

Cave Exploration, Cave Conservation: Some Thoughts on Compatibility

by John H. Ganter

Introducing: The Diverse NSS

One of the most striking aspects of the organized, or 'card carrying,' caving community is the diversity of people who choose to belong -- to call themselves cavers. We include the sedentary newsletter reader, the twice-a-year cave visitor, the deep explorer dragging a camp duffel, and the cave diver. The unifying force in this mixture is a curiosity about caves, both existing and unknown. Together we wait expectantly for new discoveries. Whether directly or vicariously we are all explorers, accepting and enjoying the proceeds as one of the last terrestrial frontiers is pushed back. The caves are never the same, because as we explore we also destroy. Frontier is not a renewable resource.

The recognition that we wield a double-edged sword has resulted in a kind of group schizophrenia. Some argue for totalitarian control; caves are sacred and must be completely preserved from the boots of all cavers. Others rebel and become outlaws at the slightest attempt to regulate or even influence their behavior. The majority stand between these two extremes, painfully aware that we are in danger of *loving our caves to death*.¹ Is this perception correct? When and where is the damage taking place, and can we minimize it?

In this essay I analyze our behavior and beliefs in exploring and knowing caves, making an important distinction between individuals who accept caves as given and those who actively reveal caves to us. I will suggest that cave damage is both subtle and poorly understood, and explore the role of technology and the limits that we must impose on our use of it through individual ethics.

The Consumer and the Producer

One of the most fundamental causes of caver schizophrenia is the division between two broad classes of cavers: those who enjoy known caves and those who explore and describe new caves. Many of us fit into both classes, yet each extreme has a different view of the same problems and it is here that misunderstandings may arise.

The pure Consumer is interested in *doing* caves; their concept of 'a cave' is tied to visitation. He or she engages in a physical and psychological excursion, carrying away a remembered environment and, more importantly, the response that it evoked. Recollections of overcoming obstacles and visiting specific landmarks --rooms, formations, drops-- may form a shared social experience, with memories rehashed endlessly around campfires.

Sometimes the Consumer has simplistic ideas of where caves come from, rather like the urban child who thinks food comes from the supermarket. Caves, the naive Consumer believes, come from friends, or Guidebooks, or the Grotto. As we will see, this simplification may cause turmoil when the Consumer is made aware that consumption is not without cost.

The cave Producer derives many of the same satisfactions as the Consumer, but these come from a much more involved, unknown and risky endeavor. The Producer begins with a potential cave or passage, often a lead found through research and fieldwork. Intensive work commences, often a long-term investment of time and money with an uncertain outcome. Locating an entrance (or extension), passage enlargement and route-finding may take months or years. At some point, a distinct and exciting breakout may occur, or with no returns the effort may simply trail off. Throughout, motivation in the face of uncertain odds must be maintained and even with rewards much misery may have to be endured in exploration and mapping. The Producer must be a manager, patiently recruiting assistance and scheduling work. Special talent may be brought in from great distances to tackle specific obstacles. Dealings with the cave owners or stewards are often long-term and exceedingly delicate. Thus the Producer often has a massive investment of time, money and emotion in a single cave project: he or she may spend more time on the telephone scheduling a trip than a Consumer spends in the cave. In this context, we can see the potential for misunderstandings. The obstacle that sends the Consumers out for a beer will likely send the Producer out for other things. Digging or blasting are simply more steps towards the goal -- exploring the cave.

The Producer has to be persistent. Imagine a dig project going on for a couple of years, far from home, consuming weekends and holidays. All for the slim chance of reward. Recruits are rare and skeptical. Why shouldn't we go somewhere else and have a good time? Digging is *work*. Call us when you find something.

And then imagine that you are in the lucky few percent that succeed: a huge breakout occurs! Now, everyone wants to help. Hundreds of cavers from across the country and around the world pour in to Consume. Where were they when work needed to be done? Today, Lechuguilla Cave has been seen by millions on television and in national magazines. Few understand that all of it --the formations, the huge boreholes, the unprecedented insight into the Capitan Reef, the re-thinking of our theories of speleogenesis-- was made possible by a handful of cavers taking a risk and destroying a portion of the cave.²

We can see a clear dichotomy in that Producers and Consumers deal with the same things, caves, but consider them from differing points of view. This difference appears whenever we become aware that we are damaging the caves that we enjoy so much. Each group points the finger. Producers break things as they explore; they are bad. Consumers go on useless recreational wanderings; they are bad. Or we band together and point outward at the great unwashed masses; it is the faceless vandal who destroys caves, not us.³

The truth is not so simple. It is fruitless to pursue the first two arguments. Producers and Consumers are locked in a symbiotic relationship. We need new caves; those who truly want to preserve caves are not cavers, by definition.⁴ And we all like to be Consumers, to be able to read about and have the option of visiting a wide variety of caves. There are too many caves and too little time, and so we have publications, slide shows and films. Together we form the community which provides both concrete and intangible support to Producers. Periodicals, meetings and Conventions are all necessary for communication, sharing, recognition and praise of accomplishments. Together we form a massive information pool on caves and caving techniques, as well as a market for specialized equipment. Thus we cannot condemn either the cave Producer or Consumer for damage to caves, nor can we transfer

blame outside our ranks. What we *can* do is distinguish between types and sources of damage to caves, and develop voluntary guidelines that will serve the individual.

Defining Damage to Caves

Many of our ideas about damage to caves are vague and conflicting, reflecting our emotional response to the alterations that we perceive in ‘natural’ state. What exactly are we reacting to? Speleogenesis, the formation of caves through physical and chemical weathering processes, is notoriously messy. Structural weaknesses such as joints and bedding planes are enlarged by chemically aggressive water, widening and collapsing as roofs and walls fall in. Sediments transported from the land surface or resting in-situ from the dissolution process lie about in untidy heaps. Calcium carbonate and other minerals fall from solution and ooze about in messy deposits. What is appealing, even attractive, about this chaotic order? *It is wild*. The works of humans are absent. Caves are wilderness -- which has been defined as a state of mind.⁵ We like caves because there is no one there and no evidence to suggest that there ever has been. Cave damage is not simply physical reality, but also an emotional suggestion and response.

Another way to consider cave damage is in terms of its *spatial distribution*: where and how does it appear? We can identify concentrated damage to a single location; for example, a removed speleothem or widened passage which is visible from a limited area. Dispersed damage, on the other hand, is widespread, affecting substantial lengths of passage and broad views. Damage to caves also occurs over time: it has a *temporal distribution*. Damage may be acute, concentrated in a short time period, or it may be chronic, occurring over long periods of time. Since many caves do little to ‘repair’ themselves, at least within humanly-perceivable spans of time, temporal spacing is important. Acute effects may gradually vanish, while chronic damage accumulates and encourages still more damage since the effects of an individual visitor are less and less visible. Clearly we cannot assess damage simply by magnitude: we must also consider how it occurs across space and time.

Damage Tolerance

Cavers often discuss ‘cave conservation’ with an unspoken assumption of what is being conserved. One caver may conjure up the image of glittering carpets of crystals and delicate helictites; the other a raging river cave. Both are caves, yet each will necessarily color the individual's assessment of what conservation is and how to achieve it.

This example illustrates a useful distinction between types of caves: their *energy level*.⁶ High-energy caves tend to flood at least annually and often carry a substantial base-flow. Bedrock erosional features such as scallops and potholes are common. Abundant sediments may be well-sorted by water movement and lying in piles which change shape and size frequently. Speleothems are rare, as they are quickly scoured away or broken off. Damage from visitation does not tend to accumulate in this type of cave.

Moderate-energy caves are disturbed by much smaller amounts of water, and often contain a variety of surface-originating debris transported by animals, wind and gravity. Speleothems tend to be large masses of flowstone, reflecting abundant saturated water but conditions that are too active for the growth of finer crystals. Moderate-energy caves accumulate some damage, but it may be masked by occasional flooding and sediment re-

arrangement.

Low-energy caves are extremely quiet. The falling of a water droplet is a major event. Speleothems are small and delicate, resulting solely from the minute forces of crystal growth. Low-energy caves are highly-susceptible to damage and do not repair themselves.

These extremes of energy exist, and may exist in different parts of the same cave. It is within these varied contexts that the effects of human visitation must be considered. The concept of current damage becoming indistinguishable from previous damage is paramount. Conduct that is utterly insignificant in a high-energy cave may indelibly affect millions of years of natural process in a low-energy cave.

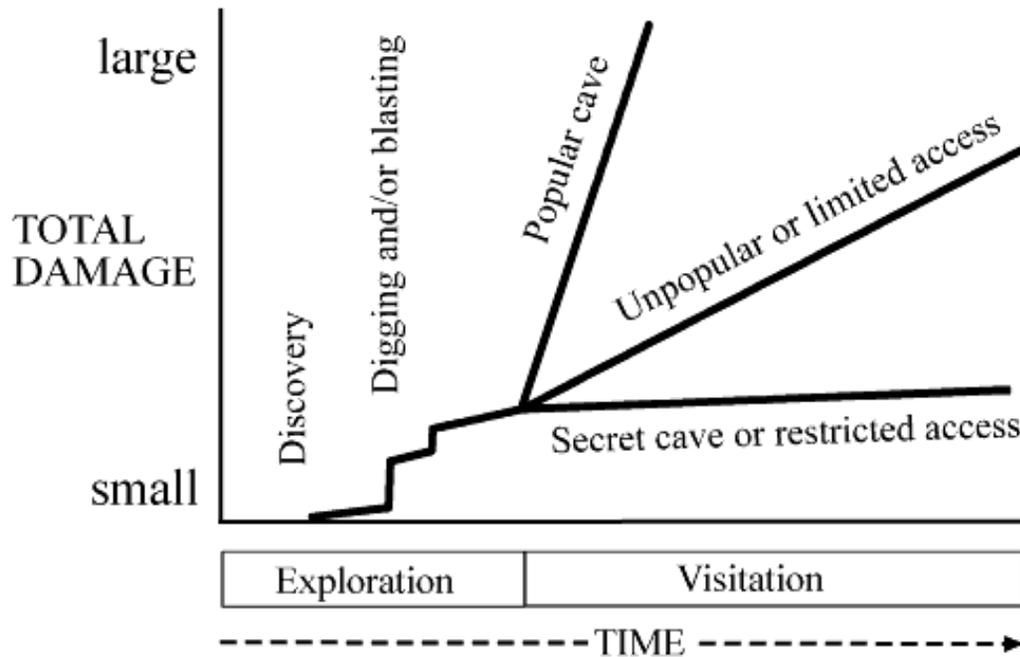
Along with this consideration of energy level is that of size, both absolute and relative. Absolute size is a popular obsession among cavers who devour lists of numbers purportedly describing the lengths and depths of caves, rather like shoppers perusing the weights and prices on cuts of meat. Perhaps more important to this discussion is *relative size*. A particular cave and its contents must be seen in the context of the region wherein it lies, and the other caves surrounding it. What constitutes a formation, or even a cave, is much different in New Jersey and New Guinea. What is sacrificed without a thought in one place might be considered a treasure in another. It has been observed that the narrow and careful trails of Lechuguilla Cave have destroyed a greater volume of formations than exist in the caves of whole states elsewhere.⁷ Clearly, context counts.

Damage Prevention

To our credit, organized cavers have reluctantly admitted our guilt in damaging caves. As Consumers, this often stems from our enthusiasm in introducing those with a demonstrated interest in caves to the reality of a trip underground. Often we are so preoccupied with the details of lights, climbing, not getting lost, wearing the proper clothes and shoes, etc. that we neglect what is much more difficult to talk about: *caving softly*. It is this "extra bit of awareness and focus"⁸ that makes it possible to be a Consumer without being a destroyer.

Unfortunately, it appears that many 'experienced' cavers are destructive. Technical competence or even prowess does not necessarily imply restraint and the ability to cave softly. Many can power their way up, down, over and through obstacles like climbs, drops, water, even speleothems, but low-impact caving requires complementary skills and outlook. It requires discipline, awareness and planning. The experienced caver who goes off of an established trail can cause dispersed damage over wide areas, instantly negating the care of hundreds of predecessors.

What I will term the *Angel's Paradise Phenomenon*⁹ occurs when Consumers trash what Producers have so carefully conserved. The Producer/explorer has great respect for the cave they are pushing, brought on by the intensity of the experience. Everything is unknown and undisturbed; the Producer is acutely aware that he or she is engaged in a creative process. For a time, the cave is an extension of the explorer themselves. Once exploration subsides, the cave becomes community property. Consumers who follow must traverse and experience much more in order to gain satisfaction. The Consumer is there to be entertained, and as a result often lacks awareness and respect. Damage to caves is often evolutionary in nature; it involves an increasing *rate* of total damage over time. Starting with discovery, the exploration phase causes relatively little damage. But in the visitation phase, damage may increase rapidly, especially when the visitor cannot distinguish new damage from that of the past (see Figure).



Damage over time in a hypothetical cave. After brief episodes of digging or blasting in the exploration phase, damage often increases considerably during visitation. Here three possible rates are shown, depending on popularity, publicity or secrecy, gating or other access restrictions, etc.

What can we do to prevent the Angel's Paradise Phenomenon? Educate and police ourselves. Use restraint in leading guests who have not demonstrated their ability to cave softly. Apply peer pressure. And, of course, we can limit access.

Limiting access to various degrees has been compared to a library which has open circulation areas, a reserve room, and a rare book room.¹⁰ Extraordinary 'rare book rooms' can be additionally protected by the *Lascaux Policy*, which involves closing of a cave or section almost completely, on the grounds that viewing or experiencing it directly is not necessary and does permanent and unjustifiable damage. In these cases, vicarious experience has to do. The only individuals admitted are those with special talents in creating and sharing the experience or some new knowledge; accomplished photographers or researchers, for example.

Do cavers have the self-discipline to respect 'rare book rooms' that are not world treasures like Lascaux? Consider the Chandelier Ballroom of Lechuguilla as an example. Surely, this spectacular display has been photographed and described in such depth that we should all be able to enjoy it vicariously ad infinitum. But instead we feel compelled to go there, to experience it directly. Why? Why, as the stench of the latrines hundreds of feet away in this low-energy cave become unbearable, do we insist on crowding into this corner of wilderness? I don't know. But by being Consumers, we are also destroyers, as the necessary and judicious damage done by the Producers dwindles to insignificance under the bootprints of the hordes.

Cave Production

Since as Consumers we often behave so irresponsibly (and perhaps even irrationally), it is not surprising that upon recognizing growing cave damage, we sometimes do strange things like blaming Producers. In some ways this is not surprising, because indeed the Producer does destroy and it is always part of the story. Destruction by Consumers --dispersed, chronic and cumulative-- is not newsworthy so we don't think about it.

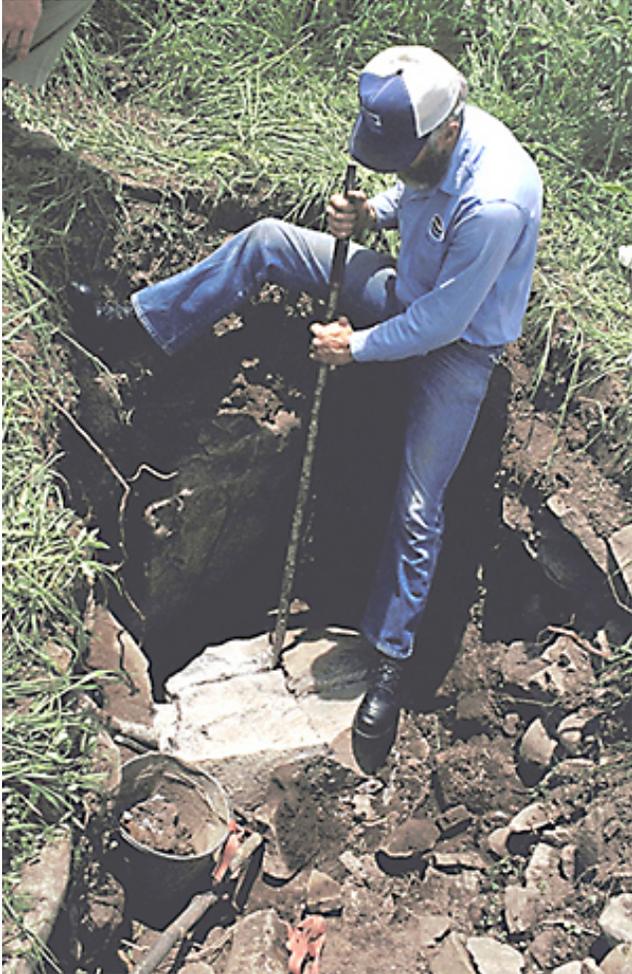
Recognizing that Consumers are sometimes queasy about the origins of the caves that they enjoy, Producers often sanitize their accounts of exploration. Just as warm blood does not flow languidly from behind the swinging doors in the supermarket, the surgical removal of formations or a tight passage bend may be politely neglected in published accounts. Yet this is a problem, for how are we to develop personal standards of conduct (ethics) unless we discuss openly the tough decisions that we collectively face?

Jim Smith is one of the few explorers to have told it like it is, in national and international publications. Not only does Smith talk frankly about repeated aid-climbing and blasting in *No Business Blowing Cave*, but a sidebar explains his feelings on the price that must be paid.¹¹ He points out that "there has to be a tradeoff between conservation and exploration. Otherwise, new frontiers will never be pushed." Smith comments that he preserves formations with great care whenever possible, and states forcefully that he "abhor[s] willful, malicious vandalism of any kind."

Yet our mixed feelings about cave production continue, and they are most evident where blasting is concerned. Our reservations have been divided into two types: conservation and "fair play."¹² I have already noted that blasting in the course of exploration may be insignificant, over space and time, compared to Consumption. There remains fair play -- what is reasonable in caving, an inherently human-powered activity? We are uncertain where to draw the line. Granted, we require artificial light to venture underground. But we may only dig by hand. Well, a shovel is OK. But then, we drive to the caves through vast roadcuts, so why not bring a bulldozer? And so our attempt at limits spirals outward. We are inextricably tied to technology in the form of nylon rope and mechanical ascenders and batteries and spectrometrically-monitored mixed diving gases and dive scooters and on and on. Attempts to draw the line are often absurd, like the Mennonite who piously drives a buggy pulled by horses wearing super-hardened alloy shoes from the cutting edge of metallurgy. Isn't blasting fair? We are not sure; the issue makes us uneasy. It's the antithesis of caves; great mountains of smoke and fire... right? Perhaps we should examine cave blasting in more detail. Cavers as a group seem uninformed about a subject that can incite such controversy.

Cave Production...

Photos by author



A farmer shows cavers how to break a large subsoil boulder using a digging bar. Two days work produced an 88 foot pit, but no access to the far reaches of the large cave below. Many digs are investments that return little or nothing.



Surface weathering and erosion often plug cave entrances at the land surface. Here cavers relocate a boulder using a ratchet winch, webbing slings and hand tools. The next obstacle was an aid climb; the passage thus gained continues.



"Annual maintenance" for a cave entrance located in a West Virginia stream bed. Many eastern caves are affected by natural processes that modify them constantly. Unfortunately, large human-induced changes (runoff, erosion, etc.) increase the need for technological counter-measures like digging and blasting



After surveys revealed the possibility, a passage was blasted and dug through 12 feet of soil to form a new entrance. This allowed explorers to avoid the natural entrance which flash-floods and is being filled by sediment. (Bill Storage photo)

Blasting in Cave Exploration

For the most part, our ideas about blowing things up come from two sources: Hollywood and quarries (or mines). Unfortunately, neither has much to do with blasting in caves. In order to titillate audiences and create visual excitement, Hollywood does not really explode things -- it burns them rapidly. Large quantities of gasoline and oil produce orange towers of smoke and flames. By contrast, cave blasting is quick, quiet and clean. In quarrying and mining, the great blasts which shake the ground and send nearby seismographs rocking involve hundreds or thousands of pounds of explosives, lifting thousands or millions of tons of rock so that it may be easily scooped up and carried away. Responsible blasting in caves is to quarrying as hand trowels are to bulldozers.

Cave-related blasting is directed at one of two basic goals: passage enlargement or excavation. Passage enlargement (which here will include reducing the size of breakdown) involves making rock yield and disintegrate by the extremely rapid application of a relatively small force. Small charges (typically 1 to 4 pounds) of high-velocity explosives are used. Modern, commercial high explosives are very stable and difficult to explode. But when initiated properly with an electrically-triggered blasting cap, these materials explode at 15,000 to 25,000 feet per second. The result is breakage of a very small adjacent area: indeed, firm contact between charge and rock is critical to the success of the blast. The explosion is like hitting the wall or breakdown with a small hammer... at 3 to 5 miles per second. It causes results, but it doesn't shake the whole cave. Energy falls off so sharply that in winding cave passages it is often difficult for blasters to hear whether the charge has gone off at distances over a couple of hundred feet. Most cave explorers use high-explosives designed and manufactured specifically for low fume production. These produce relatively small amounts of water, nitrogen and various oxides of nitrogen for minimal impact on the cave and cavers. Depending on air movement, the blast area may have to be allowed to ventilate for anywhere from a few minutes to several days.

The second type of blasting used in cave exploration is excavation, where large amounts of material are heaved using larger amounts (20 to 100+ lbs.) of relatively slow explosive. Almost without exception, excavation blasting is applied to sinkholes in attempts to remove regolith (soil and other weathering materials) from potential cave entrances. It also may be used to restore sinks that have been artificially filled with stone or other debris. Slow explosives tend to produce larger amounts of toxic fumes, and, for our own safety, must not be used underground. The energy released in excavation blasting is less concentrated, and can affect much larger portions of caves and the land surface. Breakdown may be loosened, and projectiles may fly into the air.

Often, we are concerned about the effects of blasting on the animals inhabiting a cave. For discussion purposes these can be divided into those that commute outside (bats and other mammals, mostly) and whose presence can be observed, and permanent residents. Obviously, the effects of blasting on bats and other mammals varies from destruction at close range, to disturbed sleep at the range of the blasters, to peaceful slumber out of earshot. Simply put, blasting must always be scheduled for times when these occupants are not at home, particularly if caving is seasonally regulated to protect the population. If in doubt, knowledgeable persons must be contacted for assistance in assessing the situation.¹³

Then there are the smaller beasts, the amphibians and invertebrates. Basically they are of two types: ubiquitous and endangered. Small things tend to occur in large numbers: there are trillions of insects and millions of sparrows and (there should be) thousands of raptors. If we sacrifice a few common worms or insects, who cares? No need to get distraught in the cave, because installing one guardrail on the interstate highway we drove there on killed a

lot more. Instead we need to be concerned about effects on the ecosystem as a unit, the whole web which supports the whole population, not a concentrated blast that eliminates a few individuals.

Then there are the endangered species, those whose habitats have been so ravaged that a single cave may be all that they have left. In these caves we don't blast, because we don't cave. (Naturally, the Producer must be vigilant in new caves, so that potentially significant organisms or populations can be examined by qualified individuals and protected if necessary.)

There is a trend in passage enlargement towards even smaller charges -- doing the most with the least through careful design. In surgery, bigger is not better. The same trend is occurring in excavation. Setting off a large amount of explosive in a sinkhole is a wasteful gamble which assumes that the void below is large enough and stable enough to receive part of the heaved material and a lot of energy. Often it is not, and the potential entrance is destroyed. The trend is towards careful, patient digging in sinks so that a stable entrance can be maintained over a long period of time.

So we can see that blasting is not so simple as might be thought, particularly in terms of its damage to caves. It is quite limited in spatial and temporal effect, particularly since obstacles in need of enlargement are, by definition, small. The blaster (assuming that he or she caves softly) re-arranges small parts of caves, and leaves nothing but a small organic residue. Rock dust and fragments are quickly removed in high-energy caves. In moderate-energy caves, sediments (particularly weathering residue from the bedrock) often cover blast effects rapidly -- perhaps as soon as the muddy explorer returns to squeeze through the enlargement. In contrast, low-energy caves may show blast effects for long periods.

But how often are low-energy caves blasted? Caves have varied tolerances for blasting depending on their energy levels, but there also appears to be a correlated *need* for blasting. Low-energy caves are quiet because they are not part of active earth processes. Passages and rooms tend to be quasi-random, reflecting phreatic or other multi-directional genesis. The cave may not *go* anywhere in particular. With the exception of air, there may be nothing to lead the explorer on beyond the point where his or her body stops. But contrast this with the explorer who is lying on their side in a tight, sinuous canyon with water pouring down their legs. There is *process* here; the cave is alive! The explorer is witness to speleogenesis, and can see, out of the corner of their eye, a bit of randomness which is stopping progress: a protruding blade of rock. Why is it there? A slight imperfection in the bedding plane, an errant armoring by sediment, a sudden glitch in base level. One thing is for sure, it's a noise in the signal. The explorer decides to re-write history a tiny bit. The hammer swings or the bang explodes, and the alluring darkness at the end of the canyon slowly and painfully is revealed. And, at that point, it actually *becomes* cave, in the sense that caves are as large as we measure them to be.

Utility and the Criterion of Intent

Still we have not resolved the dilemma of technology. We have the means to do virtually anything where caves are concerned: about the only barriers are time and money. As Hetch Hetchy¹⁴ and James Watt demonstrated, neither is sufficient where irreplaceable natural resources are at stake. Where do we stop? Jim Smith says blasting is " [sometimes] a necessity that must be practiced in good taste."¹⁵ Red Watson admits that he uses artificial entrances tunneled through solid rock, because they make exploration easier. Yet in the next paragraph, he concludes that "I don't have any hesitation about my disapproval of blasting. Fair's fair."¹⁶ So caving is unfair. We don't belong down there; we are not natives of caves.

Somewhere between removing a meander that makes a passage extremely tight and sinking an elevator shaft into Angel's Paradise we cross a threshold. Too much. The threshold is defined and re-defined by the opinions of peers, and it is a distinction of degree that varies by cave region.¹⁷ Smith claims that "only those that pursue... exploration have the right to sit in judgement." And indeed we do. Together the entire caving community creates a *climate* in which certain behavior is accepted or rejected. We cannot control the behavior of Producers working in specific caves, but we seek to set the trends.

But some, true preservationists, may say that the trends are all wrong. Lately, we cavers have been on a legislation binge, at both the federal and state level. Our intent is laudable: to make the public aware that caves are valuable and to impose penalties on those who destroy them. And we are not alone. Gradually, organizations devoted to the conservation of the earth in general have become aware that the underworld counts too. They see caves as significant sanctuaries, particularly for cave-dwelling biotic populations. That does not mean cavers. Is there the possibility that in the future cavers will be prosecuted under the very laws that we have put on the books? The threat has already been voiced, and sadly, it comes not from outside, but from a traumatized Consumer.¹⁸ Where there are laws, we go caving through the loopholes. Literally interpreted, caving is illegal. Again, a threshold. What is caving and what is vandalism?

A difficult question? Perhaps not. I suggest that we use the *criterion of intent*. A vandal does wanton, malicious, purposeless and destructive things that damage the cave. Damage is the goal. The vandal robs the future for the moment. The explorer also may damage the cave, but it is the means to a positive end: the production of knowledge. The explorer is concerned, creative and curious. A part of the cave is lost, but something else is created: significant new knowledge. The Producer creates documents and maps which describe and explain, and thus the proof of intent is on paper, film and disk. It is shared. It has been said that if he were prosecuted under a cave protection law, Smith's account would make good evidence in court.¹⁹ And that is precisely the point. The article proves that his intent is good -- that he is a Producer.

Conclusions: Fire Prevention and Fire Fighting

In the coming years we will repeatedly hesitate at caving thresholds, and we will probably redefine them. New technology will bring new capabilities for creation and destruction. We will question and debate whether we have gone too far. This is healthy and necessary, for we must make both newcomers to caving and newcomers to caves aware of the tough questions they present.

And I suggest that instead of getting too engrossed in the minutiae of ethics, questioning of each others intentions, and prosecuting ourselves, we turn to vaccination or prevention. We need to continually remind ourselves to cave softly, and to teach ourselves and others the virtues of restraint. We must learn to cave soft and push hard. We must also turn outward and place caves in the context of karst. For as our population matures and returns to rural areas, dispersed and insidious damage will be done. What portion of this population knows that it really isn't wise to put dead animals in sinkholes, or build drainfields on limestone, or shopping malls on aquifer recharge zones? One percent? Five percent? Those of us who do know can't police this kind of dispersed damage; instead we 'fight the fires' once they have started. By the time we start the petitions circulating, or enter the courts, it's too late -- the damage is done.

But what if we could double the percentage of people who know about karst, who know about the earth? Just a little bit, basic things like: Water moves through the ground. The ground is not a magic filter. Water is not limitless. What goes in comes out. Now 'zoom out' and visualize 250 million people.

Imagine the farmer picking up the phone and calling the renderer, the prospective homeowner nailing the real estate agent about the septic system, and the mall developers hiring a geoscientist. Think about the subtle but vast effects of this gradually diffusing knowledge and you will, I think, see where cave conservation should be headed.

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Notes

1 This expression is adapted from a discussion of human impact on wilderness in Roderick Nash, *Wilderness and the American Mind* (Yale Univ. Press, revised ed., 1973), p. 264 and 268.

2 Based loosely on Vi Allured, *Lechuguilla Cave: The Dig*, *NSS News*, Jul. 1988, p. 292-294.

3 For example, the propaganda posters developed by the Cave Vandal Deterrence Commission show a scowling masked vandal with hammer and broken formation (*NSS News*, Nov. 1984, p. 340).

4 This observation is from Red Watson, *The Philosophy of the Cave: Instant Cave* in *NSS News*, November 1983, p. 305.

5 Nash, p. 4-5.

6 The following definitions are based on Tim Heaton, *Caves: A Tremendous Range in Energy Environments on Earth*, *NSS News*, Aug. 1986, p. 302-304.

7 This comment was made to me by Jim Smith and Bill Steele.

8 Rob Stitt, *Cave Conservation*, *NSS News*, Oct. 1986, p. 360.

9 Bill Steele tells the story of being the third person to gingerly move through Angel's Paradise (Ellison's Cave, Georgia) in 1969. Three years later a large trail and other damage marred this extremely remote and difficult-to-find area. The only people in Paradise had been vertically-competent cavers, many from a nearby Convention.

10 This powerful analogy comes from Rick Smith, Cave Wilderness and Lechuguilla: A Park Service Viewpoint, NSS News, Nov. 1988, p. 432. Smith uses it to discuss the levels of cave access necessary within a national park, ranging from wheelchair access to 'wilderness' (wild caves for the experienced caver). In this discussion, I change emphasis and re-apply the analogy specifically to these wild caves and features within them.

11 First published as Thin Leads, Fat Charges, Punctuate the Story of No Business Blowing Cave, in Descent (No. 81, April/May 1988, p. 32-35). No letters followed and indeed the British being practical cavers were probably keen on the story. Next it appeared as No Business Blowing Cave: Exploration of an Epic T.A.G. Vertical Cave, NSS News, Sept. 1988, p. 349-353.

12 Watson, cited.

13 An amazingly frank, well-written and balanced (read 'British') discussion of digging, blasting and bats appears in Fauna and Flora Protection Society, Bats Underground: A Conservation Code, Descent 84, October/November 1988, p. 32-33.

14 The Hetch Hetchy Dam was the first time that Americans chose between a resource (water) and wilderness. Nash (cited) devotes a entire chapter to this significant turning point in national outlook.

15 Cited, in sidebar.

16 Watson, cited, p. 305.

17 Sarah Bishop (Cave Wilderness: Who Needs It?, NSS News, Nov. 1988, p. 433-434) points out that management of specific caves will require the consideration of many such questions, and that cavers must "be there to offer our opinions."

18 Tim Hornaday, A Cave or a Quarry? (Letter to the Editor), NSS News, Dec. 1988, p. 444. With reference to Smith (cited), the author admits that he cannot define the difference between a cave and a quarry, but claims that he is entitled to a value judgement. He suggests that this style of caving should not be covered in the NSS News. He concludes by stating that Smith's article would make good evidence for prosecution under a state cave law.

19 Hornaday, cited.

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