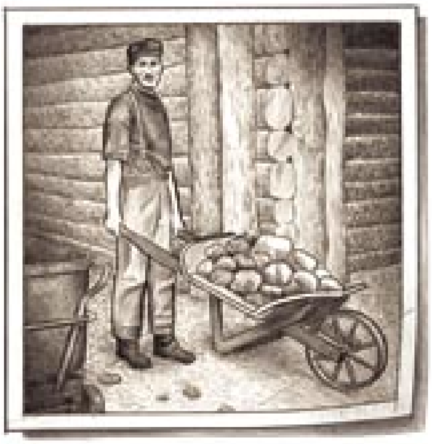
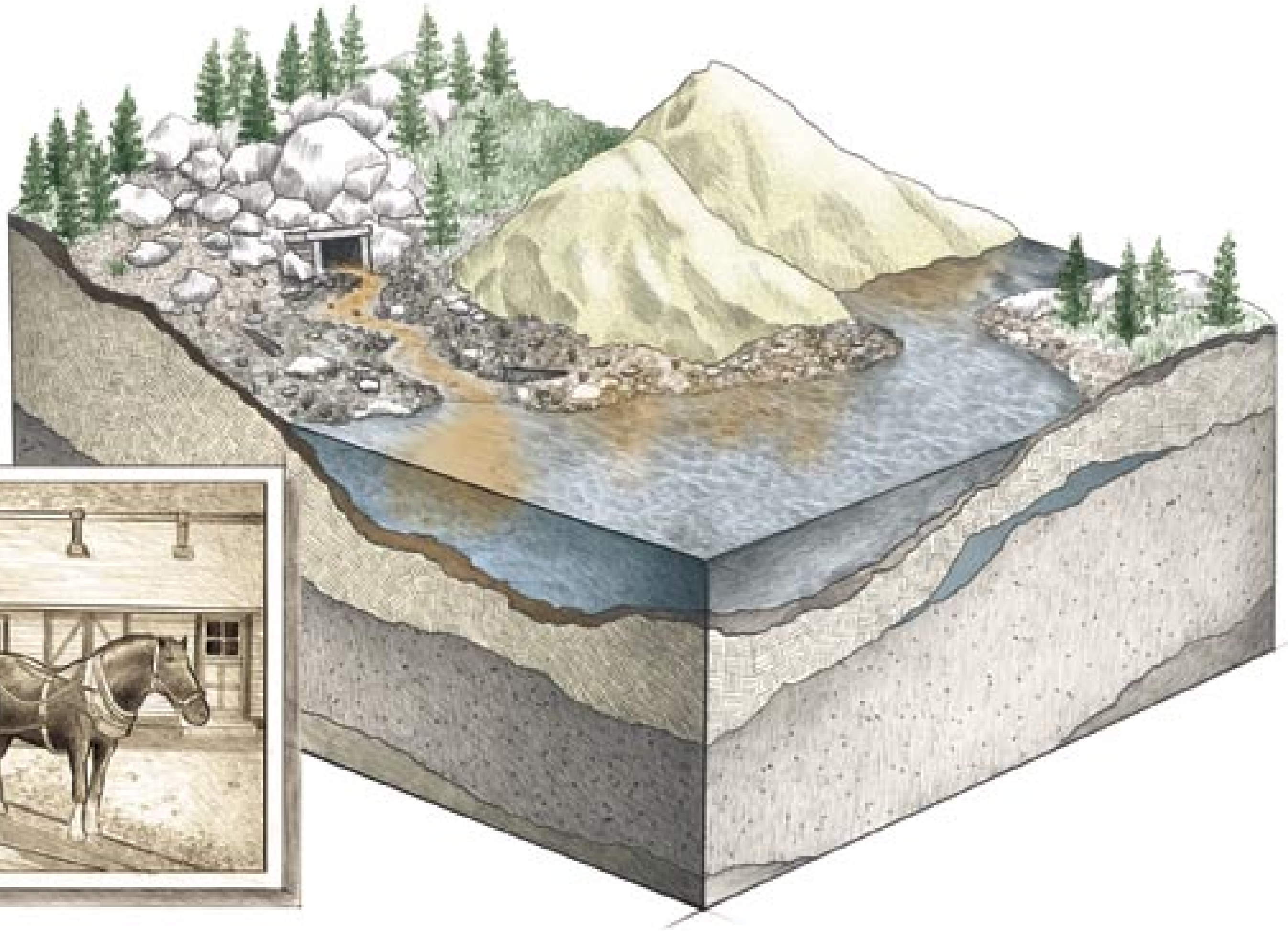
Settled, Mined & Left Behind

The Legacy of Abandoned Hardrock Mines for the Rivers and Fish of the American West, and Solutions for Cleaning Them Up





TROUT UNLIMITED

A Report Produced by Trout Unlimited's Public Lands Initiative

photo courtesy *Mineral Policy Center*

introduction

Abandoned mines pose one of the most significant and least understood problems for people, fish and water quality in the western United States. "Settled, Mined & Left Behind" highlights 10 different watersheds throughout the West that have been affected by abandoned mineland pollution. This report presents opportunities for volunteer-led conservation efforts, examples of restoration successes such as the Blackfoot River in Montana and the Animas River in Colorado, and identifies steps that must be taken in order to reclaim a toxic legacy of abandoned mines for a future of clean and healthy watersheds.

The mining industry played a significant role in opening and settling the American West. The minerals and raw materials that fueled westward expansion provided jobs and opportunity, and fueled our national economy for decades. Such economic progress was not without cost. Today over 500,000 abandoned mine sites litter the western landscape, affecting 16,000 miles of streams, largely on public lands. The Sacramento River watershed alone, profiled in this report, is estimated to have between 1,000 and 2,000 abandoned mine sites, though no accurate inventory exists.

With the support and commitment of federal agencies (such as the U.S. Forest Service, the Bureau of Land Management and the Environmental Protection Agency), state resource management agencies, restoration professionals and non-profit partners such as Trout Unlimited, communities can redress the problems associated with abandoned mines and their impacts on water quality, human health and fisheries. "Settled, Mined & Left Behind" is a first step in that direction. Existing law discourages remedial action and funding is woefully scarce for restoration efforts. Trout Unlimited believes that with issue familiarity, options for restoration participation, and the knowledge that a difference can be made through local restoration projects, a legacy of abandoned mineland pollution can be transformed into healthy, productive and diverse watersheds for the benefit and use of future generations.

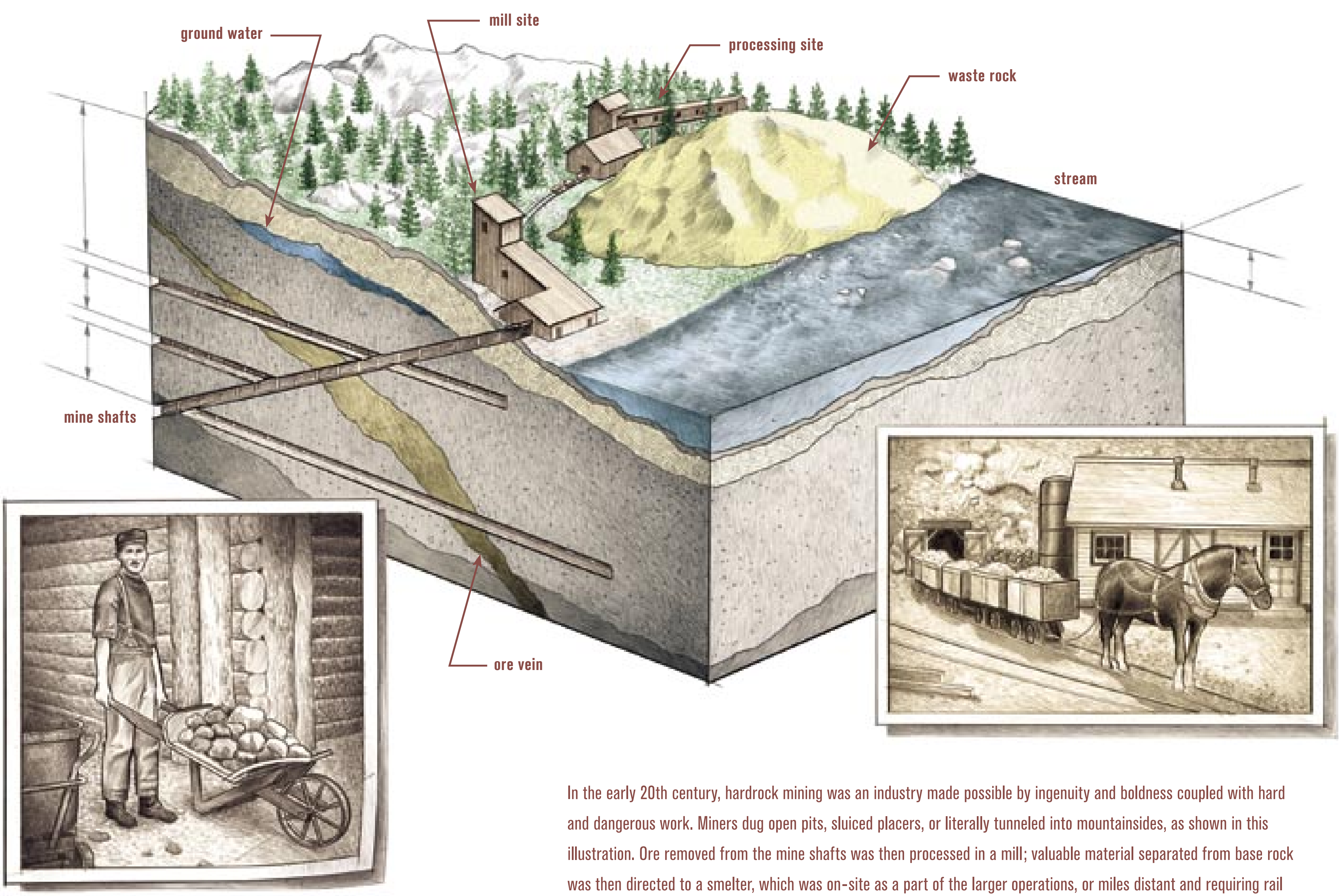
prologue

May 14, 1804 – The **Corps of Discovery** launches from Camp Dubois, Illinois in search of the elusive water route to the Pacific through President Thomas Jefferson's newly acquired Louisiana Purchase. En route it will report back to Jefferson on the West's seemingly inexhaustible abundance of natural resources. This theme of limitless abundance will drive westward expansion for the next century, spurring countless families to seek a better life west of the Mississippi River.

January 24, 1848 – An observant millwright in the employ of entrepreneur John Sutter notices that much of the silty debris clogging the millrace of Sutter's sawmill near Coloma, California, possesses an intriguing metallic sparkle. Despite Sutter's efforts to keep the discovery quiet, the **California Gold Rush** had been sparked.

May 20, 1862 – President Abraham Lincoln signs **The Homestead Act** into law, offering 160 acres to any head of household over age 21 willing to pony up a $6 filing fee. Designed during pre-Civil War tensions to inspire large numbers of Americans to migrate westward and to fill out some 270 million acres, the Homestead Act by 1900 would draw more than 600,000 new land claims. Historian Frederick Jackson Turner would call this "the greatest free gift ever bestowed on mankind."

May 10, 1872 – With the Civil War ended and the grand adventure of western settlement proving to be more challenging than initially hoped, the federal government seeks to further sweeten settlement's appeal by offering much of the West's vast mineral resources to nearly anyone willing to show up, sign up, and dig. President Ulysses S. Grant allows private interests the right to profit in perpetuity from all hardrock minerals on public lands across the vast American West – including gold, silver, and copper – by signing the **1872 General Mining Law.** The law offers public lands for sale at $2.50 to five bucks an acre, and exempts mineral extraction on public lands from taxes and royalties. Little to no thought is given to the need to clean up, reclaim, or otherwise restore lands and waterways from the after effects of mining.



In the early 20th century, hardrock mining was an industry made possible by ingenuity and boldness coupled with hard and dangerous work. Miners dug open pits, sluiced placers, or literally tunneled into mountainsides, as shown in this illustration. Ore removed from the mine shafts was then processed in a mill; valuable material separated from base rock was then directed to a smelter, which was on-site as a part of the larger operations, or miles distant and requiring rail transport by way of mules or other means. Waste rock, which is also called tailings when discharged from a mill, was piled up in the most efficient manner, usually immediately downslope from a shaft opening (adit) or, in later years, piled up using earth moving equipment.

illustration by Bob Bredemeier

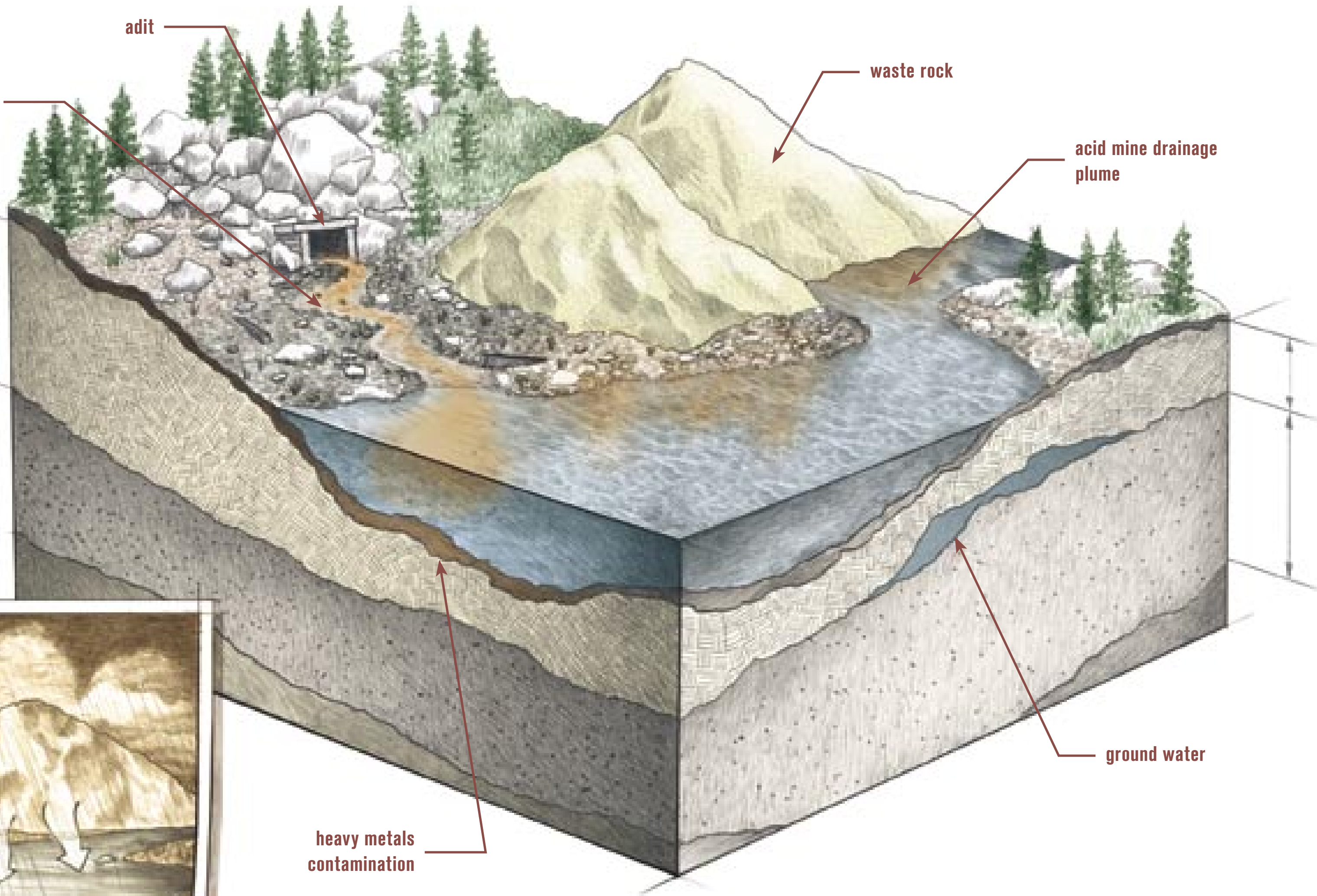
today

2004 – The West has been settled. Land is no longer cheap. We know where the Pacific Ocean lies and have plenty of ways to reach it. The Homestead Act was repealed in 1976; even in Alaska – the West's Last Frontier and site of its own Gold Rush – homesteading disappeared. Aside from the dusty remnants of boomtowns, local folklore, and a few contemporary hobbyists staking panning claims, little remains of the California Gold Rush. The industry it helped spawn throughout the West, however, continues here and far beyond. Only now, it must dig harder, deeper, and smarter than before to remove valuable minerals from the land – minerals that have fueled western growth, provided jobs and economic opportunity and fueled our national economy.

The most prominent artifact of this bygone era persists. Still on the books, the 1872 General Mining Law stands as a testament to the nation's westward expansion, speaking to the lure of riches and maps yet uncompleted. We showed up, settled in, and we mined. In many places, we mined a lot. Some mines, like any other western venture of the time, were more successful than others. And when the minerals became too difficult to extract, or simply weren't there, we moved on, over the next ridge, or into the next valley.

On one side of the coin the legacy of opening the West to hardrock mining is romantic and nostalgic: grainy photographs of crude sluice box operations manned by faceless laborers, giant water cannons blasting away at hillsides, or engineering marvels with rail trestles hundreds of feet high – decades ahead of their time – straddling sheer cliffs. Tombstones. Ghost towns. Gold nuggets the size of golf balls.

The coin's flip-side portrays more sobering images: massive piles of waste rock, strange liquids of unnatural colors seeping into streams, scarred mountains honeycombed with tunnels, and rivers devoid of insects and scattered with fish belly-up. Worse, much of this legacy is obscured from view, hidden in stream flows or concealed in rock piles along the side of streambanks. Thinking ahead in ecological terms was not at the forefront,



Precipitation naturally percolates into and through mill tailings and waste rock piles, which are exposed to weathering and oxidization processes. The outflow of precipitation and runoff from the base of this material can be quite acidic, and acutely toxic to plants, wildlife, and aquatic resources.

At many abandoned mine sites, shaft openings, called **adits**, often appear as an inconspicuous gash in a hillside. Where they are exposed to runoff or groundwater seepage, mine shafts expose mineralized earth material to water, which can create **acid mine drainage**. This occurs when base rock material rich in sulfides comes in to contact with water. The leaching process acidifies the water as it flows over and through this base rock. Additionally, this base rock is often rich in other minerals, which are leached in to water, and borne out and into surface water resources. Acid mine drainage and heavy metals contamination, the two primary threats caused by abandoned mine sites, can cause discoloration, sterilize streams of aquatic life, and pose significant human health risks for miles downstream.

illustration by Bob Bredemeier

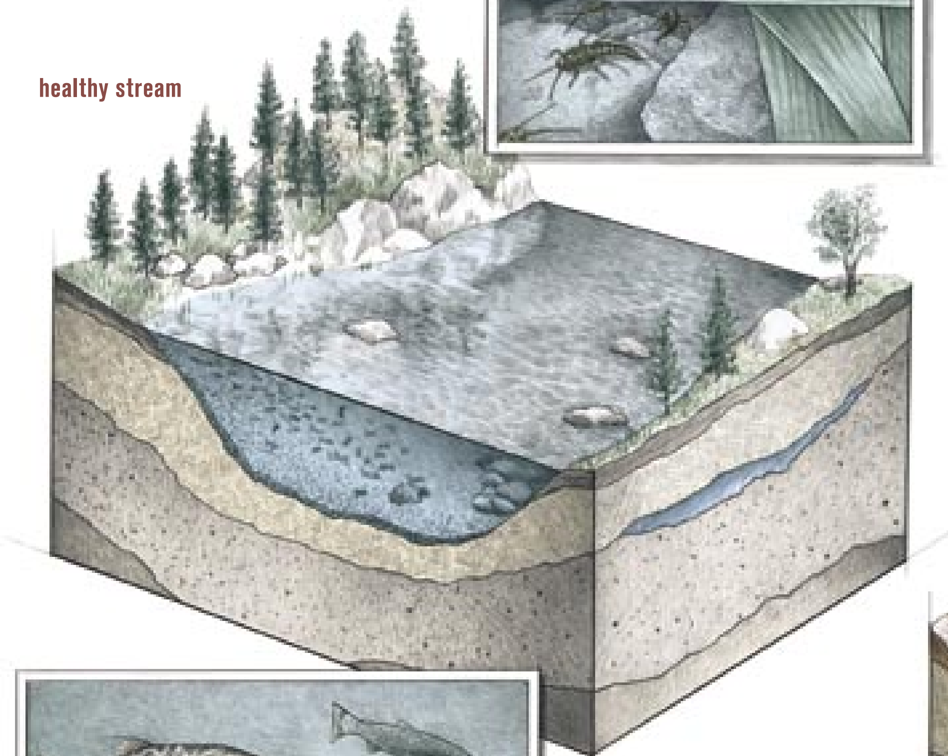
or often evident, in the rush for riches at the opening of the American West. Such a consciousness didn't come until much later, in many cases after the damage was done.

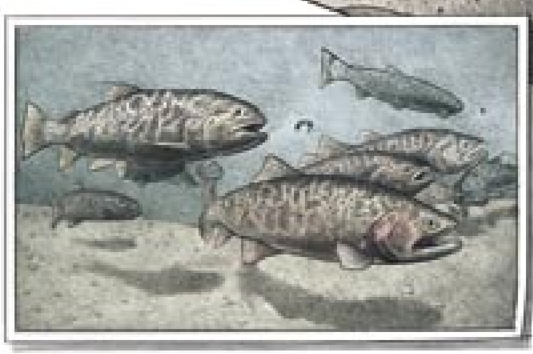
In no case is this more evident than in the advent of western hardrock mining. Now it's up to us to apply the knowledge our forbearers couldn't know and fix the slew of problems that compromise drinking water, fish habitat and river health. The good news is that we still have the opportunity to do so.

This report is a wake-up call. No single dedicated funding source is available to state and federal agencies to tackle the human health and environmental problems of abandoned mines. Left unattended, relatively small problems grow worse. Squabbles over royalties have long delayed congressional action forcing state governors, local communities and private organizations to either turn a blind eye to the problem or cobble together funding from disparate sources.

Trout, and the aquatic insects they feed upon, require clean cold water in order to exist. Healthy rivers and streams feature cool temperatures, diverse habitat, stable streambanks anchored by vegetation, and a variety of streambed features that provide both quality cover and spawning habitat. The adverse effects of abandoned mines on streams resulting from acid mine drainage and toxic loading of heavy metals can and has, in many cases, decimated native trout species such as Bonneville and Rio Grande cutthroat, aquatic insects and even riparian vegetation. In addition, acid mine drainage and heavy metals can seep in to groundwater tables, potentially affecting human health through adjacent wells. Trout species exist on a diet of aquatic insects including stoneflies, caddisflies, and mayflies, insects sensitive to decreases in water quality. They are often the first victims of acidification. Inhabitants of stream substrates, they accumulate heavy metals in their bodies. Passed along to trout upon ingestion, toxic heavy metal bioaccumulation occurs affecting growth rate, reproductive success, and possibly death.

healthy stream





stream adversely affected by abandoned mine

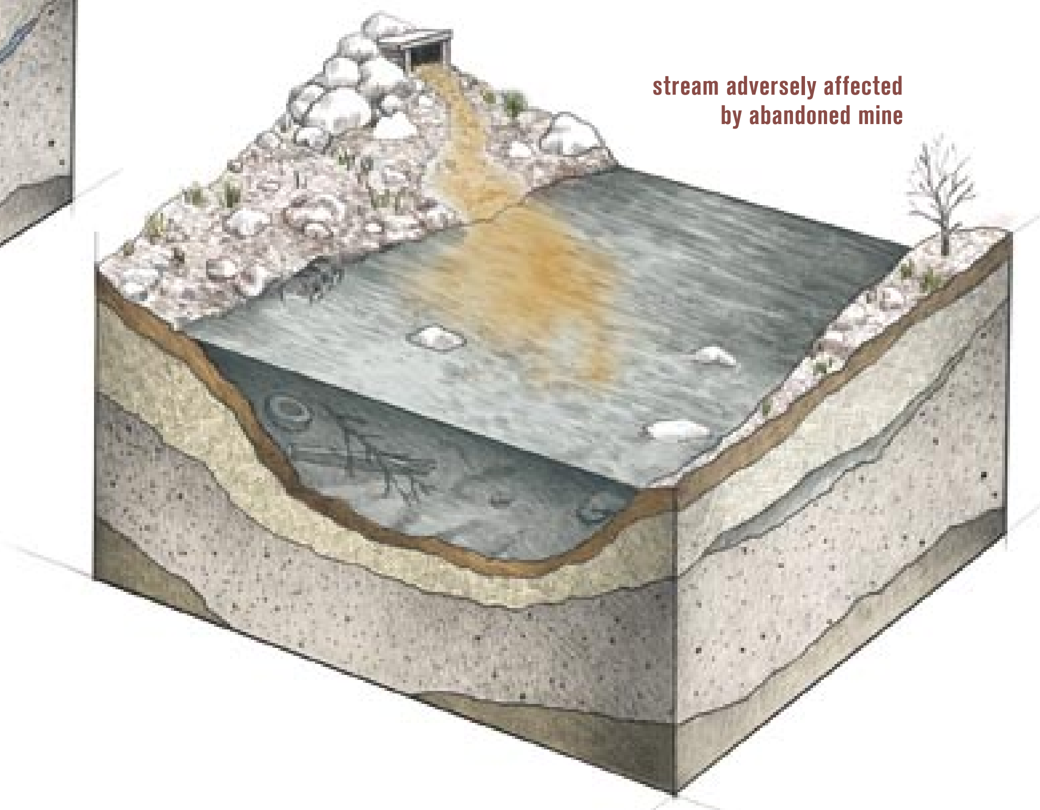


illustration by Bob Bredemeier

Explaining Superfund Sites

Often Superfund status is required before clean up can be initiated. Ongoing efforts in some local communities indicate the energy to tackle the abandoned mine problem exists. Waiting until a river is given the dubious distinction of Superfund status, by definition, means we have waited too long. Superfund sites represent the "worst of the worst," and by their nature present almost insurmountable challenges to would-be grassroots conservationists. Several of this report's watersheds do contain or are immediately adjacent to Superfund sites, including the Sacramento in California (Iron Mountain Mine), and the Upper Arkansas in Colorado (California Gulch).

Local communities and grassroots conservationists working on the smaller, non-Superfund abandoned mine sites within these watersheds and others affected to such a significant degree by historic mining activity will reinforce the work that continues to be done on Superfund sites. By improving water quality basin-wide, conservationists will make a significant difference in the overall health of local fish and wildlife habitat. Additionally, such local efforts may well be the only viable means of abandoned mineland restoration if Superfund funding continues its trend of decline in coming years.

photo courtesy Mineral Policy Center

Abandoned Mines, Mercury and Human Health

Historically, miners used mercury to recover gold from ore, soil or sediments at both placer (alluvial) and hardrock (lode) mines. Runoff from abandoned gold mines has been identified as a potential source of mercury contamination in rivers and lakes. Although mercury contamination is a risk, and assessment and cleanup of abandoned mines in ongoing, there is no focus on mercury as a criterion for cleanup at the present time.

Mercury has an affinity for gold. When added to gold-bearing ore, soil or sediments, the two metals form an amalgam. Miners separated the amalgam from the ore then later they separated the gold from the amalgam by burning off the mercury. Extraction of gold from their ores, soils and sediments by treatment with mercury is called amalgamation. At hydraulic mines, water cannons were used to turn the gold-containing placer ore into a slurry. The slurry was pumped into a sluice box (an inclined wooden platform) where mercury was spread over a mat system or behind riffles in the sluice box. Gold was then attracted to and retained by the mercury to form the amalgam. Environmental mercury contamination occurred during the amalgamation or burning steps when mercury was released directly into the environment, washed down by rainfall, carried away to the nearby surface water by runoff, then dispersed – often widely.

photo courtesy Mineral Policy Center

Metallic mercury released into the environment is converted in contaminated water bodies to a more toxic organic methyl form of mercury by microorganisms. Although inorganic mercury may enter rivers and lakes, the process of methylation by freshwater bacteria increases its bioavailability and toxicity. Methyl mercury is absorbed by algae and invertebrates then by predators up the food chain until contaminated fish are eaten by people who become exposed to mercury at levels that can be toxic.

In general, mercury exposure among people not living or working close to gold mining operations amounts to low concentrations over long periods of time. The most common effects are on the development and functioning of the central nervous system, especially when exposure occurs prenatally or during infancy. Prenatal exposure causes mental retardation and a cerebral palsy-type syndrome in children. Adults are affected differently. Mercury toxicity affects sensory, visual, and auditory functions and coordination. Although exposure to high concentrations of mercury can result in symptoms that occur within the first few days after exposure, often there may be a long period between the beginning of exposure to low concentrations and the onset of symptoms. Under these circumstances, the effects of mercury pollution are not immediately visible and intoxication becomes evident only in the long term after mercury has had a chance to establish itself in the food chain. Although this process and the onset of symptoms following the long-term exposure to low concentrations of mercury can take decades to appear, exposure and toxicity can last for generations following contamination from abandoned mine sites.

Dan Peplow, PhD.
University of Washington

Watershed: North Fork American Fork River, Uinta National Forest, Utah. The American Fork is a small watershed flowing in Utah's Uinta National Forest high country known as the backyard of the Wasatch Front. The canyon bearing the American Fork is a Utah recreational hot spot attracting hikers, ATV enthusiasts, mountain bikers, rock climbers, ice climbers, anglers, hunters, skiers, trail runners and more.

Mining Chronology: Operations spanned from 1870 through the 1950s, peaking around 1903, then again between 1910 and 1920.

What We Took Away: Primarily silver, but also copper, lead and gold

Left Behind: Heavy metals including lead, arsenic, cadmium, and zinc leached into water, soils, sediments – and fish. Tailings piles, waste rock dumps, adits and smelter wastes remain. Soil samples near the Pacific Mine site revealed a lead concentration of 17,000 parts per million, more than 8 times the federal cleanup standard for human exposure at many Superfund sites. Some have become popular recreation sites for ATV users and motorcyclists, creating hazards through the possible inhalation of toxic dust.

How the Fish Fared: The American Fork and its tributaries host populations of native Bonneville cutthroat, as well as a popular recreational fishery for introduced rainbow and brown trout. The State of Utah in 2002 issued fish advisories in the American Fork River due to high arsenic levels detected in trout.

The Road to Restoration: The American Fork has been identified by the state of Utah as important to Bonneville cutthroat trout recovery. Study of fish tissues, soils, insects and waste rock conducted in recent years by the U.S. Forest Service identified the Pacific Mill site as the worst contaminator within the historic American Fork Mining District. The Pacific Mill site consists of a large tailings pile and two tunnels, as well as remnants of various improvements constructed by miners during the area's "boom." High concentrations of lead, arsenic, zinc, iron, copper and cadmium have been washing from these tailings into the American Fork River, posing major health risks to fish, wildlife, and water quality, while also posing a human health hazard downstream. These toxic tailings actually form the banks of the river in some places.

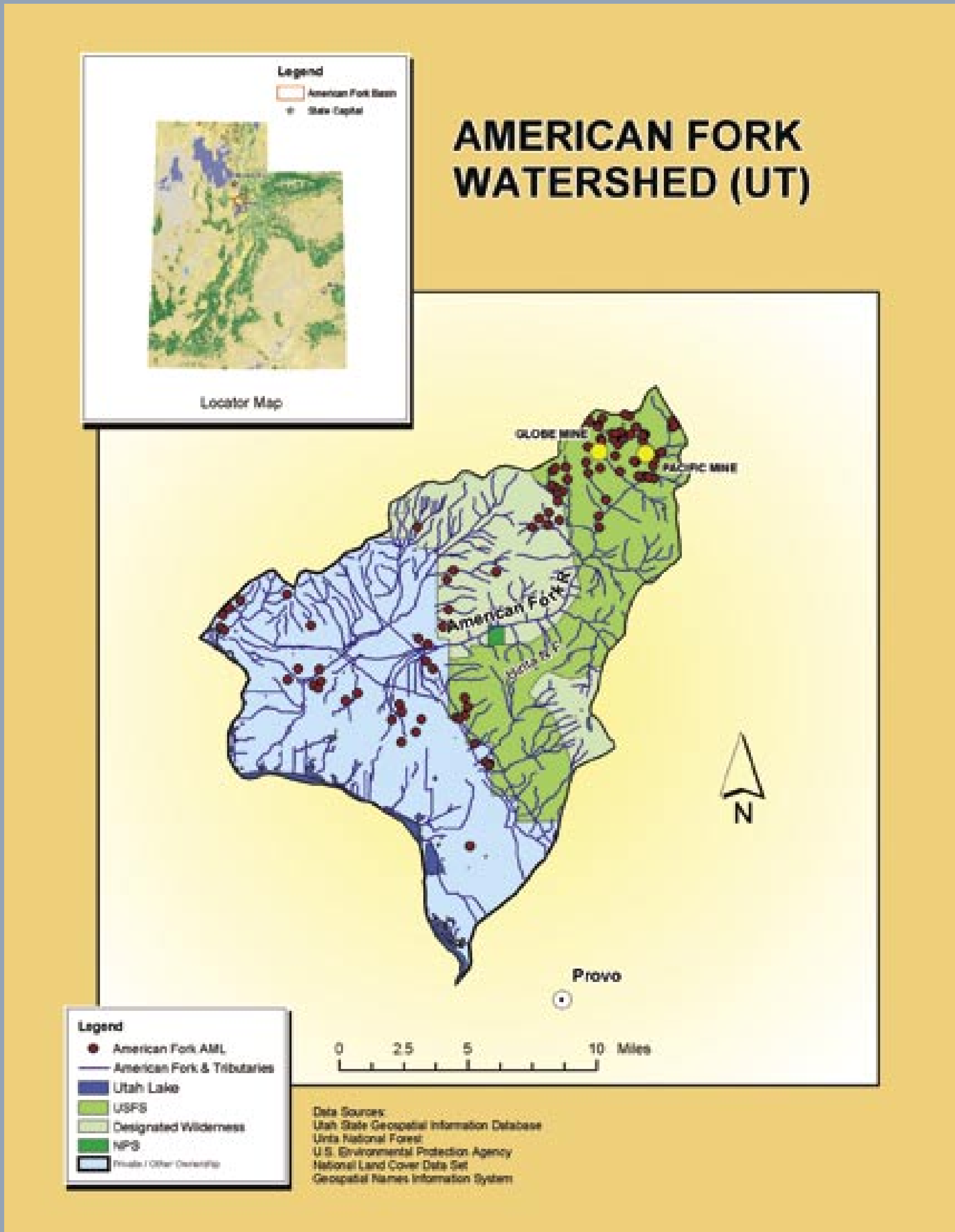
In addition to Pacific Mill, the clean-up effort has identified five other target sites within this particular mining district. These include mining, milling, and smelter sites, along with features including a number of waste rock dumps and tailing heaps, adits, and waste from smelters. Ted Fitzgerald, as an employee of the U.S. Forest Service, initiated a restoration of the American Fork and worked to clean up and close several hazardous sites to recreation in 2000 due to significant health risks. During the cleanup, crews constructed safe repositories to contain the mine, mill, and smelter wastes removed from the sites, and capped other waste sites from leakage. They also excavated contaminated waste from Forest Service lands and replaced those areas with native soil. Also, TU recently extended restoration efforts to private lands based on the initial support of Tiffany & Company and other private funding sources.

Fitzgerald, now an employee of Trout Unlimited, estimates that about 75 percent of the problem has been taken care of effectively. "There's another 25 percent still up there, but it's on private land. To do more, we need everyone to work together." Trout Unlimited's two current priorities in the American Fork watershed are finishing the job at the Pacific Mine site, and cleaning up deposits found in the Mary Ellen Gulch area that were left by the Globe Mine. The latter site offers unique challenges as a restoration project, due to the nature of the waste material, high altitude, extremely limited access, steep terrain and cost limitations.

Since the greatest share of mining activity in this region occurred long before most of the current population was either born or took residence in the region, the potential public health hazard resulting from historic mine sites has yet to be recognized. Owing to its proximity to Utah's major population centers of Provo and Salt Lake City, the fact that 1.2 million people visit this premier outdoor recreation site, and its potential to provide critical habitat for native Bonneville cutthroat trout, there are tremendous opportunities for conservationists to realize a new, restored future for the American Fork watershed.

"It's real exciting what's going on in American Fork Canyon. We've made great strides, but our cumulative efforts can do a lot more."

Reese Pope, Uinta National Forest Watershed Staff



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Watershed: Blackfoot River Basin, Montana. The 2,350 square-mile Blackfoot Basin includes one of the most popular recreational rivers in Montana. In its 132-mile journey, the Blackfoot runs through some of the most productive fish and wildlife habitat in the Northern Rockies. Mountain ranges, National Forest system land and the Bob Marshall and Scapegoat wilderness areas surround the valley.

Mining Chronology: The abandoned mines that litter the Blackfoot Basin's landscapes began operating during the late 1800s. The area was mined intermittently from 1889 to the 1950s, and then explored intermittently again throughout the 1980s.

What We Took Away: Primarily gold; later lead, silver and zinc

Left Behind: Anchored by the Mike Horse Mine, the Upper Blackfoot Mining Complex for decades oozed bright orange, acid-filled waste water into the surface waters that make up part of the Blackfoot's headwaters. Drainage from over 100 dilapidated mine sites continues to flow into the river and its tributaries, threatening fish and other aquatic organisms with dangerous levels of arsenic, as well as cadmium and other heavy metals. Mill tailings and waste rock dumps associated with these sites are often piled on or immediately adjacent to the Blackfoot's floodplain. The water rushing by is then subjected to metals-laden runoff and sediments.

The most severe impact from mining occurred here on June 10, 1975, when a flood breached the 500-foot-long Mike Horse Mine tailings dam and approximately 100,000 tons of toxic tailings dumping into Mike Horse Creek and the upper Blackfoot. Aquatic life in the upper river was devastated. Many cutthroat, brown and brook trout died, and river sediments were contaminated by heavy metals. Thirteen years after the spill the abundance of cutthroat trout aged one year and older was below 25 percent of pre-flood levels. A 1991 study found significant cadmium contamination in stone flies and brown trout more than 46 miles downstream. The Mike Horse Mine area is now a state Superfund site.

How the Fish Fared: Despite the Mike Horse Mine debacle and subsequent fish kill in 1975, the Blackfoot's renewed value to wild and native fisheries is apparent in the diversity of resident coldwater species found there today: bull trout, westslope cutthroat trout, mountain whitefish, rainbow trout and brown trout. Its lower-gradient upper reaches provide a top-class brown trout fishery, with good odds for 20-inch fish. More rainbows begin to show themselves in the river's faster mid-section; fishing for them gradually improves to world-class as the Blackfoot's gradient increases. During the 1995 fishing season alone, the Montana Department of Fish, Wildlife and Parks estimated that fishing use topped 36,000 angler days.

The Road to Restoration: Since the late 1980s, the Big Blackfoot Chapter of Trout Unlimited, under the leadership of Becky Garland and Mark Gerlach, led the charge for cleanup of the Upper Blackfoot Mining Complex.

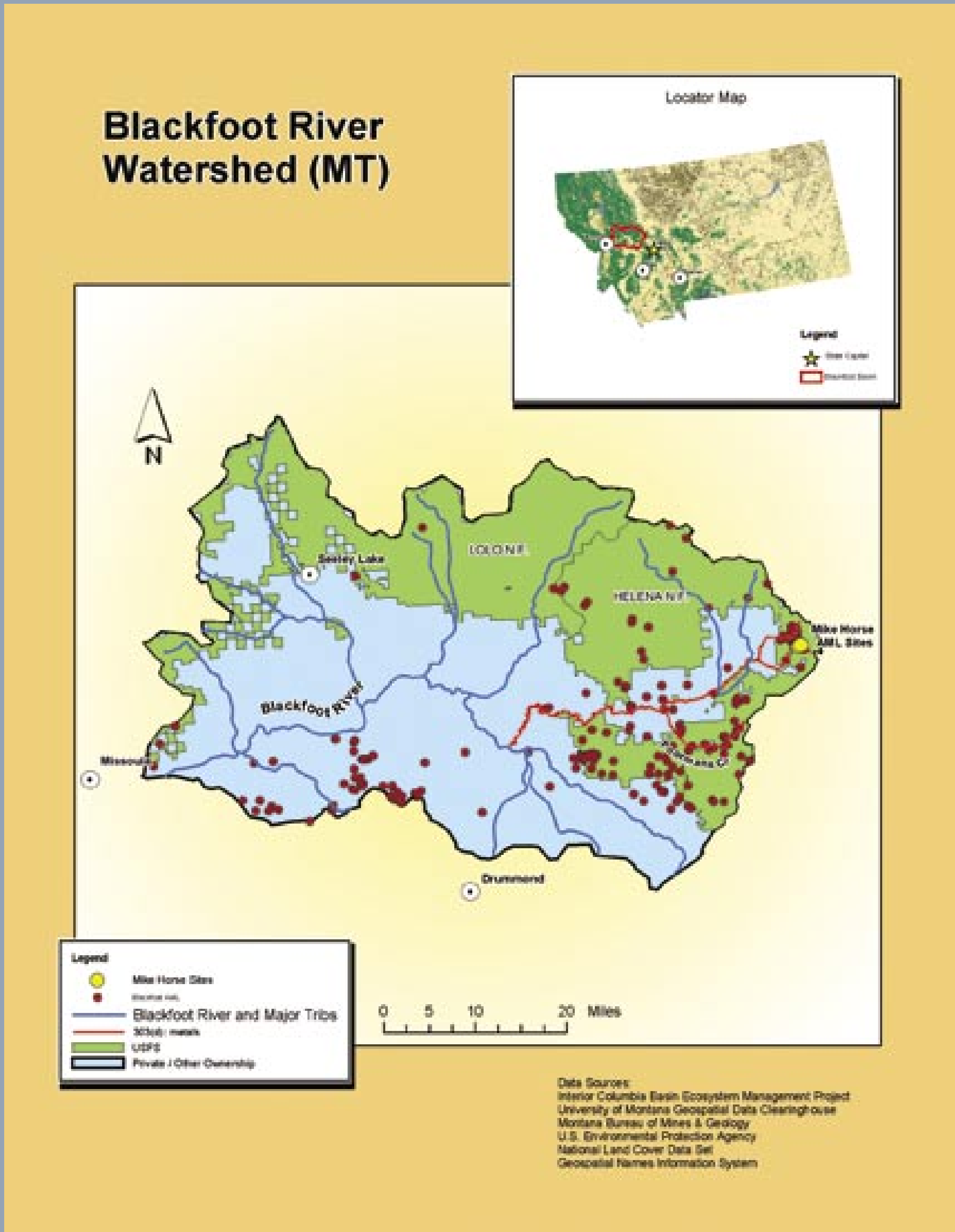
The chapter's first project was a two-year inventory and status report of fisheries in the Blackfoot River watershed (completed in 1989). This effort focused on surveying mainstem trout populations, sampling juvenile trout populations in tributaries, and establishing monitoring sites in 19 tributaries with the potential for abandoned mine drainage. From 1990 to 2001, additional fishery inventories identified significant degradation in 83 of the 88 studied tributaries.

Today, restoration has helped heal 37 tributary streams, benefiting more than 350 stream miles. In addition, more than 2,500 wetland/riparian acres have been restored; grazing systems have been implemented on more than 45,000 acres; 14 fish screens have been installed on irrigation ditches; and more than 70,000 acres of critical fish and wildlife habitat have been perpetually protected through conservation easements. This ongoing effort is in its 14th year and has raised $5 million for on-the-ground projects.

Owing to this investment, and building on the restoration work of the U.S. Forest Service, the Blackfoot fishery is now showing steady signs of improvement. Restoration efforts are continually being advanced by an organization called Blackfoot Challenge. The group has spearheaded a community-wide planning effort to guide the future ownership and management of these lands. The group's goal is to maintain traditional uses in the valley – ranching, forestry, public access and wildlife habitat. With this kind of ownership and stewardship in the basin, the Blackfoot is on the right path to a better future as a resource, a fishery and a source of inspiration for generations to come.

"The middle Blackfoot has come a long way during the past 15 years. We are seeing an actual increase in native fish numbers in the mainstem, and numbers that are directly attributable to tributary restorations carried out by the Big Blackfoot Chapter of TU, the Blackfoot Challenge and other partners. However, there is still plenty of work to do in order to realize the Blackfoot's full natural potential."

-Matt Clifford, TU National Leadership Council and Clark Fork Coalition



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Watershed: The Animas River flows about 79 miles south from Colorado's San Juan Mountains through the recreational hub of Durango, until it joins the San Juan River near Aztec, New Mexico. While no specific site stands out as the epicenter of mining damage to the Animas, it is clear that thousands of abandoned mines dot the 186-square-mile watershed, with many determined by the State of Colorado to currently impact water quality and minimize fisheries.

Mining Chronology: Gold was first discovered in an Animas tributary above Silverton, Colorado, in 1871. Mining within the Animas watershed occurred from the 1870s to the 1950s, with one large operation, the Sunnyside Mine, continuing into the 1990s.

What We Took Away: Gold, silver, lead, zinc and copper

Left Behind: Trout and other aquatic life were effectively wiped out by toxic loads of aluminum, copper, iron, zinc, cadmium and lead that washed into the Animas' soils and groundwater during active mining in the area. Though diluted over time and through recent restoration efforts, significant loads of toxics remain – evidenced in large part by habitat degradation and missing aquatic species in the upper river and tributaries.

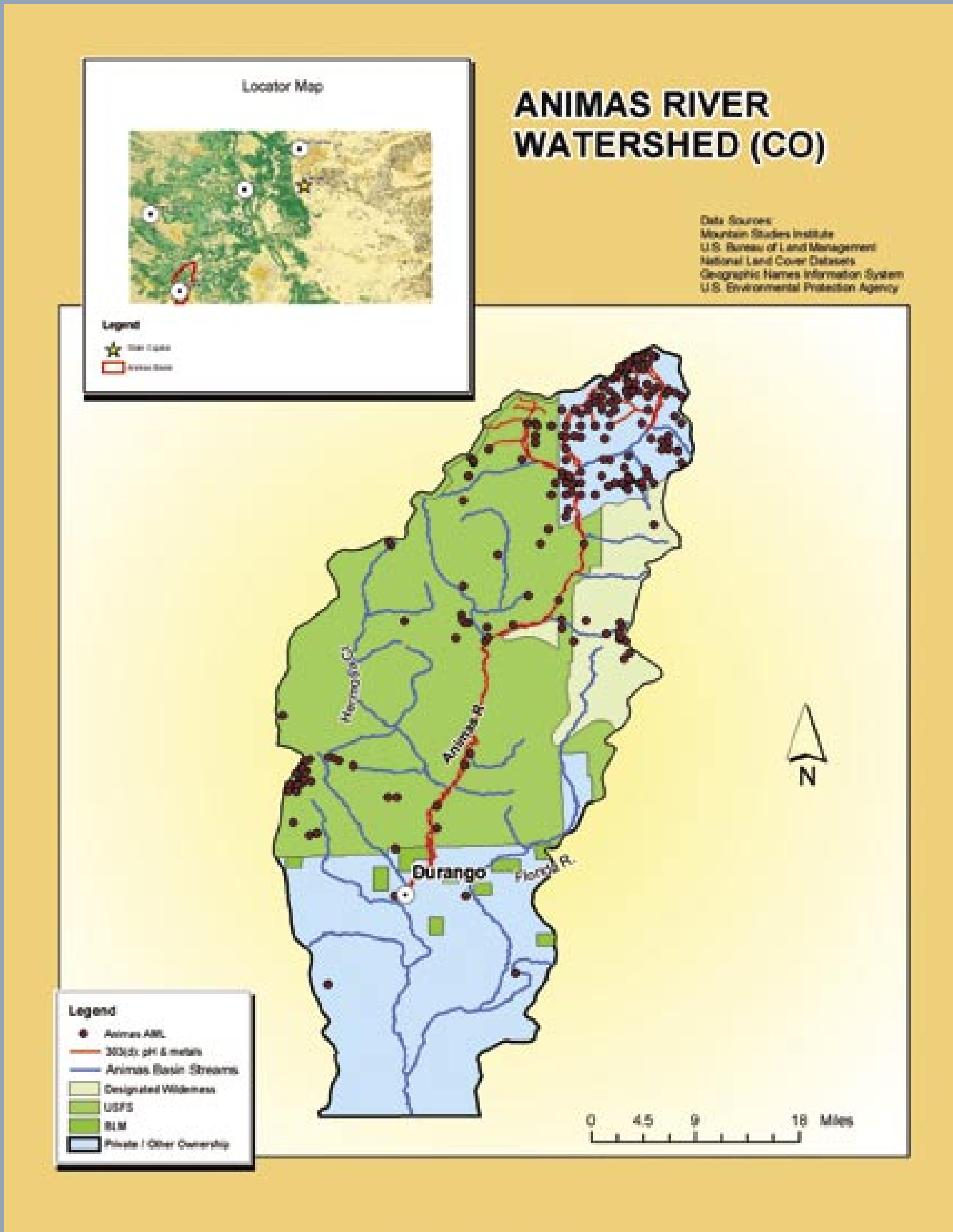
How the Fish Fared: The Animas today supports a popular Blue Ribbon fishery for trophy brown trout, as well as for rainbow and smaller numbers of cutthroat and brook trout. Two Animas tributaries – the Florida and Pine rivers – have shown potential for re-establishing native Colorado River cutthroat through an experimental re-introduction program initiated by the state. The re-emergence of plant, insect and fish populations stand as testament to the resiliency of the river, the robust qualities of this high-elevation fishery and the cooperative partnerships already under way to foster recovery. Only time and effort will reveal the Animas watershed's full potential to support healthy populations of fish and wildlife.

The Road to Restoration: Of the scores of mines that once operated within the basin, only a handful still pose a threat to the Animas River's water quality. Key strategies in cleaning up these abandoned mines in the Animas watershed include removing sources of heavy metals and acid drainage, segregating them in safe repositories and sealing existing toxic tailings piles from further leakage.

To address polluting mine sites, the Animas River Stakeholders Group was formed in 1994 to galvanize the restoration efforts necessary to protect the Animas. In addition, the U.S. Department of the Interior piloted its Abandoned Minelands Initiative with the Animas Basin. This program provided a wide range of scientific expertise to help land managers minimize and, where possible, eliminate adverse environmental effects of abandoned mineland pollution. As part of this initiative, Interior and the stakeholder group have developed a watershed-based approach for providing the necessary information to accomplish cost-effective cleanups.

photo: Russ Schnitzer

Many additional opportunities exist for grassroots restoration efforts, in cooperation with the Animas River Stakeholder Group and the land management agencies involved in the Animas cleanup effort. Community involvement, including activities led by Trout Unlimited volunteers, can help to speed up the cleanup process, bring increased public attention to the issue, assist with much-needed fund-raising and continue to improve the quality of the Animas River for future generations.



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Watershed: Upper Arkansas River Basin, Colorado. With its headwaters located more than 14,000 feet high in the Gunnison National Forest near Fremont Pass just north of Leadville, the Arkansas eventually tumbles into the Mississippi River about one-third of a continent away after weaving through Colorado, Kansas, Oklahoma, and Arkansas.

Mining Chronology: Gold was discovered in the hills near what is now Leadville in 1859. Mining continued in the Leadville District until the mid-1990s, with the Black Cloud mine being the last to operate in the district.

What We Took Away: Gold, silver, molybdenum, lead, zinc and copper

Left Behind: The Upper Arkansas Basin is littered with inactive silver and gold mines. The legacy of hardrock mining is most apparent in huge piles of waste rock and tailings, upon which mountain towns are and were built and through which streams flow, in countless smaller piles from exploratory shafts and smelter slag and in mine drainage. Less visible are the endless miles of underground tunnels and mine shafts lying beneath the landscape. Snowmelt, seeping into these subterranean features, piles of waste and groundwater are thus exposed to enormous areas of mineralized rock from which heavy metals are leached. Runoff from the piles and drainage from the mines forms an acid brew of heavy metals and iron sediment referred to as "yellow boy." Many stream miles are stained yellow and orange. Aquatic life is impaired or, in some cases, impossible because of acute and chronic exposure to mine runoff.

How the Fish Fared: A once-legendary brown trout fishery in the Upper Arkansas lost much of its luster when the state's official "Gold Medal" designation was stripped in 2001. Reduced flows and concentrations of toxic heavy metals were robbing stream banks of vegetation, the trout of insect populations, and, naturally, the river of its fish. Each passing season, however, seems to bring improved news from anglers and outfitters. Solid numbers of browns are present well into the upper reaches of the river, with evidence of older, larger fish and more holdovers from previous years surviving to spawn. A popular stocked rainbow fishery and small resident cutthroat population also help draw more anglers back each year.

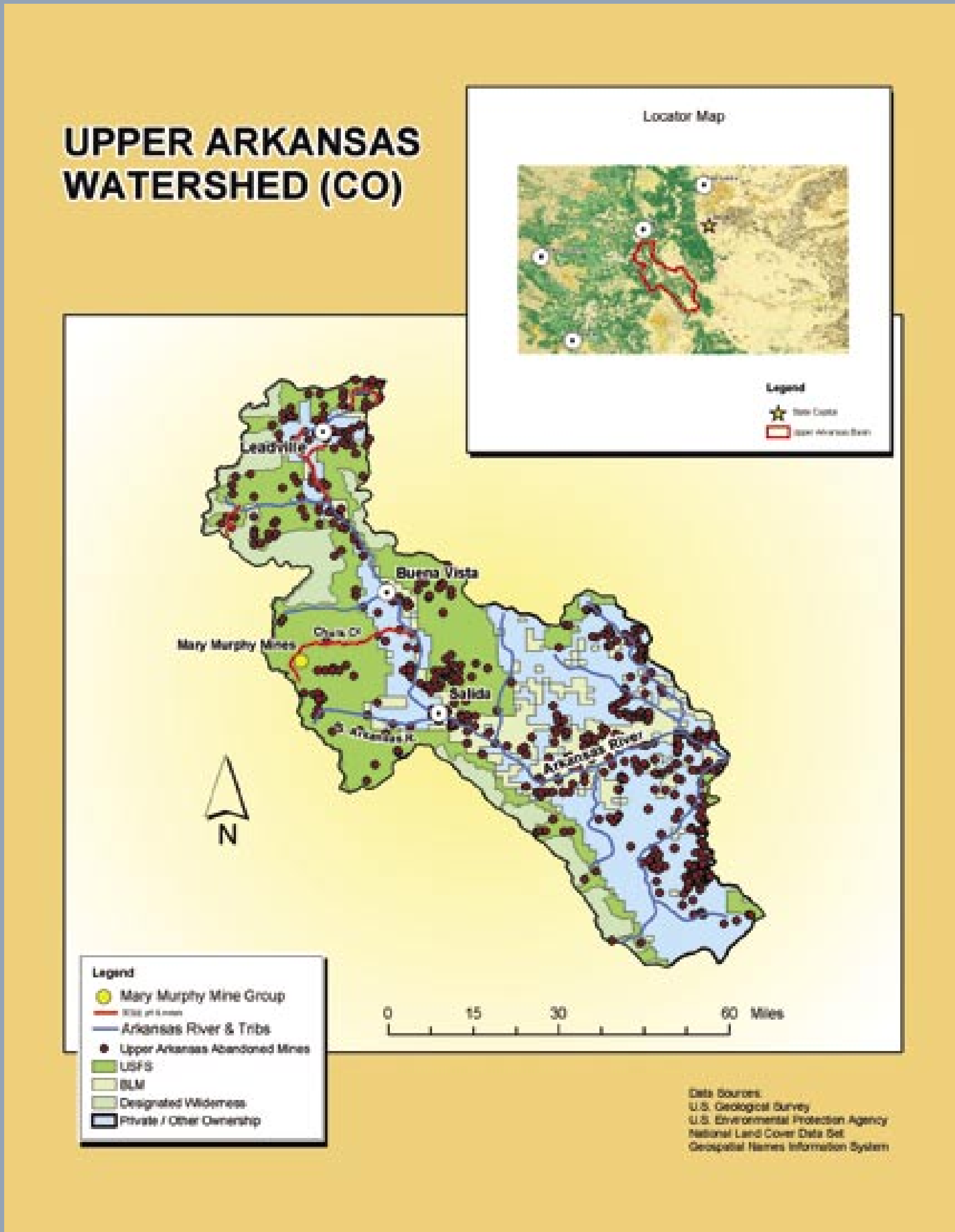
The Road to Restoration: Threats to water quality and aquatic life from abandoned mine sites are being targeted by mining companies and land management agencies in the Upper Arkansas Basin. Trout Unlimited volunteers from the Collegiate Peaks Chapter have assisted agencies with cleanup efforts on Arkansas tributaries. At the Mary Murphy Mine site, tailings were capped and re-vegetated to prevent heavy metals from continuing to leach into Chalk Creek, where high concentrations of zinc caused an annual fish kill downstream at a state-operated fish hatchery. At Dinero Tunnel, recent restoration efforts have removed tailings and incorporated passive treatment of runoff. Strategies employed in cleaning up harmful sites in the Arkansas Basin included capping and re-vegetating waste rock, re-directing mine drainage, passive treatment of drainage within and below mine features and plugging adits. Superfund cleanup in California Gulch has yielded improved water quality downstream.

Many additional opportunities exist for grassroots restoration efforts, in cooperation with the land management agencies and other groups involved in the watershed. Community participation, including activities led by Trout Unlimited chapter volunteers, will speed up the restoration process, bring public attention to this issue and others affecting water quality in the Upper Arkansas watershed, and help to provide future generations with a source of quality fishing, clean, clear water and community pride.

"Years ago, the Upper Arkansas was a river completely devoid of fish – even 50 miles downstream from Leadville. However, concerted efforts to help stem the flow of abandoned mine drainage and manage the impacts it has on the river were instrumental. Through the use of filtration at two of the more acutely polluting sites, that entire stretch of water is a respectable brown trout fishery, all the way back to Leadville."

Fred Rasmussen, Collegiate Peaks Chapter TU.

UPPER ARKANSAS WATERSHED (CO)



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A New Tool For the Mine Cleanup Toolbag

(or how we came to find the light at the end of the tunnel)

~ Jim Dunn, EPA Region 8

When it comes to dealing with the water quality impacts from old abandoned mines, we have a pretty good handle on how to characterize the releases of heavy metals into the environment. It's either runoff from surface piles, contaminated ground water discharges or drainage from tunnels drilled into the hillside. In any event, the heavy metals dissolved in the water impair the fisheries of many high mountain streams in the Rocky Mountain West.

While we have learned how to better understand these complex ecosystems, dealing with the remedies is another matter. Active physical-chemical treatment does indeed work to remove heavy metals but it is costly, requires constant operation and produces a sludge that is hard to handle. We need to have alternatives to this type of engineered solution if we are ever going to make progress in cleaning up the literally thousands of miles of impacted streams.

At EPA Region 8, we have been fortunate to have a "test site," the Mary Murphy mine on Arkansas River tributary Chalk Creek, west of Buena Vista, Colorado, where we can learn innovative lessons to deal with this problem. It's not bad enough to be on anyone's list for immediate cleanup, but up until a few years ago, the mine caused an annual fish kill at the state hatchery just downstream. Using the materials on site, Colorado Division of Minerals and Geology (CDMG) consolidated all of the surface wastes and capped them in a "high-and-dry" spot on the mill site. This reduced the dissolved metals levels enough to keep the fish kills from recurring, but did nothing for the discharges of metal-laden water flowing from two of the adits – tunnels that were drilled deep into Chrysolite Mountain to get at the mineral-rich ore. Several years' worth of mine drainage treatment experiments provided little hope for a quick cure. After going into one of these adits, mining specialists from CDMG found that the "bad" water was coming from only a few fractures in the rock. In fact, most of the mine drainage originated from the very back of the Golf Adit, in a feature called the "raise room". This was a shaft drilled vertically to intercept the mine workings some 800 feet above. So the mission became clear: if we could control the flow of water from above, we could eliminate a major source of mine drainage into Chalk Creek.

To get at the expected source of the "bad" water, we had to open up the adit at the 1,400 level of the mine, so named because it was 1,400 feet down from the top of the mountain. This was no small task, since the opening, the adit portal, had been bulldozed closed some eighteen years earlier and nobody knew what we would find once we began opening the mine. There could be a massive pool of highly contaminated water that would have to be treated on site prior to discharge. There could be no breathable air in the adit, creating entry problems. Worst of all, the entire tunnel could be collapsed, making entry impossible. Fortunately, none of these occurred. Once the adit was safe for repeated entry, a team from the EPA and CDMG began their water detective work, probing deep within Chrysolite Mountain. The findings were significant. Very little water was coming into the tunnel except where the ore was removed from the Mary Vein. These discharges could probably be segregated into:

1. clean water that can be piped out and discharged, and
2. contaminated mine drainage that can be readily collected for passive treatment, perhaps in the mine itself.

This shows that it is possible to go into a mine and do source control remediation, prior to having to deal with the entire discharge at the surface. It saves time and money in dealing more efficiently with mine drainage discharges. There are now more options for cleaning up mines and the nearby aquatic environment. What we have now is one more tool in the toolbag.

Abandoned mineland restoration can take many forms, each site dictating the most effective approach to employ. This illustration shows a generalized example of a passive-treatment **settling pond** reclamation site. Acid mine drainage flows downhill in to a series of settling ponds, each one allowing the outflow's toxic heavy metals to precipitate out and collect incrementally as the flow progresses through the treatment zone. Acid mine drainage is also often directed over and through **crushed limestone**, which helps to **neutralize acidity** as the water progresses towards the nearby stream or river. Propagation of **wetland vegetation** in and around these settling ponds not only aids in stabilizing soils, but also provides additional filtering of toxic materials and acidified water before it mixes with clean surface water resources.

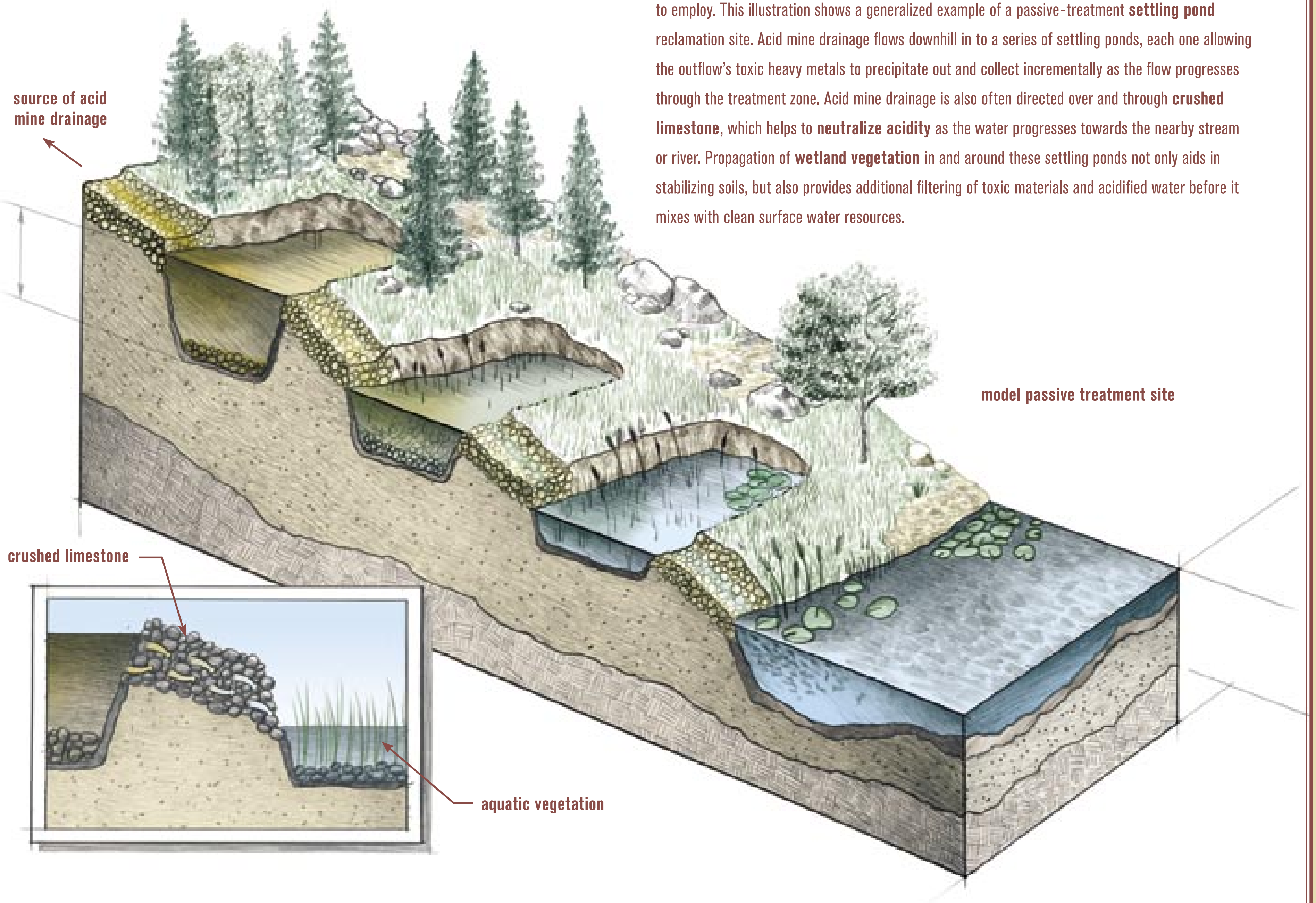


illustration by Bob Bredemeier

Watershed: Rogue River Basin, southwest Oregon. The Rogue Basin is formed by the Rogue River, federally designated as Wild & Scenic, which flows 215 miles from its headwaters on the western slope of the Cascades near Crater Lake National Park to its mouth on the Pacific Ocean at Gold Beach.

Mining Chronology: Mining began in the 1850s and extraction activity hit its high point in the area in the early 1910s. New activity has occurred periodically since then, and as recently as the 1980s. Today, recreational suction dredge mining poses the greatest risk to fishery resources.

What We Took Away: gold, silver, copper, zinc, cobalt

Left Behind: Although the Rogue Basin is almost wholly enveloped by public land, about one-third of which is designated wilderness or inventoried roadless area, this ecologically rich watershed continues to suffer from heirloom pollution sources more than 100 years old. Increased acidity, concentrations of heavy metals and the presence of arsenic can all be attributed to several hundred mine sites throughout the basin and, in particular, those adjacent to fragile headwater streams.

Many mines were abandoned after they were either mined-out or became too costly to operate. Many still pose threats to physical safety or cause environmental damage. Numerous pits, waste dumps, shafts and adits remain at these sites. Today, recreational suction dredge mining occurs along important salmon spawning areas disrupting stream bottoms and harming spawning habitat. Residual mercury continues to be a threat. The U.S. Forest Service segregated the forest from new mining claims in 2000. In 2001 the agency reopened the forest to mining.

A comprehensive inventory of abandoned mine lands has not been conducted in the Rogue River Basin; neither the Bureau of Land Management nor the Forest Service have inventory efforts planned at this time. Abandoned mine sites will continue to be uncovered during routine field project work. At this time, two sites have been targeted for remediation: Sucker Creek and the Almeda Mine site.

Operated primarily between 1908 and 1916, the Almeda Mine has been active as recently as the 1980s. Both the Almeda and Sucker Creek sites are emitting acidic water with heavy metal concentrations that exceed Oregon and national drinking water quality standards. This acidic mine drainage flows directly into the Rogue, often forming toxic pools in the flood plain.

How the Fish Fared: Fish species supported by the Rogue system include coho and spring and fall Chinook salmon, summer and winter steelhead, and resident native cutthroat and rainbow trout. Coho are listed as threatened under the Endangered Species Act. Both spring and fall chinook are proposed for listing as threatened. Summer and winter steelhead are candidates for listing. In addition, the status of coastal cutthroat is in review. In short, all anadromous fish species in the Rogue are listed or being considered under the Endangered Species Act.

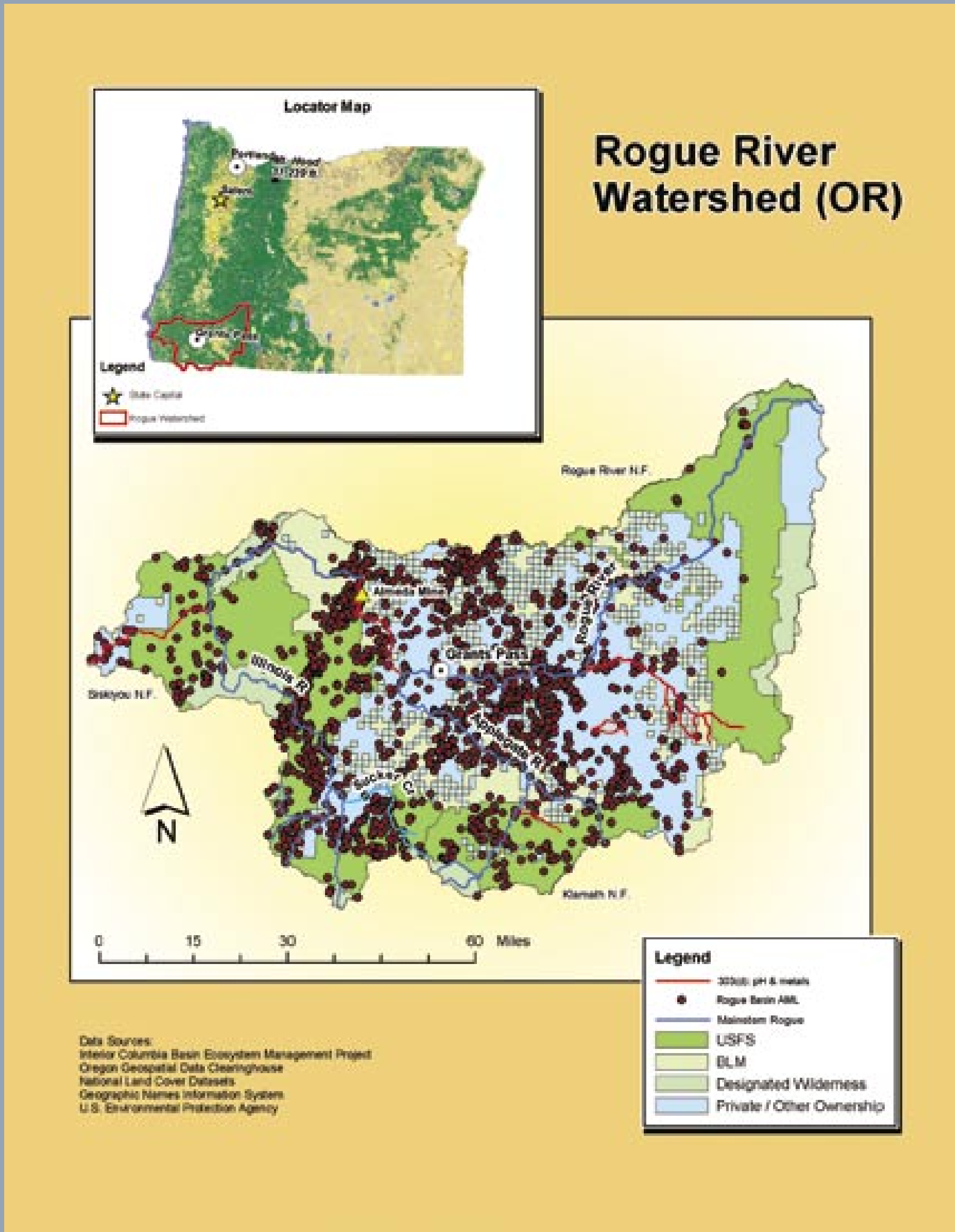
The Road to Restoration: Remediation work to restore the stream channel and riparian vegetation began on Sucker Creek in 2000 and continued through 2001. Work to eliminate the physical hazards (open shafts and adits) at the Almeda Mine site was completed in 2001. Despite the lack of an accurate inventory of abandoned mine sites within the basin – particularly those that are currently leaching acid drainage into the Rogue and its tributaries – additional reclamation projects would serve to protect the fish, wildlife and plants within the Rogue Basin.

Grassroots conservationists such as local Trout Unlimited chapters can help tackle abandoned mine restoration by locating, identifying, and documenting these sites. The lessons and information generated by recent research can be gathered to support new laws and policies, including federal funding programs to help protect taxpayers from cleanup costs.

photo: Milan Chuckovich

"The Rogue River and Siskiyou country has the strongest remaining runs of salmon and steelhead south of the Columbia River."

Jack Williams, Trout Unlimited Senior Scientist and former Siskiyou National Forest Supervisor



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Watershed: Northwest New Mexico's Red River flows from its headwaters in Carson National Forest westerly to its confluence with the Rio Grande near the town of Questa. In 1968, the lower four miles were among eight original Wild and Scenic designations. In 1980 much of the upper section became protected as part of the 20,000-acre Latir Peak Wilderness Area.

Mining Chronology: Around 1914, two local prospectors uncovered rich deposits of a blackish mineral and sensed it was something of value; they just weren't quite sure exactly what it was. It turned out to be molybdenum, useful in applications from hardening steel to plant nutrition. A few years later the R & S Molybdenum Mining Company had launched operations in the Red River Valley. Molybdenum mining has continued to the present day, subject to fits and starts relative to the economy, technologic advancement and other variables. Beginning around 1880 and continuing through the early 1900s, the area was mined for gold and copper.

What We Took Away: gold, copper, molybdenum

Left Behind: The giant Questa mine, opened in 1920 on the immediate north side of the Red River, today operates only on a small scale. This three-square-mile mine site is comprised of tailings ponds, access roads, an ore processing mill, a tailings pipeline, underground mine shafts, large waste rock dumps, numerous support buildings and the mine itself.

In 1965, open-pit operations were initiated in an attempt to extract loosely concentrated molybdenum deposits. Unfortunately, the open pit mine created giant waste rock dumps, which the Environmental Protection Agency estimates expose some 328 million tons of base rock to potential acid leaching and possible failures in stability. The majority of this material lies within a few hundred feet of the Red River. Water quality surveys have detected elevated concentrations of sulfates, manganese and molybdenum along the toe of the rock piles.

The Oro Fino mine site, situated in the headwaters of Red River tributary Bitter Creek, was a gold operation that used mercury amalgamation. Abandoned in the early 1900s, the Oro Fino site continued to pollute downstream until it was targeted for restoration. Initiated by Amigos Bravos and in partnership with Carson National Forest, a passive treatment remediation project was undertaken to reduce the flow of acidic, heavy metals-laden water from the Oro Fino site. This project successfully reduced the impacts of acid mine drainage on Bitter Creek. Clean water in Bitter Creek helps reduce the impact of pollutants on the mainstem of the Red River system and benefits wildlife and aquatic health at the site and downstream.

How the Fish Fared: Lower portions of the Red River and its trout fishery have suffered for decades from abandoned mines. Acid mine drainage from waste rock dumps has killed most of the aquatic life in an eight-mile stretch of what was once a state-designed Blue Ribbon fishery.

Instead of "blue-ribbon"-size trout, anglers are likely to encounter "blue goo:" hardened mine waste deposits that have bonded to the aquatic plants and rocks along the river bottom. According to local anglers, this insidious heavy metal leaching (aluminum, cadmium and copper) has encrusted much of the gravel trout require to spawn.

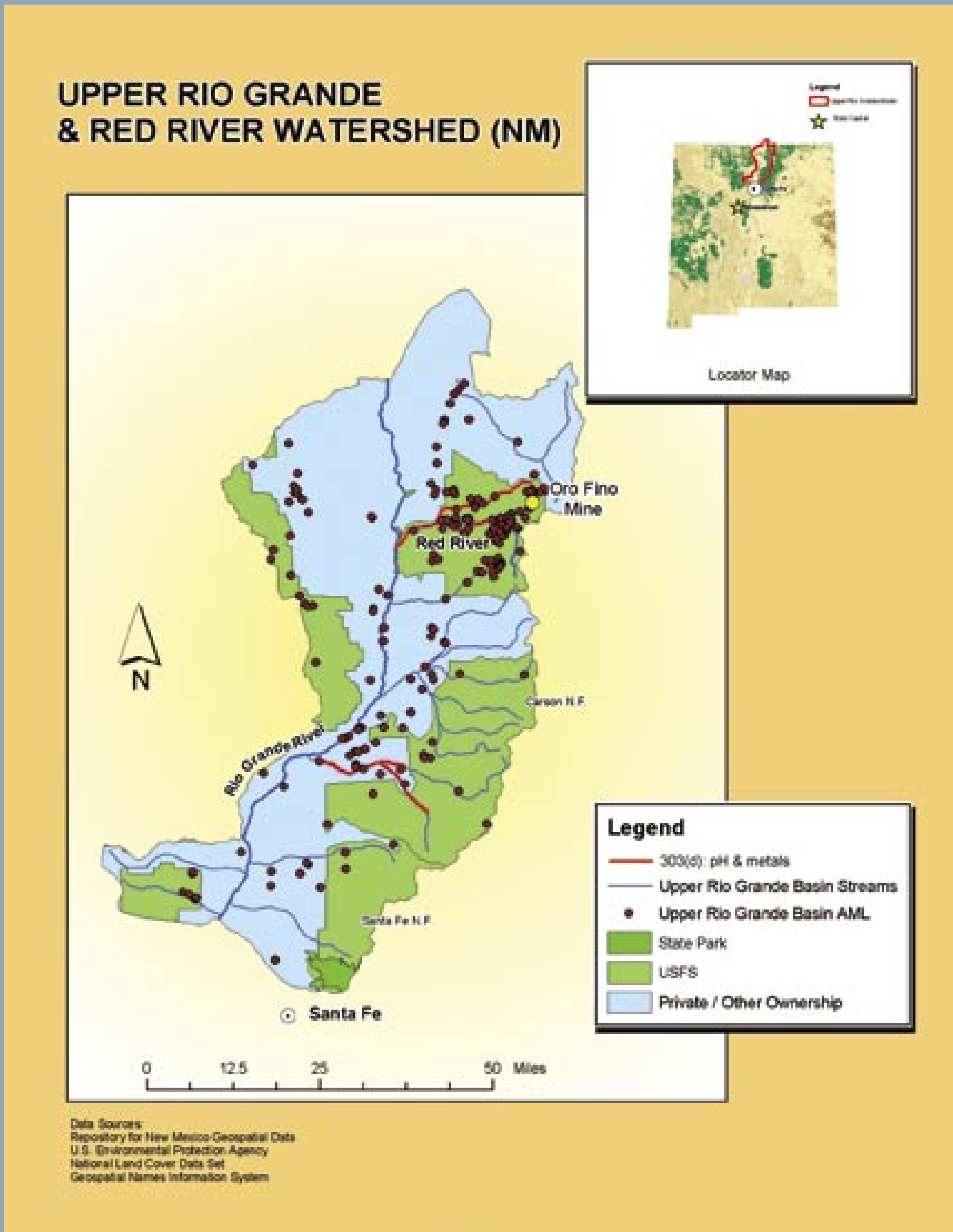
The Road to Restoration: The potential to produce quality trout fishing has been hampered by hard rock mining activity, but it is not lost forever. Long-time Red River fishing guide Van Beacham has seen that potential firsthand. "This could be a great fishery," Beacham says. "It is the only fishery in northern New Mexico that is consistently cool in the summer and warm in the winter. It used to hold 10-pound browns in some sections."

The many springs contributing water to the lower river also help it heal. The springs buffer just enough to maintain cool year-round temperatures. This allows trout to thrive even during the cold, high-elevation winters. Secondly, and more importantly, as the waste enters the river, these springs serve to dilute the heavy metal seepage. Enough dilution exists to allow the state to implement a "Special Trout Water" (STW) fishery designation. The New Mexico Game and Fish Department defines STW's as waters supporting "regulations [to] give anglers a chance at superior, high-quality fishing."

While important to keep an eye on current potential threats, it is also essential to identify ways to improve water quality throughout the basin by restoring abandoned mine sites. By following the lead of successful restoration projects like Oro Fino, conservationists partnering with agencies can hasten the healing process for the Red River.

"From Questa to the mine, the river is dead. And above the mine it's alive. What does that tell you?"

Long-time Red River fishing guide Van Beacham



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Watershed: The Salmon River drainage represents the longest un-dammed river system in the lower 48 states. This basin encompasses one of the most scenic, pristine watersheds within the interior West, draining more than 13,550 square miles with an average elevation of 6,720 feet. Much of the watershed lies within the 2.4-million-acre Frank Church River of No Return Wilderness Area. The Stibnite/Yellow Pine Mining Area is about 14 miles east of the town of Yellow Pine in Payette National Forest.

Mining Chronology: Like most other watersheds mentioned in this report, the Salmon played host to over a century of off-and-on mining operations. Some sites in the Salmon River watershed demonstrate that mines don't have to be a century old to have lasting impacts on rivers, fish and their surroundings. Although prospecting for gold, silver and other metals in the Salmon River watershed began in the late 1800s, mining and milling of gold-antimony ore in the Stibnite/Yellow Pine area did not begin until the 1930s. During World War II the area gained significance as a major producer of strategic metals, specifically antimony and tungsten. The exploration of gold reserves in the area resumed in 1970; a cyanide heap-leaching operation was used to recover gold from low-grade ore until 1991.

What We Took Away: Gold, antimony, tungsten

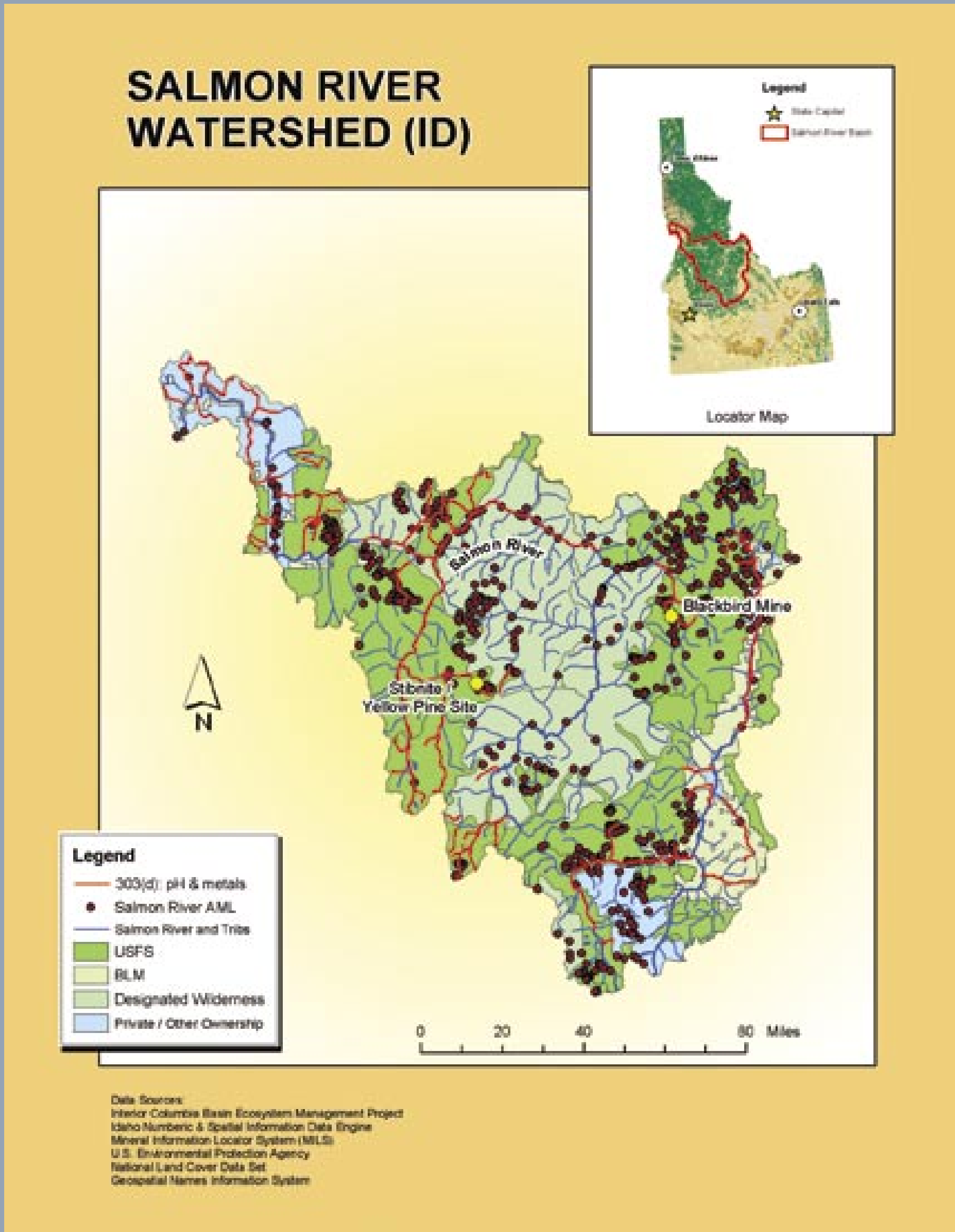
Left Behind: Mining-related disturbances in Meadow Creek and EFSF Salmon River are discrete source areas of potential heavy metal contaminants and mirror abandoned mine features found elsewhere in the watershed. These features include the Bradley tailings (main deposition area), smelter process area and wastes, process ponds, 5 heap-leach pads and an open-pit mine. Contaminants associated with these source areas include heavy metals and cyanide in area soil, groundwater, seeps and sediments.

In October 1991, the U.S. Fish and Wildlife Service documented a release of arsenic (6.38 parts per million) in steelhead trout taken from EFSF Salmon River below Sugar Creek in excess of cancer-risk levels. In June, 1993, the Forest Service collected soil, sediment, surface water and groundwater samples at 33 locations from above the Bradley tailings to Sugar Creek. Arsenic was detected in all samples. Surface water and sediment samples from Meadow Creek and EFSF Salmon River showed concentrations of metals in excess of background levels.

How the Fish Fared: Historically, the Salmon River possessed the most abundant salmon and steelhead populations in the Columbia River Basin. Native coldwater fish species found in the Salmon River watershed include bull trout, westslope cutthroat trout, rainbow trout, steelhead trout, spring/summer chinook salmon, sockeye salmon, mountain whitefish and several species of sculpin. Coho salmon were extirpated from the Salmon River watershed in the mid-1970s, shortly after the construction of the four lower Snake River dams in Washington. Declining numbers of returning salmon may be affected by non-mining related concerns, but the spare number of native fish that do make it back to the Salmon to spawn could only benefit from having critical habitat reclaimed from the dangers of cyanide, heavy metals and other abandoned mine-related threats.

The Road to Restoration: By working closely with the U.S. Forest Service, the State of Idaho, and other partner agencies and organizations, Trout Unlimited and other conservationists can begin to make a difference in turning back the tide of historical mining damages for the future of native trout and salmon species and the ecological integrity of one of the wildest river basins in the lower 48 states

> **"The Salmon River Basin within the central Idaho Mountains represents one of our best opportunities to maintain existing native salmon and trout and rebuild a larger network of complex and connected habitats.**
>
> **Protection of core areas will not be sufficient to achieve this goal; watershed rehabilitation and the development of more ecologically compatible land uses on both private and federal lands will likely be required."**
>
> *Russ Thurow, Fisheries Research Biologist,*
> *U.S. Forest Service Rocky Mountain Research Station*



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Watershed: The Sacramento River rolls 382 miles through north-central California. From its origins near Mount Shasta, it bisects the northern Sierra Nevada and southern Cascade ranges, eventually emptying into the north arm of San Francisco Bay. Primary tributaries to the Sacramento include the fabled fishing waters of the American, Feather, Bear, McCloud, Pit and Yuba rivers.

Mining Chronology: Discovery of gold along the American River in the late 1830s and the subsequent California gold rush began to alter the local landscape and its rivers soon after it began. Mining exploration throughout the Sierra and the remainder of the Sacramento River watershed persisted through much of the 20th century.

What We Took Away: Primarily gold, also iron, mercury, silver, copper, zinc and pyrite

Left Behind: Now, 140-plus years after the rush, an estimated 13,500 abandoned gold mines litter the California landscape. Several thousand are in the greater Sacramento watershed. Although mining operations were discontinued in the 1960s, underground mine workings, waste rock dumps, piles of mine tailings and open mine pits remain. These continue to produce acidic drainage that enters into local streams, reservoirs and the Sacramento River. Historic records documenting the Iron Mountain Mine site in the northern reaches of the watershed describe numerous cases of adult salmon and steelhead mortality beginning shortly after mining activity began, with salmon kills reported as early as 1899-1900.

The footprint left behind from so many hardrock mining sites is not subtle. Waste rock, tailings heaps, open pits and shafts are just some of the reminders. The real problems occur, however, when rainwater and runoff mix with these sites and the throwaways from the mining process. The result is acid mine drainage discharging into surface and ground water, often leaving a great deal dead in its wake.

Until recently, the Iron Mountain Mine contributed an average of one ton of toxic metals per day into the Sacramento, thus earning the in-distinction of "largest point-source of toxic metals in the country." Fish kills were not uncommon here (see below) and once-robust runs of chinook salmon and steelhead fell off sharply around the 1950s. Recent cleanup efforts have many observers hopeful for a rebound for these fisheries.

The Sacramento's mining-related problems don't end with acid. One of the most insidious heavy metals, mercury (quicksilver), was mined locally in the Coast Ranges of California and used extensively in the gold recovery process throughout the western United States. Unfortunately, while we carted away the gold, much of the mercury used to cull it from base rock was left behind. Millions of tons ended up in the river and its surroundings. In the Upper Yuba River alone, it is estimated that more than 1 million pounds of liquid mercury remain in placer gold mining tailings. According to state geologists, abandoned mine sites are the source of more than 90 percent of the mercury found in the watershed.

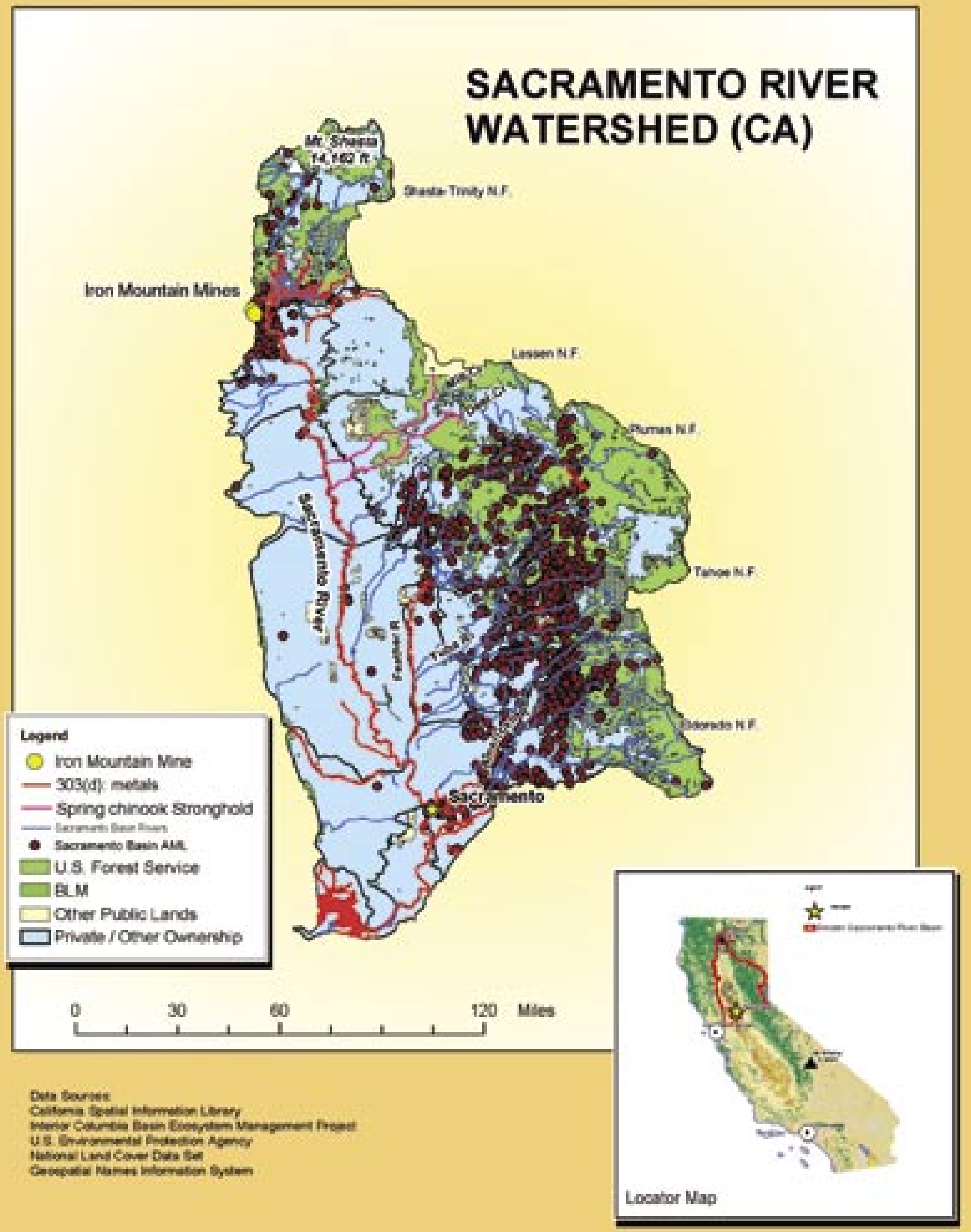
> **"Controlling toxic releases from this massive hazardous waste site will allow salmon to once again migrate and spawn in the Sacramento River."**
>
> *Craig O'Connor, Acting General Counsel, NOAA, October, 2000, announcing a cleanup settlement agreement reached for the Sacramento.*

How the Fish Fared: Historically the upper Sacramento offered spawning habitat for four distinct runs of chinook salmon, as well steelhead. This changed in the wake of the hardrock mining boom. Large fish kills resulting from acid mine drainage became common, especially during winter storms. One reported in 1969 killed an estimated 200,000 adult salmon. According to the EPA, chinook spawning in the Sacramento and its tributaries fell off sharply after the 1950s, with estimated populations dropping from over 400,000 in 1953 to fewer than 30,000 in 1983.

Of the 13 California waters now having fish consumption advisories, over half lie in the Sacramento River watershed and all are related to methylmercury poisoning.

The Road to Restoration: Iron Mountain was designated a Superfund site by the Environmental Protection Agency in 1994. In October, 2000, the State of California and the U.S. signed a settlement with Aventis CropSciences USA, Inc., the owners of the Iron Mountain Mine, to initiate one of the largest single-party cleanup agreements in U.S. history. According to the EPA, the settlement, which could reach payments of $1 billion, guarantees long-term funding to make the cleanup as complete as possible, lending hope for the return of a strong fishery to the Sacramento.

With the Iron Mountain site being addressed, the Bureau of Land Management in California has been actively working towards restoring other sites within the Sacramento watershed as part of an interagency partnership effort with the U.S. Geological Survey, U.S. Forest Service, California State Water Resources Control Board and county government. Priority abandoned mine sites have been identified in the Bear and Yuba drainages in the eastern portion of the Sacramento watershed as a result of these efforts.



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CALFED: California Bay-Delta Authority
The mission of the CALFED Bay-Delta Program is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System.
http://calwater.ca.gov/AboutCalfed/PolicyGroupMembers.shtml

Watershed: Kettle River Basin, Colville and Okanogan national forests, central Washington. The Kettle River winds its way through the Kettle Range of north-central Washington from its origins in the mountains of British Columbia. Flowing east across southern British Columbia, the Kettle then turns south and enters Washington a couple of times, lastly at Laurier. From Laurier it flows south and joins Lake Roosevelt, an impoundment of the Upper Columbia River.

Mining Chronology: Gold was discovered in 1857. A relatively short 10-year boom period followed and most major mining operations had closed by 1920.

What We Took Away: Gold, silver

Left Behind: True to the boom-and-bust character of so many mining hot spots throughout the West, the population of northeast Washington dropped by one-half between 1910 and 1920. Today spent mines pock the hillsides and rotting cabins stand abandoned in fields throughout the Colville National Forest, visible reminders of what the area looked like at the height of the boom era.

Seasonal, yet harmful, levels of aluminum, copper, cyanide, lead and zinc are the persistent, albeit less visible, evidence of the Kettle's abandoned mines and the pollution they contribute to the river and its tributaries. This annual "pulse" of metals-laden runoff continues to be a primary cause for reduced numbers of coldwater fish species, as well as a persistent threat to the aquatic insects fish feed upon. Toxic riverbed sediments fail to offer suitable spawning habitat for resident trout species, keeping reproductive viability low. As a result, sportfishing on the Kettle must be supported by expensive stocking by the Washington Department of Fish and Wildlife (WDFW).

How the Fish Fared: The two most common sport fish in the basin at present are resident rainbow trout and eastern brook trout. The stocking of brook trout ceased on Colville National Forest about 20 years ago and numbers of this non-native species are giving way to distinct populations of redband rainbow and westslope cutthroat trout in some tributary streams. There are also populations of other coldwater fish species, including brown trout and mountain whitefish. The threatened bull trout has been documented in one major tributary to the Kettle River, although the status of the resident fish population is unknown.

Prior to construction of Grand Coulee Dam and other dams on the Columbia River system, several species of salmon migrated and spawned in the Kettle River. Today, no anadromous fish are found within the Kettle River system.

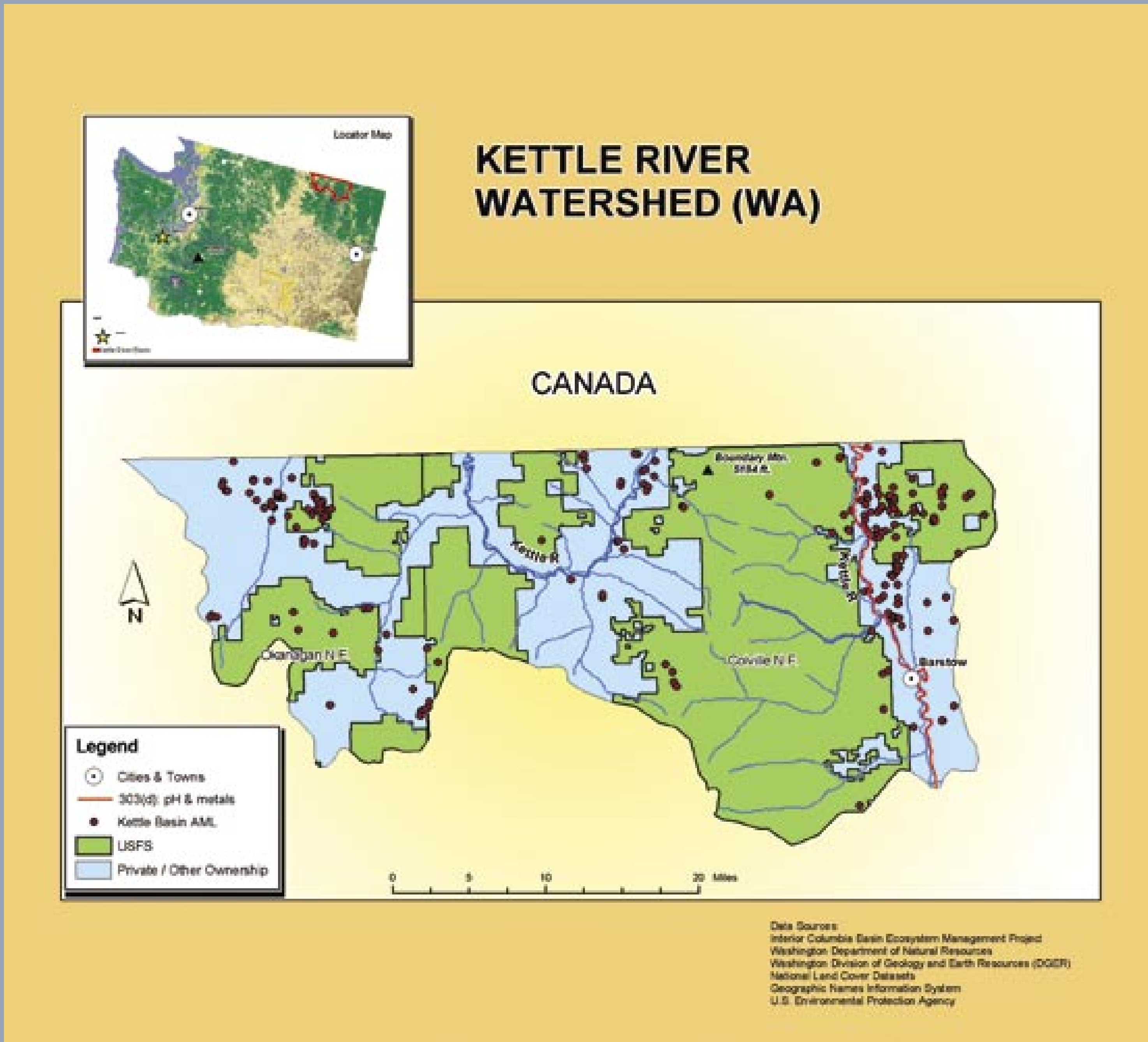
Curt Vail, a biologist with the WDFW, said his department has been aware for some time of the Kettle's tremendous potential. For the past several years the state has been augmenting the fishery by stocking hatchery-raised rainbows taken from wild Kettle River stock. Vail says that, in Washington, the Kettle is predominantly a rainbow trout stream. "There are a few brown trout in the river, but generally speaking not very many," he said. "The only planting of browns we made was back in the 70's. But they do seem to be hanging on and occasionally some big ones are caught. There are some areas on the river that are prime big brown habitat."

The Road to Restoration: Working with the Washington Department of Natural Resources, as well as with the national forests managing the Kettle River watershed, concerned conservationists and sportsmen and women can work to reverse much of the damage left by abandoned mine sites.

People vested in restoring the Kettle have a number of opportunities to bring attention to the restoration necessary to return the river and its tributaries back to greatness as coldwater fisheries and prime wildlife habitat. An inventory of the abandoned mine sites is a necessary first step. Water quality sampling and monitoring at these sites will aid in prioritizing restoration proposals. Once prioritized, restoration activities can be planned, funding sought and volunteers recruited to assist with implementation. Partnerships with state agencies, other conservation organizations and communities are necessary to help this jewel of the Okanogan Highlands shine once again.

"The runs are so beautiful, the pools so full of character, and the water so crystalline that if the Kettle regularly gave up 16- to 18-inch rainbows it could become one of North America's greatest trout streams."

Outdoor author Mark Hume



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Kettle River Watershed (WRIA 60)
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Watershed: Methow River Basin, northeastern Washington state. From its origins 9,000-feet high in the eastern Cascade Range, the Methow flows south-southeast, bordering the Okanogan National Forest until it meets the Columbia near the town of Pateros.

Mining Chronology: Gold was first discovered in the nearby Similkameen River in 1859. A boom period soon followed with white settlement in numbers showing up in the Methow around the early 1880s. The boom lasted until about 1898, by which time hordes of fortune-seekers had packed up and headed north to the Klondike. Some limited forms of Modern mining operations continued here until about the 1930s.

What We Took Away: Gold

Left Behind: Impacts from historic mine operations continue to compromise the Methow's health today. Abandoned mines in the Twisp area of the Methow Valley continue to degrade water quality, with serious detriments to the people and fish that depend on the river. A University of Washington study in 2003 found that accumulations of heavy metals from adjacent abandoned mines reduced growth of young trout and compromised their survival. Eleven harmful elements such as lead, copper and zinc were found in elevated amounts below these historic mining and mill sites.

Within Okanogan County, more than 150 abandoned mines have degraded the rivers and their fisheries to varying degrees. Acid mine runoff and a steady infusion of mining-waste-produced metals enter the river from sites throughout the Methow Basin. Chemicals such as cyanide salts – used to mill and concentrate the ore – remain a threat to the water and its fish. Domestic well water supplies downstream of these mine sites have also been contaminated with heavy metals, often exceeding the state health department's allowances.

Stream-borne insects also have been affected. Caddis flies, a critical food source for young salmon and trout, have been lost in terms of both density and diversity below the mine waste's entry into the Methow, according to a recent study.

How the Fish Fared: The Methow's spring chinook salmon, summer steelhead and bull trout all have landed on the federal Endangered Species List. Westslope cutthroat trout were petitioned for listing and remain on the state list for species of special concern. Resident rainbow trout have shown "excessive mortality and the accumulation of cadmium and zinc…exceeding background levels."

The survival of the Methow's ocean-going salmon and steelhead remains tenuous. Through much of the 1960s, the spring chinook run averaged about 1,000 returning adults. Recent Methow returns number about 100 fish – a drop of some 90 percent in four decades.

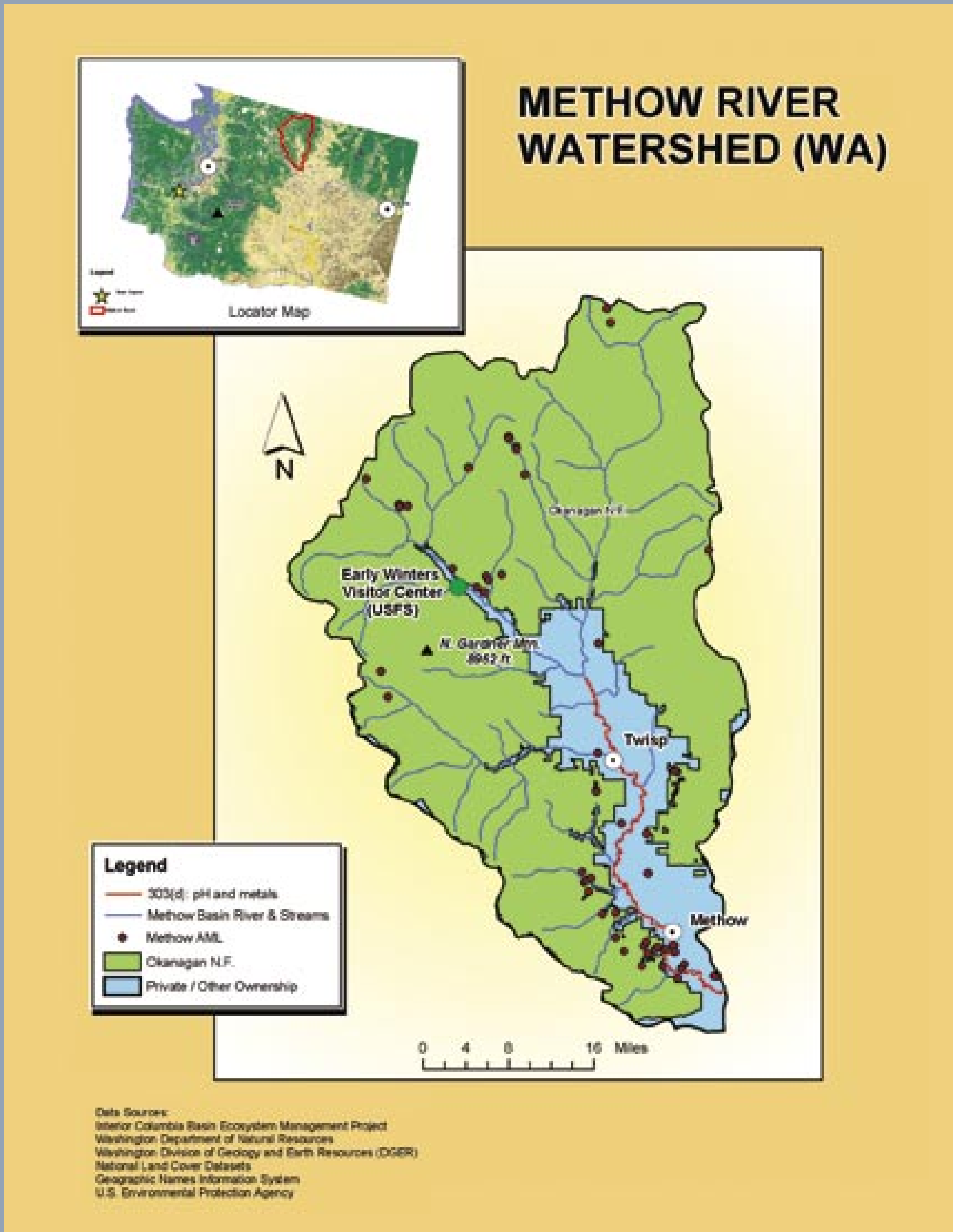
The river's summer steelhead have fared only slightly better in the last three years (enough fish to allow an intermittent, shortened fishing season). Unfortunately, wild steelhead numbers show that in 2001 only about 2,000 wild fish returned to the Methow. The remaining 12,500 steelhead for the year were hatchery fish – a mere fraction of the historic runs prior to the 1960s.

The Road to Restoration: The Methow is an under-studied waterway, and, as such, is a prime candidate for grassroots involvement. The number of abandoned mine sites and the extent of the pollution that flows from them must first be accurately gauged. Sites meriting priority cleanups need to be identified, remediation projects must be planned for both priority and secondary sites and comprehensive reclamation needs to be executed.

The beneficiaries will not only be the native fish and wildlife that make the Methow special, but also the local communities and their residents. Today we have an opportunity to lay a different, sustainable claim to the landscape in the form of abandoned mine restoration projects.

"Methow Valley residents are being forced to return to their community's past and question whether the gains made by their grandfathers who liquidated the valley's finite mineral resources a generation ago justify the effects caused by the byproducts of mining and the waste that was left behind."

Dan Peplow, PhD.
University of Washington



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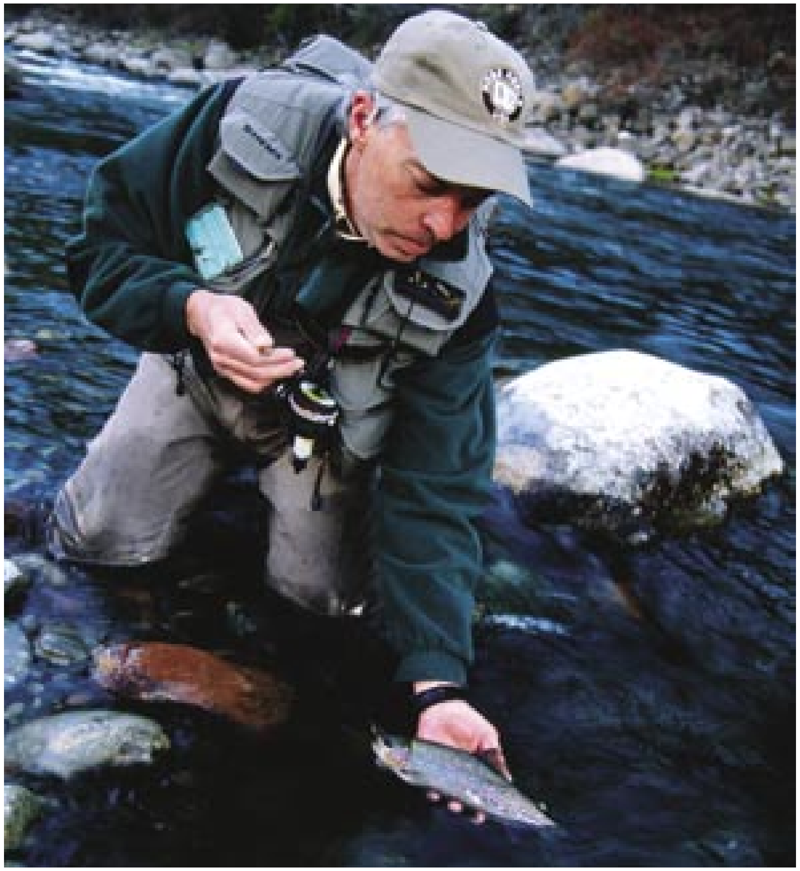

photo: Russ Schnitzer

Trout Unlimited's Public Lands Initiative

Protecting The Places We Hunt and Fish

All of our actions on the land are ultimately reflected in the quality of fish and wildlife habitat. More than 50 million Americans hunt and fish. Too often, their voices and interests are lost in the din of controversy that has come to define public land management. The intent of TU's Public Lands Initiative is to cut through the noise and:

- Develop sound scientific and technical information demonstrating the importance of public lands to coldwater fisheries, wildlife and fishing/hunting opportunities;
- Build an alliance of TU members, wildlife and fisheries conservation groups, hunting and angling clubs, and fish and wildlife professionals to advocate for management policies on public lands that protect the long term health of coldwater fisheries as well as wildlife; and
- Inform the broader public on how incredibly important public lands are to protecting and restoring coldwater fisheries and wildlife habitat, and the tremendous fishing, hunting and other outdoor opportunities public lands provide.

Under this Initiative Trout Unlimited has established specific field programs to address three major management issues affecting fish and wildlife habitat on public lands:

- Restoring lands degraded by abandoned hard rock mines;
- Oil, gas and coal bed methane development in the Interior West; and
- Roadless and wilderness area protection.

Trout Unlimited staff Russ Schnitzer and Rob Roberts produced this report.

To learn more, please visit our website at http://publiclands.tu.org

Join Trout Unlimited on-line at http://www.tu.org/join or call (800) 834-2419

cover illustration by Bob Bredemeier

photo: Russ Schnitzer

"Like many fly fishermen in western Montana where the summer days are almost Arctic in length, I often do not start fishing until the cool of the evening. Then in the Arctic half-light of the canyon, all existence fades to a being with my soul and memories and the sounds of the Big Blackfoot River and a four-count rhythm and the hope that a fish will rise."

– *Norman Maclean,* A River Runs Through It*, 1976*

"Restoration work is not fixing beautiful machinery, replacing stolen parts, adding fresh lubricants, cobbling and welding and rewiring. It is accepting an abandoned responsibility. It is a humble and often joyful mending of biological ties, with a hope clearly recognized, that working from this foundation we might, too, begin to mend human society."

– Barry Lopez

photo: Milan Chuckovich

Trout Unlimited
PUBLIC LANDS INITIATIVE
PUBLICLANDS.TU.ORG

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