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Protecting Resources

Assessing Visitor Harvesting of Wild Morel Mushrooms in Two National Capital Region Parks

Natural Resource Technical Report NPS/NCR/NCRO/NRTR—2009/002



ON THE COVER

Morel harvesting in Catoctin Mountain Park, Thurmont, MD. Clockwise: Morel hunters in popular hunting area, morel cluster, spring ephemerals commonly associated with morels, and traditional harvesting method of pinching.

Photograph by: Elizabeth S. Barron

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Executive Summary

Anecdotal reports have sparked concerns that morel mushroom populations may be declining at National Park sites in the greater Washington, D.C. area. The research reported here focuses on two of these parks, Catoctin Mountain Park (CATO) and the Chesapeake and Ohio Canal National Historical Park (CHOH). Oral histories conducted with 41 harvesters in 2005 and 2007 had dual objectives: (1) explore and utilize local ecological knowledge to develop further understanding of morels in the mid-Atlantic region, and (2) develop practical suggestions for morel management.

Harvesters interviewed for this study commonly recognize five types of morels and identify seasonal weather variation, dark soils, and a select set of tree species as key factors in morel fruiting. Closed stands dominated by tulip poplar (*Liriodendron tulipifera*), ash (*Fraxinus americana*), and elm (*Ulmus americana*) are the ideal habitat for morels in this area. Other indicators of potential morel habitat are apple trees (*Malus pumila*), spicebush (*Lindera benzoin*), mayapple (*Podophyllum peltatum*), jack-in-the-pulpit, (*Arisaema triphyllum*), ferns, and poison ivy (*Toxicodendron radicans*).

Opinion as to whether there has been a decline in morels varies amongst harvesters. Most study participants agree that the morel season is getting shorter, likely in response to changing weather patterns. Other factors that may contribute to reduced morel harvests include loss of habitat due to development and increased competition from wildlife and other humans. The scientific literature suggests that if there has been a decline in morel populations, it is unlikely that this is due to over-harvesting. However, evidence suggests that raking, although unusual, does occur and can be damaging to mushrooms, their habitat, and to other species.

Morel hunting is a valued activity for many visitors to National Capital Region (NCR) parks. It has particular significance for residents of towns surrounding CATO and the northern reaches of CHOH. There is no evidence of large-scale commercial harvesting although morels sometimes are sold to local restaurants and individuals. The overwhelming majority of morels are harvested for personal consumption.

Substantial confusion surrounds the current status of morel regulations on NCR parks. This confusion generates resentment and causes some local residents to avoid the parks altogether. Management strategies such as permitting, harvesting limits, and entrance fees could have negative effects on visitor-harvesters and are unlikely to achieve the goal of morel conservation.

We recommend outreach to the local communities through the regular use of press releases and educational materials, including pamphlets about morel biology and proper harvesting techniques, the latter developed in conjunction with experienced harvesters. Morel ecology should be considered when undertaking active management practices such as protection of saplings or removal of hazard trees, when those trees are known morel associates. Several participants appreciated the effort of this study to understand their perspectives on morel hunting and expressed a willingness to contribute to further research and monitoring. Involving harvesters in decision making and incorporating their local ecological knowledge would enhance the effectiveness of morel management, increase the perceived legitimacy of guidelines and regulations, decrease enforcement costs, and reinforce good park-community relations.

Acknowledgements

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Table of Contents

	Page
Executive Summary	iii
Acknowledgements	iv
Table of Contents	v
List of Tables	vii
List of Figures	viii
Introduction.....	1
Methods.....	5
Results.....	7
Demographics	7
Hunting Locations.....	9
Raking	9
Wildlife	10
Commercial Activity.....	11
Management and Conservation.....	11
Local Ecological Knowledge.....	13
Types of Morels	13
Morel Season	13
Habitat and Vegetative Associations	15
Harvesting and Extraction.....	18
Other Non-Timber Forest Products	19
Park-Community Relations.....	20
Deer Management.....	22
Relationship with Biological Study Results	23

Discussion.....	25
Morel Taxonomy and Local Ecological Knowledge in the NCR.....	25
Morel Decline	26
Proposed Management Actions	28
Access	28
Modifying Visitor Expectations.....	30
No Action.....	30
Findings and Recommendations	30
Education and Outreach.....	33
Future Research	35
Conclusions.....	37
Literature Cited	39
Appendix A: Harvesters: Your Questions Answered	42
Appendix B: 2007 Oral History Protocol	47
Appendix C: 2005 Oral History Questions.....	48
Appendix D: 2007 Oral History Questions.....	50

List of Tables

Table 1: Participants by Age and Gender	8
Table 2: Income Distribution of Participants.....	8
Table 3: Most Common Associations Between Tree Species and Morel Types.....	17

List of Figures

Figure 1: National Capital Region Parks Included in Study 3

Figure 2: Map of Participants by Town of Residence 7

Figure 3: Mid-Atlantic Morels: (a) black, (b) cappy, (c) gray/white, (d) yellow 14

Figure 4: Photographic Records of Hunting Success 19

Figure 5: Non-Timber Forest Products Collected in the NCR 20

Figure 6: Regulations at Area Parks as of August 2008 22

Figure 7: Management Suggestions that Incorporate Morels 31

Figure 8: Harvester Proposed Study Guidelines 33

Figure 9: Guidelines for New Harvesters 34

Introduction

Mushrooms constitute a major group of non-timber forest products (NTFPs) harvested by people worldwide. Wild edible fungi are collected for food in more than 80 countries (Pieroni et al. 2005). Research on NTFP harvesters suggests that people engage in these activities for a variety of reasons: to earn income, to meet subsistence needs, to maintain lifeways and a sense of identity, and to strengthen intergenerational ties.

Despite the common characterization of the United States as a “post-industrial developed society,” the collection and use of NTFPs occur here as well (Emery & Pierce 2005). Historically, certain NTFPs were especially important in the United States. For example, ginseng and naval stores (products derived from the resin or oleoresin of pine trees) were included in the 1840 census. Wild plants and fungi continued to be important after the period of industrialization and were a critical component of survival for many families through the Great Depression (Emery & O’Halek 2001).

Since the mid-1990s, NTFP gathering has again received increasing attention in the United States (Love & Jones 2001), coinciding with a decline in timber-oriented forest policy (Wilmsen & Isom 2003). Forest management is now considered in terms of overall ecosystem management where a wide variety of forest values are being managed for interactively (Luoma et al. 1996). The ecosystem approach has shifted some forest industry attention to small timber and salvage operations, and highlighted other forest products as economically viable uses of forest lands (Alexander et al. 2002). In fact, many NTFP collectors in the western United States are former loggers (Jones et al. 2002).

Thousands of people throughout the United States hunt for wild mushrooms and other NTFPs. Since the mid-1980s, harvesting of wild edible fungi has skyrocketed in the Pacific Northwest (PNW), where large quantities of morels, chanterelles, and matsutakes occur (Pilz & Molina 2002). Very large quantities of morels are extracted every year from the PNW (Oregon, Washington, California, Idaho, Montana and Alaska). U.S. Forest Service records show that approximately 770,000 pounds were harvested each year from national forests just in Oregon and Washington in 2004 and 2005. “Globally, 300,000 pounds of dried morels are traded annually, [representing] nearly 3 million pounds of fresh morels,” (Pilz et al. 2007:75). In 1993, international commerce in morels was approximately \$15 to \$18 million.

Based on these figures, wild edible mushrooms are among the most valuable NTFPs in the United States. These increases in extraction are directly responsible for increased management and research attention (Parks & Schmitt 1997; Pilz & Molina 1996; Wurtz et al. 2005). Popular media attention has increased as well with sensationalized stories of shoot-outs over harvesting spots, hordes of recent immigrants roaming the forests of northern California, Oregon, and Washington for months at a time, and people getting rich on matsutake buttons selling for \$100 an ounce (Arora 1999). Morel tales have graced the pages of *The New York Times*, *The Washington Post*, *The Los Angeles Times*, *National Geographic*, and *The New Yorker*, and the airwaves of National Public Radio.

Much of this media coverage, with a few exceptions, focuses on commercial hunters in the PNW and on the international trade centered there. However, the region is ecologically distinctive and

is characterized by heavier commercial mushroom harvesting than other regions. Harvesting in other regions of the country has remained relatively unnoticed until recently because the scale of extraction is comparatively small. One such location is the mid-Atlantic region, including the greater Washington, D.C. area, where morel harvesting is allowed on some of the 15 parks in the National Park Service's National Capital Region (NCR).

In the mid-Atlantic region of the United States, morels have been harvested by local people for over 100 years (Hufford 2000). Unlike in the PNW, it is still legal to collect mushrooms for personal consumption in many national and state parks in the region. By 2002, anecdotal evidence suggested that morels might be declining. However, the parks recognized that they (1) lacked quantified data on morel distribution and abundance, (2) had limited information on the experience of visitor-harvesters, and (3) had not assessed the impact of harvest on the morel population.

At the macro-level, morels are known to grow in all northern hemisphere countries that have temperate or boreal forests, as well as some subtropical and Mediterranean regions and the Middle East. They can be found throughout the United States. At the local level their distribution is dependent on micro-habitat requirements such as areas of recent disturbance (ranging from a gap in the canopy to a large-scale forest fire), and the occurrence of associated tree species, the species of which vary by region (Pilz et al. 2007). However, although a tree associate may occur in a specific area that is no guarantee that morels will be found there. The only way to determine if morels will be found in a specific area is to observe them there. Morel inventory is further complicated by the fact that morels do not fruit in the same spot every year. This makes quantifying their distribution and abundance a difficult and time consuming task.

Assessing the impact of harvesting on the morel population is also a long-term task. There have been at least three longitudinal studies that attempted to examine the effects of harvesting on fungal species. The first was initiated in 1995 by Lorelei Norvell, with assistance from the Oregon Mycological Society, in response to concerns over declining populations of edible forest mushrooms. After 10 years of study, no significant negative or positive trends were observed in chanterelle abundance (Norvell 1995). Based on 29 years of data, Egli et al. (2006) determined that mushroom harvesting does not impair future harvests, although forest floor trampling appeared to reduce fruiting body numbers. The Man and the Biosphere study of chanterelle mushrooms, although shorter in duration, drew similar conclusions. Published in 1998 and based in the PNW, this study integrated biological, socioeconomic, and managerial data. Researchers concluded that harvesting was unlikely to have adverse effects given estimated chanterelle productivity combined with the known picking habits and areas covered by pickers (Liegel et al. 1998).

Anecdotal reports of reduced morel hunting success at Catoctin Mountain Park (CATO) raised concerns about the possibility of over-harvesting. In recent years, CATO and other parks have established harvest limits on morels. In 2007, a one gallon per day limit was put in place at CATO; citizens were informed of this change in regulations through a press release. At the Chesapeake and Ohio Canal National Historical Park (CHOH), visitors may harvest up to one-half (1/2) gallon each day. In an additional response to these concerns, the National Park Service's Urban Ecology Research Learning Alliance (NCR), commissioned this study of visitor-harvester experiences. The study focuses particularly on CATO and CHOH (Figure 1).

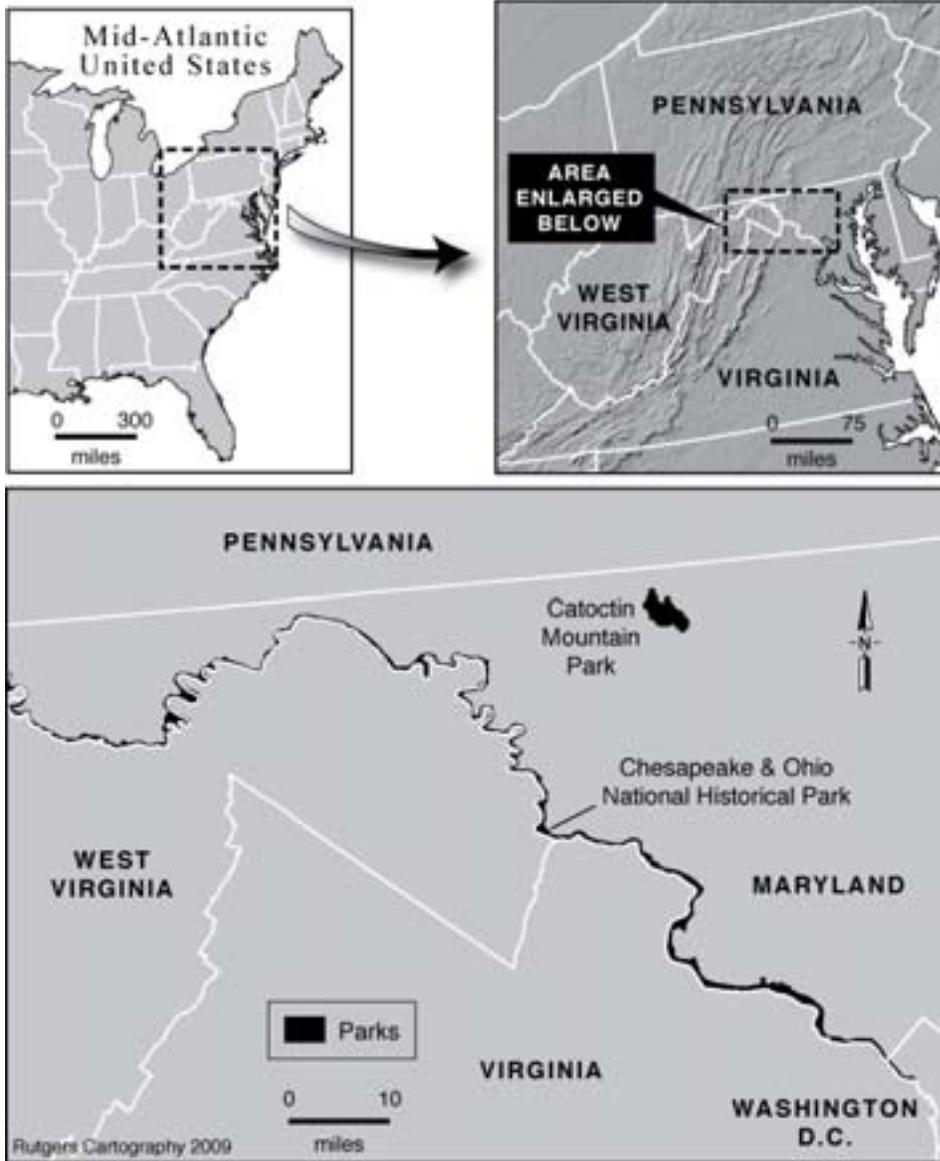


Figure 1: National Capital Region Parks Included in Study

Although visitors are known to harvest morels at both CATO and CHOH, the two parks differ in their biological, social, and management characteristics. CATO, located in rural western Maryland, is managed with a strong focus on ecosystem management. CHOH, which transitions from rural to urban Maryland and Washington, D.C., has a primary emphasis on historical preservation and interpretation in addition to managing natural resources. Because of its configuration, CHOH is one of the most biologically diverse parks in the system, while CATO is made up primarily of mid-latitude eastern deciduous forest. The parks also differ in terms of their geology. CHOH primarily consists of thin strips of land along the Potomac River, making the erosive action of the river the dominant geological force (Chesapeake and Ohio National Historical Park 2006). Precambrian and Cambrian rock dominate the mountains and valleys of CATO. The geology of CATO was significant to both Native Americans, who used metarhyolite found in the western portion of the park to make tools, and later to European settlers who mined iron ore for early industry in the region (Catoctin Mountain Park 2006). Both parks are now

used primarily as recreational parks by people living in the greater Washington, D.C. and Baltimore areas.

We hope that the knowledge collected from visitor-harvesters through this study will be of value in addressing concerns about the long-term sustainability of morel harvesting on NCR parks, particularly given the lack of quantitative data on morel distribution and abundance. Indeed, like Love and Jones (2001), “without romanticizing, we are coming to understand that some pickers and buyers- those most engaged in NTFP activity- are in many ways ahead of the research community in understanding the biology and ecology of mushrooms” (p. 117).

Methods

Based on the NPS scope of work, we developed the following research objectives: (1) explore and utilize local ecological knowledge to develop a further understanding of morel habitat in the mid-Atlantic region; (2) develop practical suggestions for morel mushroom management in the region; and (3) develop a conceptual model of fungal conservation. This report addresses the first two of these. The third objective will be addressed in a doctoral dissertation slated for completion in 2010.

In order to meet these objectives, oral histories were collected in 2005 as part of a preliminary field season. At that time we were interested in learning more about the communities in close proximity to the parks, and about residents' relationships with the parks and knowledge of morels. Questions on harvester's picking habits and harvesting areas, as well as general knowledge of morel ecology and feelings about the parks and mushroom hunting were all included (Appendix C).

Using a grounded theory approach (Glaser & Strauss 1967), we developed a protocol for the collection of oral histories based on the preliminary field season results (Appendix B). Oral histories collected in 2007 focused more specifically on the following subject areas: (1) morel productivity and harvesting practices, (2) abundance and over-harvesting concerns, (3) ideas about appropriate conservation strategies and their necessity, (4) fungal biology and ecology, (5) management and conservation policies, (6) relationships between stakeholder groups (harvesters, managers and mycologists), and (7) social networks associated with morel harvesting (Appendix D).

Harvesters who frequent CATO and/or CHOH, as well as surrounding areas, were included in the study. Participants were identified through the use of community presentations and meetings, and snowball sampling. At local presentations throughout the region in early 2007, people were asked to sign up if they were interested in participating in the study. Over 30 potential participants for 2007 were recruited in this manner.

Rather than surveys, the oral history method was selected for this study due to the use of the grounded theory approach, which requires the researcher to continually assess the data as it is collected and adjust the protocols accordingly. For example, the 2005 set of questions inquired about the quality of the mushrooms collected over time. We discovered that no changes had been observed by mushroom hunters in the quality of the morels harvested, nor did they think this was an area of concern. This line of questioning was subsequently dropped from the study. If asked in a survey format, the lack of concern over this topic would have been more difficult to assess. The richness of the oral history data collected in 2005 allowed us to more thoroughly understand what aspects of morel harvesting were of greater importance or significance to morel harvesters in the area, and this approach was therefore maintained in 2007.

Although sketch maps were suggested in the scope of work, this method was not employed because it was deemed that harvester spots were highly secretive and that asking participants to record their in-park activities on paper maps would potentially hinder the relationship between the harvester and the researcher. An alternate method was developed in which harvesters filled out a questionnaire on ideal and poor perceived habitat requirements of morels. Unfortunately,

the results from this part of the study are not currently available due to GIS data-layer acquisition delays.

All oral histories and field notes were transcribed into MS Word documents from digital audio files using WAVpedal 5.05 software (The Programmers' Consortium, Inc. 1997). This process produced a total of 1034 pages of raw data for analysis. Analysis of oral history data was conducted using Microsoft Excel and NVivo software (QSR International 2006) for qualitative data analysis.

Results

Forty-four oral histories were collected from morel harvesters in the mid-Atlantic region over two field seasons. Due to poor audio quality, one oral history was eliminated. The remaining 43 oral histories resulted in approximately 41 hours of audio digital files and 1034 pages of transcripts for analysis. These oral histories were collected from 41 participants; two participants from 2005 were considered as key informants and included again in 2007. Residents of Maryland, Pennsylvania, West Virginia and the District of Columbia were represented (Figure 2). The total number of participants residing in each town was as follows: Artemas, PA: 1; Cumberland, MD: 1; Emmitsburg, MD: 1; Falling Waters, WV: 1; Frederick, MD: 1; Hagerstown, MD: 1; Hancock, MD: 2; Harper's Ferry, WV: 1; Inwood, WV: 1; Little Orleans, MD: 3; Martinsburg, WV: 4; Myersville, MD: 1; Sabillasville, MD: 7; Sharpsburg, MD: 3; Smithburg, MD: 3; Tacoma Park, MD: 1; Thurmont, MD: 8; Waynesboro, PA: 3. For the remainder of this report these 41 participants are referred to simply as participants, harvesters, or individually by their personal identification number (PIN), assigned to each participant for the purpose of confidentiality. The PIN is a combination of H (for harvester), the year when they participated (2005 or 2007), and the order in which they were spoken with. For example, H0701 represents the first harvester who participated in 2007.

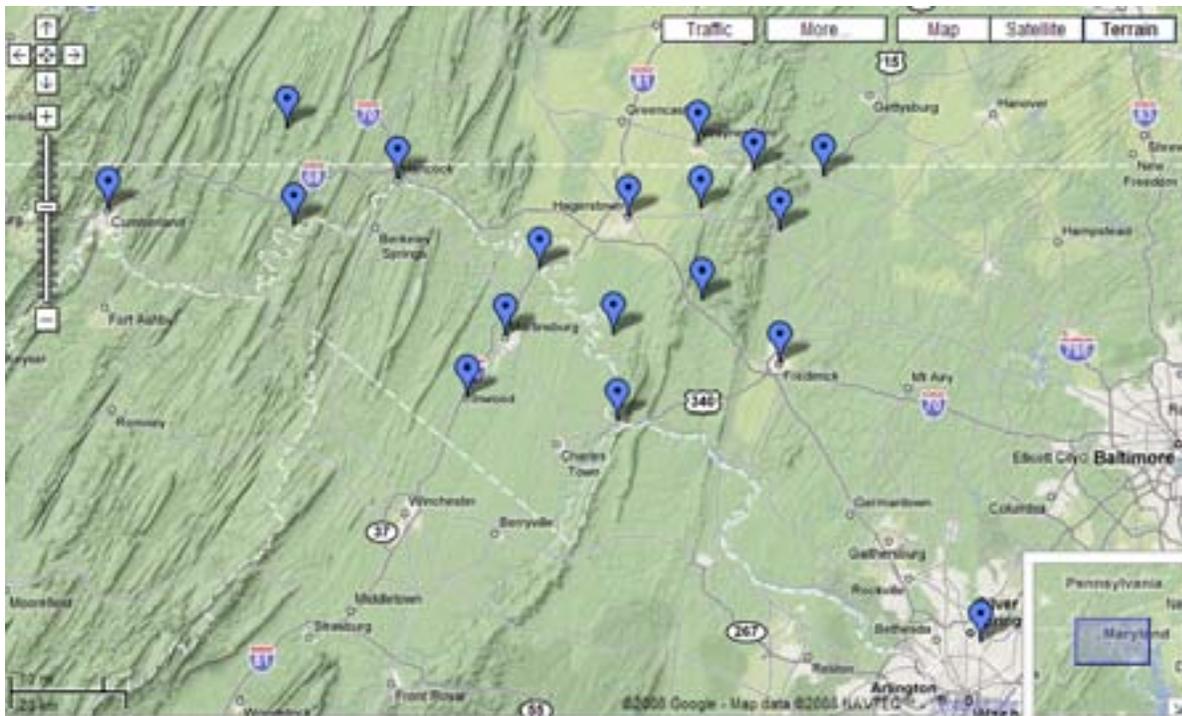


Figure 2: Map of Participants by Town of Residence

Demographics

Morel hunting is considered a predominantly male activity in the NCR region, and 61% of participants were male (Table 1). Of the 16 women included in this study, seven of them did not actually hunt morels or only went with their husbands. Thirty-five percent of participants were over the age of 65, and 71% of participants were over the age of 40. There are several reasons

for this disproportionate sampling of age groups among morel harvesters, the first being simply that individuals over the age of 50 tend to have more free time to dedicate to mushroom hunting and to participating in research studies. They were less likely to work full-time or have childcare obligations. It is interesting however, that of those over 65 years old, only 40% of participants self-identified as retired; many older individuals now worked in a second career or stayed on part-time at their old job.

Table 1: Participants by Age and Gender¹

Age	Male	Female	Total by Age
1: Under 18	0	0	0
2: 18 – 24	1	1	2
2.5: 19 – 30	2	0	2
3: 25 – 44	4	4	8
3.5: 41 – 50	1	1	2
4: 45 – 64	9	3	12
5: 65 and over	8	7	15
Total by Gender	25	16	41

The greater representation of older participants is also an artifact of the sampling method. Participants were recruited in several ways as outlined above, but two initial entry points were through press releases to local newspapers and through attendance at presentations given by the primary researcher throughout central and western Maryland. Both of these techniques have a greater appeal to older people, who are more likely to read the newspaper and to attend public meetings. Once initial communications were set up, the snowball sampling technique relies on existing networks within the community. Therefore, this technique accentuates family lines, friendship networks and peer groups. Indeed, of the three participants under 30, one was a NPS employee, and two participated at the request of older relatives or work colleagues. However, there is no evidence to suggest that young people are not engaging in morel hunting and participants were mixed on whether there were more or fewer young people doing so today. Many participants did report hunting with their children and grandchildren.

Study participants had a wide range of incomes (Table 2). Of special interest is the relatively large number of participants making over \$60,000 a year. Clearly these individuals are not mushroom hunting for economic subsistence. In fact, of those who reported selling morels (see section on commercial activity), none were making less than \$25,000 a year where income was reported, and no one reported financial gain as a motivation for morel hunting. Rather, the main reasons people hunted morels were to eat them, for the joy of getting outside, because of tradition, and for the challenge.

Table 2: Income Distribution of Participants. Categories based on U.S. Census.

Income	<\$14,999	\$15,000 - \$24,999	\$25,000 - \$34,999	\$35,000 - \$44,999	\$45,000 - \$59,999	\$60,000 - \$99,999	Not reported
Reported Income	4	1	5	7	4	11	9

¹ The age categories overlap due to inconsistencies in data collection between 2005 and 2007, the whole number categories being those used in 2007 based on US Census data collection techniques. In most cases the 2005 data were successfully merged into the 2007 categories, with the exception of categories 2.5 and 3.5.

Hunting Locations

Participants were not asked outright whether or not they hunted at CATO or CHOH because this was deemed to be a potentially threatening line of questioning. They were, however, questioned on whether they hunted on public or private land, and during our conversations the majority of participants shared information about their hunting locations including those on national parks. Five people hunt only on public land. Twenty-five people report hunting on private and public land. Ten people only hunt on private land.² Of those who hunt on public land, eight reported hunting on public land that was not national park land, for a total of 18 people (44%) who do not hunt in national parks. In other words, 22 (56%) of participants in this study hunt for mushrooms on federal parks. Twenty-one people reported morel hunting specifically at CATO, while only seven people reported hunting specifically at CHOH. Three people reported hunting at Gettysburg National Military Park.³

Raking

Raking of the forest floor to look for morels is an issue that was of special concern to the park service and elicited a great amount of discussion among participants. Among other things, raking disturbs ground cover vegetation, litter deposition, and can potentially harm the fruiting bodies and the mycelia of the morels themselves. When discussing raking, participants made a clear distinction between actual raking with a garden or leaf rake and moving leaf litter and ground cover around with a walking stick. The first of these activities was severely looked down upon as damaging and unnecessary, while the second was a common activity and deemed necessary for checking under leaves and taller ground cover such as mayapples. Comments about use of a rake were uniformly negative. For example:

H0714: "I have heard of that and that's ridiculous."

H0713: "It's pure stupid."

H0716: "I've heard of that but that's, like, taboo."

Only five participants (12%) reported seeing evidence of raking anywhere in the woods. It is unknown whether or not raking is occurring at CHOH. It is likely that raking is occurring on some level at CATO, where raking was observed by one participant, and strong evidence of raking was observed by another.

ESB: "So those ladies with the rakes, what kind of rakes were they? Like regular yard rakes?"

H0725: "Yeah, like you rake the leaves out here in the yard with."

ESB: "Like a big metal yard rake?"

H0725: "Umhm."

ESB: "Wow."

H0725: "You know they were raking around logs, downed trees, that's what they were raking along. They weren't just in the woods, raking anywhere, they were raking along the logs is what they were doing."

² The remaining participant has never actually hunted morels.

³ Because individuals may hunt at more than one national park, these figures exceed the number of participants hunting on federal parks.

A third participant recounted an incident between a law enforcement ranger at CATO and someone with a leaf blower, apparently intent on morel hunting. This was the only comment on the use of leaf blowers.

Turkey scratching was also often discussed in the context of raking because it is widely known that turkeys scratch around morels (see section on wildlife), sometimes producing what looks like a raked over area. However, when questioned, several participants were able to clearly distinguish between turkey scratching and human raking activity:

H0713: “The turkeys tend to scratch a small pile, a small area, and skip ahead a few feet and scratch another, you can almost follow them through the woods.”

ESB: “Ok, alright. But then people raking, it’s more obvious?”

H0713: “It’s more of a larger area, yeah.”

H0718: “But it looked like someone had went in and raked and it wasn’t turkeys.”

ESB: “So, how do you tell the difference between the turkey scratch and a raked area?”

H0718: “A turkey scratch, they’re kind of random. But this area looked like it had been *raked* you know? That was only one area that I seen that and that was on [state park].”

Wildlife

Little is known about the ecological role of morels, including whether they are a food source for wildlife. However, the impact of animal predation on morels came up several times in the 2005 oral histories, and was therefore included explicitly in 2007. Turkey, deer, and turtles were the animals most frequently mentioned by harvesters as having an impact on the morel mushroom populations and habitats. Squirrels, bears, rabbits, foxes, and raccoons were also mentioned as potential predators, while it is widely known that a variety of insects, slugs and worms eat morels. Twenty-three percent of 2007 participants commented that turtles, usually box turtles, will eat morel mushrooms and at least two participants have observed this.

Turkey populations have significantly increased in the region over the past 50 years due to an intensive restoration effort by the Maryland Department of Natural Resources. In that time populations have risen from a few hundred statewide to over 30,000 (Long 2007). This recovery of the turkey population may have implications for the morel population. Harvesters reported extensive observation of turkey scratching in and around morel patches, where the turkeys are most likely searching for worms or insects which are feeding on the mushrooms. There is speculation about whether or not the turkeys are eating the morels as well, but none of the participants had directly observed this.

The situation with the deer is similar to that of turkeys in that the population has been increasing rapidly over the past few decades. Deer have been an issue statewide and also within the boundaries of national parks. Due to the popularity of deer hunting in the region, the nuisance of deer to farmers and gardeners, and NPS efforts to address the deer management options at CATO, there were many comments on this topic. Speculation about whether the deer eat morels was mixed. Like with turkeys, people were more willing to believe that deer would take a bite out of the mushroom than consume the whole thing. Many people assume that deer do eat

morels because at the time of year when they are available, the deer have already exhausted other food resources. People have observed nips out of the tops of morels which they attribute to deer, and many people mentioned the simple fact that morels are delicious, so it only makes sense that deer would enjoy them. On the other hand, people reasoned that they have often found morels along deer trails in the woods. If deer were eating morels, there would be none left for people to find because deer are so numerous. This second group of people often commented, however, that deer have a direct negative effect on morels due to trampling of the mushrooms.

Commercial Activity

Although there was a lot of talk of morels being sold and traded, only four participants actually reported that they sometimes sell a portion of their harvest to other local people. One hunts only on private land; therefore, only 7% of participants who hunt at national parks also sell or have sold morels at any point in the past. Only one participant hunts exclusively for sale to others and does not personally consume morels. Whether any of the fungi that were sold were harvested on NPS land cannot be determined. For another four participants, it was unclear whether they have sold morels or not, but none of them hunt morels in national parks.

Several participants were aware of people selling morels, but never to a store or wholesale buyer. Sales take place largely through informal networks such as hunting clubs, churches, work colleagues, neighbors and relatives. There is some evidence of sales of locally harvested morels to independently owned restaurants in the area. The volume of local morels sold to local restaurants could not be determined but most likely is modest in comparison to those collected for personal use and consumption since most harvesters report that they will only begin to sell morels once their own needs, and those of their own friends and family, have been met.

Wild morels are not widely available in grocery stores or specialty shops in central and western Maryland and the surrounding vicinity. Based on the oral history data, it is extremely unlikely that morels harvested in the NCR enter large-scale markets, whether regional, national, or international. Indeed, the produce manager at a chain grocery store in Frederick, Maryland indicated that the morels for sale in her store originated in the PNW. Differential prices are another indication that NCR morels are not entering any larger scale markets. Morels collected for commercial sale in the PNW are sold to wholesale buyers for a maximum of \$8 per pound. Based on comments from actual sellers, morels in the NCR are often sold for roughly \$30- \$50 per gallon, and have been known to bring in the equivalent of \$100 per gallon when sold in smaller quantities.⁴ This difference in cost is indicative of independent markets.

Management and Conservation

In 2007 participants were asked if they thought land management policies worked best when trained professionals made decisions or when professionals and local residents worked together to make decisions. Not surprisingly, all participants responded that they believed it was better when the local community was involved in decision-making. They cited times in the past when

⁴ The common practice of measuring harvest quantities by volume and wholesale and retail mushroom sales by weight makes precise comparisons difficult. However, harvesters in the PNW estimate the conversion factor to be anywhere from 1:1 (pounds: gallons) to 1:2. In either case, the price per unit value of morels sold in the mid-Atlantic would be substantially different than that in the PNW.

this has not been the case, such as with land acquisition and changes in fishing access at CHOH, and registered their discontent with these actions regardless of how long ago they took place. Participants were keenly aware of the fact that many professionals are not from the area and felt that despite extensive knowledge, most professionals lack a clear understanding of this place. It was also noted that locals, not the often-transient professionals, have to live with the long-term ramifications of management changes. This project was commented on as an example of one which was taking the time to get input from the local residents. Comments such as these were common:

H0709: "I think they need to work with the local residents. Cause if you have somebody from the government come in that's not been in the area, who's transplanted let's say, from Utah, just because they're an elected official and they're trying to make decisions on the state parks in Maryland, they really don't know what goes on. What's good for Utah might not be good for Maryland because of different circumstances, different types of people, different types of weather, animals."

H0722: "Well, it just adds a different perspective. I mean, book knowledge is different from practical knowledge, you need a combination... You need a co-op situation there as far as between the technical people and the local people because the local people have to live with the decisions that are made by the technical people that may well end up moving to another location in a couple years so they don't have to pay the consequences to live with the results."

Building on this desire for inclusion, many participants understood the concern for morel populations, but had varied answers to questions about access. Participants felt strongly about the need for public participation in morel population monitoring and conservation. Thirty-seven percent of those asked in 2007 felt that morels should remain an open access resource for people to enjoy, while 30% of 2007 participants felt that the public should have restricted access to a resource as long as there was clear education and communication about why these restrictions were in place. The remaining 33% felt the issue was too complex to commit to any position. Others commented that the actual regulations regarding a resource were unimportant because people are going to do what they want, and the park service does not have the staff available to enforce restrictions:

H0709: "You can't just restrict it and not communicate. If you restrict access and you don't tell them why, then the people aren't going to understand, they're going to complain, and then they're going to, sometimes, not listen."

H0727: "I would have to say the somewhat restricted access, because you don't want to completely destroy or deplete whatever it is you're hunting for. If it's mushrooms or whatever else that you don't want to destroy for future, so if it comes down to where you can see that it's becoming extinct you need to control to get the population, the growth back."

Local Ecological Knowledge

Types of Morels

Morel mushrooms are called “mushrooms” in the NCR region, but are further separated into several types. In 2005 different types were mentioned often enough that in 2007 participants were asked to explicitly list the different types. The types are referred to here using the common names in use in the NCR. The taxonomy of these types is addressed in the discussion.

Types are differentiated primarily on the basis of color, and sometimes also on size. There are five commonly recognized types (Figure 3): black (a), cappy (b), white and gray (c), and yellow (d). Two residents of Frederick County and three from Washington County, (all originally from Frederick County) also collect a type of mushroom they identified as a poplar mushroom (not pictured). It was variously described as white, gray, with irregular annual fruiting, small, and fruiting specifically around poplar trees (*Liriodendron tulipifera*). These common names were consistent, for the most part, with the exception of the cappy, which is known by various common names: cappy, cow-head, corn cob, umbrel, dog pecker, and long-stem, plus a few others which participants shared off-record. We refer here to this type as cappy because that was the common name most frequently given by harvesters. There was general agreement that the later season mushrooms were larger than the early season mushrooms, and this sometimes led to further differentiation between types: early blacks, late blacks, large blacks, long-stemmed blacks, short-stemmed blacks, blacks with a pointed cap and round-cap blacks, white/yellow, white/blonde, and big yellow were all terms used to try to describe the morels fully.

Not all participants collected all types. Most residents of West Virginia distinguished between two types of mushrooms: black and white. Two also identified cappy as a third type, which they collected. Residents of Frederick County identified four types: black, gray, yellow and cappy. White was not a type identified in Frederick County except by two residents who referred to grays/whites as one type. Two participants who had learned morel types from books (rather than from friends or family) specified a “common” morel, which they believed to be the same as the yellow morel. One of those two, a member of the Mycological Association of Washington, referenced a fire morel which she believed was similar to a black morel.

Morel Season

The length of the morel season varied greatly among participants, with the shortest reported being about a week and the longest nearly two months. To some extent, this reflects the time a participant dedicates to mushroom hunting each year, but all harvesters are aware that the season length is directly dependent on the weather. Morels are very sensitive to temperature and rainfall, and differences in fruiting abundance are noticeable across the region due to changes in elevation, habitat, and micro-climate. Given the spatial distribution of the participants, differences in observed morel seasons are not surprising. Therefore, all data below should be considered in terms of general trends, with an understanding that temporal and spatial fluctuations in weather and spring onset have a considerable impact on the morel season.



Figure 3: Mid-Atlantic Morels: (a) black, (b) cappy, (c) gray/white, (d) yellow

Long-term hunters often reported incidents of finding morels as early as the end of March, although they were quick to point out that this was a rare finding and that the season usually did not begin in earnest until the second week of April. A majority of participants agreed that the morel season in the NCR is approximately one month, from mid-April to mid-May. It was widely agreed upon that in average years, the last week of April and the first week of May are traditionally the peak of the season. Many participants use Mother's Day as a convenient way to mark the end of a regular season.

A large majority of participants identified the black as the first to fruit in the spring, and the yellow as the last to fruit at the end of the season. Most commonly, the white and/or gray mushrooms fruit in between the black and the yellow. Cappies were reported variously as fruiting after blacks, after grays and whites, and after yellows. The poplar mushroom is a late season mushroom, fruiting irregularly after the blacks have finished.

The proper weather conditions trigger morels to fruit, so harvesters are very aware of spring onset and changes in climate. Changes in morel abundance, fruiting patterns and productivity in response to fluctuating weather patterns over the last several years was a concern mentioned by every hunter who participated in the study.

There were three primary changes in phenology that were commented on by harvesters. The first of these was changes in the beginning of the season. Several life-long mushroom hunters, all of whom hunt primarily in Frederick County, Maryland believe that the season is getting earlier each year, one participant felt by as much as two weeks. Another key participant, who has hunted very successfully for over 30 years, noted based on his records that around April 28th used to be the most productive point in the season, and that has shifted to April 20th. However, several participants who have been mushroom hunting for less than 20 years felt that the season was generally starting later due to late spring onset. Associated with these observations, were comments that the traditional ways for determining the start of morel season are no longer reliable. Seasonal changes in several native and ornamental plant species have traditionally been used to signal the beginning of morel season, and some participants pointed out that past indicators such as lilac blossoms are no longer clearly correlated with morel fruiting. Between bud break and leaf out of tree associates, however, remains an ideal time for early morels.

Changes in the length of the overall season and in the season for the individual types were also observed by participants, all of whom agreed that the season is getting shorter. Harvesters observed that the last morels used to commonly be found later in the spring:

H0725: "I always hunted big mushrooms the last week of May. Now they're over by 15th, 18th of May."

Thirdly, once the first morels are found, all four or five types can potentially now be found within two weeks and changes in fruiting patterns during the season have become another concern for morel hunters. Life-long hunters throughout central Maryland have observed, along with the overall compression of the season, an overlap in the fruiting of the different types of morels. In the past, up to two types could often be found in one day: blacks and cappies, cappies and whites/grays, and finally whites/grays and yellows. Harvesters reported that over the last five to ten years they are finding blacks and whites together in western Maryland, and up to four types together have been found on the same day in Frederick County, Maryland.

Habitat and Vegetative Associations

Unlike in the PNW, the vast majority of morels in the NCR do not appear to fruit due to disturbance. Morels in this region seem to be associated with middle to old-age stands. It should be noted that morels are known for fruiting almost anywhere once or twice, so the habitat descriptions here are based on long-term observations made by several participants. Again, the weather conditions more than the habitat, are consistently noted as the most important factor in morel fruiting.

Harvesters describe the ideal habitat for NCR morels primarily based on soil type, soil moisture, and vegetative associates, and secondarily on aspect, stand age, and disturbance. Habitat does not differ greatly for the different types of morels, although generally the black morels are found more frequently at higher altitudes, and are therefore are much less likely to be found along the

C&O Canal. The yellow and white ones are found at the Canal, but are also found throughout higher elevations where conditions are favorable.

Ideal soil for morels was described as dark, loamy, rich, black, and fertile, often with a thick organic layer. One participant specified limestone soil as a good substrate.

H0714: “You can tell by the ground. You don’t just walk in any place at all. You tell by the texture of the ground and it’s black, very fertile. [E: ok] Not sandy soil or red clay, you know.”

Contraindicated soils are high in clay, slate, shale, and reddish. Rocky areas, of which there are many at CATO, are good habitat for black morels that seem to grow alongside the rocks, although overly rocky areas are avoided. Soil moisture is also considered by harvesters, who avoid swampy areas and drier, sandier soils.

Participants in the CATO area specified that morels can be found in the mountains, not in the flatlands, meaning in this case the towns of Thurmont and Emmitsburg. This is most likely due to variations in the soil profile throughout the region. In the mountains, eastern and southern aspects are widely known to be early season habitat for morels, while northern and western aspects are better towards the end of the season, if at all.

Participants felt that disturbances such as heavy timbering or blow-downs negatively affected morel fruiting, especially if they affected morel tree associates. The 2005 hurricane that passed through part of CATO was often mentioned by harvesters, who have not found morels in the area most affected by the storm. At CHOH, heavy flooding over the canal prism apparently suppresses morel fruiting for up to three years due to silt deposition. Due to complete fire suppression policies by the park service and other public agencies, fire is not a part of the landscape in this region and, therefore, has little to no effect on morel productivity. Human disturbances, such as raking and walking in the woods, have an unmeasured impact on the habitat. Small scale disturbances such as the mortality of individual trees due to disease or insect pests have varying effects on morels. The most notable of these was the widespread mortality of elm trees due to Dutch elm disease, which led to a several year-long flush of yellow morels as these trees were dying. Individual tree mortality is discussed below in further detail.

Fields and areas with dense undergrowth are not well suited for morels. Stands dominated by tulip poplar, white ash (*Fraxinus americana*), and American elm (*Ulmus americana*) that are over 40 years old, in conjunction with the right soil, are the ideal habitat for morels. No upper limit on stand age was indicated by harvesters, although since tulip poplar and mature white ash are classified as shade-intolerant pioneer species, and American elm is a facultatively seral species, stand age may be a factor in morel fruiting (Coladonato 1992; Griffith 1991a, Griffith 1991b).⁵

Several participants did not associate specific types of morels with specific tree species. Rather, they identified elms, poplars, ash, and apple trees (*Malus pumila*) generally as trees which they look for. Of those participants who did specify associations between morel types and tree

⁵ Facultatively seral species can be found both in recently disturbed areas and more stable (climax) communities.

species, those associations made by 10% or more of harvesters are noted in Table 3. In addition, 12% of participants reported rarely finding morels near white pine trees.

Table 3: Most Common Associations Between Tree Species and Morel Types.⁶ Most frequently mentioned associations are in bold type.

Species/Name	Black	White	Gray	Yellow
Tulip Poplar	29%	10%	--	10%
Elm	--	12%	--	27%
Ash	10%	10%	10%	17%
Apple	--	15%	--	17%

Due to the plasticity of the morel genus, there are many exceptions to these rules, but distinct trends are noticeable. Morels used to be found near walnut trees, which were identified by harvesters using the following common names: white walnut, black walnut, walnut and butternut, and could therefore include *Juglans nigra* and *Juglans cinerea*. Regardless of the correct species, harvesters reported that trees of this type are no longer as common on the landscape, and therefore are not sought out as a morel associate. It should be noted that although harvesters often look at the closest tree as the likely associate, tree root systems overlap widely and the host tree might be more distant (D. Pilz, personal communication 2006).

The life-stage of the tree associate was seen as an important aspect of morel fruiting. Yellow morels only rarely fruit near living elm trees. They fruit most abundantly with elm trees very soon after the elm tree dies, once the bark starts to loosen and flake off. Once the bark is gone from the bole, morels will no longer be found at that tree. This process lasts 1- 5 years, depending on the age and size of the elm tree. Due to the overall decline in elm trees over the past few decades and the widespread development of land that was previously old apple orchards, harvesters reported that yellow and white morels are harder to find than in the past, and that their focus when hunting yellows has shifted to ash trees.

The age of other tree associates was also considered. Good apple trees for morels were specified as those growing in old and abandoned orchards. Several participants reported that morels will fruit more abundantly at an apple tree the first year after that tree has died. This process diminishes quickly, and after even a year or two, morels are no longer found there. Conversely, morels will not fruit near tulip poplar or ash trees once those trees have died.

These vegetative associations differ greatly from the arboreal associations of morels in other regions, such as oaks (*Quercus* sp.) in the Midwest and lodgepole pines (*Pinus contorta*) in Wyoming. Oaks were specifically mentioned as poor places to find morels, although a few have occurred near them.

H0501/0701: “Trees that are important, you know, what trees you wouldn't look around, I mean I walk past a 1000 oak to look at one ash...Here at the park, if I had never hunted mushrooms in this area in my entire life, the thing I would start lookin' for is poplar, ash, and elm. You know, and depend on what time in the mushroom season it was, to what trees I'd look at first.”

⁶ All harvesters who noted finding yellow morels with poplar trees hunt in areas west of Frederick County.

Several other species are also indicators of potential morel habitat, such as spicebush (*Lindera benzoin*), mayapple (*Podophyllum peltatum*), jack-in-the-pulpit, (*Arisaema triphyllum*), ferns, and poison ivy (*Toxicodendron radicans*).

Harvesting and Extraction

Throughout the region morels are collected using similar methods. Most participants use all three methods at some point, depending on the circumstances. These are to pinch the mushroom off at the base, to cut it off at the base, or to break it off at the base. There were a few people who “just pick it up,” and did not further specify their method. One participant noted that she cuts them off right below the head, leaving the stem of the morel fully intact. There is a widely held taboo against pulling up or extracting the roots, although many acknowledge that it can be difficult to pinch off the morel without at least a bit of the roots coming with it. This part is then pinched off and placed back onto the ground, often at the extraction point. When the base of the stem remains in the ground it is often covered up with leaves to prevent others from seeing it.

Although plastic bread bags traditionally were used to carry mushrooms out of the woods, very few harvesters still use them. Instead, many reported using a plastic grocery or Wal-Mart bag. Paper bags, shirts, hats, bushel baskets, and wash-tubs have apparently all come in handy to get mushrooms from the forest to the kitchen. In recent years the idea of using some sort of mesh bag in order to let the spores circulate has been popularized by newspapers, television, internet, and word of mouth. Several harvesters have switched to at least periodically using some type of bag with holes, whether bags commercially marketed for mushroom collecting or something from the grocery store like an onion sac. The use of a mesh bag is not always positive, sometimes leading to the drying out or tearing of the morels. However, participants were willing to do this in order to help sustain the morel population.

Harvesters’ love of mushroom hunting periodically translates into some sort of record-keeping, most often as photographs of prize finds (Figure 4). These photographs usually have dates printed or hand-written on them. In this way people are able to keep track of good years, and document the quantity and quality of morels in the region at key times.

Four participants have kept written records of their morel hunting activities over the years. For two people, this has consisted of writing down in a small calendar the total number and location of each day’s find. Another has kept a digital record of the best days’ harvests and created a map of “hotspots” on his land for his children to use in the future. The fourth participant has extensive records dating back to 1979, in which he has recorded daily totals and locations. These very extensive and complete records provide a long-term data set for morels in the region which could be very informative for future management decisions, and demonstrate the ability of local citizens to participate in data collection.



Figure 4: Photographic Records of Hunting Success

Other Non-Timber Forest Products

Many study participants also collect other NTFPs in addition to morels (Figure 5). The most common of these is the milk plate. There are several common names for this popular wild edible mushroom: milk plate, milk brook, and milk monkey among them. This is a widely collected mushroom in the area, and rivals the morel in its popularity. Some harvesters commented that milk plates have declined over the years even more than the morel. Although identified in the 2005 report as *Lactarius subplinthogalus*, with additional descriptions of habitat and morphology by harvesters, we suspect that the common names may actually refer to more than one species from the *Lactarius* genus. Several species from this genus are considered choice edibles worldwide, including *Lactarius deliciosus* and *Lactarius indigo*. Without samples for identification the correct species is unknown.

Participants in the study also gather other species of NTFPs in the NCR region or have done so in the past. These species are listed here by common usage, common name, and possible scientific name based on descriptions and information provided by participants.⁷

Edible fungi: milk plate (*Lactarius* sp.), chanterelles (*Cantharellus* sp.), horn-of-plenty (*Craterellus cornucopioides*), oyster mushrooms (*Pleurotus* sp.), pasture mushrooms (*Agaricus* sp.), puffballs (*Bovista* sp.), chicken-of-the-woods (also called sulphur shelf; *Laetiporus sulphureus*), shaggy manes (*Coprinus cornatus* [old name given by participant: *Coprinus comatus* in 1987 field guide]), aborted entoloma (*Entoloma abortivum*), winecap stropharia (*Stropharia rugosoannulata*), hen of the woods (also called maitake; *Grifola frondosa*), lion's mane (*Hericium erinaceus*), coral mushrooms (*Auricularia auricula*), and blewits (*Clitocybe* sp.).

Edible plants (leaves, fruits, flowers, roots): poke or pokeweed (*Phytolacca americana*), ramps (*Allium tricoccum*), lamb's quarters (*Chenopodium album*), landcress (*Barbarea vulgaris*), red root (*Amaranthus retroflexus*), dandelion (*Taraxicum officinale*), elderberry (*Sambucus canadensis*), blueberry (*Vaccinium* sp.), raspberry and blackberry (*Rubus* sp.), mustard greens (*Brassica* sp?), wild asparagus (*Asparagus officinalis*), pawpaw (*Asimina triloba*), bluebell (*Mertensia virginica*), redbud (*Cercis canadensis*), watercress (*Rorripa nasturtium-aquaticum*), and jack-in-the-pulpit (*Arisaema triphyllum*).

Leaves used to smoke meat: tulip poplar (*Liriodendron tulipifera*), and sassafras (*Sassafras albidum*).

Nuts: chestnuts (*Castanea dentata*), black walnut (*Juglans nigra*), hickory nuts (*Carya* sp.), and butternut (*Juglans cinerea*).

Value-added products: catnip (*Nepeta cataria*), and American ginseng (*Panax quinquefolius*; reportedly no longer collected by study participants).

Plants used to make beverages (wine/tea): wineberry (*Rubus phoenicolasius*), dandelion (*Taraxicum officinale*), elderberry (*Sambucus canadensis*), wild grape (*Vitis* sp.), locust blossom (*Robinia pseudoacacia*), spearmint (*Mentha spicata*), wood betony (*Lycopus virginicus*), pawpaw (*Asimina triloba*), and dewberry (*Rubus ursinus*).

Ornamental greens: Bittersweet (*Celastrus orbiculatus*), mountain holly (*Ilex* sp.), crowfoot grass (*Dactyloctenium aegyptium*), and mountain laurel (*Kalmia latifolia*).

Figure 5: Non-Timber Forest Products Collected in the NCR

Park-Community Relations

Participants were questioned about their opinions on community-park relations, and this line of discussion provoked a wide variety of answers which were related to how long the person had lived in the area, how long their family had lived in the area, whether or not they went mushroom hunting in the parks, and where their property was located in relation to either CATO or CHOH.

⁷ The common names provided here are what the mushrooms were called by participants. We have included scientific names as general guidelines, but these were not provided by participants. One exception is in the case of the shaggy mane, where the participant looked it up in an old book while we were talking.

At least five families who participated in this study had previously owned land which was incorporated into Catoctin Mountain Park when it was created in the 1930s. Several other participants either knew personally or knew of people whose land is now part of both parks. This is a very sensitive topic and even 70 years later, there are still some hard feelings. This situation was not aided by plans approximately 15- 20 years ago for the extensive expansion of CATO. Five participants clearly remembered these additional attempts at land acquisition by the NPS. At that time, the community formed an organization called the Catoctin Mountain Association specifically to fight this expansion, which eventually was abandoned. CHOH also was criticized for recent expansions, specifically for land purchases which were deemed unrelated to the maintenance of the canal prism and the historical nature of the park.

Despite these difficulties, CATO was lauded by several participants for what they see as a general change in attitude towards the local community. The park was praised for allowing mushroom hunting, for participating in community shows, and for general affability. More open lines of communication between park staff and local residents have improved relations significantly at CATO, especially with locals who felt that they knew who to talk to when they had a question or concern. Local residents take notice of friendly gestures by rangers, of rangers and other staff participating in local social organizations, and of management decisions which they deem “reasonable” and based on “common sense.” Residents are keenly aware of the rapid development in their county, and many were glad that the park exists in order to protect the land from development and, therefore, protect the mushrooms.

CHOH, a much newer park, has experienced recent changes that drew more criticism. Local residents commented on the expensive move of park headquarters to Hagerstown, of land acquisition they feel was unnecessary, and of the park’s general under-funding. One local resident expressed frustration with a focus on tourism, another with a part of the towpath between Williamsport, MD, and Shepherdstown, WV, that has been washed out for several years. Both parks drew criticism for not allowing animal hunting or wood collecting.

Regulatory variations among the regional parks have substantial implications for morel harvesters and management alike (Figure 6). Many participants in this study were misinformed about morel hunting regulations, believing it completely illegal to collect morels at CHOH. Some believed this was true at CATO as well. Past differences in allowable daily harvest quantities in the two parks and recent changes in this regard are particularly problematic. In addition, some study participants have observed postings throughout the parks with incorrect information regarding what is and is not legal to collect. These discrepancies are confusing for people and have caused some to avoid parks altogether, which in turn leads to resentment. Differences in harvest limits, possibly erroneous notices regarding permissible gathering activities, and challenges to broad, fair enforcement are all significant study findings because these regulations have already had a negative effect on some harvesters.

As of summer 2008, these are the regulations for harvesting mushrooms at selected regional parks:

Catoctin Mountain Park: “The gathering in amounts of less than one gallon of mushrooms or berries for personal consumption per person / per day is permitted.” It goes on to specify ½ gallon per person per day is allowed for all mushrooms (2008 Compendium, p. 8). Note: this is a change from 2007, when it was “less than one gallon” and a further change from 2006, when it was “small amounts”.

C&O Canal NHP: “Edible fruits, nuts, berries, and mushrooms may be gathered by hand for personal use or consumption. Commercial use is prohibited. Removal of fruits, nuts, berries, and mushrooms cannot disturb the remainder of the plant.” Limit: ½ gallon per person per day. (2006 Compendium, p. 6)

Rock Creek Park: “No fruits, nuts, berries, seeds, mushrooms or cut greenery may be gathered or collected for personal or business use or consumption in Rock Creek Park.”
(<http://www.nps.gov/archive/rocr/compendium.htm>, accessed August 15, 2008)

For all state parks in Maryland: Title 8, subtitle 7 section 6.13: 08.07.06.13:

B. In a State park an individual may not:

- (1) Remove, disturb, damage, or destroy a plant, rock, mineral, or animal;
- (2) Cut down, remove, or destroy a tree; or
- (3) Feed, touch, tease, frighten, or intentionally disturb wildlife.

(<http://www.dsd.state.md.us/comar/08/08.07.06.13.htm>, accessed August 15, 2008)

Figure 6: Regulations at Area Parks as of August 2008

Misinformation regarding mushroom hunting regulations is not only a problem for the public. Several long-time local mushroom hunters have, at some point over the years, had uncomfortable encounters with CATO law enforcement, who reportedly were uninformed as to morel hunting regulations and park property lines. For the most part these run-ins were trouble-free. However, two of them are remembered as very unpleasant. One person was allegedly threatened with a fine for collecting morels in a park where it is allowed. A couple out hunting morels was confronted by three armed security personnel who surprised them while they were walking on Manahan Road.

For those that were aware of the current regulations, there was an underlying suspicion that as time goes by regulations will progressively restrict access to morels on the park. Concerns about the introduction of a park entrance fee, a morel hunting permit system, and the outlawing of morel hunting altogether were expressed by several participants. These fears have perhaps been fueled by extensive temporary closures at CATO during morel season, and an expanding security perimeter within the park which now encompasses some prime morel habitat.

Deer Management

Most likely due to the extensive outreach and efforts by CATO staff, all the participants in the vicinity of CATO had something to say about deer management, even though no questions were asked about this topic. Participants also commented on large populations of deer at CHOH.

In general, participants seemed dubious of park management of the deer population, particularly the prohibition against hunting them. This prohibition was seen as at least partially responsible for the population problem, and as an easy way to fix it if only it were lifted. The argument put forth by NPS staff that this would take an act of Congress did not sway public opinion:

H0701: “They said it would take an act of Congress to change the hunting on the park. I mean, Congress changes things everyday.”

Speculation about what the park might do or has done to thin the deer herd ranged from burning the carcasses, to mass burial of carcasses, to donating the meat to local food pantries and homeless shelters. Park managers reported that none of these activities have taken place.

Although there was not a consensus on whether deer eat morels, there was a strong consensus that the deer population is negatively affecting the morel population due to trampling, seedling predation of morel associates, and habitat destruction. The lack of understory at both parks was commented on by several people, although some believed this was due to crown shading and not deer.

Unfortunately, despite several public meetings and press releases, the participants in this study seemed to have a generally negative view of the park’s handling of the deer issue, fueled in part by misinformation communicated between residents regarding deer management and park regulations.

Relationship with Biological Study Results

The original scope of work for this study specified that it would be coordinated with the companion ecological study. Although field researchers for both studies met on one occasion, no significant exchange of information occurred and results of the studies should be regarded as distinct and not mutually informed. We recognize that this represents a missed opportunity. However, there may be occasion in the future to affect some connection between the two studies, for example by involving participants from this study in identification of voucher samples from the ecological study.

Discussion

Morel hunting in the NCR is a common activity among local people, but one which is not readily talked about in public. Unlike in other regions, people do not come together around mushroom hunting outside their immediate circles of family and friends. Indeed, of the 41 participants included in this study, only two were members of a mycological society, the Mycological Association of Washington. Two of the 39 remaining participants knew that such clubs exist. Upon being told about them, responses from the other 37 participants ranged from mildly interested to actively negative. When combined with the fact that the participants in this study were neither commercial nor immigrant harvesters, what emerges is a relatively unknown population of mushroom hunters who have been understudied in terms of their hunting habits and norms, motivations, and their potential input into mushroom research and management. These morel harvesters have extensive knowledge of morels, which often overlaps with current scientific knowledge.

Morel Taxonomy and Local Ecological Knowledge in the NCR

Both the local ecological knowledge detailed in the results section above and the scientific literature contribute to understanding the ecology and taxonomy of morels in the NCR.⁸ Indeed, there is significant overlap between what harvesters and mycologists know about morels east of the Rockies. Mycologists and harvesters agree that morels fruit in the spring, and do so more abundantly in response to a warming trend after an especially cold winter (Arora 1986). Ash trees, dead elms, tulip poplars and apple orchards are prime habitat (Kuo 2005). Seasonality has been consistent along latitudes, with species appearing in a “definite succession from late April through early June,” (Arora 1986:785). However, NCR harvesters note that this may be changing, with the season starting in early April, and overlapping fruiting of species.

Morels exhibit a wide variety of forms, likely influenced by both genetics and the environment. They are extremely complicated biologically, and their taxonomy continues to challenge scientists. Even the use of genetic analysis has led to a clear understanding of the genus only but not of species within it. Instead, researchers continue to revise species distinctions based on both genetic analysis and morphological descriptions (Kuo 2005; Pilz et al. 2007).

Morel nomenclature is similarly challenging. Most North American morels have been given the names of European species, although they likely are distinct. Hence few, if any, eastern North American morels yet have scientific names that meet the standards of the International Code of Botanical Nomenclature (D. Pilz, personal communication 2008). Until this issue is resolved, we suggest scientific names for the five most common NCR morels that conform with those generally used in North American field guides.

The yellow morel is almost assuredly *Morchella esculenta*, also called the common morel or classic North American yellow morel (Figure 3d). Based on harvester photographs, late season

⁸ The scientific literature on North American morels east of the Rockies consists primarily of two books about morels in the Midwest (Weber 1988; Kuo 2005). Weber’s book, updated in 1995, is out of print and difficult to obtain. Our discussion here is based primarily on Kuo (2005) and David Arora’s well-regarded tome, *Mushrooms Demystified* (1986).

yellow morels could be considered to be the thick-footed morel, *Morchella crassipes*, although DNA testing has shown specimens of this type to be genetically identical to *M. esculenta* (Kuo 2005).

Ironically, the morel with the widest variety of common names is the easiest to connect to a scientific name. We are confident that the cappy is *Morchella semilibera*. Harvesters consistently described this type as being mostly stem, and with the small cap only partially attached to the stem (Figure 3b). This is not a prized morel, so no harvesters had photographs of it.

The remaining three morels are somewhat more difficult to link to scientific names due to incomplete descriptions by harvesters and taxonomic confusion. Kuo (2005) refrains from using any established scientific names to identify black morels, but NCR harvesters collect what he calls the classic North American black morel (Figure 3a). Arora (1986) refers to these as the *Morchella elata* group, or *M. elata*-*M. angusticeps*-*M. conica* complex. Harvesters differentiated between two types of black morels, both of which are described within this complex by Arora.

It is unclear whether the gray and the white morels are two different types or the same type with more than one common name. The fact that West Virginia and some western Maryland residents collect only white morels, and Frederick County residents collected gray morels, described as whitish-grayish, suggests that perhaps these are all the same species (Figure 3c). It is likely that this species is *Morchella deliciosa*, a species which has been recorded throughout eastern North America and seems to encompass a variety of small-to-medium, white-to-gray, yellowish-tan, or brown mushrooms (Arora 1986; Kuo 2005).

We anticipate that the companion ecological study will contribute further to this body of knowledge, specifically providing data on the morels of central and western Maryland, West Virginia, and Virginia. Harvesters may be able to identify voucher samples with their local common names, in which case the traditional knowledge about these species could be linked to the mycological data collected in the companion study.

Morel Decline

Whether morels are declining could not be definitively determined by this study. However, 70% of harvesters believe that morels have declined in their area. Fifteen percent do not think morels are declining, and the remaining 15% are unsure. Those who believe morels have declined report that they observe the trend on both public and private land. Overall, 24% of participants believe morels are being over-harvested (34% of those who believe morels are declining attribute it to over-harvesting), 49% believe that they are not being over-harvested, and 27% are unsure. Those who believe over-harvesting is a factor uniformly agree that it is not the only factor contributing to morel decline. The data suggest other possible explanations for morel hunters' experiences of decreased harvests. Many participants believe that there are more people hunting morels than in the past and several note that what they perceive as a decline in morels may actually be increased competition for them. Less time to get out and hunt also is cited as a reason.

Harvesters and mycologists are largely in agreement about the major threats to fungi, in general, and morels in particular. Scientists identify large scale habitat destruction, pollution, and climate change as the real threats to fungi (Egli et al. 2006; Moore et al. 2001; Watling 2005). Participants in this study were asked what they considered to be the top three threats to morels. The most common answers were habitat destruction, climate change (often referred to just as “the weather”), and people.

Development is a major concern for study participants. Over the past several years, and increasingly since the events of 11 September 2001, people have been moving from the Washington, D.C. and Baltimore metropolitan areas to central and western Maryland, northern West Virginia, and south-central Pennsylvania. The counties in which participants live have experienced rapid population growth. For example, between 1990 and 2000 the populations of Frederick County, Maryland and Berkeley County, West Virginia grew approximately 30%. Washington County, Maryland grew almost nine percent and Franklin County, Pennsylvania grew approximately seven percent. These rates of increase in Frederick and Berkeley Counties were approximately 17% above the national average of 13% (CensusScope 2008). This development most likely accounts for substantial loss of morel habitat.

Weather is the primary factor associated with morel fruiting. Fluctuating weather patterns and air pollution are considered primary reasons for a decline in morels. Another frequently cited reason was the die off of associated tree species such as elm, ash and apple trees. Yellow morels have declined markedly due to the crash in the elm population and concerns over the incipient arrival of the emerald ash borer were frequently mentioned, although no correlation between affected ash trees and changes in fruiting have been observed at this point. Several participants believe that the spray used to fight gypsy moth infestations kills morels, and that any place sprayed for gypsy moth will therefore show decreased abundance of morels.⁹ Increasing wildlife populations was also mentioned as a contributing factor.

As previously discussed, research on the impact of harvesting wild edible fungal species has come to the conclusion that there is no measurable negative impact due strictly to harvesting (Egli et al. 2006; Norvell 1995). Neither of these studies focused specifically on morels, and until the ecology of morels is more clearly understood, a definitive conclusion is impossible. However, within the mycological community harvesting is not considered a significant threat to edible species (Moore et al. 2001). Harvesters point out that it is extremely unlikely, if not impossible, to harvest all of the morels that grow each spring, with many citing harvesting figures as low as 25- 50% of the available mushrooms annually. However, trampling and habitat disturbance by harvesters is recognized as having a potentially negative effect.

Several additional environmental factors may be contributing to declines in morel abundance. For example, acid rain and nitrogen deposition are known to have a negative effect on mycorrhizal fungi (Watling 2003). The trophic modes of morels remain uncertain, but it seems likely that they utilize several strategies and the effect of acid rain and nitrogen deposition on them is unclear. In the western United States, morels often fruit where soil alkalinity temporarily

⁹ In 2008, 3370 acres at CATO were sprayed with the bacterium *Bacillus thuringiensis* (Btk). We speculate that if there is an association between use of Btk and reduced morel fruiting, it may be attributable to improvements in the health of host trees (D. Pilz, personal communication 2008).

is increased by ash following a fire. In the eastern United States, acid deposition may be a factor in actual declines of morel populations and/or their ability to garner nutrients for fruiting (D. Pilz, personal communication 2008).

Dramatic increases in turkey populations over the past 30 years could be damaging morels and other fungi; turkeys scratching for insects could damage the fruiting bodies and the mycelium of the morel. Changes in understory composition due to the explosive deer population may also be having a negative impact on the morels because as older vegetative associates die out, there are few young individuals to replace them. Perhaps even more significant are the changes in stand age, composition, and structure that have occurred since the National Park Service acquired the properties. In older, stable stands, morels may stay below ground and fruit less frequently (Wipf et al. 1997). Therefore what may be perceived as a decline in morels may simply be a decline in fruiting bodies.

Proposed Management Actions

The scope of work for this study specifies that “any management actions undertaken for these natural resources will be regulating human activities and are fundamentally social in nature” (Emery 2004:1). Our research suggests that visitor harvesting likely does not have a significant impact on morel populations. However, we address three possible management options in light of our findings: (1) changes in access to morels, (2) modification of visitor expectations, and (3) no action. We note that public support for any change in morel management will increase its likelihood of achieving the desired results.

Access

Overall access to morels has changed substantially for morel hunters over the past 25 years due to development and increased posting of private property. In the parks, however, access to mushrooms did not change markedly for harvesters when the parks were established and the legal terms of access remained fairly consistent until the recent institution of harvest limits at CATO and CHOH. These limits do not enjoy broad support amongst those who are aware of them. Participants in this research believe that harvest limits are largely irrelevant because it is unusual to find more than one half gallon per day. However, when people are lucky enough to encounter large patches they report that they are unlikely to leave any desirable morels.

There are three options for modifying access to morels: changing legal access, changing temporal access, and changing spatial access. The daily harvesting limits that already have been established are examples of changes in legal access. Entrance fees and permit systems are additional examples of potential changes to legal access.

Entrance fees sometimes are viewed as a means to regulate visitor access to park resources. Fees provide both a rough count of numbers of visitors and an opportunity to disseminate information, including park rules. However, because many harvesters hold the conviction that the public owns and has a right to use public land, there would almost certainly be strong resentment toward the imposition of a fee. A park entrance fee would be virtually impossible to collect along the 184.5 miles of towpath at CHOH. It could be more feasible to establish entry fees at CATO, although there are four distinct entrances into the main part of the park and additional entrances to popular morel areas. Local hunters often walk in or are dropped off near the park

and their mushroom spots in order to keep them private. Because they do not pass through formal entrances they would not pay the entrance fee and their visits would be systematically undercounted. Further, as one local harvester put it when reacting to the possibility of an entrance fee: “You're just going to make criminals out of law-abiding citizens.” In contrast, out-of-area residents must drive into the park and would therefore be disproportionately affected by entrance fees.

It is not uncommon for public land managers to consider permit systems as a means to regulate and monitor access to natural resources such as mushrooms. Several harvesters were concerned about the potential for implementation of a morel permit system in the future and did not believe that such an approach would be successful. The public is well aware of the budgetary limitations and constraints on the NPS, and study participants noted that a permit system would require book-keeping and human resources. Experience elsewhere shows that permits do not provide a reliable mechanism for monitoring either numbers of harvesters or harvest quantities and would be more difficult to enforce than an entrance fee.

Another strategy would be to change temporal access to morels by instituting a morel mushroom season. Prime morel season typically lasts four weeks from mid-April to mid-May, although many harvesters find morels before and after this time period. A one month season coinciding with peak fruiting time would give people ample opportunities to hunt in the park. An open access approach during this time would require substantially less oversight and paperwork than would a permit system and limiting the overall time which morels may be harvested from the parks would increase the likelihood of early season and late season morels releasing their spores. Since morel fruiting fluctuates with weather patterns, park staff would have to closely monitor popular morel areas to set the season each year and identify effective means for getting this information out to the affected public. Additional enforcement would be required throughout the entire park to prohibit morel hunting out of season.

Affecting spatial access to morels may be the most feasible of these types of management change and was, in fact, an idea often proposed by participants concerned about the future of morel populations. If it is clearly demonstrated that picking has a detrimental effect on morels and a clear explanation of this is communicated to the public, closing off sections of the park to morel harvesters on a rotating basis may be tolerated. No one believed that all morel hunters would abide by these closures, but many suggested that if morel hunters were involved in the development of and educated about such a process, most would bear it for the sake of future harvests. They stressed that any type of closure program would need to include sound scientific support, education, and public input.

While there is some support for short-term closure of areas, such an approach also presents several challenges. Determining which visitors are there for recreation and which are there for morel hunting may be difficult because anyone is equally capable of picking a few mushrooms and putting them in their backpack. Thus, full closure would be required to protect the morels in an area. Again, this would require additional resources. As one study participant said:

H0719: “I think there’s gotta be a conservation area. Like certain areas that are blocked off certain years. Like on even years or for a period of two or three years you can’t hunt in

certain areas. Now again that would go back to, during those times then they would need more staff to monitor or patrol.”

It is unlikely that closing large sections of park would enjoy broad popular support. One way to anticipate and address potential public objections would be to close off smaller areas, working with harvesters to determine their size and location. Some participants in this study have suggested that closures be no larger than 100 square feet. It should be noted that CATO already has a de-facto conservation area which has expanded into prime morel habitat, and the park experiences closures during morel season, effectively limiting spatial and temporal access to morels in this park and perhaps making the implementation of additional measures for restricted access unnecessary.

Modifying Visitor Expectations

The most efficient and non-confrontational way to modify visitor expectations is through education. Certainly, if any changes are made in access to morels, public outreach about these decisions and why they were made will be necessary. As demonstrated by the widespread adoption of the use of mesh bags over the last several years, providing harvesters with credible, scientifically based information about factors that benefit or damage morel populations likely would lead to modifications in harvester behavior. This may be accomplished through press releases, well placed flyers and pamphlets, and a park service website with information on morel biology and benign harvesting techniques. Visitor center exhibits and programs could also be utilized. Public education and outreach is addressed more fully below.

No Action

In contrast with deer management issues, the population of people concerned about morel mushrooms is primarily limited to those who collect them; there are few outside organizations exerting pressure on the parks to take action. When participants were asked about their views on management and conservation of morels, a strong majority of people felt that there should be no management action. Specifically, people were concerned that regulations, education or media coverage would draw attention to the activity and create greater competition for mushrooms. Many cited a lack of scientific knowledge and understanding about morel biology and ecology as a justification for inaction, specifying that to target harvesters without this additional knowledge was inappropriate.

H0706: “I think that if you’re going to restrict somebody from gathering [morels] then you should be doing something to protect them, more than just restricting people from gathering. Then you should then learn how they propagate, what their life cycle looks like and if they are truly endangered. You know, you should know that. If not, then let it alone.”

Findings and Recommendations

As a result of their comparatively short duration, neither the social science study nor the companion ecological study can conclusively determine trends in the morel populations of the parks or the influence of human harvesting on them. Nevertheless, our findings, in combination with the literature, advance the state of knowledge on morels in the mid-Atlantic region and provide the basis for recommendations that may be pursued as part of ongoing efforts to

understand and manage for sustainable morel mushroom populations as well as good visitor-harvester experiences.

Recent research on *Morchella* sp. in the western United States illustrates the scientific uncertainty that is associated with morel management at the present time. Pilz et al. (2007) point out that morel productivity fluctuates greatly from year to year, “therefore decades of monitoring is typically necessary to detect trends with a useful degree of statistical confidence,” (p. 108). They go on to state, “during such timeframes, however, the forest ages and changes, possibly enough to affect morel production more than harvesting. Hence it would be difficult to assign a reason for noted changes in productivity over time,” (*ibid*). They suggest that the most useful ecological management approach is to utilize current knowledge about the biology, reproductive potential, growth rates, and ecology of morels “to design forest management and product harvesting guidelines that reduce or mitigate the risks of potential over-harvesting...[or] even proactively use this information to increase or enhance the availability of morel harvesting opportunities,” (*ibid*). For morels, Pilz et al. specifically recommend “managing forests for a mixture of stands in various age classes and in sufficiently close proximity for morels to spread their spores between stands,” (p.112). No-cut policies on national parks eliminate large-scale vegetative management as an option to achieve this goal. Alternatively, active management for morels can be linked with allowable management activities (Figure 7).

Although an active management plan for morels is not feasible at this time, concern for morels can easily be integrated into existing management activities, such as hazard tree removal. When these trees are morel associates, special care can be taken in their removal. For example at CHOH when an elm falls across the towpath if it has only recently died, it could be rotated off the path (leaving the root structure intact) rather than removed (see Local Ecological Knowledge section for discussion of elm mortality as it relates to morel fruiting). At CATO, saplings are fenced off to protect them from the large deer population. With the demise of the elms, ashes are now a preferred vegetative associate for yellow morels, and could therefore be given priority for protective exclosures. These are just two examples of ways in which positive measures can be taken for morel management without considerable extra effort.

Figure 7: Management Suggestions that Incorporate Morels

The PNW sometimes is looked to as a model for management of non-timber forest products, including fungi. However, both the ecosystem dynamics and socioeconomic conditions of the region are quite different from those of the mid-Atlantic and therefore have limited applicability for NCR parks. Formal regulation of morel hunting did not begin in the western United States until the 1980s, when it was precipitated by restructuring of the timber industry and entry of PNW mushrooms into the global market following several years of poor yields in Europe and Asia. Subsequently, massive fires in the western United States have produced large flushes of morels accompanied by similarly scaled commercial harvests (Pilz et al. 2007).

Unlike mushrooms in the PNW, mid-Atlantic morels have not become global commodities and fruiting is unrelated to disturbance. Thus, many of the factors leading to wild mushroom regulation do not exist or are not relevant in the NCR region. However, some common concerns do exist and it may be useful to compare management strategies for these factors. One such concern is potential road damage from driving on dirt roads that are wet and soft as a result of spring rains and snowmelt. At CATO, this issue was dealt with several years ago by the creation and enforcement of designated parking areas on the park’s main roads. Even this small change has cut down on morel hunters in the park. Several local residents complained about the

designated parking areas and cited parking regulations as a reason why they no longer hunt at CATO. Only Manahan Road does not have designated parking areas, but harvesters often pull over in specific cut-outs for fear of the car blocking the road and getting towed.

Another issue of potential concern to managers in both the PNW and the NCR is the trampling of vegetation, especially threatened and endangered species (T&E). At CATO popular morel hunting areas and T&E species habitats do not overlap (B. Loncosky, personal communication 2005). We were unable to establish whether this is also the case for CHOH. Some trampling of vegetation is inevitable when people enter the woods and walk off-trail. Although many would consider themselves stewards of the land on some level, a harvester's goal is to obtain morels and that sometimes leads to fighting through thickets.

People hunt morels to eat them, for the joy of getting outside, because of tradition, and for the challenge of it. Mushroom collecting in the NCR contributes in a fundamental way to hunters' physical and emotional well being, and it might be argued, to the survival of local cultural traditions:

H0718: "I live to hunt the mushrooms, [it's] part of my life, you know. Yup, I look forward to spring, mushrooms, turkeys, trout fishing, and to playing in the ground. I guess if I couldn't play in the ground I'd just as soon be under it."

H0719: "What if I couldn't do this anymore? That would be a catastrophe. I would hate that. I enjoy it, watching my grandkids do it, probably more so."

Because morels are important to people, some hunters have spent considerable time thinking about the resource, and there is good potential for collaborations with local mushroom hunters on projects related to mushroom management. Several experienced hunters suggested sampling designs to look at long-term morel fruiting and abundance (Figure 8).

A project similar to the chanterelle study in Oregon (Norvell, 1995) may be possible in Maryland, where scientists and amateurs can work together in a long-term study on morels. Here one participant identifies a location at CATO that he believes would be ideal for this experiment and volunteers to organize a group of “old-timers” to monitor the plots. Other suggestions include taking soil samples and linking harvesting records with climatic patterns over the last several years to determine if changing weather has actually caused a decline in the morel population.

E = Elizabeth Barron

P = H0725

E: “Um, so can you think of any action, or any work that you might do together with mushroom scientists?”

P: “Any work?”

E: “Yeah, like you said earlier, if they were going to try to do an experiment or close an area off that they would need, like life-long mushroom hunters to help ‘em with that.”

P: “Yeah, I’d help with something like that. You could just gather ‘em in a certain area and mark it down and then maybe another area, don’t gather ‘em up, and write down what’s there. And then, you know, compare the two the next year. But, you know, that’d have to be something done over at least a five year period. You’re not going to get it done in two years because the weather can make a drastic difference from one year to the next. So it would have to be a pretty long term thing to actually see.”

E: “Do you think that that is a project that maybe five or ten guys from around here that have been hunting a long time, that they’d be interested in, or be willing to do?”

P: “I’d say you could probably find enough people to do it. Because, you know, you have to do one area to try to prove if it had anything to do with them coming back or not.”

E: “Right, well that’s what I think too would be the only way to try to figure it out. [name taken out] that met those two guys in the park, that’s kind of like the project that they’re doing, but they’re doing a small area with two little areas like 3 ft by 5 ft.”

P: “Unhuh, that’s no good. No, you got to take a section where you know they grow, at least 100 feet square. And pick ‘em off, say two places. If you got 100 feet there that you can keep people out of there and you know they grow there every year, ok, ah, pick ‘em off of this end, say 25 feet here, and ah, let the next 25 feet be. And then pick over here 25 feet, let these be, then try to get an idea how many is in these areas that you let be. You know, write ‘em all down. And then the next year come back, see what you got. You know, compare ‘em, “I picked all these, didn’t bother ‘em here.” And what are they going to say when I say, “Well, there’s more over here where I picked ‘em all last year, than is where I left em.” That way you could figure all that out.”

E: “Umhm, yeah, I think that’s a really good idea. Ok.”

Figure 8: Harvester Proposed Study Guidelines

Education and Outreach

There is clear need for education and outreach that promotes two-way communication between parks and the harvesting community. In terms of outreach, the parks commonly use press releases to communicate with the public. We recommend a more active use of press releases during morel season to publicize existing regulations and any future changes to them. Weekly distribution of press releases between March 15 and May 15 to newspapers, social organizations,

churches, hunting clubs, and service organizations would be beneficial. Posting of press release information on park websites and in municipal buildings would insure maximum viewing.

Harvesters have an understanding of morel ecology that could serve as one basis for educational materials, as well as efforts to assure positive, long-term visitor-harvester experiences (Appendix A). However, harvesters have comparatively little understanding of morel biology. This provides an opportunity for the parks to share information that will be of interest to morel hunters and promote good practices where these may be absent due to lack of information or misinformation. In recommending development of educational materials, we appreciate morel hunters' concerns that such efforts could lead to increased competition for mushrooms. However, we believe it is unlikely that visitors with no previous interest will see a display about morels and set off in search of them, while harvesters who learn that they have been engaging in a practice that is damaging or ineffective likely will cease doing so.

Pamphlets and Visitor Center displays about morel biology including life cycle, fruiting, and spore dispersal would complement, educate, and support conservation-minded activities by harvesters. Traditional harvester knowledge teaches not to disturb the roots of the morel, and this is widely practiced. Harvesters also uniformly report leaving behind morels which are old, dried out, soggy, or starting to rot. Some people pick these, crumble them up and scatter the bits; others simply leave them in place. These practices benefit the existing mycelial structure but picking and scattering morels may eliminate the possibility for spore dispersal, because spores become mature and are released only when the fruiting body is fully mature (D. Pilz, personal communication 2007). Explaining the roles and effects of these activities on the morel life cycle would allow harvesters to make informed decisions about their practices.

Educational efforts also could address the benefits of minimizing disturbance while mushroom hunting, such as the need to avoid trampling vegetation. While our research provided no first-hand testimony of raking for morels, there is sufficient observational information to confirm that it sometimes occurs. Educational materials should include information about the damaging effects of raking for mushrooms, their habitat, and other species. Based on harvester input we suggest a five point set of guidelines for new harvesters, which could provide the foundation for an educational pamphlet (Figure 9).

1. **Learn what morels look like before you set out.** Ideally, have someone who knows them take you out the first time. This will prevent the unnecessary collection of other mushrooms, like stinkhorns, or plants like *Conopholis americana*, both of which are not edible and then have to be thrown away.
2. **Be patient.** Tearing through, or tearing up, the woods will not help you find morels.
3. **Be ready to hike** and don't give up if you don't find them your first time out.
4. **Do not use a rake.** Raking will tear up the mushrooms. If you have to rake the leaves away to see the morels, they are too small to harvest.
5. **Know where you are and how to get back to your car.** It's easy to get lost in the excitement of hunting morels. Take a map and compass or GPS unit, especially if you are not familiar with the park.

Figure 9: Guidelines for New Harvesters

Education and outreach such as this report can help to foster positive relationships between national parks in the NCR and neighboring communities. While some were suspicious of interest in morel hunting, participants overall were gracious and forthcoming with their input to this study. Continuing to build relationships with local communities and including them in

management discussions can lead to more effective resource management and greater respect for the NPS (Lynch et al. 2004). The following comment by one study participant illustrates the good will and credibility that respectful engagement with morel hunters engenders:

H0720: “Well, it's like what you're doing now. I'll use you as an example. Simple fact is you're in college and you're studying all this, and you're getting ready to write up a big report about it for the government, for your college or whatever, but you're out here also, doing it. You've evidently been out hunting mushrooms and eating mushrooms, so you know, and that just makes it more real to the other person because you've actually experienced it... You'll see two sides of it.”

Future Research

Many aspects of morel management will benefit from additional consideration and research. In order to make future management decisions, accurate assessments of morel productivity and abundance should be a long-term goal of the parks in the region. Using the data provided here, researchers can now focus on specific habitats and parts of each park for a more in-depth morel habitat assessment.

A biogeographical study to identify the spatial distribution of each type of morel and more fully assess the habitat variation would aid management and contribute to the scientific understanding of eastern morel species. Harvesters are well equipped to participate in any long-term study by contributing to both design and execution. Indeed, they would be invaluable in locating morels, in site selection, data collection, and community outreach. They also have an understanding of the appropriate duration for such a study. In many cases, their local ecological knowledge and concerns about the long-term availability of morels make them uniquely qualified to dedicate time and energy to seeing it through. We suggest the establishment of a long-term study based on L. Norvell's 10-year plus collaborative study of the effects of chanterelle harvesting (Norvell 1995). Harvesters can contribute their knowledge and time to work in association with scientists in exchange for suitable compensation. This study and the relationships developed through it provide a foundation for this type of future research.

Research into the mycorrhizal relationships between morels and their tree associates will be fundamental to management. Saprotrophic and mycorrhizal fungi have completely different life strategies and requirements. The local ecological knowledge documented through this study suggests that at least some morels in the region may be facultatively mycorrhizal. If this is the case, the condition of the morel population would be dependent on the condition of mycorrhizal associates such as poplar or ash and managing for these tree species would have a greater effect on morel populations than regulating harvesting activities.

Conservation of species is often dependent on proper species identification. Because morel taxonomy is unclear, targeting some species of the genus for conservation but not others would represent a special challenge. Harvesters have noted that different types of morels are now fruiting at the same time. This may further complicate taxonomic identification because these types may now have a greater potential for hybridization (J. Dighton, personal communication 2008). Changes in seasonality almost certainly are connected to changes in climate. Harvester records suggest that weather patterns may also be responsible for changes in abundance. For

example, several harvesters identified 1996 as an excellent morel season. That same year over 82 inches of snowfall were recorded at CATO, well above the annual average of 35 inches (Catoctin Mountain Park 2006). Old-timers say that a good snow pack means a good morel season, but that snowfall has been decreasing in recent years. These reports and anecdotal evidence make studies which connect fungal biogeography and climate a potentially promising research frontier.

If morels are deemed an important resource, park general management plans, forest management plans and fire management plans should be updated to reflect this. Management policies such as those described in Figure 7 to protect and benefit morel habitats, including tree associates, could be incorporated. If parks currently do not have such plans in place, when they are created, they can reflect these concerns.

Conclusions

This research was undertaken in response to concerns about morel populations in NCR parks, occasioned in good part by anecdotal reports of reduced hunting success by visitor-harvesters. We note the importance, for effective policy development, of being clear about the range of causal factors that might underlie such observations. These include morel population decline and/or reduced fruiting, but also reduced access to mushroom patches and increased competition from other humans or wildlife. In addition, it is important to be precise about spatial dynamics, understanding whether the experiences being described pertain to the mid-Atlantic in general or NCR parks in particular.

Opinion as to whether there has been a decline in morels varies among harvesters who participated in this study. Some report that they continue to enjoy success finding mushrooms. Others feel they have experienced a reduction in the amounts they are able to harvest and variously attribute this to changing climate, increased competition, and less time spent hunting morels. The scientific literature suggests that if there has been a decline in morel populations, it is unlikely that this is due to over-harvesting. The literature and harvester knowledge suggest at least two clear explanations for reduced morel populations and/or fruiting in the NCR: habitat loss due to development and further decline in American elm. Strong associations between morels and ash trees raise the concern that emerald ash borer could lead to a further decline in yellow morel fruiting similar to that observed in association with mortality from Dutch elm disease. Loss of apple orchards to mortality or development also could reduce morel habitat. Although conscientious harvesting probably does not adversely affect morels, results from the research suggest that some raking does occur despite widespread harvester disapproval of the practice. Raking can be damaging to mushrooms, their habitat, and to other species and, thus, represents a significant concern.

This study turned up no evidence of large-scale commercial harvest and we are confident that morels from the NCR do not enter global or national commodity markets at the present time. Indeed, the density and abundance of morels in the region are such that it is unlikely this would ever be economically feasible. However, morels sometimes are sold to local restaurants and individuals. We were not able to ascertain whether mushrooms harvested on parks enter this local market. We did not quantify these activities, but local sales volumes almost certainly are modest because the overwhelming majority of morels are harvested for personal consumption.

Participants in this study believe that collaboration between parks personnel and harvesters would produce better decisions about morel management than would result if the latter were not consulted. Potential benefits of involving harvesters include enhancing the effectiveness of management strategies through incorporation of local ecological knowledge, increasing the perceived legitimacy of any guidelines or regulations, decreasing enforcement costs, and reinforcing park-community relations. Several people with whom we spoke expressed appreciation for the effort to understand their perspectives and experience through this research. Some also indicated their willingness to contribute to further research and monitoring.

Substantial confusion surrounds the current status of morel regulations on NCR parks. This confusion generates resentment and causes some local residents to avoid the parks altogether. Clear, consistent communication could help remedy this. CATO and CHOH may wish to revisit

the question of harvest limits in consultation with harvesters. If regulatory changes are made, using public outreach strategies outlined elsewhere in this report will increase harvester awareness and compliance. Opportunities also exist for educational programming that would be of interest to morel hunters. Visitor Center exhibits and pamphlets on basic morel biology particularly would be of value.

Morel hunting continues to be a valued activity for many visitors to NCR parks. It is a source of pride in towns surrounding CATO and the northern reaches of CHOH and reinforces ties to family, community, and land. This study demonstrates that harvesters possess valuable knowledge that has gone largely untapped, and an interest in being active participants in morel conservation. It also demonstrates that in-depth ethnographic research can provide significant contributions to ecological understanding and has the potential to build strong connections with communities.

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Appendix A: Harvesters: Your Questions Answered

Over the course of our visits many of you had the same questions and concerns. For example, a lot of you have developed methods for processing and preserving your mushrooms, and were curious what others have done. This appendix is an attempt to answer some of those questions, and some of the questions that I asked that many of you were curious about.

I hope you find this section useful and informative. The scientific information here is excerpted heavily from the following publication about western morels:

Pilz, David R. McLain, S. Alexander, L. Villarreal-Ruiz, S. Berch, T.L. Wurtz, C.G. Parks, E. McFarlane, B. Baker, R. Molina, and J.E. Smith. 2007. Ecology and management of morels harvested from the forests of western North America. Gen. Tech. Rep. PNW-GTR-710. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 161 p.

If you would like to learn more about morel biology, ecology, and commerce in the west, you can receive this publication for free by going to the following website: <http://www.fs.fed.us/pnw/publications/gtr710/> and downloading it from the internet. Or, to request this document by mail, please send your name, address and phone number to the following address:

PNW Publications
Portland Habilitation Center
5312 NE 148th Avenue
Portland, OR 97230.

Or, call (503) 261-1211 to order by phone. Make sure you have the complete citation information (above) available when you write or call.

If you have any additional comments or questions, please feel free to call me at 732-445-4103 or email me at esbarron@eden.rutgers.edu. You can also always feel free to contact the Natural Resources Staff at Catoctin Mountain Park at 301-416-0536 or C&O Canal at 301-714-2224.

Thanks for all your help!

Elizabeth Barron

(1) How do the morels grow? Where do they fit into the cycle of the forest? Do morels grow or do they pop up their final size?

Morels, like other mushrooms, are the fruiting structure of certain kinds of fungi. They are like the apple on the apple tree, but in this case the rest of the tree is underground, and it is called the mycelia (explained in further detail below in #2). Like the apple, the morel contains the seeds of the fungus, and it is there in order to disperse the seeds, which in this case are called spores. The spores are very small and are in little pouches deep in the pits of the mushroom. Scientists now know that the spores do not come out of the mushroom until it has reached its full size and started to dry out.

Many of you were unsure what role mushrooms play in the forest other than to provide food for people, insects and maybe other animals. In fact, fungi play a really important role in the forest as decomposers of other organisms. If it wasn't for fungi (and insects), we would all be buried under tons and tons of dead plants and animals. Fungi also provide assistance to many plants and trees in their absorption of nutrients. Morels do both of these things, so they play an important role in the forest.

Morels do grow. I know this is a hotly debated subject, and many of you have done experiments to examine whether morels grow or not. As everyone knows, morels are very tricky and they only grow under the right conditions. When the temperature and rainfall are good, the mycelia will create what are called primordia. These are very small baby mushrooms (also called buttons) that are just under the surface of the soil and can take 3 to 4 weeks to form. If the conditions stay good, the primordia will grow up through the soil and become a mushroom, sometimes growing to two-thirds its final size on that first day. It then takes about 1 – 10 more days for the mushroom to reach its final size. Sometimes if the weather and rainfall are good morels will come up, but then the weather turns and they stop growing.

(2) What are those little roots and does it matter if you pull them up or not?

Everyone knows the best way to pick a morel is to twist it off or cut it off at the base, but does it matter if you get any of those little roots up with it? Is it good enough to just throw those roots back on the ground? In fact, those little white strands are actually the main part of the morel growing through the soil. You have probably seen these white strings if you've ever pulled the bark off a dead tree branch or log. These strings are called hyphae. Very often the hyphae get together to make a thick, rope-like or web-like structure called a mycelium (singular) or mycelia (plural). These are the "roots" you may see if you accidentally pull up the bottom of the mushroom from the soil. They're not actually roots, but more like branches and stalks of the morel. No one knows how harmful it is if you break the mycelia by pulling out the bottom of the morel from the soil, but you wouldn't pick an apple by breaking off the branch! Accidentally picking the base and throwing it back is like throwing that branch at the bottom of the apple tree and hoping it will grow a new tree. In other words, twisting off or cutting off the morel at the base and making sure you don't get that bottom part up really is the best way to pick a mushroom. (note: This approach also works for milkbrooks).

(3) Does it help to pick them and crumble them up?

Some of you reported that you pick older looking mushrooms, crumble them up and toss them out onto the ground as a way to try to spread them around. The idea behind this is sort of like planting potatoes: you get a lot more potatoes if you cut the one up and plant the bits rather than

planting a whole potato in the ground. This makes sense with potatoes, but not really with mushrooms. Unlike some other mushrooms, there is no way of telling when the morel has released its spores, and if you pick it too early and crumble it up, it will no longer be able to release them. These little spores get picked up and carried by the wind, so it's better to just leave the mushroom there to shed its spores when it is ready rather than try to interfere with it.

(4) Does it matter what kind of bag you use?

As I wrote in the main part of the report, many of you have heard that using mesh bags can be beneficial for the mushrooms by letting their spores fall out while you walk through the woods. These can be mesh bags that you buy especially for mushroom hunting, or just an onion or potato bag from the grocery store. Because the morel spores mature only when the morel itself approaches its full size, if you are collecting fresh and young morels they are likely not distributing viable spores. If you are collecting mature morels and large numbers of spores are falling out of your mesh bag, it is unclear what effect this is having on the morels.

Scientists agree that using mesh bags and other ventilated containers (such as baskets) at least has the potential for spore distribution, unlike plastic or paper bags. Out west people carry large numbers of ventilated plastic baskets around on their backs. This makes sense in places where they can collect hundreds of morels every day and most people go out hunting for the whole day. Unfortunately, this is not the case in Maryland and West Virginia, where most people only go out for a few hours and are lucky to get a couple gallons. So, if you are really opposed to using a mesh bag because it tears up your mushrooms (which some of you mentioned), it's probably not a big deal. But the fact remains that this is something everyone can easily do, and just like pinching off or cutting of the mushroom rather than pulling it up, better safe than sorry.

(5) Does tossing out the water do anything?

Many of you reported that you throw out the soaking water from your morels in the hopes that you are spreading the spores. Spores are often released from morels as they dry, but it is unknown whether they release their spores in water. As I mentioned in the answer for question 4, only mature morels have mature spores which are ready to be released into the world. If you have young morels, even if they do release their spores into the soaking water, the spores are not fully grown and will therefore not grow to make new morels. If you have mature morels throwing out the water certainly can't hurt, but no one reported that this led to a new morel patch.

(6) Why it's not worth picking those little tiny ones

Almost all of you leave behind old, rotted or shriveled mushrooms. Some people leave the really small ones, others pick them. You will have read by now that only fully grown morels release their spores, so in order for morels to propagate, picking them when they are still small should be avoided. You also now know that morels do grow, so another reason to leave the small ones is that they may become bigger ones. Many of you suggested that covering up small ones with leaves and sticks was a good way to hide them until they got larger. Thirdly, many morels often have morel buttons at the base. Even if you pinch or cut off the mushroom, if you harvest a very small one there is a greater chance of damaging that button, which will then not be able to grow into a new mushroom. If everyone leaves behind the youngest and the oldest morels, it might help.

(7) Ways to preserve morels

Out west they dry a lot of their morels because they have so many, and many people think that drying them helps to concentrate and enhance the flavor. Here in the East, things are a little different. Our morels are precious, and we like to eat them while they are still fresh to get the most out of them. However, if we are really lucky, we may get enough that we want to put some up for later in the year. In the past the most popular way to preserve morels was to string them up by the base and hang them in a hot, dry place (like the attic) to dry out. The secret to this is to have dry, circulating air. If the morels get too hot or stay too damp they won't dry well and might spoil or get moldy.

Drying mushrooms is ok, and certainly the best way to preserve them if you don't have a fridge or a freezer. General consensus is that canning them, cold-packing them or freezing them suspended in water is not good. The most popular way to preserve them, which is still fairly tasty, is to prepare them just like you always do, and then about half way through the frying process, take them out of the pan and place them on paper towels to let them cool. Then arrange them in a single layer on a cookie sheet and freeze them overnight. Once they are frozen you can put them in a plastic bag or container until you want to eat them. Then, take them out of the freezer and put them right into the frying pan, still frozen. Cook them until they're done and enjoy!

(8) Purchasing spore kits

Many of you have heard of, bought or received spore kits as gifts so you can try to grow your own morels at home. No one has had success with these. This may be because these kits often come from Washington or Oregon, and the mushrooms and their environment are different out there. In general, morels are extremely difficult to grow even in the best conditions, so I would recommend not buying these kits.

(9) Current rules and regulations for different parks

As of summer, 2008 these are the current regulations for harvesting mushrooms at regional parks:

Catoctin Mountain Park: "The gathering in amounts of less than one gallon of mushrooms or berries for personal consumption per person / per day is permitted." It goes on to specify ½ gallon per person per day is allowed for all mushrooms (2008 Compendium p. 8). Note: this is a change from last year, when it was "less than one gallon", and from the previous year when it was "small amounts".

C&O Canal National Historical Park: "Edible fruits, nuts, berries, and mushrooms may be gathered by hand for personal use or consumption. Commercial use is prohibited. Removal of fruits, nuts, berries, and mushrooms cannot disturb the remainder of the plant." Limit: ½ gallon per person per day. (2006 Compendium, p. 6)

Rock Creek Park: "No fruits, nuts, berries, seeds, mushrooms or cut greenery may be gathered or collected for personal or business use or consumption in Rock Creek Park."
(<http://www.nps.gov/archive/rocr/compendium.htm>, accessed August 15, 2008)

For all state parks in Maryland: Title 8, subtitle 7 section 6.13: 08.07.06.13: Plants, Rocks, Minerals, and Animals. B. In a State park an individual may not: (1) Remove, disturb, damage, or destroy a plant, rock, mineral, or animal; (2) Cut down, remove, or destroy a tree; or (3) Feed, touch, tease, frighten, or intentionally disturb wildlife.

(<http://www.dsd.state.md.us/comar/08/08.07.06.13.htm>, accessed August 15, 2008)

So if you are found by a state park ranger, this is the official rule for plants, minerals, and animals. They do recognize that people come in and collect small amounts of mushrooms for personal use, which seems to be tolerated, but it is technically illegal.

(10) What you can do to help

If you participated in this study and read this report, you've already done a lot. Following the simple guidelines outlined in this appendix, which are all suggestions from other harvesters, will likely help the morel population in the future. Share this information with others in your community. If you have any ideas or suggestions for other things people can do to help, please contact me (see the first page of this appendix for contact information). Also, at some point in the future there may be more opportunities to be involved. If you would be interested in participating in these opportunities to learn about and preserve morels for future generations, contact me or the natural resources staff at Catoctin or C&O Canal.

(11) What makes a good mushroom hunter? You said:

“You gotta start em out young,” and I can see why with all that they have to learn: go slow, know the trees and have a knowledge of the woods, a love of mushrooms, respect for the land, respect for the other mushroom hunters, a love of nature and the outdoors, obey the rules and regulations of where you're hunting, use an onion/mesh bag to help morels re-populate, be able to identify mushrooms, like to do a lot of walking, have strong legs, keep the tradition going by passing it on in the family, and otherwise keep your mouth shut. It also helps to have good eye sight, patience, be short, hungry, crazy, persistent, and have plenty of oomph.

Appendix B: 2007 Oral History Protocol

Materials

Questions:

- Digital voice recorder (charged) with extra battery
- Digital camera (charged)
- Notebook/pen
- Proper set of questions
- Forms: IRB consent form, NPS consent form, confidential information form, demographics form

Environmental Questionnaire:

- Blank questionnaire form

Q-Sampling:

- Laminated, numbered index cards with each statement printed on a single card
- Laminated index cards with each ranking printed on a single card
- Data sheet to record ranking and participant ID
- Instruction sheet

I. Oral history questions

II. Environmental Questionnaire

After the participant has filled out the form, request clarification on chosen environmental attributes. For example, if they select soil texture, ask them to write next to that variable what they are referring to, whether they think coarse, sandy, clay-like etc. If they select dry soil, ask them to write down how dry. This will aid in the interpretation of the results and the selection of the cut-off criteria. Depth to water table: how deep is good? That sort of thing.

III. Q-sampling Protocol

2. Set out the distribution marker cards. Make sure that cards are placed in the same order for each participant, from -4 on the far left to +4 on the far right. Ask subject to read through all the items first to become familiar with them, perhaps at this point sorting into three initial piles: important, not important, uncertain or ambivalent.

4. Remind them to work from the outside in, alternating between positive and negative. After placing the appropriate number of statements under each marker, work inward alternating back and forth between the most important and least important sides. The final statements you place should be under the “0” marker. The cards can be changed at any time. After all the statements have been placed, review your selections and make adjustments as necessary.

5. Once the participant is done placing the statements, the researcher records their position on the data sheet by writing down the number of each statement in the appropriate box.

Appendix C: 2005 Oral History Questions

General/community:

- How has this area changed in the time that you have lived here?
- Do you belong to any local clubs or groups? Are there any local clubs or groups focused on mushroom collecting, that you know of?

About morels:

- How long have you been hunting?
- How did you learn how to harvest morels?
- Quantity:
 - Are you seeing more of some types than others?
 - When you find a patch of morels, do you take all of them or are you looking for certain sizes or ages?
 - When you go morel hunting, how many are you hoping to get?
 - How many have you gotten in the last few years?
 - Has that changed over time? Do you have any idea why it changed?
 - Have you noticed any other changes in the time you've been hunting morels?
- Quality:
 - Have you seen a change in the quality of the morels over time?
 - Are certain types of better quality?
 - Are certain types only found in certain areas?
- Who:
 - Who else harvests? Are they locals or do they come from "outside"?
 - Do you think there is a large demand for morels?
 - Who do you harvest with?
- How do you harvest morels? What tools do you use for collecting and carrying morels? Have you heard of anyone using a rake when hunting morels around here?
- How far do you think other people travel to hunt morels?
- Do you keep records? What kinds of things do you write down? Can I see them?
- What else do you gather?
- Do you do anything else while you pick morels, like hunt, gather other things, take your dog for a walk, get exercise...

Ecology

- Have you noticed any differences in morel populations in the different areas that you collect in? What might you attribute these differences to?
- Have you noticed any differences in morel populations since you've been collecting? If so, why do you think this is happening (for example, changes in rain fall, temperature, disturbance [fire, deer, blowdown, other?])
- Do you do anything to spread morels around or to try to make sure there are morels in the future?
- Do you know about lots of different types of mushrooms, or are you specifically interested only in morels? How do the other kinds you've mentioned differ from morels? How do you learn about these things?

- What kinds of places do you usually find morels? On hillsides or on flat areas? In shady places or sunny places? Where it is wet or where it is more dry? Are there places that you would never expect to find morels?

Health related questions

- What health risks exist in collecting wild mushrooms? How can you tell if the mushrooms you collect are safe?

Specifically about the park:

- Roughly what percent of your harvesting time is actually in the park?
- When you come to the park to hunt morels, what kind of a day are you hoping to have? What are you hoping to find?
- Do you harvest in other places like the state park? How would you compare harvesting in the national park with harvesting in the state park and the other areas you go to?
- Which parts of the parks do you prefer to gather in? Are there different names for different parts of the park? Like what?
- What is your impression of park management practices? Of the park in general?
- Are there some parts of this area where you're more likely to find morels than others? What is it about those spots that make them better for morels?
- How would you describe the relationships between the park(s) and locals? How is it different with the federal parks and the state parks?
- What did it mean for morel gatherers when the parks were established? What types of things changed, if anything, in terms of morel hunting?

Significance questions (ask these near the end):

- What do you do with the morels that you pick? Do you eat them yourself? Do you share them with other people? Have you ever sold any? To whom?
- Why do you hunt morels? What is it about hunting morels that makes you do it?
- How does gathering fit into the rest of your life?
- What if you couldn't do this anymore?
- What would someone need to know to collect morels, and how would you suggest they go about learning that?
- Some of the park managers are saying that there are fewer morels lately than there have been in many years:
 - What is your sense of the morels over the past couple years? Have morels been down? Up? About the same?
 - Are there some areas where the numbers are down more than others? What do you think that might be from?
 - Is there anything you would like to see the park do differently to make your morel hunting experience better?
- Do you have any other thoughts or other information you would like to get into this study?

Appendix D: 2007 Oral History Questions

A. Local History:

1. How long have you lived in this county? How has the county changed in that time?
2. Do you belong to any local clubs or groups? Which ones?
3. Are there any clubs or groups focused on mushroom collecting in Maryland, that you know of?
4. Can you tell me about any major weather/ecological events that you remember or that people still talk about? (e.g. hurricanes, fires, windstorms). What kind of damage did it do? What effect did it have on the mushrooms?

B. About morels [morel productivity and harvesting practices]:

1. How many years have you been hunting mushrooms for? Who do you hunt with? How did you learn how to harvest morels? What do you like best about it?
2. What time of year is the morel season? How long does the season last? Does that seem to be changing over the years? How many days during that time of year do you go mushroom hunting? What percentage of that time are you successful?
3. How do you pick morels? What tools do you use for collecting and carrying morels? Have you heard of anyone using a rake to look for mushrooms? (where?)
4. Quantity/Quality:
 - a. What are the different types? What differentiates them? (Are certain types only found in certain areas? Certain times? Are you seeing more of some types than others?)
 - b. Are certain types of morels more valuable or more prized? Do you have a favorite?
 - c. When you find a patch of morels, how do you decide which ones to take?
 - d. When you go morel hunting, how many are you hoping to get? (what's that in pounds?) How many have you gotten in the last few years?
5. Who:
 - a. How long has your family been hunting mushrooms?
 - b. How private do you think your hunting locations are? Are you aware of other people hunting for mushrooms at that same site?
 - c. Do you think there is a large demand for morels? By whom?
 - d. Describe the average morel hunter for me, where they come from, what they bring with them, how they learned to hunt mushrooms...
 - e. How far do you/would you travel to hunt mushrooms? How far do you think other people go?
6. What do you do with the morels that you pick? (Eat them yourself? share them? Have you ever sold any? To whom?)
7. Do you keep records – writing/pictures? What do you record? Can I see?
8. Do you do anything else while you pick mushrooms, like hunt turkey, gather other things, take your dog for a walk, get exercise...
9. What else do you gather at other times of the year?

C. Abundance through time/Over-harvesting Concerns/Conservation:

1. In your opinion, how has the quantity of morels in the woods changed over the past 4 – 5 years? Is this difference especially noticeable in certain areas? What changes have you noticed in the environment that you think might be contributing to this?
2. Do morels in different areas: appear at different times? Are they different sizes? Are associated with different types of trees? Has any of this changed over the past 4 – 5 years? If so, why?
3. Where are some places that you used to hunt morels that you no longer have access to? Why are you no longer allowed there? Since when? Do any morels hunters still have access to these places? How do you think the morels are doing on those areas?
4. What do you think could be done to help morels be more abundant again? Who could do this? What would you be willing to do to insure morels in the future?
5. What type of land management policies do you think work the best – when trained professionals make decisions, or when professionals and local residents work together to make decisions, or a different way that I have not mentioned?
6. What type of conservation policies do you think work the best – no access, restricted access, or another way I haven't mentioned?
7. Do you think there needs to be action taken to insure morels in the future? What would that entail? What about for other wild mushrooms?
8. Do you think mushrooms are being over-harvested?
9. What would you consider to be the top three threats to mushrooms today?

D. Ecology [general knowledge of fungi and fungi in ecosystems]

1. Do you do anything to spread morels around or to try to make sure there are morels in the future?
2. Describe for me how morels reproduce and grow. Where do the mushrooms come from?
3. Do you think any wildlife eat morels? Which ones? Have you seen or read any evidence of this?
4. What do you know about other types of mushrooms? Do you collect other types or are you specifically interested only in morels? (How do the other kinds you've mentioned differ from morels? How do you learn about these things?)
5. How do mushrooms fit into the cycle of forest life?
6. When you go out to look for a new morel spot, what are you looking for?

E. Park Management/ Relationship and perception of managers/scientists:

1. Where do you do most of your hunting? How would you compare and contrast these areas? How do you think the ownership of the property affects the morels that occur there?
2. What is your impression of the park in general? What do you like or dislike about how they're handling their land?
3. How would you describe the relationships between the park(s) and locals? How is it different with the federal parks and other public land?
4. When the park(s) were established did anything change for morel hunters?
5. Are you satisfied with your level of interaction with park staff regarding morels? What about with other resources like deer or trees?
6. In your opinion, should park staff be concerned about the mushrooms, and if so what should they do about it?
7. What type of regulations would help mushroom hunters?

8. Have you ever met anyone that studies mushrooms for a living? Would you be interested in talking with someone like that, and what would you talk about? What type of work might you do together?
10. Do you think there needs to be action taken for more growth? Why or why not?

F. Other:

1. What makes a good mushroom hunter?
2. What if you couldn't do this anymore?
3. Do you have any other thoughts or other information you would like to get into this study? Would you like a copy of the final report?

The U.S. Department of the Interior (DOI) is the nation's principal conservation agency, charged with the mission "*to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities.*" More specifically, Interior protects America's treasures for future generations, provides access to our nation's natural and cultural heritage, offers recreation opportunities, honors its trust responsibilities to American Indians and Alaska Natives and its responsibilities to island communities, conducts scientific research, provides wise stewardship of energy and mineral resources, fosters sound use of land and water resources, and conserves and protects fish and wildlife. The work that we do affects the lives of millions of people; from the family taking a vacation in one of our national parks to the children studying in one of our Indian schools.

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National Park Service
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