spending | Total Spending | Pct of Spending |
|---|---|---|---|---|
| NL-Day | 23,511 | $ 80 | $ 1,873,045 | 5% |
| NL-OVN-NF | 59,793 | 230 | $ 13,752,329 | 38% |
| NL-OVN | 61,825 | 315 | $ 19,474,726 | 56% |
| TOTAL | 145,128 | 250 | 36,333,568 | 100% |

The estimates of visits by type and their associated expenditures are used in the MGM input / output analysis to assess the economy's ability to create direct and secondary impacts from visitor spending in the local area. Jobs, income, and other measures of local market economic impacts are generated within an economy in one of three ways: 1) directly, for example, when cavers buy supplies at a local retail store it directly supports the employees' jobs and income; 2) indirectly, for example, when the cavers' spending at the retail store indirectly supports related local wholesaler and manufacturing jobs and income; and 3) induced, as for example, when the retail store clerks spend their paychecks in the local economy. The total economic impact of caving activities represents the sum of the direct, indirect, and induced impacts. The indirect and induced economic impacts are collectively referred to as secondary effects in the MGM modeling results.

The total economic impacts in the local MNF area resulting from caving activities were estimated using MGM software and the MNF visitor characteristics outlined in the tables above as inputs. Table 3 shows the estimated direct, secondary, and total impacts by industrial sector resulting from annual nonlocal MNF recreation visitor spending in the local economy. Note that the input / output model was primarily constructed using NVUM round 2 data where appropriate because that is now considered to provide the most valid results nationwide. If the model used NVUM round 1 data, the impact estimates would be about 7% larger. The secondary impacts and jobs multipliers were calculated for a rural economy based on the size of the population in the area surrounding the MNF. This is a conservative approach to estimating impacts because, in general, the more urban an economy is, the greater is its ability to capture expenditures and the larger are its output multipliers. The values in table 3 are presented in 2011 dollars. The estimated number of jobs that are supported by nonlocal visitor expenditures are reported as total annual jobs (however, these may not be full-time 2080 hour-per-year jobs). Table 3 shows that visitor spending of $36 million results in $23 million in direct sales (a capture rate of 64% after immediate leakages from the economy are accounted for) and $31 million in total sales in the local economy. This level of activity creates $10 million in local labor income and supports 457

local jobs, annually. The greatest number of jobs (136) is supported in the local restaurant and bar service sector.

Table 3. Economic impacts of annual nonlocal Monongahela National Forest visitor spending in the local area: direct and secondary effects, reported in 2011 dollars, based on an MGM economic impact model with rural multipliers and US Forest Service round 2 NVUM data.

| Sector/Spending category | Sales (000) | Jobs | Labor Income (000) | Value Added (000) |
|---|---|---|---|---|
| Direct Effects | | | | |
| Motel, hotel cabin or B&B | $ 3,621 | 46 | $ 922 | $ 1,923 |
| Camping fees | 2,672 | 38 | 705 | 1,115 |
| Restaurants & bars | 6,954 | 136 | 2,325 | 3,618 |
| Admissions & fees | 1,596 | 39 | 390 | 888 |
| Other vehicle expenses | 409 | 5 | 204 | 236 |
| Local transportation | 409 | 11 | 208 | 294 |
| Grocery stores | 1,371 | 26 | 675 | 994 |
| Gas stations | 2,399 | 29 | 905 | 1,637 |
| Other retail | 2,050 | 44 | 869 | 1,477 |
| Wholesale Trade | 976 | 7 | 339 | 725 |
| Local Production of goods | 266 | 1 | 35 | 61 |
| Total Direct Effects | 22,722 | 381 | 7,577 | 12,967 |
| Secondary Effects | 7,814 | 76 | 2,154 | 4,538 |
| Total Effects | $ 30,536 | 457 | $ 9,731 | $ 17,506 |
| Multiplier | 1.34 | 1.20 | 1.28 | 1.35 |

## Potential Cave Closure Economic Impacts

Information from the analysis of cave visitor qualitative interviews and their economic impacts can provide perspective on the values and socio-economic tradeoffs associated with the MNF cave closure policy. The key informants from the caving community characterized their nonlocal travel behavior in ways that are typical of all nonlocal visitors to the MNF described in the US Forest Service NVUM report. The cavers described a variety of caving trip types, including overnight campouts on the forest, stays in local motels, and some that were based at the homes of friends (or the local grotto bunkhouse). A few describe coming to the area on long day trips. The caving community key informants also described expenditures for gas, food, groceries, retail, and other expenses that are typical of those reported in the NVUM visitor expenditure profiles. In the absence of primary quantitative cave visitor survey data, the characteristics of recreation forest visitors reported by the NVUM system provide reasonable estimates of travel characteristics of cavers for use in the economic impact analysis presented in this report.

In addition to estimating expenditures, economic impact modeling requires estimates of total visitation to a project area. There is currently no primary data that reflects total annual nonlocal caving visits to the MNF prior to the cave closures. The findings of this study suggest that wildland caving has a limited number of participants. Participation is limited enough that it is not tracked nationally by the US Forest Service in its NVUM reporting system (which tracks participation rates on all national forests in more than 20 wildland recreation activities). Most of the key informants agreed that the majority of serious wildland cavers belong to the National Speleological Society. In the interviews, they described local use as more varied and more likely to consist of casual or unaffiliated participants. Cavers that invest in the activity enough to travel longer distances are more likely to become part of the mainstream community and join the NSS. With this knowledge, the model employed the assumption that national membership of the NSS, at about 11,000 in the United States (Aley 2010) provides some indication of the potential population of nonlocal caving visitors to the MNF. Another indication of the draw of the local area around the MNF to the caving community is the location and interest in the NSS 2012 annual convention in Lewisburg, West Virginia. As of six weeks prior to the NSS convention there were more than 750 participants, representing more than 35 states, who had pre-registered for the conference located within a few miles of the MNF.

Table 4 provides marginal impact estimates that have been standardized to the number of visits. Considering marginal impacts allows the modeling results to be applied to a change in use like that caused by the cave closure policy. Table 4 shows the estimates of what happens in the local economy to income, jobs, and value added when there is a change of 1,000 nonlocal recreation visits on the MNF. The table includes marginal estimates for travel groups (more realistic) and individual visits (easier to describe). The final column of the table shows the impact of a change in 10,000 individual visits. A comparison of the second and third columns provides some idea of the potential range of impacts of the cave closures on the MNF (the assumptions for this range are explained following the table).

Table 4. Marginal economic impacts from nonlocal recreation visitation to the Monongahela National Forest: direct and total effects, reported in 2011 dollars, calculated using MGM visitor impact model and NVUM round 2 MNF data.

| | Change per 1,000 group visits | Change per 1,000 visits | Change per 10,000 visits |
|---|---|---|---|
| Direct personal income | $ 52,211 | $20,081 | $200,813 |
| Direct value added | $ 89,353 | $34,367 | $343,666 |
| Direct jobs | 2.6 | 1.0 | 10.1 |
| Total personal income | $ 67,054 | $25,790 | $257,900 |
| Total value added | $ 120,625 | $46,394 | $463,942 |
| Total jobs | 3.1 | 1.2 | 12.1 |

West Virginia was described as the 'holey' land by one of the study respondents, suggesting that the area around the MNF truly has a regional and national draw for wildland caving enthusiasts. Yet, even if West Virginia and the MNF are the Mecca of wildland caving, the potential economic impacts from this activity appear limited. Table 4 shows that a change of 1,000 visits directly supports just one job (aggregated across all of the involved industrial sectors) and supports slightly more than one job when the total effects are considered. Given the outstanding wildland caving resource found on the MNF, and the ability of the NSS convention to draw significant national attendance to the area, it seems reasonable to assume that the MNF is capable of generating at least 1,000 wildland caving visits annually from the nonlocal caving community. It also seems very optimistic to assume that all nonlocal NSS members would go on an average of one annual caving trip to the MNF. Using the NSS national convention attendance of about 1,000 as a lower bound for annual wildland caving visits to the MNF and the NSS national membership as an upper bound of visits (about 10,000 if local membership is assumed to be 5% - 10%), the potential economic impact from the cave closures on the MNF would range between 1 and 12 jobs that would be distributed across all involved industrial sectors. With the lack of actual data on wildland caving use of the MNF prior to cave closures, it is not possible to precisely calculate economic impacts. Certainly, not all NSS members would have taken an annual trip to the MNF caves; however, many members would have taken multiple trips to the area. Although most nonlocal caving is thought to be practiced by affiliated cavers, it is also likely that some recreational caving would have occurred on the MNF by nonlocal and unaffiliated cavers. With the uncertainties about actual historic use, the range of estimates in table 4 provides a reasonable sense of the types and numbers of jobs and income at stake in the local economy surrounding the MNF. The table also provides a tool for continued analysis of the cave closure policy by varying assumptions about wildland caving use and visitor behavior.

## Conclusions

This research project assessed a group of people interested in the underground environment of caves. Experts on the caving community participated in a series of qualitative interviews that revealed a wide range of types and intensities of involvement in caving activities. They described some aspects of their connections to MNF caves as not being substitutable, and all of the key informants described a sense of loss from the closures. They felt that opportunities for wildland recreation, stewardship, and science have been lost. They described a sense of belonging offered by caves on public lands that cannot be found elsewhere. Because of the specialized nature of caving. the cave closure policy on the MNF has resulted in social impacts that are particularly concentrated within this mainstream caving community.

The economic impacts of cave closures on the MNF are likely small, but not insignificant. The research findings suggested that the local negative economic impacts of the cave closures can be particularly felt by a few businesses; for example, lodges that have lost bookings from annual

grotto caving trips and locally owned restaurants. The economic impact analysis also shows a wide range of service, retail, and wholesale businesses linked to the local tourism economy.

There are costs associated with the cave closures on the MNF that go beyond the economic impacts related to equipment and travel-related expenditures by caving participants. Costs that were mentioned include lost opportunities to introduce people to nature, reduction of progress in science, less volunteer stewardship work, less variety of recreation opportunities, a loss of protection of caves, and a decline in interest in caving activities. Caves and bats may be more vulnerable to human caused negative impacts, such as vandalism, because the caves are closed to the mainstream caving community.

This report suggested a genuine passion and concern for the health of the cave environment among the mainstream caving community. While respondents described a sense of loss from the cave closure policy on the MNF, they also described concerns for the well-being of these public lands and their wild inhabitants, as well as an attitude reflecting the importance of being good stewards of these places. In making decisions about the protection of these resources, managers should be aware of the social and economic values at stake that are described in this report. Informed decisions that acknowledge and consider the importance of these public places to the caving community will enhance the acceptance of management policies. Relationships between the agency and the caving community could be enhanced by further engagement with these stakeholders in planning and implementation of stewardship efforts to provide the best management for the caves and bats.

> "...compared to a place that does not have public land…away from West Virginia, there is hardly any guarantee of public access." R#5
>
> "...it is hard to have a caving project if you can't go into the caves." R#9

## References


Aley, Tom (2010). Management strategies for responding to White-Nose Syndrome in bats. NSS News, February, 10-14.

Seiser, P. E. and Schuett, M. A. (2006). "Defining the concept of cave wilderness and its designation values." *International Journal of Wilderness*, 12(2), 8-16.