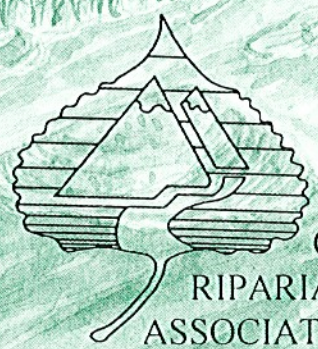
IS THE GREEN LINE GREEN?

STATUS, TREND AND TREATMENT OF COLORADO'S RIPARIAN AREAS

October 1-3, 1996
Pagosa Springs, Colorado

Proceedings of the
Eighth Annual Conference



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What is the Colorado Riparian Association?

The Colorado Riparian Association is a group of landowners, resource managers, organizations, and individuals interested in promoting awareness of the values and long-term benefits of proper management of Colorado's thin green line-our riparian areas.

Our mission is to promote protection and restoration of Colorado's riparian areas and wetlands through better awareness of these values and benefits. Annual conferences are a part of our efforts to foster a practical and scientific understanding of riparian areas and wetlands in Colorado. The Association promotes sound management of riparian areas and wetlands through demonstration and education, and promotes communication and coordination among all people interested in riparian areas and wetlands in Colorado.

COLORADO
RIPARIAN
ASSOCIATION

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Collaborative Management

Don Glaser, Executive Director
Western Water Policy Review Commission

There are so many important issues to talk about as it related to the riparian resource that it is hard to know exactly which one to address today to be most helpful to your deliberations. In addition, it is necessary to consider the perspective from which to make my observations. There are so many negative messages being tossed around today that one could easily lose hope for a better tomorrow. In fact, recent polls indicate that for the first time in this century, people feel the quality of life will not be as good for their children as it was for them. As I honestly look around, I can personally see little to make me despair for the future of my children and grandchildren. Surely there is much to be concerned about and even more that deserves society's attention. My message isn't that all is well and nothing needs to be done. That would be foolish on its surface. Rather, my message is there are many things that are not right, and we can do much about it. My vision of the future is one of hopefulness in action.

I think this country is entering a period of great awakening. I believe we are moving away from a period of extreme self interest and a focus on material wealth to one that addresses the broader realm I will call "quality of life." To me, quality of life is made up of the physical or natural environment as well as the socioeconomic environment in which we live. At the community level, almost every individual shares a common interest in their quality of life. This is most evident in the more rural west. People, whether native or new, chose to live there for the physical and cultural qualities of the area and are keenly aware of threats to those physical attributes. They are also interested in a stable economy which provides good jobs. This local interest seems to be driving us to community-based resolution of conflict between competing demands placed on our natural resources; therefore, natural systems. As one moves further away from the local community, the issue advocates seem to become narrower in their prospective and more polarized their positions. The ideology of special interest becomes more important than the actual natural resource. However, both the national policy and local interest play an important role in effective public decision making related to natural resource preservation and utilization.

Many interests hold little hope for the local collaborative decision making processes emerging around the country. These initiatives are known by many names: place-based management, ecosystem management, watershed initiatives, resource recovery initiatives, etc., but tend to have common characteristics. There are usually locally debilitating resource use conflicts that risk the quality of local life either socioeconomically, environmentally, culturally, or a combination

thereof. Local citizens rally to solve the resource problem and eliminate the debilitating effect on the community. The focus is clearly on resolution. The critics of this resolution process acknowledge the greater ability for local problem solving, but they view this as "back to the future." This is not unlike the decision making philosophy that predated enactment of the environmental laws of the sixties and seventies. They fear the same 1950's results of these local processes. That is, the economic interests will dominate or the negative environmental effects will be exported out of the local area therefore not be given appropriate consideration in the local decision process. This was, in fact, the effect of many pre-1960 local decisions. The 1970's reaction to local this parochialism was the public planning process and national regulation. This was, I believe, an effective solution for the 1970's and served the necessary purpose of interjecting the national interest into local resource decisions and actions. These new processes were founded in a series of Federal statutes including the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, National Environmental Policy Act, etc. and implemented through a significant amount of codified regulation. This resulted in an entirely new Federal/state/local relationship that tended to be confrontational in nature and threatened the states' historic authority to allocate natural resources, particularly water. This new relationship raised the concern of many western states and local interests such as those reflected by states rights, county supremacy, and private property rights advocates.

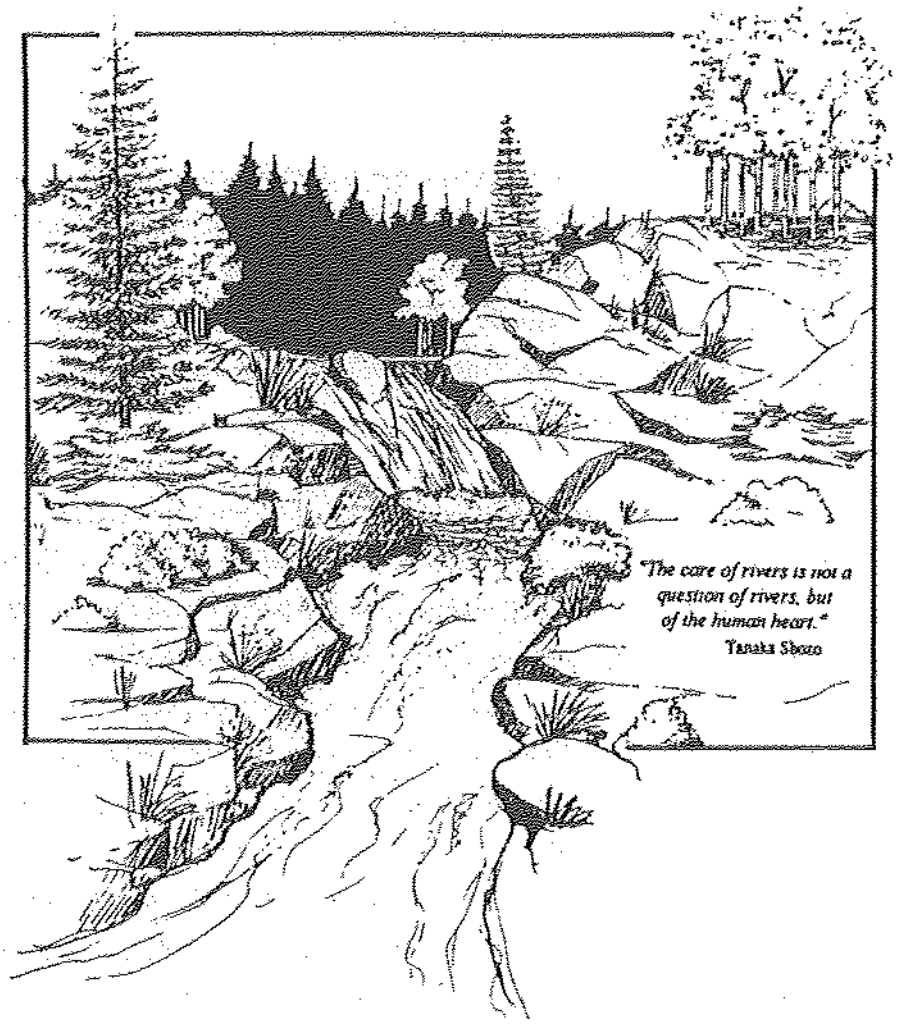
This gets us to where we are today. Relying on Federal statutes and regulations to resolve local problems as we have for the past 25 years is leading more often to confrontation, frustration, and anger. The sides are picked, and the fight rages on. The stakes are high as the principle Federal statutes come up for reauthorization. Elections are won and lost over these issues; the victims are many. One unintended result is the total inability to resolve local resource issues where there is a Federal interest. In the west that is nearly every issue considering the Federal presence in land and water. I believe this combination of circumstances has driven us back to the local resolution forum. What is different today is the very presence of the defined national policy or interest expressed in the above-cited Federal statutes. They serve the necessary purpose of requiring the local interests to consider the broader consequences of their decisions. This is a significant departure from the 1950's and argues for the retention of the broad national objectives defined in statutes like the hotly-contested Endangered Species Act. On the other hand, it equally argues for a loosening of Federal regulatory control to allow local interest to find solutions to local problems taking into consideration the national objectives.

In response, we are currently seeing an entire review of the Federal, state and local relationship. Federal agencies have become advocates for their program responsibilities over the past 25 years,

often to the point of adversarial relationships to other Federal programs. Today these very agencies are rethinking their institutional approaches. The national objectives are being maintained while the institutional methods are being revisited. You are seeing a blurring of institutional lines, not only between Federal agencies, but also between Federal, state, and local entities. Rather than Federal interest prevailing by force of Federal regulation, the issues themselves are compelling and are the focus of resolution with the participation of all interested local parties. What remains to be resolved is the manner by which interested individuals outside the local area can participate in these local decision making processes. This may well be accomplished through a more effective NEPA process. What does seem evident at this point is the need to allow these local processes to focus on resolution of local resource issues with the support of national agencies and interests. Resolution is possible at this level given the personal interest in real solutions and the observable effects the decision can have on improving the current and future quality of life at the community resource. Equally evident is the need to retain the clear national objectives defined in current Federal laws. Current rigid Federal regulations needs to be loosened, not to allow a weakening of national objectives, but rather to accommodate achievement of the national, as well as local, objectives through collaborative processes.

So what does this means to you and the riparian resource you care so much about? If you see any merit in my perspective, it suggests three distinct courses of action for your organization. First, you need to stay abreast of, and involved in, the national debate over basic Federal environmental law. You need to assure the reauthorization of current Federal environmental laws, such as the Endangered Species Act, provide clear and appropriate national objectives and enforcement methodologies. This will assure the continued consideration of national interests in local decisions needed for maintenance of healthy natural systems. Second, you need to encourage Federal agencies in their current efforts to improve their relationships, processes, and effectiveness associated with local and regional resource issues. Although they are on the right track, it will take your patience and support as they attempt to redefine their appropriate governmental role related to future resource management and protection. Third, you need to focus your resource protection and improvement efforts at the resource level in the local community. You need to remain a catalyst for local resource initiatives that are inclusive in nature. This seems to be the only way to gain lasting resolution and assure sustained improvement of the riparian resource. You must act holistically at the local level involving all interested parties. Only through resolutions that address the needs of all parties can you find lasting resource solutions. You must not fail in your search for meaningful solutions. In my opinion, how we address the riparian resource at risk today will have as much to do with our childrens' quality of life as any resource issue we face. The riparian is the single greatest indicator

of ecological health within western watersheds and defines socioeconomic health in the arid west. Our actions or lack, thereof, will truly define our legacy to future generations.



What is Ecological Restoration and Why is it Important?

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What do we mean when we say we want to restore the landscape, or restore the health of the earth? What is it that needs to be restored? How do we know when the land is healthy? Such questions can be hard to answer for a people who have become so distant, so remote from the idea that the earth is more than "virtually" real, and removed from the idea that their cultural relationship with their earth is integral both to the long-term perpetuation of their culture and the renewability of the earth's living surface.

One way of approaching the answers to these questions in human societies is to regard a culture healthy so long as it continues to renew itself with each new generation of individuals and families. The health of a culture is dependent upon the behavior of the individuals within it. Each individual is unlike any that has ever lived or will live again. Each is born with a unique combination of genes that the culture has never experienced before, and is born into a time and circumstance that has never been before or will be again. Individuals are reared in the ways of their people by the family within the culture, and draw strength and experience from the knowledge and wisdom of their elders. With an eye toward tomorrow, these elders have tested the knowledge and wisdom of their forbearers, made scarcely detectable modifications in response to their own experience with their people and their land, and passed it along to young ones. In this way, the health of the culture is assured, as the people, utterly respectful of the experience of the past, respond to the subtle vicissitudes of an ever changing earth, that their culture might perpetuate itself and replicate the full potential of human experience with each passing year.

So it is with the ecosystems of the earth with which human cultures interact. The warp and weave of life and human culture on any remnant acre of the earth is unique to the earth. No other complex of genetic expressions has such an experience of the singular geological, historical, and climatic definition of a place as do the organisms that have long residency in it. With each passing season there is a propagation of young with genes that are at once nearly identical to those of

their parents, yet manifesting combinations of genes that have never been before. With the inborn "experience" of long-time residency in their habitat, they are at the same time equipped to accommodate subtle shifts in climate, and the gradual changes brought on by mountains and seas rising and falling. This co-evolution of life forms with the geological and meteorological transformations of the earth occurs at a time scale that is inextricably linked with the regular cycles of the earth around the sun, and the time periods necessary for individuals of populations both to transmit the experience of the place to subsequent generations and yet to allow small genetic changes to satisfy subtly new conditions.

Rates of change in human cultures and ecosystems are buffered against catastrophic collapse by an internal diversity that works to protect the whole against the development of exaggerated, untested individual behaviors or genetic malformations. Without such protections, the replication of rapid, system-wide changes can cripple the system's ability to renew itself and conserve its local knowledge of the place. The health of an ecosystem or a culture degrades in accordance with the degree to which it destabilizes or simplifies itself, and there comes a time when there is not enough diversity within the system, with either enough memory of the past nor enough potential for the future, to continue. The evolution of a system so compromised ceases.

Ecological restoration, as a cultural discipline, seeks to discover those places of the earth where evolution has been seriously compromised or truncated, where the earth no longer can renew itself. In such places restoration ecologists seek to replenish the biodiversity of species native there, along with any abiotic processes and human cultural relationships upon which such complexes of species depend. The extent to which the genetic diversity of the place can coalesce into a self-sustaining, self-replicating system is the extent to which the health of the system develops. Ecological restoration is the process by which humans relearn the realities of a place, the importance of acquired wisdom and knowledge, and the relationship that the resident human culture must develop with the place, and its biota.

Let us examine an example of a place on the earth that has lost the capacity to renew itself: the suburban lawn. By defaulting the "undeveloped" lands around us to a single species of grass, the unique qualities of the place where it is planted must be erased and suitable conditions created for the grass. Instead of 100 species of plants, their pollinators, seed dispersers, mycorrhizae, etc., singularly adapted to the site, the horticulture of the one species becomes paramount. The site, whatever its original condition, must be transformed to accommodate the nutrient, soil, and moisture requirements of the grass monoculture. In most circumstances, this remediation requires exaggerated translocations of nutrients and water, and inputs of pesticides to discourage

infestations of disease. The human relationship with such lands becomes one more akin to a handmaiden than that of a coinhabitant. The land's ability to inform the resident humans about its uniqueness is eliminated. The human inhabitants become peculiarly unaware of, or oblivious to, any consequent impacts, however real and threatening they might be.

This cultural obliviousness leads to an inability to recognize certain realities of the landscape, realities that are peculiar to each particular landscape. Airplane pilots know, for example, that if a plane has a stall speed of 100 mph, and they try to bring it in for a landing at 95 mph, they are going to fail. They would not fail because they are morally bad. They would fail because they ignored a reality, they broke a real rule. Certainly, they didn't mean to break such an unforgiving rule, but they did.

One of the real rules that we seem frequently to ignore in the landscape is that landscapes are outdoors and water falls on them. Actually, it falls everywhere, not just in wetlands or in places designated by engineers and ecologists. In the Chicago area, precipitation amounts to about 37 inches, or about 1 million gallons of non-compressible fluid per acre per year. When it falls, two things can happen. It can infiltrate and manifest itself as an asset to local life, or it can run off and become a liability to life downstream, leaving the place where it fell bereft of water.

Some cultures regard landscapes as little more than living rooms to be designed only with attention to the vagaries and vicissitudes of the design aesthetic of their day. But water is a real thing. It is non-compressible, and it flows downhill. The more of it there is, the greater the volume; the greater the volume, the greater the potential flow energy. The greater the energy, the more resources it can carry with it. Water is one of the few resources that wind up on the top of the hill free, as a result of evaporation and condensation, rain, dew, or snow. Other resources, such as nutrients and soil, are less easily restored to the top of the hill. Generally, the energy required is not sunlight energy, which mediates water restoration, but some other energy source, and usually one that involves money and labor.

Resources that flow downhill with water leave the top of the hill bereft of resources, and render the bottom of the hill surfeited with them. The same force that brings water free to the top of the hill, enforces evaporation potentials such that, in the Chicago area, about 1 million gallons of water are evaporated from each acre per year. The first principle of our contemporary culture seems to be: get as much water out of sight as fast as possible. Depending upon local ordinances, this disposal can range from almost immediately, to 0.15 cfs/acre to 0.05 cfs/acre, but all must leave. Just how downstream neighbors handle it is their problem.

In order to achieve this underlying goal, the landscape must take on a certain morphology. The topsoil is removed, the underlying clay is compacted, and a thin layer of sod is rolled out over it. Such sods commonly consists of Kentucky Bluegrass, Poa pratensis, which is not native to Kentucky or even the Americas. The root system is but a couple of inches deep, and the whole layer represents little more than a rug with an exaggerated floor pad. Water cannot penetrate the clay floor, but will sit in the root system and kill the rug. The solution to rug killing is to tilt all portions of the landscape at no less than 2% slope. There are usually local ordinances requiring this. The more expensive designs include bumps or berms placed artistically through the landscape, and usually include storm drains so that water will arrive at detention basins with all deliberate speed.

This contrived "living" rug phenomenon has lead to a curious infrastructural aesthetic: no other living thing is acceptable on the rug. Only certain shrubs, planted in artistic groupings of 5's and 7's, and only even-sized, lollipop-shaped trees planted in rows are allowed. Expensive plantings include huge clumps of mulch placed in small rings at the bases of the trees and shrubs. Trees growing in clay holes on bumps commonly do not live long, partly because the holes have either too much water in them, or not enough. The relevant point here is that such trees and shrubs are not really alive in the sense that they are members of a community and participate in the annual replication of that community. Other than mowing, fertilizing, and pesticiding, the only human involvement in such a landscape consists of workers who replace dead trees.

Bearing in mind that it really does rain, water that falls on such landscapes begins its course downhill, carrying with it herbicides, extra fertilizer, and anything else. Designers of such landscapes have contrived huge holes in the ground that are placed tactically to receive such waters and any pollutants or unused nutrients. There the water sits, its volume and any dissolved or suspended components being metered into the nearest stream. Waters from such landscapes throughout the watershed accumulate in massive storm surges, filling the rivers with filthy water, passing the waters along to the Gulf of Mexico.

This regular movement of huge volumes of dirty waters into the estuarine regions of the Mississippi River delta, is contributing to a catastrophic decline in the productivity of the spawning grounds of the Gulf of Mexico. The fishery economy of the region is heavily impacted by waste water from the hinterland. Meanwhile, having sent our rain water out of sight to remote areas, we no longer have our rain water here. Since 24-hour days really exist, and since sunlight energy really exists, water continues to evaporate or transpire from everywhere in the landscape.

The absence of local precipitation, it having been shunted to the Gulf of Mexico, renders our landscapes soon dry and sear, often within hours of the last rain. Our culture's solution inevitably has been to install expensive irrigation networks in order to mine water from deep within the ground, the largess of a landscape far away that actually infiltrates and stores water in net amounts.

The cultural aesthetic makes it important to maintain the height of the Kentucky Bluegrass as low as is physiologically possible and still have something that looks like a green rug. This requires virtually constant mowing, lest grass blades here or there get taller than others. Mowing, of itself, might be relatively harmless if it did not use fossil fuel in unremediated internal combustion engines. For every gallon of gas burned, about 15 pounds of carbon dioxide (and other worse things), which the ecosystem of the earth has not seen since the Paleozoic, are produced and given over to our atmosphere, potentially contributing to the phenomenon known as "global warming."

Since it is culturally important to grow Kentucky Bluegrass short, it must be fertilized regularly, which makes it grow fast, so that it must be mowed often. Inasmuch as no other living things are allowed in the landscape, the full aesthetic requires the application of as much broad-leaf herbicide and pesticide as the landscape maintenance budget will permit. Unused nutrients, pesticides, herbicides, and herbicide derivatives migrate to the detention basin in accordance with the slope of the landscape, the duration and volume of the next rain, and their residual concentrations.

The aesthetic dictated by the lawn implies a landscape that requires lots of water, yet can never be wet, that must at once be short, yet lives on fertilizer. The landscape is essentially designed to divest itself of water and resources, two input components it needs most. At the end of the day, the culture pays a lot for this infrastructural aesthetic that demands that the outdoors look ever more like a living groom, and inculcates its people to become ever more discomfited with any idea other than that. Indeed, with a "good" landscape architect, the outdoors should become more and more like the lobby of a grand hotel.

It is ironic, because our technology allows us to fly high above the earth and look down upon the scar tissue that once was a living land, a land that could renew itself each year. We can see that it really is the outdoors. We can see white clouds blowing around, turning dark, and raining down upon a blasted landscape, and the brown rivers run their ever straighter chutes to the Gulf. That blessed water that falls graciously to the earth, is turned to filth, and purged.

With each passing generation the culture becomes more distant to reality. Its words take on new meanings in accordance to the real experience of the young. "River." What image does the word evoke? We picture a long channel, with steep muddy banks, that surges with brown roiling water after the rains, and during the "droughts", a scarcely wet ditch with shallow pools of gulping carp, abandoned grocery carts, and doll baby heads. The people of the culture no longer can see that there really is such a thing as an outdoors, or that it matters.

It is not sufficient simply, once aware of the liabilities associated with the contemporary aesthetic, to stop all the mowing, watering, fertilizing, and pesticiding, and "let nature take its course!" There persists the reality that our contemporary landscape has nowhere near the biodiversity to coalesce itself into a self-sustaining, self replicating ecosystem. If current human involvement were simply to disappear, the landscape would not "succeed" into some pre-Columbian Eden. Rather, the Kentucky Bluegrass would go unmowed, fouled by its own mulch, and a few other weeds like Bull Thistle and Dandelion would flourish along with the bluegrass for a few years, giving way to weedy shrubs and trees, such as Buckthorn, Box Elder, Amur Honeysuckle, and Black Locust. The few groundcover weeds would shade out, the soil would erode, and the roots of the trees would become exposed as the last remaining topsoil disappeared and the trees began to topple. There would be few butterflies, birds, or anything else, other than perhaps some roving gangs of Starlings feeding on Box Elder Bugs, but mostly just system collapse. Maybe another brief boom of weeds, then a bust. All the while, water, soil, and other resources run downhill and befoul the rivers.

A contemporary landscape, however clever, ingenious, or attentive to aesthetics of the day, is a lot like the space shuttle. It can be amazing in its seeming complexity, but set it out behind the hanger, it rusts. It cannot make itself new again. Rather, the contemporary landscape requires continued subsidies of energy and resources to sustain it.

The real, evolving world works in a different way. It is alive. It is alive not in the sense that there are numerous living species growing in eclectic assemblages, but alive in the sense that each acre is inhabited by a community of species interlinked in time, space, and genetics, with a vital adaptive memory of the place. With 800 to 1000 native vascular plants in any particular Midwestern county, a given tract of tall-grass prairie might have as many as 100 species of vascular plants per acre, and no one acre would have the exact combination of species present in any other acre.

These plants and their associates have lived in their place for thousands of years, adapting to the unique aspects of various acreages, husbanding water and recycling resources. For thousands of years, the landscape has experienced a relationship with human beings that nurtured and stewarded the plants and animals known to have been present at the time of aboriginal "removal." Just as it is an artifact of the region's reality today that contemporary human beings are an integral aspect of the places where they live, and foster the habitat for contemporary inhabitants.

So, what are the prospects? What must we do to re-establish or restore a sustainable covenant with a living earth? Our culture is inexperienced, but we do know that the root systems of a complex of native species can increase the water-holding capacities of our soils by an order of magnitudes in a relatively short period. For example, land in the Conservation Reserve Program, after just a few years, can store a great amount of water that falls on it, and also can accumulate a ton or more of fixed carbon per acre, per year. A clue.

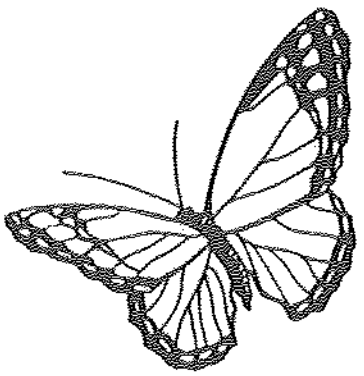
We could look at our landscapes and ask ourselves, why must it look like an industrial rug punctuated by smallish, perfectly shaped, lollipop trees, ringed at the base by tiny, perfectly engineered saucers of mulch? Would it be so wrong, so unattractive, so heretical, such an anathema to our culture's aesthetic, to look out upon, and walk within a landscaped inhabited by a profusion of native grasses and sedges, replete with comely perennials, infused with flowering shrubs, and dominated here and there, such as along the north and east faces of tall buildings, by groves of trees with futures. Would it be so radical to propose that trees be free to grow branches however their habitats permit, and to grow broad, expansive root systems with a diversely populated rhizosphere rich in water and mycorrhizal fungi? Would we be so unable to countenance clean streams and rivers with healthy base flows that flourish with fish and mussels?

Some cultures have chosen to ignore the realities of water, and the transient tendencies of water-borne resources. Others have taken a more proprietary approach. Those cultures that lay waste to their landscape, divest it of water, compact heavily the soil, and import excessive amounts of nutrient, now live in a landscape nearly without other living things, save a very few weeds that have become highly adapted to such landscapes. These landscapes are so inherently unstable that few organisms can reside long enough to establish long-term, resource-recycling systems. Evolution effectively stops, the biodiversity being so depauperate as scarcely to exist, replaced instead by steel, tar, concrete, vast rows of monoculture, and a few weeds living more or less independent, disconnected existences, without community or future.

Other cultures have chosen not to ignore the realities of water and the transient tendencies of other resources. They have taken a more stewardly approach to their landscape. Those cultures find value in a panoply of living things, connected and interconnected in resource-recycling systems. Such cultures have seen that there are advantages in fostering ambient life systems in which the broader community of organisms is sustained. Such communities provide the long-term system stability that allows each new generation, each with a new combination of genes that the earth has never seen before, to respond to an earth that has never been before. The species of such systems rely heavily upon the ancient wisdoms of their parents to inhabit the community of their birth, yet are sustained by their ability to manifest change and to continue to evolve.

Some cultures have drawn strength from yesterday, gloried in today, and ensured tomorrow; others have ignored yesterday, endured today, and forsaken tomorrow. It matters. We who wield a kind of hegemony over the landscape must be attentive to the fact that it is a landscape that receives the rain. It is our responsibility to treat landscapes not as mere canvases upon which we are wholly free to "express ourselves," but as actual acreages of the earth's surface, receivers of the rain and deliverers of "milk and honey", to borrow from an ancient metaphor.

The lawn is but one of many landscape applications in which our culture must examine its default behaviors. Similar examinations must occur with agricultural land and all aspects of the developed urban and suburban environment. Ecological restoration is our culture's recognition that there are physical realities relevant to sustained living on the earth and an appreciation that such realities can limit or liberate a culture's development. The goal of the restoration ecologist is to apply our technologies to the revitalization of every aspect of our culture's relationship with the earth, that both might continue to renew themselves and accrue the wisdom to sustain.



Gunnison Basin Riparian Ecosystems: The Good, The Bad And The Ugly

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ABSTRACT

Over the last six years the Colorado Natural Heritage Program and The Nature Conservancy have been gathering data for a statewide vegetation classification. We have visited over 1000 sites that were chosen with a random-stratified approach. In order to locate stands in relatively undisturbed sites we assessed aerial photographs. Perennial streams for most of the Gunnison Basin were categorized as excellent, good, fair, or poor condition by using 1:24,000 and 1:40,000 IR photos. Over half of the basin was unacceptable for sampling (fair and poor conditions). The proportionate breakdown of streams in the basin is as follows: 41% poor, 13% fair, 25% good, and 22% excellent. Small order streams, upper elevations, and public lands were more likely to be in excellent to good condition, while large order streams, lower elevations, and private lands are more likely to be in fair to poor condition. Heavy or improper grazing, intensive agriculture practices and altered Hydrologic regime were the primary causes for stream degradation.

STUDY AREA

The Gunnison River basin is located in west-central Colorado (Figure 1). It encompasses an area of approximately 12960 square km (8000 square miles), and includes the Uncompahgre River, the Lake Fork and North Fork of the Gunnison River, draining about eight percent of Colorado (HDR Engineering 1988). Basin elevated ranges from 1375 m (4550 feet) at Grand Junction to 4360 m (14,300 feet) at Uncompahgre Peak and has highly varied topography. The majority of the basin's upper portion's are glaciated steep peaks, descending into strongly sloping U-shaped mountain valleys. Long, steep-sided ridges running north to south typify the lower slopes of the central portion of the basin. In the lower basin, nearly level to moderately sloping valleys, flanked by low rolling hills are broken abruptly by steep sided mesas. The Uncompahgre Plateau drains the western half of the watershed and is characterized by highly dissected and steep-sided canyons. The basin has over 3200 perennial stream miles. Over 1,100 miles occur as first-order streams

above 2740 m (9,000 feet) while relatively few miles occur at lower elevations, these evenly distributed across stream order (Figure 2).

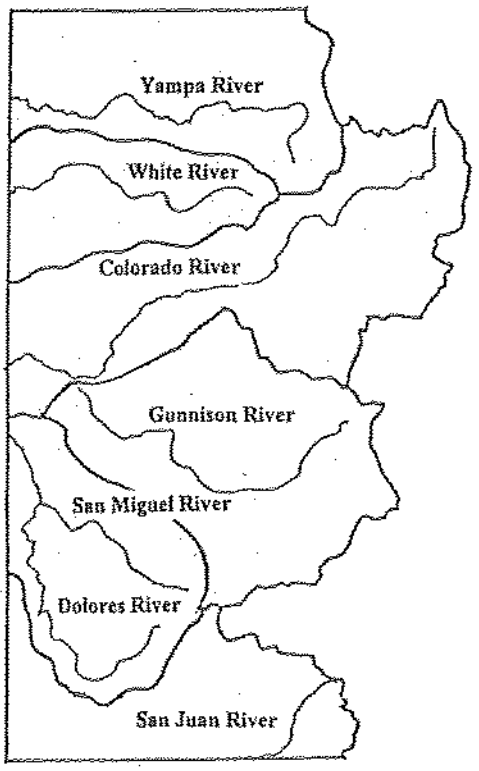


Figure 1. Major river basins of the Colorado western slope.

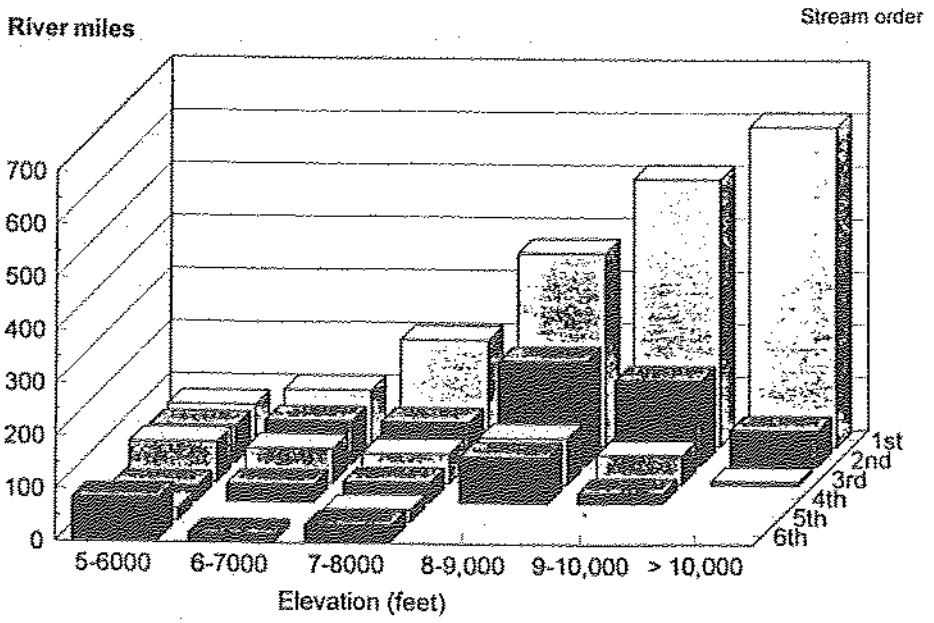


Figure 2. Gunnison Basin river miles per stream order and elevation.

Climate in the Gunnison Basin is considered semiarid, although the upper elevations are wetter. Average precipitation per year varies from more than 40 inches in the upper basin to less then 10 inches in the lower valleys (HDR Engineering 1988). Average annual snowfall varies from more than 460 inches at Ruby, 170 inches at crested Butte, to 20 inches at Grand Junction. Water supply for the basin is principally from spring snow-melt runoff, augmented by summer precipitation. The upper basin has an annual frost-free period of less than 70 days, while the lower valleys near Grand Junction average 190 frost-free days (Colorado Climate Center 1984).

Historically, the Gunnison Basin was inhabited by the Ute Indians until a large tract was opened for settlement in 1873, and the remainder of the basin was ceded in 1881 (Vandembusche 1980). The first settlers were miners, many of whom turned to farming and ranching as their means of livelihood when the mining industry declined after 1893 (Vandembusche 1980). Agriculture soon established itself as the basin's primary industry in the area and extensive agriculture supply systems were developed in the ensuing years (HDR Engineering 1988).

METHODS

For the purposes of this project, riparian areas are defined as the interface between the riverine aquatic ecosystem and the adjacent upland ecosystem (Gregory *et al.* 1991; Risser 1990; Knopf *et al.* 1988; Brinson *et al.* 1981). These areas are frequently flooded, or are at least seasonally saturated by a fluctuating water table, and have plant species, soils, and topography that differ considerable from those of the adjacent uplands (Elmore and Beschita 1987; Jones 1990). Riparian areas in this project include vegetation occurring along natural water courses, poorly drained overflow areas, and associated natural bodies of water, such as oxbow lakes. This classification focuses on lands along perennial streams as defined on U.S. Geological Survey 1:100,000 topographic maps.

Representative site selection

To sample as much of the diversity within each basin as possible in one field season, we used a stratified-random approach based on the gradsect concept as described by Austin and Heyligers (1989). We chose two major environmental gradients, stream order and elevation to stratify the study area. Stream order is surrogate for basin size, channel size and stream volume (Schumm 1977; Knighton 1984) and elevation is an important predictor of climate. Using USGS 1:100,000 topographic maps we denoted 300 meter (1000 ft) elevation bands from 1525 m (5000 ft) to over 3050 m (10,000 ft) and stream

order for all perennial streams. Stream order was calculated using Strahler's (1952) system (Fig. 3). The largest stream order within the Gunnison Basin was sixth order. Thirty-six combinations of elevation and stream order, or stream reach call types, were possible in the basin (Fig 2).

Aerial photographs were reviewed to eliminate areas of heavy disturbance. Only riparian areas which resemble a natural system were included in the sampling regime. In this way, the classification will be limited to plant associations native to Colorado, whose descriptions can serve as a reference point for management and restoration needs. We used 1989 and 1990 NAPP 1:40,000, and 1983 1:24,000 color infra-red 9 x 9 inch photographs to delineate riparian corridors and determine their condition. Condition was ranked by degree of disturbance, both within and surrounding the riparian corridor. All perennial riparian corridors were easily delineated. Hydrophilic vegetation appears bright red relative to dry hillside vegetation and has a texture unlike irrigated monoculture crop areas. In addition, conifer-dominated riparian reaches, which do not stand out as red, were also delineated. From aerial photograph interpretation and field verification work in 1993, we determined that disturbance of surrounding lands can be a strong predictor of the abundance of non-native species in the understory of the riparian corridor.

Ranking criteria used were: 1) evidence of drastic human disturbance such as agriculture conversion, adjacent irrigated fields, square-edge fields, road and railroad embankments, power line maintenance roads, gravel mining, logging, mining, dams, reservoir developments, etc.; 2) heavy recreational use, such as off-road vehicle use, etc.; 3) heavy livestock use such as overgrazing (Hillside trailing), or livestock holding sites, etc.; and 4) road maintenance sand and gravel piles or other dumping grounds.

The condition of riparian areas fell into four categories: 1) **Excellent** -- riparian corridor and the surrounding area appears natural with no major disturbances. Within the corridor itself, the area appeared unfragmented and the vegetation follows a natural alluvial pattern (Fig 4); 2). **Good** -- riparian corridor exhibits excellent vegetative cover but the surrounding area is altered, (Fig 5): 3). **Fair** -- the riparian corridor is fragmented, and/or the surrounding lands disturbed (Fig 6); 4). **Poor** -- the riparian corridor is disturbed, vegetation nonexistent or highly fragmented and the surrounding land is slightly to drastically altered (Fig 7). Deep canyons were an exception to the above criteria, as they tend to have naturally low amounts of riparian vegetation. (That is if the surrounding land looked undisturbed, a canyon reach would be ranked 'excellent').

By visually overlaying BLM 1:100,000 topographic and land ownership maps with the aerial Photographs, we were able to place each perennial stream mile into riparian condition categories and tally the elevation, stream order, and land ownership for all perennial streams in the basin.

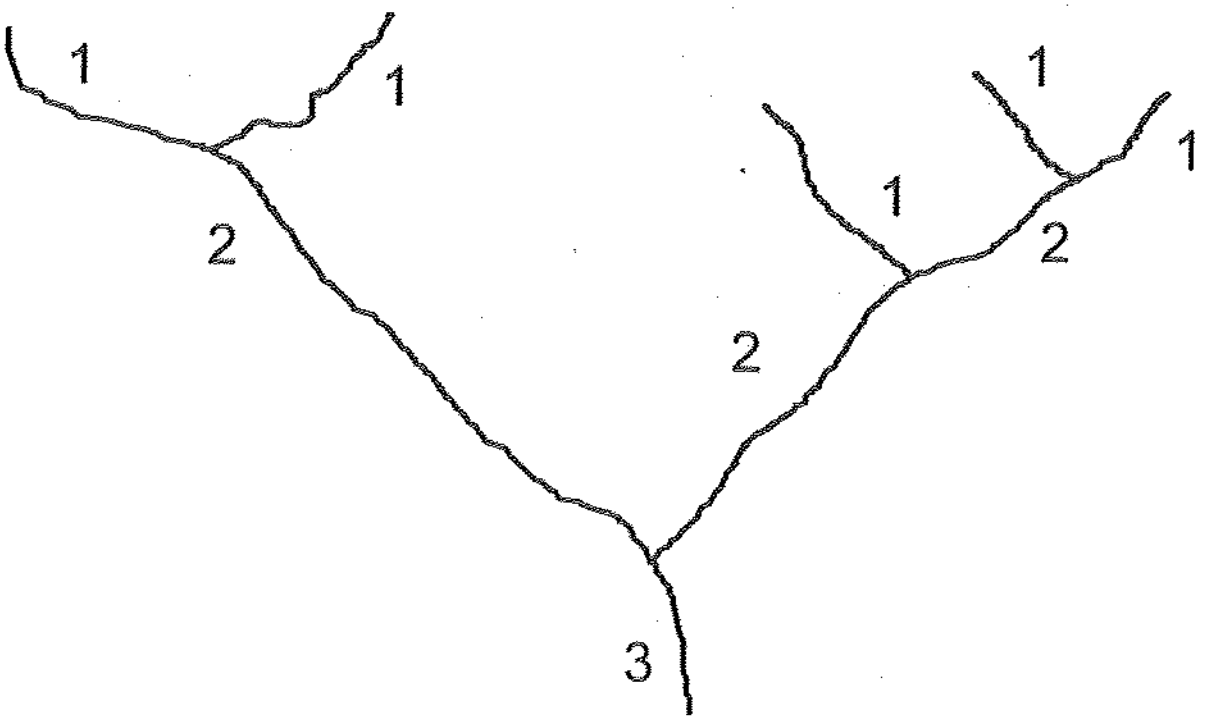


Figure 3. Strahler's (1952) stream order system, used as a surrogate for stream volume.

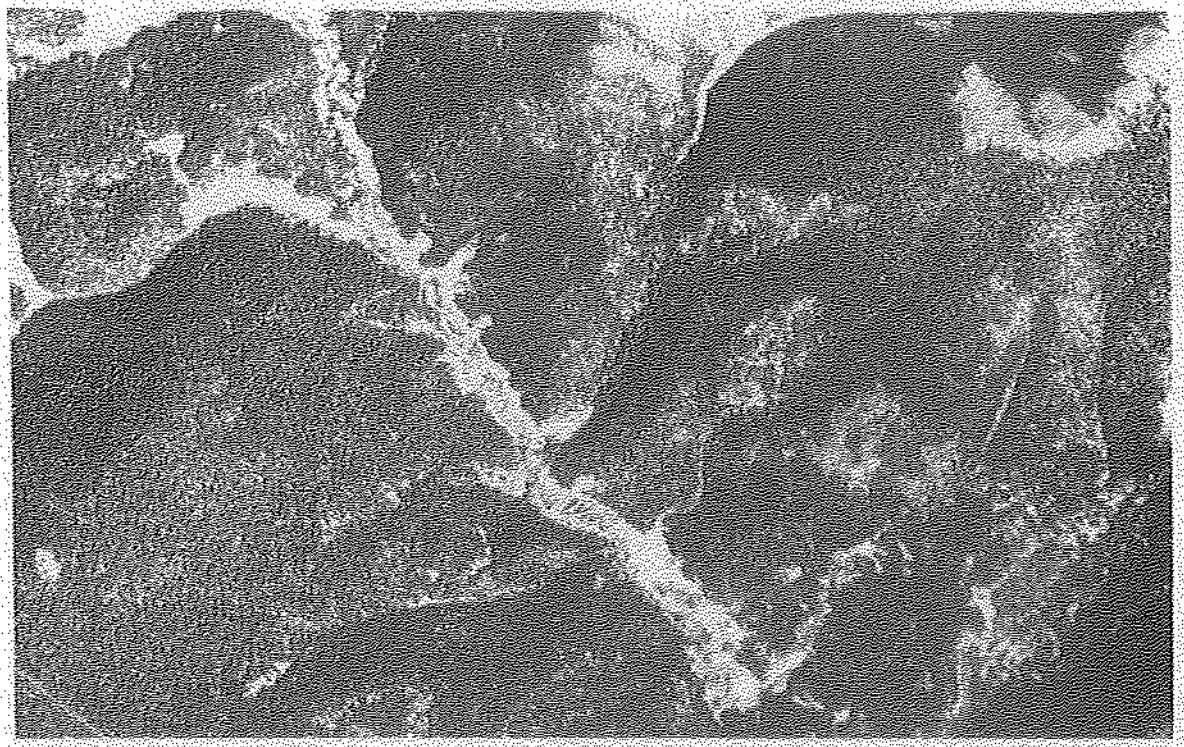


Figure 4. This infrared aerial photograph shows an example of an **excellent** first and second order stream. The riparian area is continuous and unfragmented. The surrounding area is intact, having no features (e.g., no roads, logging, mining, etc.) likely to disrupt natural hydrology or bring introduced species into the riparian zone.

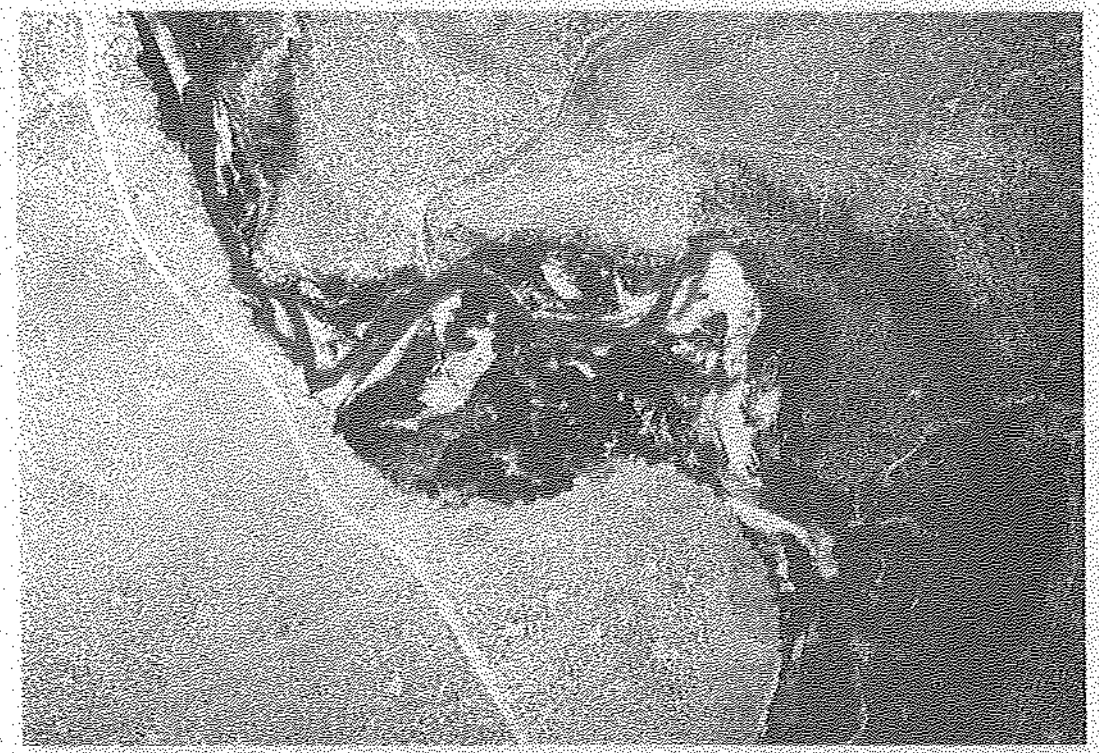


Figure 5. This infrared aerial photograph shows an example of a **good** riparian area. The primary difference between this and the excellent example above is that a two track and several grazing trails are evident. At first glance, these disturbances may not appear significant, but they almost always alter the species composition (more exotics) and may effect the hydrology.

Figure 6. This example of a riparian area scored as **fair** shows riparian vegetation still exists but it has been fragmented by a railroad, a highway, and multiple bridges. The section on the right has been converted to agricultural lands. All of these disturbances along with the adjacent mining activity have a negative impact on natural vegetation in the riparian zone.

Figure 7. This example of a riparian stretch ranked as **poor** shows only small pockets of native riparian vegetation still existing. The urbanization and intensive agricultural practices in the lower half of the picture have had a severe negative influence on the riparian ecosystem.

RESULTS

Stream distribution and Riparian Condition

Many of the perennial stream miles in the basin occur as first order streams above 8,000 ft, while the number of stream miles by stream order remains relatively constant for 2 - 5th order streams (Figure 2). Nearly 50% of the stream miles fell into the fair and poor category. The overall quality of the Gunnison Basin riparian was: 21% excellent, 25% good, 135 fair, and 41% poor (Fig. 8). Smaller streams were in better condition than larger streams. The first and second order streams had nearly 90% of their miles in excellent to good condition, while third and fourth order streams had 60% in these states. For larger volume streams, 5th and 6th order, only 33% were in excellent to good condition (Fig, 9a). A similar downward pattern occurs in relation to elevation. Ninety-five percent of the stream mile in the 9 - 10,000 foot elevation band were in excellent to good condition, while 73% of the rivers in the 7 - 9,000 foot elevation band were in equivalent condition. For the lower elevation of 5 - 7,000 feet only 56% of the river miles were in excellent to good condition (Fig. 9b).

Land ownership in the basin is 71% federal government (U.S. Forest Service and Bureau of Land Management) and 18% private (Fig. 10a). Quality of riparian areas strongly correlates with land ownership. Nearly 70% of public scored within the excellent to good category, while private lands faired much worse, with only 20% of the riparian areas intact (Fig. 10)

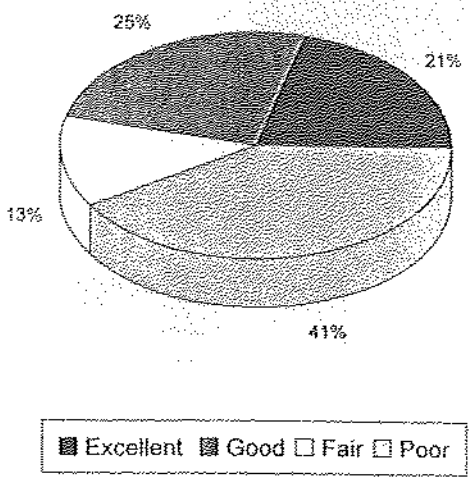


Figure 8. Quality of Gunnison Basin riparian areas.
Excellent-- Riparian corridor and surrounding area appear natural with no major disturbances, the corridor itself is unfragmented and the vegetation follows a natural alluvial pattern;
Good-- Riparian corridor exhibits excellent vegetative cover, but the surrounding area is altered;
Fair-- Riparian corridor is fragmented and/or the surrounding land is disturbed;
Poor-- Riparian corridor is disturbed, vegetation is sparse or highly fragmented, and the surrounding land is lightly to drastically altered.

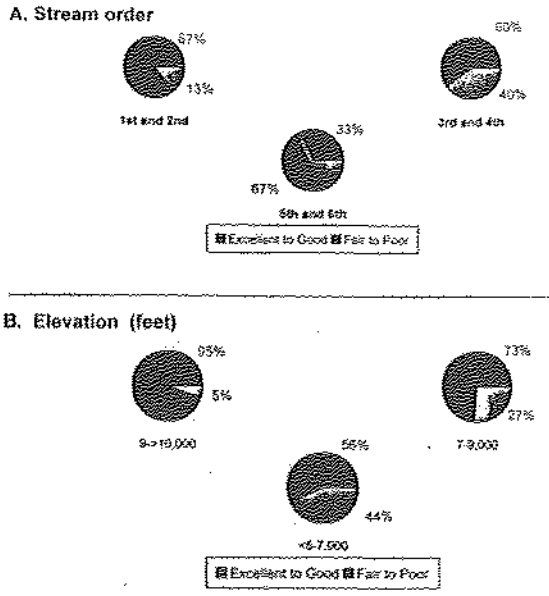
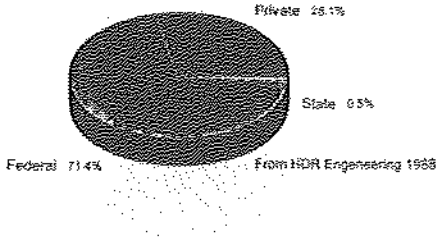


Figure 9. Quality of Gunnison Basin riparian areas by (a) stream order and (b) elevation.
Excellent-- Riparian corridor and surrounding area appear natural with no major disturbances, the corridor itself is unfragmented and the vegetation follows a natural alluvial pattern;
Good-- Riparian corridor exhibits excellent vegetative cover, but thesurrounding area is altered;
Fair-- Riparian corridor is fragmented *and/or* the surrounding land is disturbed; and
Poor-- Riparian corridor is disturbed, vegetation is sparse or highly fragmented and the surrounding land is lightly to drastically altered.

A. Land ownership of the Gunnison Basin



B. Riparian Condition by Land Ownership

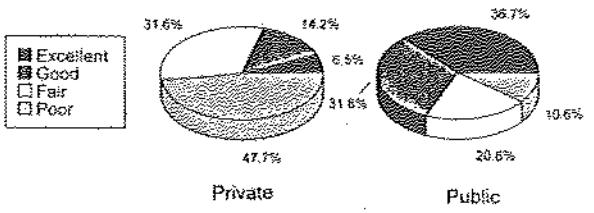


Figure 10. A. Land ownership of Gunnison Basin , B. Condition of perennial riparian areas based on 1:40,000 NAPP aerial photographs, by private and public sectors.
Excellent-- Riparian corridor and surrounding area appear natural with no major disturbances, the corridor itself is unfragmented and the vegetation follows a natural alluvial pattern;
Good-- Riparian corridor exhibits excellent vegetative cover, but the surrounding area is altered;
Fair-- Riparian corridor is fragmented and/or the surrounding land is disturbed; and
Poor-- Riparian corridor is disturbed, vegetation is sparse or highly fragmented and the surrounding land is lightly to drastically altered.

CONCLUSIONS

Over 50% of the Gunnison basin streams were inadequate for vegetation sampling. Small order streams, upper elevations, and public lands were more likely to be in excellent to good condition, while large order streams, lower elevations, and private lands were more likely to be in fair to poor condition. The eliminated areas were too degraded to adequately represent native riparian ecosystems. Eliminated areas altered by improper grazing, altered hydrologic regimes, cleared for intensive agriculture, or were impacted by coal and gravel mining. Land ownership within the basin reflects this pattern of use. Most of the private lands were used for irrigate agriculture, under active mining, or urbanized, while public lands were more likely used for range, timber harvest, and recreation.

The protection of functioning riparian ecosystems will be easier on public lands than on private lands, since most of these systems are in relatively good condition. Although, in order to capture plant communities found only on the larger streams we will have to focus part of our attention to private lands.

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Uncompaghre Basin Resource Area
Stream/Riparian Condition
and
BLM Assessment Method

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INTRODUCTION

The Uncompahgre Basin Resource Area, in 1989, began a systematic inventory of its stream/riparian areas, to gain information necessary for their proper management into the future. Although information existed for many stream/riparian areas, we did not have a good Resource Area-wide perspective on where our stream/riparian areas were and what condition whey were in. This effort was consistent with the Bureau's riparian initiative to do a better job managing riparian ecosystems.

Shortly after beginning this task it quickly became apparent we did not have all the knowledge we needed about riparian systems to easily answer all our questions. Often we had discussions, and sometimes disagreement, about basic issues such as, what is a riparian area? How do they function? Do they all function alike? Do they all look the same when they are functioning properly? What factors are responsible for making them function? And, how do you know they are functioning the way they are supposed to?

Using available BLM, State and National, guidance regarding inventory procedures and stream classification, we continued with our efforts, and made progress. However, we did not feel we had a good, or standard means of assessing the functionality of our streams. During the first few years of the inventory we accomplished the basic steps of; 1) identifying all named drainage's (on USGS Topo maps) within the Resource Area (Map1), 2) assigning them unique identifier numbers, generated by using the USGS Hydrologic Unit numbering system (USDI, 1989 - Draft BLM, Colorado "Fish Habitat inventory and Monitoring Handbook), and 3) entering drainage's and their numbers into UBRA's GIS system.

In 1991, the BLM Director approved the **Riparian-Wetland Initiative for the 1990's**, which established clear national goals and objectives for managing riparian-wetlands on public lands. The main goal was to restore and maintain riparian-wetland areas so that 75% or more are in proper functioning condition (PFC) by 1997. Also from this initiative came a process, developed by a national level interdisciplinary team, for assessing functionality of a riparian-wetland areas, with standard definitions and procedures.

BLM ASSESSMENT METHOD

The Bureau of Land Management's "Process for Assessing Proper Functioning Condition" of Riparian-Wetland areas is presented in technical reference 1737-9 (Prichard 1993). Presented in this paper, is an abbreviated version of this method, focusing on the most important parts, as they relate to UBRA's assessment of stream/riparian areas.

The BLM for determining the functionality of riparian-wetland areas is a rapid assessment method requiring an interdisciplinary team of specialists in vegetation, soils, hydrology, wildlife, and perhaps offer disciplines to make assessments.

BLM regards natural riparian-wetland areas as resources whose capability and potential are the products of the interactions of vegetation, land form/soils, and hydrology. Also, wildlife are sometimes factors because they can alter a site's capability or potential (beaver is a good example).

Definitions

Before assessing functionality of riparian-wetland areas it is important to have a knowledge and understanding of the following terms.

Wetland: Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and which, under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (included are marshes, shallow swamps, lake shores, bogs, muskegs, wet meadows, estuaries, and riparian areas).

Riparian: A form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the

shores of lakes a reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

Perennial: A stream that flows continuously. Perennial streams are generally associated with a water table in the localities through which they flow.

Intermittent: A stream that flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas.

Ephemeral: A stream that flows only in direct response to precipitation, and whose channel is at all times above the water table.

Potential: The highest ecological status an area can attain given no political, social, or economical constraints: often referred to as the "potential natural community" (PNC).

Capability: The highest ecological status a riparian-wetland area can attain given political, social, or economical constraints. These constraints are often referred to as limiting factors.

Proper Functioning Condition (PFC) - Riparian-wetland areas are functioning properly when adequate vegetation, land form, or large woody debris is present top dissipate stream energy associated with high water-flows, whereby reducing erosion and improving water quality; filter sediment, capture bed-load, and aid flood plain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize stream-banks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater bio-diversity.

Functioning At Risk (FAR) - Riparian-wetland areas that are in functional condition bat an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Nonfunctional (NF) - Riparian-wetland areas that clearly are not providing adequate vegetation, land form, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc., as listed

above. The absence of certain physical attributes such as a flood plain where one should be are indicators of nonfunctioning conditions.

Unknown (UNK) - Riparian-wetland areas that BLM lacks sufficient information to make any form of determination.

The Process

A. Review Existing Documents

Start the process by reviewing existing documents, identified in TR 1737-9, to gain a basic understanding about riparian-wetland inventory, classification, function, ecological site identification and inventory, and stream channel morphology, etc. .

B. Analyze Definition

Next, analyze the definition of PFC. "Riparian-wetland areas are functioning properly when adequate vegetation, land form, or large woody debris is present to:

- dissipate stream energy associated with high water-flows, thereby reducing erosion and improving water quality;
- Filter sediment, capture bed-load, and aid flood plain development;
- improve flood-water retention and ground-water recharge;
- develop root masses that stabilize stream-banks against cutting action;
- develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, water-flow, breeding, and other uses;
- and support greater biodiversity.

Also, very important. The analysis and determination of functionality should be made based upon an area's capability and potential. For example, if an area does not have the potential to support large woody debris, that criterion should not be used as a factor in determining it's functionality.

C. Assess Functionality

1. Attributes and Processes

It is important to know and understand the following attributes and processes occurring in a riparian-wetland area:

Hydrogeomorphic

Ground-Water Discharge	Active Flood plain
Ground-Water Recharge	Flood plain Storage and Release
Flood modification	Bankfull Width
Width/Depth Ratio	Sinuosity
Gradient	Stream Power
Hydraulic Controls	Bed Elevation

Vegetation

Community Types	Community Type Distribution
Surface Density	Canopy
Community Dynamic and Succession	Recruitment/Reproduction
Root Density	Survival

Erosion/Deposition

Band Stability
Bed Stability (Bed-load Transport Rate)
Depositional Features

Soils

Soil Type
Distribution of Aerobic/Anaerobic Soils
Capillarity
Annual Pattern of Soil Water States

Water Quality

Temperature
Salinity
Nutrients
Dissolved Oxygen
Sediment

To help understand the interactions of these attributes and processes on stream functionality it helps to look at a cross-section of a valley-bottom (Figure 1). Two types are possible, 1) vertically unstable systems, and 2) laterally unstable systems. The example

Figure 1.

SUCCESSION OF VERTICALLY UNSTABLE CHANNELS

PFC
- HIGH DEGREE OF BANK STABILITY
- DEVELOPED FLOODPLAIN
- DEVELOPED PLANT COMMUNITY

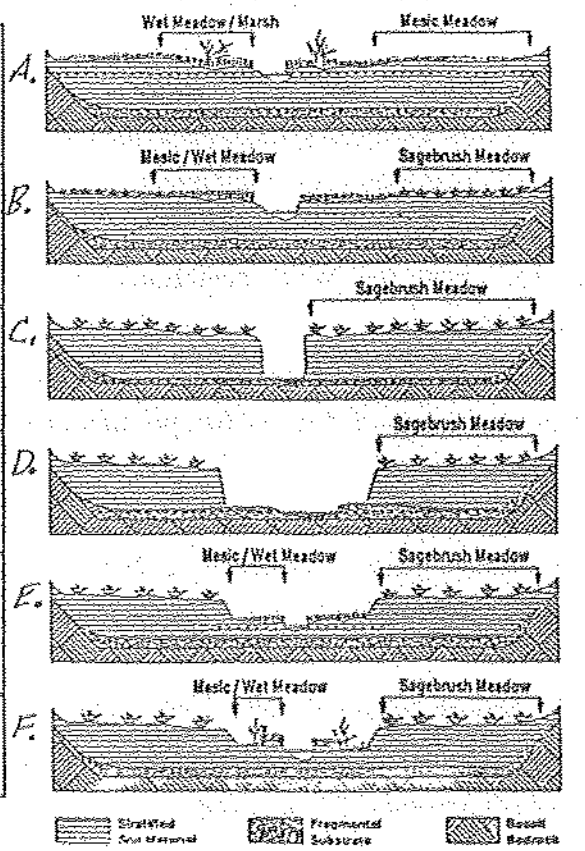
PFC IF:
- BANK STABILIZING VEG IS DOMINANT
- SOIL DISTURBANCE NOT EVIDENT

NON-FUNCTIONAL
- INCISEMENT TO A NEW BASE LEVEL
- LITTLE OR NO BANK STABILIZING BANK VEG.
- NO FLOODPLAIN

NON-FUNCTIONAL
- THIS MUST OCCUR TO RESTORE FLOODPLAIN DEVELOPMENT
- VEG. IF PRESENT, IS ONLY TEMPORARY DUE TO CHANNEL ADJUSTMENTS

PFC IF:
- ESTABLISHED FLOODPLAIN
- BANK STABILIZING VEG ESTABLISHED

PFC IF:
- BANKS STABILIZED
- WIDE FLOODPLAIN TO DISSIPATE STREAM ENERGY FROM MOST FLOWS



FUNCTIONAL - AT RISK IF:
- BANK STABILIZING VEG. IS NOT DOMINANT
- SOIL DISTURBANCE EVIDENT
- DEGRADED WATERSHED WHERE HIGH FLOWS MAY DAMAGE THE REACH.

FUNCTIONAL - AT RISK IF:
- BANK STABILIZING VEG IS NOT SUFFICIENT
- SOIL DISTURBANCE IS EVIDENT
- DEGRADED WATERSHED WHERE HIGH FLOWS MAY DEGRADE THE REACH

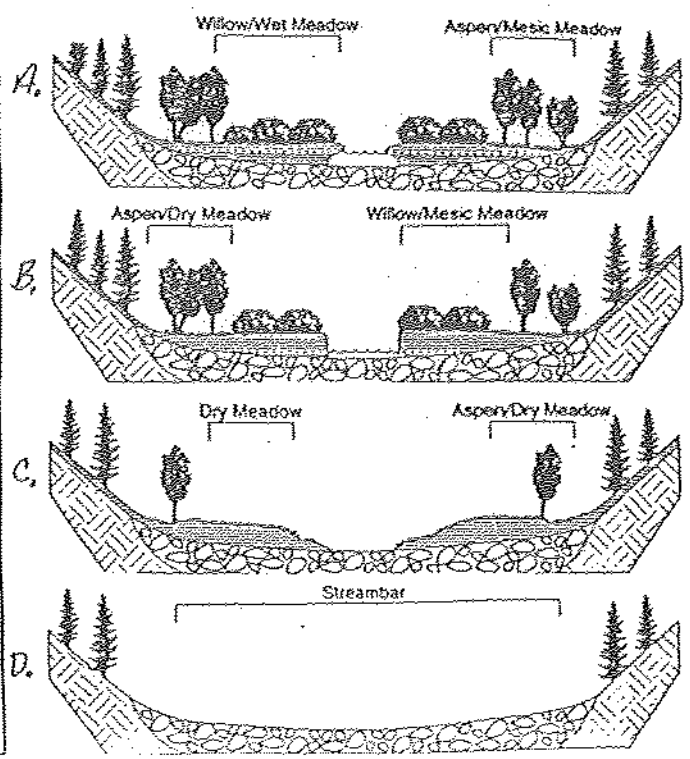
SUCCESSION OF LATERALLY UNSTABLE CHANNELS

PFC
- HIGH DEGREE OF BANK STABILITY
- DEVELOPED FLOODPLAIN
- DEVELOPED PLANT COMMUNITY

PFC IF:
- BANKS STABILIZING VEG IS SUFFICIENT
- SOIL DISTURBANCE IS NOT EVIDENT

NON-FUNCTIONAL
- BANK STABILIZING VEG IS NOT SUFFICIENT
- SOIL DISTURBANCE IS EVIDENT
- VEG. IF PRESENT, IS ONLY TEMPORARY DUE TO CHANNEL ADJUSTMENTS

NON-FUNCTIONAL
- ABSENCE OF BANKS
- ABSENCE OF SOIL
- ABSENCE OF VEG



FUNCTIONAL - AT RISK IF:
- BANK STABILIZING VEG IS NOT SUFFICIENT
- SOIL DISTURBANCE IS EVIDENT
- DEGRADED WATERSHED WHERE HIGH FLOWS MAY DAMAGE THE REACH

shows , for each type, the successional stages, going from PFC, to FAR, to NF, and then returning to PFC.

State A - is a PFC, with a huge degree of bank stability, well developed flood plain, and a well developed plant community.

State B - Is at PFC if bank stabilizing vegetation is dominant, and soil disturbance is not evident.
- Is FAR if bank stabilizing vegetation is not dominant, soil disturbance is evident, and a degraded watershed produces high flows which damage the reach.

State C - Is NF, channel incised to a new base level, little or no bank stabilizing vegetation, and no flood plain.

State D - Is NF, channel widening, which must occur to restore flood plain development, and if vegetation is present it is only temporary due to channel adjustments still occurring.

State E - Is at PFC when a flood plain has developed, and a bank stabilizing vegetation has established.

State F - Is PFC if banks are stable, there is a wide flood plain to dissipate stream energy from most flows.

It is important to remember that riparian-wetland areas do have fundamental commonalties in how they function, but they also have unique qualities too. Therefore, each area should be evaluated against their own capacity and potential. Human influence may have introduced components that have altered the area's capacity and potential.

2. Capacity and Potential

The riparian-wetland area's capacity and potential must be determined, using the following criteria, before functionality assessments can be made:

- Look for relic areas (exclosures, preserves, etc.).
- Seek out Historic Photos, survey notes, and/or documents that indicate historic condition

- Search our species lists (animal & plant - historic & present).
- Determine species habitat needs (animal & plant) related to species that are/were present.
- Examine the soils and determine if they were saturated at one time and are now well drained.
- Examine the hydrology, establish cross sections if necessary to determine frequency and duration of flooding.
- Determine the entire watershed's general condition and identify it's major land form.
- Look for limiting factors, both human caused and natural, and determine if they can be corrected.

Once this information is know it will be possible to determine whether the riparian-wetland area can reach it's potential or if it's capacity has been reduced due to limiting factors. then, more realistic management objectives can be established once it's clear what the potential or capacity of the site is. Factors such as dams, and roads placed along a stream, are examples of where a riparian-wetland area would not be able to attain its "natural potential." It's "capacity" would now be limited, based on the affect of the structure. Therefore, the assessments made should be with respect to the new "Capacity" of the site.

3. Functioning Condition

In determining if a riparian-wetland area is in PFC, the condition of the entire watershed is important. Watershed processes can influence the quality, abundance, and stability of riparian-wetland areas by controlling production of sediment, nutrients, influencing stream-flow in timing and amount, and modifying the distribution of chemicals in area. Riparian-wetland health (functioning condition) refers to the ecological status of vegetation, geomorphic, and hydrologic development, along with the degree of structural integrity exhibited by the riparian-wetland area. A healthy riparian-wetland area is in dynamic equilibrium with the steam-flow forces and channel aggradation/degradation processes producing change with vegetative, geomorphic, and structural resistance.

Riparian-wetland areas can reach PFC before they achieve their Potential Plant Community (PPC), or Potential Natural Community (PNC). Assuming vegetative succession progresses uninterrupted through time, the channel will evolve through some predictable stages from bare ground to PNC. Therefore, the functionality of the

riparian-wetland area will also progress from NF, to FAR, to PFC along with the plant succession. Because different values are provided by each stage, management objectives beyond attaining PFC should depend upon landscape and societal needs.

4. Standard Checklist

To provide consistence to evaluating functionality of riparian-wetland areas, a standard checklist (data sheet) was provided (Figure 2).

UNCOMPAHGRE BASIN STREAM/RIPARIAN CONDITIONS

The functionality of UBRA Stream/riparian areas was determined during 1994 and 1995 using temporary employees and volunteers. Training was given by Don Prichard.

Ubra Inventory Procedure

1. Office

As much information as possible was assembled for each stream to be surveyed, which included existing information as mentioned earlier, aerial photos, maps, etc. Preliminary reach delineations were made for each stream based on land form, gradient, sinuosity, land use, and vegetation. Data packets for each stream reach were prepared in advance for field use. Because the flow classification (perennial, intermittent, or ephemeral) was not known for all streams, each was planned to be visited for verification and additional data collected.

2. Field

Field visits were made to each stream to verify preliminary office flow classifications and reach delineations, or make corrections. As much of each reach was visited as possible before functionality assessments were made. A standard checklist (Figure 2) was completed for each stream reach.

Status

The Uncompahgre Basin Resource Area is approximately 86.4% complete with inventories to determine stream/riparian conditions. That is, we have looked at 606.2 miles (86.4%) of the 701.9 miles of drainage's within the Resource Area. See Map 2, attached, for locations of streams in each functionality class.

Figure 2. **Standard Checklist**

Name of Riparian-Wetland Area: _____

Date: _____ Segment/Reach ID: _____

Miles: _____ Acres: _____

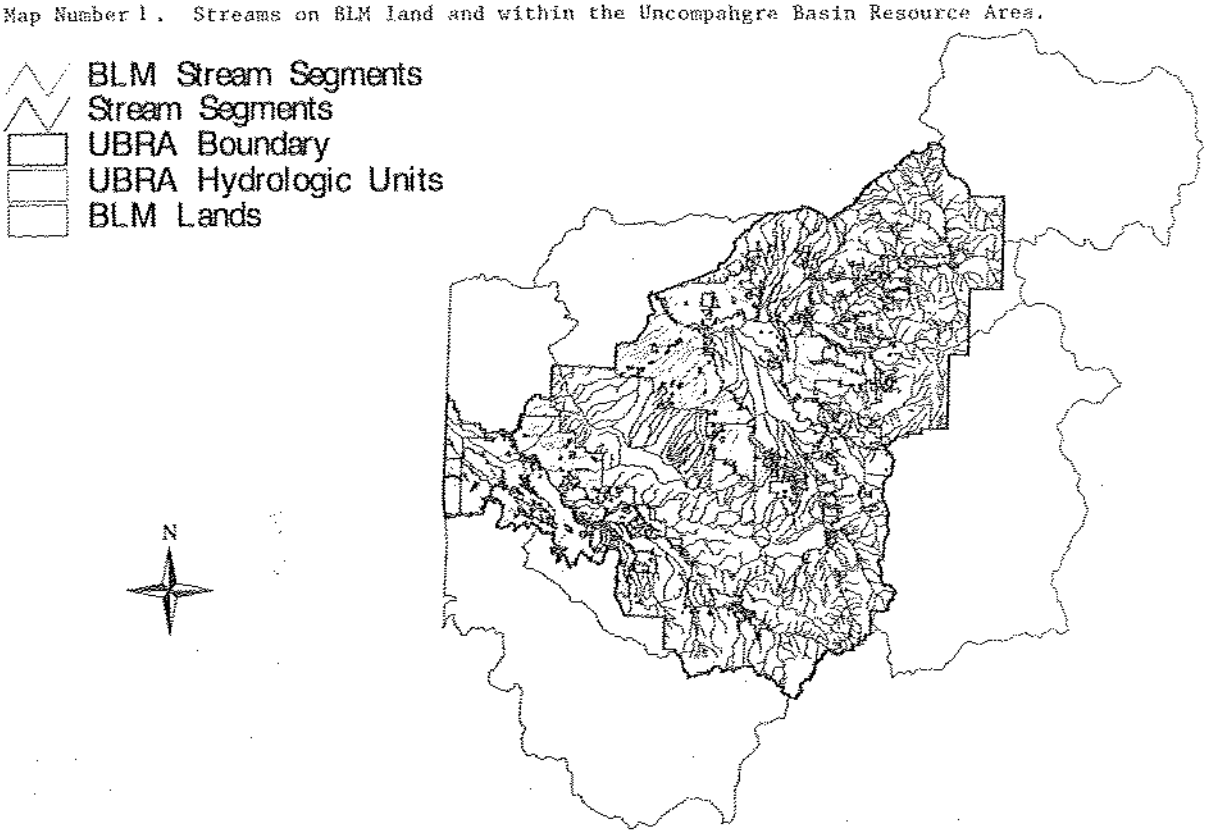
ID Team Observers: _____

Yes	No	N/A	HYDROLOGIC
			Floodplain inundated in "relatively frequent" events (1-3 years)
			Active/stable beaver dams
			Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			Riparian zone is widening
			Upland watershed not contributing to riparian degradation

Yes	No	N/A	VEGETATIVE
			Diverse age structure of vegetation
			Diverse composition of vegetation
			Species present indicate maintenance of riparian soil moisture characteristics
			Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			Riparian plants exhibit high vigor
			Adequate vegetative cover present to protect banks and dissipate energy during high flows
			Plant communities in the riparian area are an adequate source of coarse and/or large woody debris

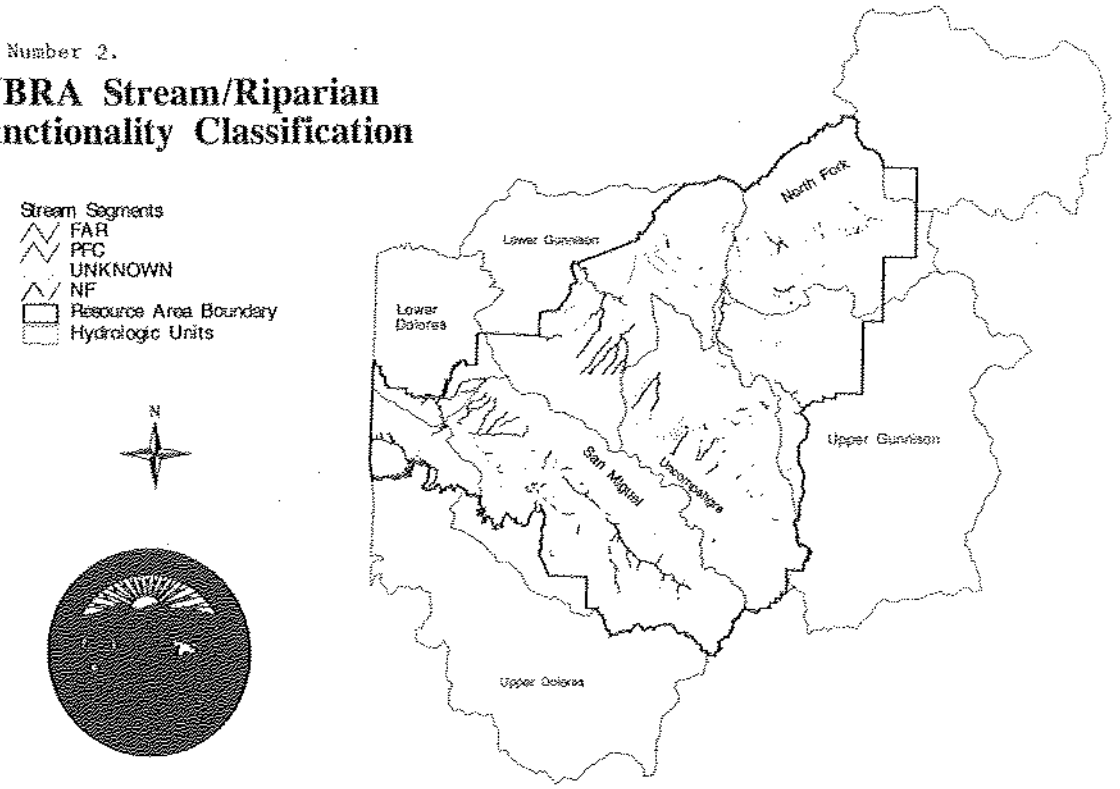
Yes	No	N/A	EROSION DEPOSITION
			Floodplain and channel characteristics (i.e., rocks, coarse and/or large woody debris) adequate to dissipate energy
			Point bars are revegetating
			Lateral stream movement is associated with natural sinuosity
			System is vertically stable
			Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Map Number 1. Streams on BLM land and within the Uncompahgre Basin Resource Area.



Map Number 2.

UBRA Stream/Riparian Functionality Classification



Of the total miles of streams classified, 339.5 miles (48.4%) supported riparian-wetland, and 266.7 miles (38.0%) are ephemeral. There are 95.7 miles of stream unsurveyed, and in the UNK category. The unsurveyed streams are ones that have no public access or are isolated 40-80 acre tracts, which are considered low priority at this time. Of the 339.5 miles of streams supporting riparian, 251.8 miles (74.2%) are in PFC, 79.3 (23.4%) miles are FAR, and 8.4 (2.4%) miles are NF. Within the FAR category, the group most in need of improved management, there are 34 streams with 40 reaches that have factors contributing to their unacceptable conditions within BLM's control. There are nine streams with 14 reaches that have factors contributing to their unacceptable conditions outside BLM's control. In the near future UBRA will focus on management changes needed for streams where BLM has control of the effecting factors. Of the streams with factors outside BLM's control, road placement was the most frequent problem at 69.2%, followed by flow regulation at 23.1%, and mining activity at 7.7%.

Summary

Development of the BLM method for assessing the functioning condition of riparian-wetland areas has provided us continuity in our riparian management. It basically does three things for us, 1) it provides that ability to assess the conditions of a large number of areas in a relatively short amount of time, 2) it provides a standard method for evaluating riparian-wetland areas and gives us a high degree of relativity when comparing results, 3) and it still allows each area to be evaluated on its own unique qualities.

The results of these evaluations, in conjunction with multi-layered GIS data capability, gives managers the ability to quickly get a large scale view of where riparian-wetland areas are located, what condition they are in, make risks assessments, and implement management that will move us toward riparian area, and landscape health.

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Comparative Analysis of Riparian Condition Assessment Techniques Used in Colorado

Kris Darling
Colorado State University

Riparian areas have important implications in regard to water quality and water quantity. They provide habitat for many endangered species, as well as other valuable wildlife. These areas also provide recreation activities that are important to humans. The green line has often been used to describe riparian areas, but does this term accurately describe the riparian areas within Colorado? The purpose of this study was to investigate riparian wetland conditions that have been evaluated in Colorado. In order to accomplish this task, the manner in which riparian areas are assessed was reviewed.

There are many organizations in Colorado which manage riparian areas. They include the Bureau of Land Management (BLM), Forest Service (FS), Colorado Division of Wildlife (CDOW), Natural Resource Conservation Service (NRCS), Parks Service, and Colorado Nature Conservancy. Each of these organizations was interviewed for the purpose of determining their policy in regard to riparian areas and if the policy included assessing condition. They were also asked if riparian condition inventories had been completed. Out of the six organizations interviewed, only three had specific riparian condition assessment techniques. They were the BLM, FS, and Colorado Natural Heritage Program (CHNP), a branch of the Colorado Nature Conservancy.

BLM's technique has four categories: properly functioning (PFC), functional-at risk (FAR), nonfunctional, (NON) and unknown. This technique is used nationwide. It has been implemented in each District in Colorado, and most inventories have been completed on every major watershed found on BLM land. The concept involves use of an interdisciplinary (ID) team and a checklist to help determine condition. Both lotic and lentic environments are assessed. The checklist considers four main components in order to assess riparian condition. They are vegetation, landform, soils, and hydrology.

In 1994, the Rocky Mountain Region of the FS adopted Al Winward's Integrated Riparian Evaluation Guide in order to assess condition of riparian areas. This technique looks at seral stages of a stream in order to assess condition of riparian areas. None of the Forests within Colorado have fully implemented this technique. However, the Arapaho Roosevelt Forest

implemented another technique which has five condition levels. The five levels are reference, non-degraded, at risk, degraded, and unknown. The focus of this assessment technique is human caused disturbances and how they affect resident plant and animal communities, and stream channel morphology.

CNHP's condition assessment technique has four rankings, A-D, which signify excellent, fair, good, and poor. The components used for this ranking are stream bottoms, streambanks, vegetation cover, hydrologic regime, and livestock grazing. It is important to note the CNHP selected areas along relatively undisturbed intact reaches for the purpose of developing a riparian community classification system. In the study, the condition of these riparian areas were also ranked.

The BLM and CNHP had completed extensive inventories throughout the entire state, therefore data from these organizations were used to begin an assessment of the condition of Colorado's riparian areas. Upon preliminary review, it was hypothesized that these two techniques were similar. A cross-walk between BLM's technique and CNHP's technique was completed. BLM's technique was used as a basis for the comparison because data was collected on a standardized basis statewide using broader criteria. The CNHP technique deals with lotic riparian environments so the lotic checklist from the BLM was used for the cross-walk.

During the construction of the cross-walk a few differences between the techniques were discovered. The BLM is more specific when the natural characteristics of the stream are considered. The ID team looks specifically at sinuosity, width/depth ratio, and gradient of the riverine system with respect to its surrounding landscape. If the system is in sync then the banks of the stream will be stabilized, sedimentation will be low, and there will be no bank sloughing. These components are considered in the CNHP technique. The CNHP also considers the surrounding or 'mosaic' landscape but not with respect to hydrology. The 'mosaic' landscape has to do with the degree of internal fragmentation with the surrounding landscape. In other words, the condition of a riparian area is lower if it is surrounded by roads, trails, or culverts or if these run through a riparian area. This component would fall under BLM's category of riparian area widening since a road or trail near the riparian area would keep the area from widening. BLM's technique considers diverse composition of vegetation within the riparian area to be important. The CNHP considers this as well, but in a more detailed fashion. Their technique takes into account the percent composition of native vs. non-native species. Their goal for a riparian area is for it to contain all native species with no exotics. The BLM, on the other hand, is concerned with ground cover. Another difference is the BLM considers the vertical stability of the

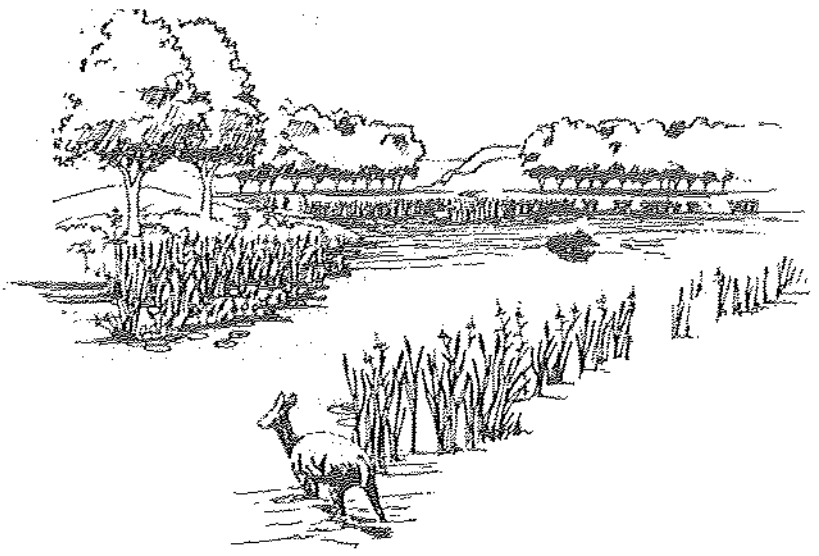
hydrologic regime. The CNHP does examine this component, but it is considered under bank erosion or bank sloughing. If the hydrology of the stream is stable, then bank erosion is less likely to occur. When examining these two techniques further, CNHP's technique has more specific criteria than BLM's technique. The CNHP has percentages that the criterion must meet, whereas the BLM has general statements that are left up to the ID team's interpretation. For example, the BLM calls for adequate cover present to protect banks and dissipate energy during high flows.

The CNHP's criteria specifies that less than ten percent of the ground be exposed or over 80 percent of the streambank surface be covered by vegetation in vigorous condition. There are some categories that the BLM considers that the CNHP does not list specifically on the criteria sheet, but are noted in the field data sheets. These include: active/stable beaver dams, diverse age structure of vegetation, species present indicate maintenance of riparian soil moisture characteristics, and plant communities in the riparian area are an adequate source of coarse and/or large woody debris. The latter component was added by the BLM for riparian areas located in the northwestern United States. The BLM also looks at a riparian area's capability. For example, a dam that has been placed in a system will eliminate the potential for flooding. The fact that the riparian area will not be flooded will reduce the possibility of cottonwoods to regenerate. The condition of this riparian area must be assessed with respect to the placement of the dam. This riparian area might never contain cottonwoods no matter what kind of management takes place. From the cross-walk, a conversion from CNHP's technique to BLM's technique was determined. The ranks of A and B are comparable to BLM's PFC, rank C to BLM's FAR, and rank D to BLM's NON. In order to test the conversion, a watershed with the most complete data from each organization was chosen. The BLM had already mapped the streams of the San Miguel watershed on GIS and the condition of each stream reach had been determined. The CNHP also had complete data for this watershed. Therefore, the GIS map of the San Miguel watershed with the perspective condition levels was used for the test. Corresponding data points from the CNHP were added to the GIS map. The plot locations were used to keep a running tally of the condition ranks as they related to the two techniques. A Wilcoxon Signed-Rank test was used to determine whether the two techniques were statistically different. At a significance level of 0.01, the hypothesis that the techniques were similar was not rejected.

The results of the Wilcoxon Signed-Rank test allowed for the conversion of the rest of CNHP's data to BLM's condition levels. Riparian condition data from these two organizations were compiled by watershed. There were ten watersheds in all. They include the Upper Arkansas River, Colorado River, Dolores River, Gunnison River, Lower South Platte, Rio Grande River, San Miguel River, San Juan River, White River, and Yampa River. After the data were compiled,

CNHP's data were converted to BLM's condition levels. These data were then combined with BLM's riparian data. When the CNHP conducted their assessments, land ownership was included. Therefore, all data gathered by CNHP that included BLM land were taken out in order to prevent a stream from being included twice in the combined results. It was found that of the riparian areas assessed in Colorado 56.79% were PFC, 28.72% FAR, and 14.49% NON. Among the riparian areas that the BLM assessed 42.37% were PFC, 36.46% FAR, and 21.17% NON. It is important to note that the condition levels provided by the CNHP were taken from better quality riparian areas. Hence, the totals are most likely skewed upward. Combined totals from the CNHP were 76.99% PFC, 22.12% FAR, and 0.89% NON.

Colorado has approximately 25,126 miles of perennial and intermittent streams. This study examined 4762 stream miles which is approximately 19% of all the streams in Colorado. Although this is a good start, much more needs to be done in terms of assessing condition of riparian areas. A single condition assessment technique would help produce a collaborative effort among organizations, both public and private to help save this vital ecosystem. Currently, riparian condition data is not readily available to the public. Constructing maps on GIS of all the major watersheds with their perspective condition levels would allow any organization access to the information. From these maps, organizations could locate the degraded riparian areas and initiate projects to help improve these areas. I believe the bottom line comes down to the question, "How much is the green line worth keeping green?"



Fountain Creek Watershed Project

Tom Johnson
Project coordinator
Fountain Creek Watershed Project

I've been coordinator of the Fountain Creek Watershed Project for nine months now, and thanks to the recent generosity of some of our sponsors, it looks like I'll keep the title for a t least another 18 months.

I am not a great scientist. I don't share the technical knowledge that many of you have. While I hold a masters degree in Watershed Sciences, most of my career has been spent in the field of communications, both writing and in video production. What I bring to the business of watershed and riparian management is what is what I guess you would call public relations experience: translating technical information into terms which are understanding and compelling to the lay-person and getting the information out to enhance public awareness of watershed issues. This is particularly important in my project, and I would argue that it is probably more important in most projects than people might realize.

Fountain Creek is a case in point: How do you come into a basin that is famous state-wide for its anti-tax, anti-regulation, pro-resource utilization stance and convince the community that it's a good idea to expand the flood plain, condemn developable land, and institute funding mechanisms to improve storm water management? This is the home of Douglas Bruce, remember. It takes some creative thinking and some skills of persuasion. It takes arguments that make economic sense. And the frequent reminder that the conservation movement was founded by conservatives.

I share this with you because I think it's easy for technically-minded people to forget the importance of communicating their work with the people in their community. An important connection is broken, leaving people detached from the complexity of, for instance, drainage issues. The direct connection between lifestyle and the condition of the natural world is often lost. And when that connection is lost, the choices available to us become obscured. I'm reminded of Gerald Wilhelm's talk yesterday about Chicago's corporate lawnscapes. Why should people understand this stuff unless we're out there explaining it to them? Who else is going to do it?

I also feel it is important for you to know that without the dedication of a few key federal and local government employees, we wouldn't have a Fountain Creek Watershed Project. A few visionaries took it upon themselves to identify all potential stakeholders in the watershed and bring them together to identify the issues and interest groups at hand. They had the wisdom to use government resources and data to start the project and then turned it over to the stakeholders as a legitimate grass roots effort. Place-based watershed management. This is something that any of you could do. And it's possible that if you don't it might not get done.

I'd like to share with you a story that has stuck with me over the past couple of years. Two summers ago, I served as an intern in Senator Ben Nighthorse Campbell's office in Washington, D.C. I was there when the Senator's office was in turmoil. The Senator had just switched parties, from Democrat to Republican. Half of his staff had jumped ship, including his natural resources advisors. As a result, I was given responsibilities well beyond what my experience could justify.

One task I was given concerned writing a policy statement on the Senator's behalf outlining how he stood on the issue of renewing the Clean Water Act. I was asked to call some Colorado water officials to gain an understanding of what was needed at the local level. I called Paul Fronhardt and David Holm at the Water Quality Control Division, and both emphasized the need for greater utilization of the watershed management approach.

I wrote a policy statement reiterating their words and passed it along to the Senator's Legislative Director for review. My statement came back covered in red ink. The word "watershed" was circled, and next to it was scrawled, "bad word!" My heart sank. At the time, I was enrolled in a Watershed Sciences masters program...were all of my efforts invalidated?

I met with the Legislative director for two hours in an attempt to find some common ground. He spoke a lot about property rights, interstate commerce, the usual battleground issues. He was convinced that watersheds cross jurisdictional boundaries, any endorsement ant the federal level of the watershed management concept would be the first step toward federal usurpation of a state's right to manage its waters. Water is a local issue, he insisted.

I left the meeting wondering what planet he had arrived from, but since then, I've come to appreciate some of his points. The Fountain Creek Watershed is undergoing locally-induced change. There are no federal or state laws mandating that the situation be remedied. Any solutions must come from the local level. While federal seed money may help get this and other projects started, the responsibility for managing a watershed responsibly certainly falls on local people. Unfortunately, that's not something that has happened in the Fountain Creek Watershed

The Fountain Creek Watershed is a substantial drainage serving some 500,000 people, the majority of which live in Colorado Springs. In Fountain Creek, we have a true top-to-bottom watershed problem. The most obvious problem to the eye is stream-bank erosion. Without question, the system is naturally unstable. And without question, this instability is exacerbated by regional policy regarding water importation and storm water management. Population growth has add to storm water flows over the past 30 years and has magnified the challenges we face.

Upon my arrival as coordinator of the Fountain Creek Watershed Project 9 months ago, we focused upon two important needs and set out immediately to get them filled. Those needs were a project infrastructure and a project group structure.

By infrastructure, I mean that our watershed group needed to have the tools necessary to form opinions on practices and policies in the watershed, and a means for communicating those opinions to the public and to decision makers. This infrastructure was started immediately, and to date we have accomplished the following:

* 250-item watershed resource database and library
* GIS-based resource data system
* educational video program (in progress)
* community outreach program/Speakers Bureau (20 presentations)
* newsletter (6 issues published)
* public education strategy
* aerial photography of the watershed (to be incorporated into GIS)
* streambank stabilization project using fast-growing hybrid trees

We had quite a challenge in developing an effective group structure. This project had gone through some false starts before my arrival. In 1988, the project had developed to

the point of a partially signed legal agreement, only to have some major partners pull out. Then in 1994, a large stakeholders meeting greatly increased stakeholders excitement about the project, and then no action for a year.

So there was a great deal of skepticism about the project when I came on board. We saw a need to convince stakeholders that with a full-time, paid coordinator, things would be different. We immediately expanded the stakeholders group to include nearly 300 entities, including landowners along the creek; local, state and federal government officials; elected officials from every community in the watershed; utility companies with property at risk; and concerned citizens and environmentalists. These people were inundated with information about project activities. I had my first newsletter designed and mailed in two weeks, and have sent out 7 issues in 9 months.

Initial funding was in place to cover the coordinator position for 9 month. An immediate concern was that of procuring funding for a more extended time period. Additional funding was attained through grants from the U.S. Environmental Protection Agency, Fort Carson Military Reserve and the Natural Resources Conservation Service.

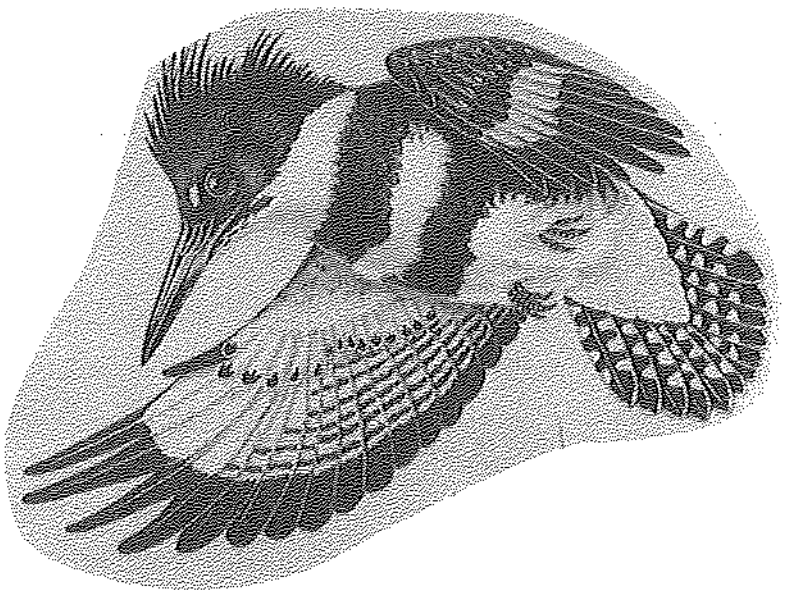
Gaining publicity of accomplishments of the Fountain Creek Watershed Project was also an early goal. In June, the Fountain Creek Watershed Project was recognized as a recipient of the Colorado Governor's Smart Growth and Development Award, and was the subject of a major story in the Colorado Springs Gazette Telegraph Newspaper.

Most importantly, as the project coordinator, I set out to define who we were and why we had come together. We spent three months meeting as focus groups constructing a project vision statement that all stakeholders could buy into. Agreeing on a project vision was an important first step. It got us all on the same page as to why we are here, and what we would like the project to accomplish.
The project vision dovetailed us nicely into development of a Memorandum of Understanding (MOU). An MOU is a voluntary non-binding agreement which lays out the project objectives, a roadmap for accomplishing them, and the responsibilities of the stakeholders in making it happen. Our MOU will serve as a reference document to help guide us during the next 18 months, during which we will create the main product of our watershed project: development of the watershed management plan.

The MOU will provide the cooperative framework which guides development of a Comprehensive Watershed Management Plan (CWMP), scheduled for completion in the fall of 1997. The CWMP will outline a non-regulatory, interdisciplinary approach for restoring watershed health, based on the nine objectives in the MOU. If we produce a plan that can genuinely improve conditions in the watershed and persuade the region's population to come on board and support it, we will be well on our way. The plan will recognize the interdependence of human action and watershed health.

At this time next year, we hope to be shopping our plan around to organizations, municipalities, and agencies seeking their endorsement. We will then produce a new document, called a memorandum of agreement, which offers organizations the opportunity to legally agree on how we can better manage our water resources for the benefit of all citizens in the basin.

Don Glazer spoke of this as an era of hope. A few months ago, I may have argued that point. But two weeks ago, I gave a presentation to the Colorado Springs City Council and won their endorsement of our plan. We have funding. I've taken on an employee, doubling our work force in a single stroke. It's hard not to be hopeful. But this is a critical time for Fountain Creek. Policy changes must occur now before the next wave of immigrants comes in. We'll keep you posted on our progress.



Alamosa River Restoration

Jeff Stern and Alan Miller
Alamosa River Project
La Jara, Colorado

Damaged riparian areas along the Alamosa River in south-central Colorado are receiving care and attention worthy of their ecological importance as part of a community-driven watershed protection effort.

The Alamosa River Watershed Project, sponsored by the Conejos County Soil Conservation District, got its start in early 1995. Since then, a publicly-selected steering committee consisting of local water users, farmers, ranchers, and government officials has worked diligently to address resource issues in the 127,000 -acre watershed.

"Riparian areas are critical for the ecology of the system, as well as aesthetics," said Ben Rizzi, resource conservationist for the National Resources Conservation service and member of the watershed committee. "These areas provide wildlife habitat and forage, slow riverbank erosion, and protect the soil."

The Alamosa River flows east off the Atlantic Ocean side of the Continental Divide for about 53 miles before it dissipates in wetlands near the Rio Grande River. Agriculture is the principal industry in the watershed, which contains some of the oldest and poorest communities in Colorado. Alfalfa hay, small grains, and potatoes are produced, along with cattle and sheep.

At first glance, the Alamosa River and the country it drains appear to be a sort of agrarian paradise smack in the middle of our increasingly congested society -- except that recent mine pollution has killed aquatic life in the river, and channel straightening has destabilized the river in its lower reach.

These insults, particularly the latter, to what once was a healthy river system nudged riparian areas into a state of decline that continues to this day.

After straightening -- the most recent and largest effort took place in the 1970's to prevent flooding in the town of Capulin -- flow velocities increased. Where the water once slowed as it looped around meanders, more rapid flows in the straightened section dug a deeper

channel. The water table dropped, wetlands were dewatered, and river banks eroded. The channel widened as the river banks eroded. The channel widened as the river sought to re-establish equilibrium.

Overuse of riparian pastures by livestock compounded the problem. Along the river there are places that resemble a city park -- ancient cottonwoods arch above closly-cropped meadows. Nowhere is a sapling or willow to be seen. The banks of the river are bare.

The watershed steering committee has made stabilizing the river and restoring adjacent riparian areas a high priority. The committee has learned that these two concerns are closely linked.

This fall, the watershed committee will sponsor installation of two erosion-control demonstration projects at critical sites in the river. Nationally-known hydrologists Dave Rosgen and Don Reichmust each designed one project. Their work will feature the use of rock drop-structures placed carefully in the channel to deflect flows from vulnerable banks and structures, and to slow river velocity.

These projects will show landowners alternatives that can be used in other areas [where erosion is a problem]. Slowing down water will raise the water table and allow for more lateral recharge to benefit vegetation.

A healthy plant community on river banks, in turn, is probably the most cost-effective, longest-lasting type of erosion protection available. Grasses and willows have been planted at the demonstration sites. Restoration of riparian vegetation through livestock management will be the primary tool to stabilize the stream-banks.

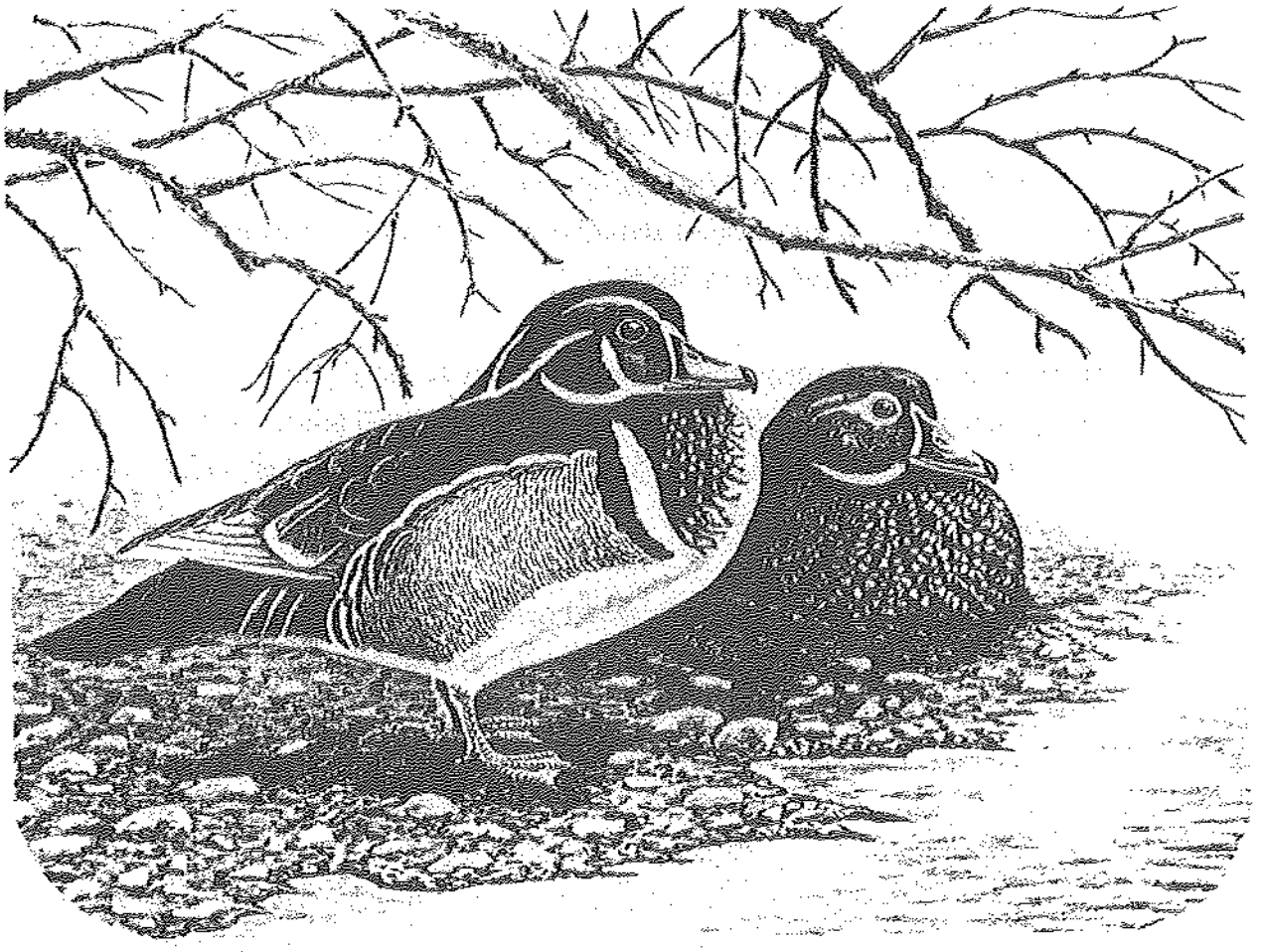
Benny Martinez, a cooperating rancher, has experimented with different methods of grazing management. After resting a riparian meadow for one growing season, grass, willows, and cottonwood saplings came back. New he keeps a close eye on his cows to make sure they don't nip young cottonwoods and willows before the plants grow large enough to hold their own.

Some landowners are reluctant to remove entire pastures from use for an extended period. But short-term rest combined with rotation could be a key to restoring the health and

productivity of riparian areas. A little initial sacrifice can provide long-term improvement in production of vegetation.

The watershed committee is also working to ensure effective clean-up of the Summitville Gold Mine Superfund site, abandoned by Galactic resources, Inc., of Canada in 1992. Toxic pollution from the mine threatens wildlife, riparian areas, water supplies, and agriculture in the watershed.

Restoring the Alamosa River corridor is a major undertaking. However, people and organizations can accomplish great things by working together. The river is already showing signs of its former glory.



Open Space Inventory and Analysis of the Uncompahgre River

Tony Hoag, Ecologist
Valley Land Conservancy in Partnership

Summary

The goals of the open space component of the Uncompahgre Riverway Planning Grant were to (1) develop a digital river corridor map based on land parcel, open space and natural resource inventories, (2) identify critical land parcels for conservation, (3) identify landowners willing to consider open space conservation, (4) perform preliminary baseline assessments of selected parcels and (5) formulate and apply evaluation criteria for the acquisition of open space parcels.

The development of a digital base map necessitated working closely with several agencies, contractors, and local governments to integrate disparate data sets into one useable map. Computer map data was collected from Colorado Division of Wildlife; Delta, Montrose and Ouray Counties; Bureau of Land Management; and the City of Montrose. Integration of datasets across county boundaries and other administrative boundaries is crucial to long term planning of the Uncompahgre River.

Analysis of the computer maps (digital data) was used to identify land parcels along the Uncompahgre River. Digital data used in the analysis included private land parcel, public lands, wildlife, river and irrigated lands maps. The final maps identified private land parcels with several of the above criteria.

A public process including phone calls, letters and meetings produced several landowners willing to talk about land conservation. Adjoining landowners were then contacted and the idea of a 'conservation area' with several properties was developed.

Preliminary baseline surveys of nineteen properties in six conservation areas totaling 1231 acres were conducted. Four additional Possible Conservation Areas (PCA's) were identified, but baselines were not conducted. Properties were surveyed, in general, for vegetation communities, principal structures and improvements, wildlife habitat values, presence of wetlands, environmental hazards and land title concerns.

Using the Uncompahgre River Corridor Partner's criteria and preliminary baseline information, eighteen land parcels and six conservation areas were prioritized.

Habitat Conservation Concerns

The Valley Land Conservancy (VLC) proposes to conserve parts of the Uncompahgre River and in so doing perpetuate the important role that a riverine system plays in the regional context. This is especially important given the aridity of the region. The Uncompahgre has been used extensively for the past hundred years, and parts of the natural environment along it have been lost or seriously degraded. The physical nature of the river has also been altered by man's activities so that in places the river is not functioning naturally. But does this mean that there should not be efforts to protect or enhance the natural environment that is left on the river?

The Uncompahgre River, and the projects proposed on it are seen by URCP as the backbone from which we can build future projects forming connecting "ribs" between the river and public lands.

Understand and Map the River's Resources

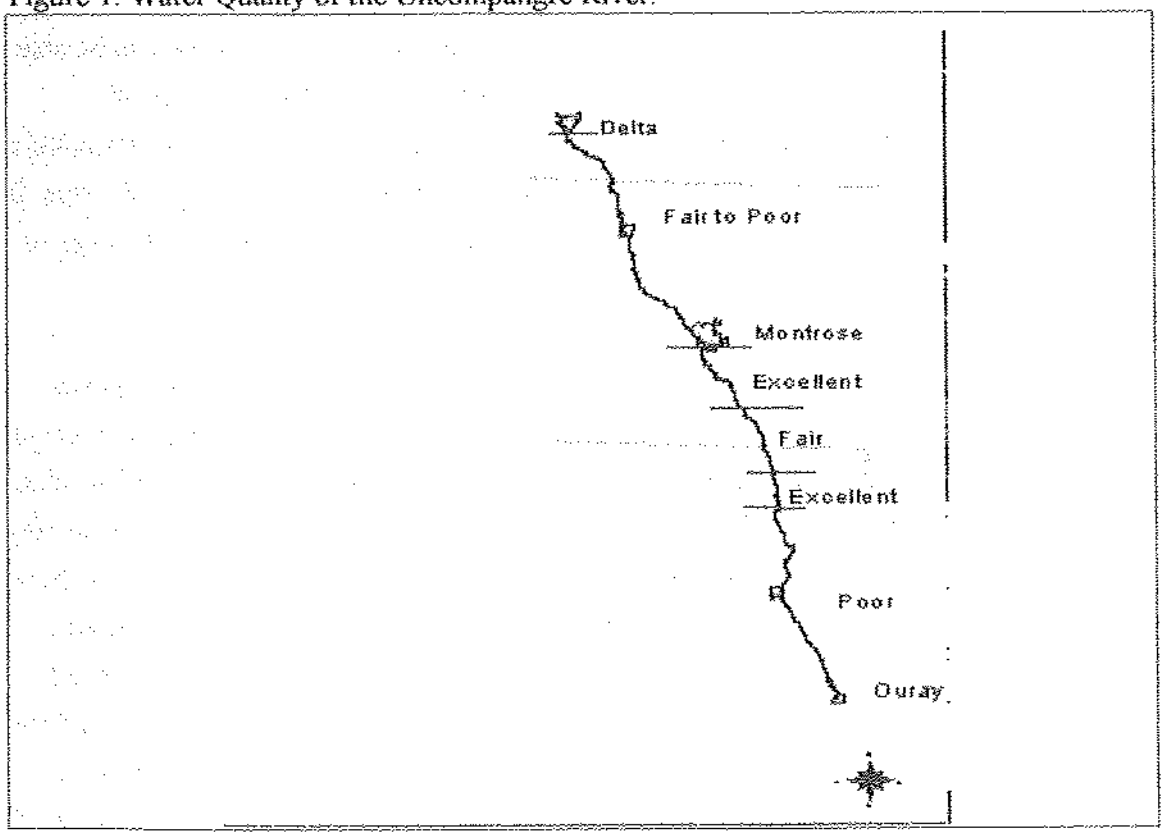
Understanding of the river's processes, both biotic and abiotic, was necessary to be able to adequately plan for conservation of the Uncompahgre River. Various sources of information such as water quality, hydrological functions, animal habitats and agricultural properties are pieces of information that can frame the river's health in different terms. By geographically referencing these pieces of information on maps we can identify areas on the river that are critical to conserve so that river health can be sustained.

Conversations with experts from the USFWS, BLM, CDOW, private consultants and other people who had spent time on the Uncompahgre River produced a general view of the river's health that varies widely in both the aquatic and terrestrial communities. Water quality, fisheries, hydrology, riparian, wetland and terrestrial communities vary from poor to good. Many factors have negatively influenced the overall health of the Uncompahgre River including acid-mine waste, high sediment transport, stream bank cutting, stream braiding, lower water tables, decreased water quality from irrigation runoff, increased water temperature, and encroachment by subdivision. Positive factors that have kept the river healthy or indicate its health include: a restored one mile segment of the river, a globally rare plant community, a bird list of over 160 breeding birds, conservation of 490

acres, a major terrestrial and avian travel corridor, home to 80% of the valley's waterfowl during winter, four town parks, a heron rookery, a wetland complex from south Montrose to Delta and improving water quality conditions north of the Ridgway Reservoir. A conversation with Dave Langolis, fishery biologist from the Colorado Division of Wildlife, produced a generalized picture of the river's water quality.

Water quality is an indicator of the aquatic health of a river. Unhealthy rivers with low water quality may support low numbers of aquatic species. The section of the river between Ouray and Ridgway is in poor condition due to the influence of high acid runoff from mines above Ouray and the historic uses of the river. These include gravel mining, and grazing which have caused the water table to drop, the stream to braid and vegetation to be lost. Water quality improves downstream with the inflow of cleaner water and Ridgway Reservoir, acting as a sink collecting the heavy metals. Irrigation runoff lowers the water quality as the river flows towards Colona, but at Colona, Gunnison River water is dumped into the Uncompahgre improving the water quality. As the water continues to flow north the water quality varies from fair to poor as irrigation runoff flows into the river at various spots. The water quality improves as water flows through wetlands only to become subject to further inflows of warmer, turbid runoff downstream.

Figure 1. Water Quality of the Uncompahgre River.



Map Data

A key component that was necessary to bring all the projects together was a map of the Uncompahgre River with the associated wetlands. With this map key areas with wetland complexes could be identified and the land parcels near them identified. Additional digital map(s) used for analysis of the Uncompahgre River consisted of:

- private land parcels (each parcel = one landowner)
- public land parcels
- wildlife ranges (black bear, bald eagle, bighorn sheep, turkey ,chukar, duck, elk, great blue heron, golden eagle, gambel's quail, mule deer, mountain lion peregrine falcon, ring necked pheasant, river otter)
- primary and secondary roads
- irrigated land parcels
- location of cities
- county boundaries
- general map of the soils in the valley

Analysis of the Digital Maps

The focus of the analysis was to interpret the data and use it to identify critical land parcels or groups of parcels that would contribute to the conservation of the Uncompahgre River. To craft an effective conservation approach it was necessary to identify critical areas for analysis, identify willing landowners, and collect preliminary baseline data on properties of willing landowners.

Although, the whole picture of the Uncompahgre River cannot be seen through these digital maps a general understanding of the value of individual land parcels can be developed by combining and intersecting these maps from various perspectives. This knowledge can then be combined with open space priorities of the Uncompahgre Valley's residents and data from other sources to identify potential land parcels for conservation.

Assessing Open Space Values

In meeting with the URCP group, county commissioners, planning commissions, and reading long term planning tools (master plans) an understanding of the types of lands that were important to the valley's residents was developed. Two general concepts were identified as priorities; (1.) As a provider of large open spaces, agricultural land is on the mind of many people in the valley, and (2.) wildlife and their habitat are also a concern for the residents of the valley. People recognize that with growth native wildlife habitats are

lost or seriously degraded. In addition, scenic values, which are difficult to quantify, are a value that is an important asset to many people in the Uncompahgre Valley, but will not be addressed in the digital analysis.

Agricultural Properties

In all three counties agricultural land is an important part of the local economy. Typically, much of the agricultural land is located adjacent to the rivers on the flatter ground. Flat ground is also attractive to developers as engineering problems are much simpler than on sites with greater slopes. Thus, much of the agricultural ground in the valley is threatened with development and as such is an important general criteria for identifying parcels for land conservation.

Identification of agricultural land parcels near the river was done by intersecting parcels near the river with irrigated land maps. In both Delta and Montrose Counties greater than 90% of the land parcels near the river were irrigated and had agricultural zoning. In Ouray County most of the river parcels were also irrigated except for the land north of Ouray in the narrow canyon.

Irrigated parcels were intersected with wetlands along the Uncompahgre River to provide a focus on agricultural parcels that may indicate higher quality river property. This process resulted in the elimination of many irrigated land parcels, but it did identify areas where the agricultural practice may be sustainable and not a threat to the river's health.

Wildlife Habitats

The next step in the analysis was to identify land parcels that would be important to wildlife. The type of digital data supplied by the CDOW for this analysis was in the form of individual species maps (deer highway crossing areas) or general habitat maps (winter duck concentration areas). In a broad overview of the Uncompahgre River with all the wildlife ranges overlaid, concentration areas of overlapping habitats was identified.

Delta County

In Delta County both the Gunnison and Uncompahgre Rivers were mapped as winter habitat (usually the most limiting type of habitat), for waterfowl, bald eagles and river otter. In conversations with area biologists from USFWS, CDOW, and NRCS there are three properties south of Delta that actually provide habitat for 80% of the waterfowl in the valley during winter. The CDOW mapped the area between both rivers as bald eagle

winter range as the cottonwoods along the rivers offer excellent roosting areas and the habitat off river is usually free of snow during winter making it an excellent feeding area.

The southern part of Delta county along the river appears to support the majority of wildlife habitat. The three waterfowl properties occur here along with several properties supporting populations of gambel's quail which have been found using the rocky hillsides and riverbottoms near the Uncompahgre, and a mule deer highway crossing area. North of the town of Delta there is an extensive great blue heron rookery across from Confluence Park. The mixture of the old cottonwoods with slow moving water next to the Gunnison River makes it attractive for water loving wildlife species including amphibians (which are though to be on the decline worldwide).

Montrose County

The Uncompahgre River as it passes through Montrose County also supports a diversity of wildlife habitats. Due to the semi-arid area nature of the valley the water and the lush vegetation near the river are especially attractive to wildlife. Again, the entire stretch of the river has been mapped as a duck winter concentration area. The wildlife maps of Montrose (not all species could be placed on one map) clearly indicate two areas that are especially attractive to wildlife species. North of Montrose, habitat for gambel's quail and a golden eagle nesting site are mapped. South of Montrose is a block of habitat that supports ducks, gambel's quail, mule deer, elk, black bear, and mountain lion. Data from the Black Canyon Audubon Society also indicate the area south of Montrose as high quality habitat. An example of the rarer birds found breeding includes: trumpeter swans, golden eagle, belted kingfisher, northern mockingbird and yellow-billed cuckoo.

Ouray County

The Montrose and Delta wildlife maps illustrated one species per map, but Ouray County's wildlife map illustrates all species on one map. This is accomplished by assigning one symbol to areas where overlapping wildlife habitats occur. The Ouray wildlife map indicates two principal wildlife concentration areas. The area at the mouth of Billy Creek south to 1/2 mile of the town of Ridgway is habitat for mule deer, elk, mountain lion and turkey. One bird watcher has reported 210 different bird species indicating the area contains diverse habitats which supply food, cover and nesting areas for a large variety of birds. On the southern edge of the county mule deer and elk can be found with the addition of bighorn sheep, but the bird life diminishes sharply as the increasing elevation leads to a decline in diversity.

Although the majority of wildlife data presented in this report relate to game species many wildlife biologists have argued that conservation of habitat for umbrella species (wide ranging species) will also conserve smaller, non-game species habitat (Wilcox 1984). In summary, each of the wildlife concentration areas along the Uncompahgre River contains habitat for game species, a variety of avian and small mammal communities as well as habitat for aquatic and amphibious animals.

Public Lands

The locations of public lands along with other protected wildland parcels should be considered when selecting parcels for conservation, especially if the conserved parcel creates a corridor suitable for wildlife and plant species to maintain contact with other populations, to disperse, and to enhance genetic diversity. A quote from Shafer's (1990) helps to drive home the need for corridors: " the presence of multiple reserves, if they are close enough or connected by useable corridors, allows for some organisms to migrate and thwart demographic accidents and genetic erosion; may capture more habitat variation than would a single large tract; or may guard against the effects of drastic environmental change, natural catastrophes, and human destruction". By overlaying public land ownership with the Uncompahgre River and wildlife concentration areas, obvious connections develop.

On the Uncompahgre River there are less than 500 acres of public lands since the riverbottoms were all homesteaded for the fertile soil and easy access to water. The creation of core riparian protection areas linked by the identified corridors to public lands may provide the best opportunity for wildlife to continue to flourish as the Uncompahgre Valley grows.

Delta County

Delta County has two places where migration corridors to public lands could be developed. There are only two private parcels between the border of Sweitzer Lake and the Uncompahgre River. The development of a corridor would connect the park and its plant and animal species to the river and other favorable habitats. A long shot for development of a corridor also exists between the river and BLM property one mile east of Highway 50. Two hundred acres of BLM lie in close proximity of each other and within 1/2 mile of a large block of BLM property that includes the Gunnison Gorge.

Montrose County

Montrose County also has two feasible options for connecting the Uncompahgre River to public lands. On the border with Delta County the same option of connecting to BLM land to the east of the highway exists. On the Ouray County line CDOW and BLM property occur within one mile of the river. Many wildlife species already use the area extensively. The CDOW property is 800 acres adjoined with 80 acres of BLM property. Within 1/2 mile of the CDOW property there are two large blocks of BLM land that would connect to the Uncompahgre National Forest. On the east side of the river only scattered parcels of BLM exist in Montrose County.

Ouray County

Ouray County adds an extensive block of public land to the southern Montrose public land. BLM and CDOW land are located on both sides of the river, but are blocked from the river in places by private land. The 400 acre Double-Shoe Ranch has been placed into a conservation easement connecting Billy Creek State Wildlife Area to the river. A few other private parcels exist on the river, but mostly the public lands south of Colona to just north of Ridgway are fairly well connected for migration corridors.

The final analysis of the digital data was to intersect private land parcels near the river with wildlife habitats. The final result of this analysis identifies private land parcels that already support wildlife species. To illustrate the need for corridors once again, public lands were also plotted along with the wildlife parcels. These maps give VLC another perspective to use in identifying land parcels for conservation. Ultimately, the parcels that combine the highest number of positive factors will be the highest priority for conservation by URCP .

Public Participation and Identification of Willing Landowners

To reach out to as many landowners as possible the Valley Land Conservancy formed a partnership with CDOW and NRCS. It was thought that contacting landowners through a person already known to them would produce more positive results. The CDOW and NRCS already had people who were in regular contact with landowners and these agencies are partners in the URCP project. As a result of several discussions the CDOW and NRCS agreed to act as liaisons between the landowner and VLC. In addition, both the CDOW and NRCS had sources of money for wetland or riparian habitat development projects and agreed to extend the possibility of these funds for land conservation projects.

As a result of these meetings, a relationship with natural resource agencies, a strategy for contacting landowners, and a conceptual framework for all three goups to work within were developed. Through this relationship nineteen landowners agreed to consider conservation of their property and to allow a preliminary baseline inventory of their property.

Preliminary Baseline Study

The digital analysis, and public process to identify interested landowners has revealed several parcels which merit further study of their conservation potential based on parcel characteristics, resource values, and initial dialogue with landowners. This report provides preliminary baseline descriptions of 18 potential conservation parcels in the Uncompahgre Valley in Montrose and Delta Counties. These baseline descriptions include the following information:

Site maps locating approximate parcel boundaries.
Parcel map indicating natural features such as the river, and major vegetation communities.
Parcel map indicating principal structures and improvements.
Brief description of wetlands.
Description of wildlife habitat values.
Description of any environmental hazards observed, such as landfills or stored toxic materials.
Brief summary of Preliminary Title Report.

Methods

Parcel boundaries were determined by Geographic Information System (GIS) maps from Delta and Montrose County Planning Offices, interviews with landowners, survey plats obtained from landowners, and/or legal descriptions from Preliminary Title Reports. Geophysical features, boundaries of major vegetation communities, and some structures and improvements were determined from U.S. Geological Survey (USGS) 1:24,000 scale topographic maps, U.S. Natural Resources Conservation Service (NRCS) 1:7,200 scale aerial photos taken in 1982 and 1989, and U.S. Bureau of Reclamation (BUREC) 1:2,400 scale orthophotos (aerial photos showing topographic contours) prepared in 1977.

Each landowner was contacted by phone and in person, when possible, to verify parcel ownership, identify land uses, obtain information on wildlife present, and develop the

dialogue concerning conservation options. A 2 to 4-hour site visit was made to each Parcel. During each site visit, landowner contact was made when possible, and most of the parcel was viewed on foot. Principal structures and improvements were mapped. These included buildings, roads, railroads, fences, farm fields and pastures, artificial ponds, and major powerlines, pipelines, and ditches. Not mapped were small powerlines, telephone lines, or pipelines feeding individual structures or small groups of structures. Also not mapped were small irrigation ditches such as laterals to individual fields, and field drains. Locations of mapped objects are approximate, and represent the best locations that could be determined from topographic maps, aerial photos, and on-site observations without an actual land survey. Major vegetation communities were identified and boundaries refined, principal land uses were noted, and wildlife sign and habitat potential noted. Any sign of environmental hazards was noted, such as dumps, landfills, or stored toxic materials.

Preliminary Title Reports were obtained from Western Land and Title Company, Montrose and Delta Offices, for each Parcel, except for two which could not be obtained without significant additional expense for research due to the state of county government records. The Preliminary Title Reports included information from the appropriate county recorder's office on parcel ownership and encumbrances. Not all existing rights of way or easements are identified or adequately described in the Preliminary Title Reports, and additional property records research is recommended before finalizing any conservation agreements.

Common Resources Description

All of the Parcels share some common resources, and these are described for the region in this section.

The Parcels occur in an area encompassing about 32 miles of the Uncompahgre River Valley, from the confluence of the Uncompahgre and Gunnison Rivers near the city of Delta, Delta County, upstream to about 10 miles south of Montrose, Montrose County (Figure 1). Elevation ranges from about 4,920 feet at the Gunnison River edge of Parcel 16, to about 6,350 feet in the upland portion of Parcel 1. All of the Parcels lie along the Uncompahgre River, or the Gunnison River within one mile of the Uncompahgre Confluence. Most Parcels contain a portion of river, and all parcels except Parcel 14 contain significant stands of riverine riparian forest/shrub communities. Most of the riparian communities in the Uncompahgre Valley occur on the edges of the major rivers,

and along with riverine wetlands these communities represent the most significant wildlife habitats remaining in the valley, occupied by over 200 species of vertebrates constituting at least two-thirds of all species in western Colorado. Habitat exists for important game species including mule deer, pheasant, quail, and waterfowl. The Uncompahgre Valley represents an important branch of the Pacific Flyway for waterfowl, and tens of thousands of migrating ducks, geese, and cranes pass through in spring and fall. About 12,000 ducks winter in the valley each year, mostly in the river corridor and on associated floodplain wetlands (Sherman, 1996).

The river corridor also provides significant habitat for vertebrate species of conservation concern. At least 150 federally threatened bald eagles winter in the valley each year, feeding and roosting mostly in the river corridor. Bald eagles rarely nest in Colorado, and the Uncompahgre Valley has hosted at least three of the 15 or so nesting pairs in recent years (Andrews and Righter, 1992; Guadagno, 1996). The federally threatened southwestern willow flycatcher occurs near the Gunnison confluence in riparian shrub communities, and significant potential habitat exists in many other locations along the Uncompahgre River. Habitat for many neotropical migrant songbirds exists throughout the river corridor, and the bird fauna of the riparian forests and associated wetlands is extremely diverse. Many of these species are declining in parts of their North American range (Robbins et al., 1989), and protection of remaining habitat is believed to be vital to halting or reversing declines. The yellow-billed cuckoo has seriously declined in Colorado in recent years (Andrews and Righter, 1992), but at least one population remains in riparian forests of the Uncompahgre River (Guadagno, 1996).

All of the Parcels contain significant wetlands. For most of these, the Uncompahgre River is the hydrological source, and they lie within current or former river channels (Greystone, 1994). They consist of the current river, seasonally inundated islands and banks, and natural channels and sloughs cut off from the river seasonally or permanently by river course changes.

Other wetlands consist of artificially constructed ponds, often built under cost-share agreements with federal agencies for salinity control (Woodis, 1996) and wildlife habitat development (Sherman, 1996). Hydrologic sources for these ponds and associated wetlands are varied, including river flows, irrigation water from canals, drain water from irrigated lands, and subsurface flows from irrigated lands.

Wetlands also occur in some of the Parcels along irrigation canals and ditches. These nonjurisdictional wetlands consist of narrow discontinuous bands of riparian vegetation along ditch and canal banks, as well as low-lying areas on field margins which collect surface or subsurface irrigation runoff.

All of the above-described wetlands feature hydric soils (NRCS, 1991) and a variety of (obligate and facultative) hydrophytic plants.

Application of Criteria to Preliminary Parcels

Nineteen landowners were identified and Preliminary baseline descriptions prepared on the Uncompahgre River. One landowner is in the process of donating a conservation easement to VLC and as such will not be discussed here. VLC identified 'anchor properties' and built conservation areas with additional willing landowners adjacent to the anchor properties. Of the eighteen properties, six separate conservation areas were developed. In addition, four possible conservation areas were developed.

Although all the conservation areas contained significant natural resources there were significant differences between them. Some properties were more agricultural and others were more wildlife oriented. As a result an objective process for prioritizing the identified properties was developed. The Natural Areas Program developed a criteria list for ranking properties for indentifying important 'natural areas' properties in the state for Great Outdoors Colorado. The Yampa Valley Legacy Project also had developed a criteria list for identifying important agricultural properties for conservation. Reflecting on The Uncompahgre Valley's priorities it was decided to combine the two lists into one for the prioritization of the Uncompahgre River properties. This list included: Rarity of habitat type, Representativeness of habitat type, Ecological Integrity, Threats to natural functions, Stewardship, Value to the Community, Agricultural Value, Size of the Property, Visibility, and Donation/Cost.

Application of URCP's criteria list was applied to each conservation area and to each parcel within the conservation area to produce a priority list of conservation areas and properties (Table 1).

Prioritizing Conservation Areas

Problems, in terms of differing priorities presents themselves in this analysis as properties with high ecological value often have lower agricultural value. In addition, an extra criteria was added to this analysis -recreational opportunities- to account for the possible public use of the area, further complicating the priorities.

By summing the number of positive responses to the criteria Conservation Area 5 and Possible Conservation Area 4 are the highest priority conservation areas for the URCP group. Both parcels scored had positive ecological attributes, are threatened and are highly visible to the public. Conservation Area 5 coupled ecological and agricultural lands together, while PCA 4 coupled ecological and recreational lands together. Both may be expensive to conserve, but with their high visibility and public agency support the likelihood of their conservation remains strong.

Table 1. Priority Rankings for Conservation Areas.

	CA 1	**CA2**	**CA3**	**CA4**	**CA5**	**CA6**	**PCA1**	**PCA2**	**PCA3**	**PCA4**
Rarity					X	X			X	X
Representative					X				X	X
Ecological Int.	X	X	X	X	X	X	X		X	X
Threats	X	X	X	X	X		X	X	X	X
Stewardship	X	X	X	X	X		X		X	X
Value	X	X	X	X	X	X	X	X	X	X
Contiguity	X			X	X	X	X	X		X
Agricultural		X	X	X	X		X	X		
Visibility	X		X	X	X	X	X	X	X	X
Size	X	X	X	X	X	X	X	X	X	X
Donation/Cost	X*	X*		X		X		X#		?
Recreational						X	X		X	X
# of positive responses	8	7	7	9	10	8	9	7	9	10
ACRES	267	154	59	215	436	100	?	1480	160	640
# of Landowners	2	5	1	2	4	4	8	3	1	1

* one landowner has committed to donating development rights

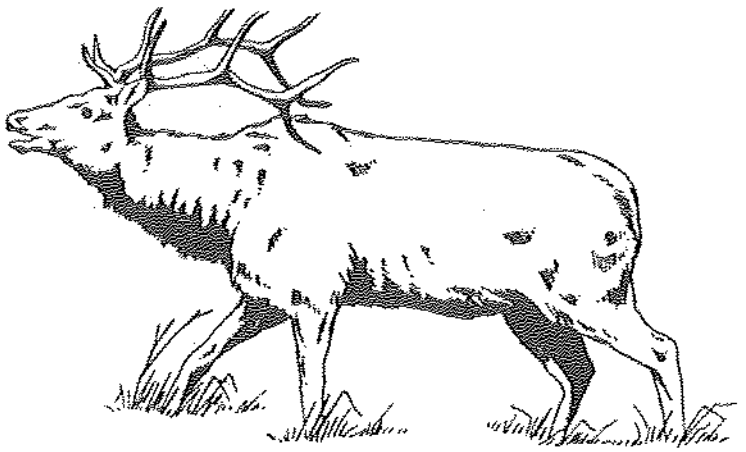
one landowner has already donated a conservation easement

Potential Conservation Properties

In addition to these areas, there are also lands for sale. An inquiry to the Multiple Listing Service in Ouray and Montrose Counties showed there were 34 properties (2,294 acres) for sale and 13 properties with more than 20 acres available on the Uncompahgre River. These are all willing sellers, but many are asking for more than the suggested appraisal values. The combined value of those 34 properties totaled over 10 million dollars.

Conclusion

Land use issues are very important to residents of the Uncompahgre Valley. The quality of life and the open space character of the valley are threatened with increasing numbers of people moving into the valley. The Uncompahgre River and the open space it provides is of particular concern as it supplies many valuable amenities to the valley's residents. Plants and wildlife are especially dependent on the river for habitat and as a travel corridor. The creation of conservation areas along the river will help to contribute to the high quality of life expected by people in the Uncompahgre Valley and ensure there is habitat for plants and animals to use well into the future.



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Restoration of Riparian Areas near Trout Creek Pass

Joe Cogan, Rancher
Nathrop, Colorado

My grandfather came to the US as a fugitive in the late 1800s from the British Royalty. He escaped a date with the hangman's noose, and came to the great metropolis of Nathrop, Colorado. My father came at a later date in 1883. My father was 57 when I was born. So we have spanned a great many years between us ranching in this area. My father, being there form 1883 on witnessed the decline of the Trout Creek Area-The Bassam, and Chub Park areas. The early time people came in and built railroads. There were two railroads that went through Trout Creek. There was quite a bit of mining and the tracks that we are looking at today in there were made by the wagons and the skid horses etc. of that day. They tied skid loads to bring crossties off the mountains down to the wagons and brought the crossties in on the wagons and we wound up with a lot of erosion. The willow was not native to this country. It was strictly alder and river birch along Trout Creek. One early day pioneer told us that when he would come there and stop with his freight wagon, he would take a toe sack which to us was a gunny sack, and they would lay it in the middle of the stream, and natives(trout) being what they were, you will observe that natives stay in the middle of the stream instead of hiding under the bank where they are easy to catch. They would put a toe sack in the middle of the stream and pin it down to the bottom and in short order lift it out and they would have enough fish for a meal. That is why it was called Trout Creek.

The decline kept on with over grazing by 700 horses and around 3,000 domestic cattle and wandering herds of sheep. This continued until about 1900 when they had a drought of two years duration. It didn't rain at all in the higher range. So there was no snow and there was no rain. It was so critical and so badly overgrazed that cattle and horses starved to death in the summertime on the public range. This had to come to an end somewhere. Even the farmers and ranchers would starve out or something would have to give. Someone was smart enough to start an outfit called the Forest Service. Which was not appreciated by many. The Forest Service charter was much the same then as it is today. They came in and established permit areas and permits for people to stabilize the economy. Because we had butchering outfits that would come in with a trainload of cattle and turn them loose on the range in the spring. They would turn them loose on the range, round up so many each day to butcher to ship to Leadville to the miners and other places. These cattle kept the range denuded so in the winter, the local peoples' cattle starved. The decline had stopped and the rebuilding (of the range) had begun after 1900.

By 1935 the CCC came in and it was largely laughed at because they were largely inner city kid, but you will still see evidence of their tacks. They put in 20,000 gully plugs in with rocks. The only thing they did wrong with that, was that they didn't put seed within the rocks. The gully plugs didn't work until in the 40's when enough seed got imbedded in the rocks to make roots. The T-walk study yesterday showed the value of this. That stopped the washing. When I was a boy, my father and I would run the cattle up off Trout Creek. There was nothing to eat in the creek, but the cattle still came down there. Trout creek was only a sand spit at that time. You would go up and the water would be on the left side of the channel and an hour later it may be on the right side of the channel. It was an ugly tasting, warm, slimy stream. There was not one live fish in the whole stream-about 10 miles of it. There was not one live willow. There was not a beaver, not a muskrat. It was just a totally dead stream.

By 1950 some people had realized the problem. Some people had curtailed their grazing enough in the upper reaches (of the watershed) so that it wasn't running wild. Then there were a few fish near the head where there is a spring breaks out near the highway . It runs about three cubic feet per second. There is a contact between the sedimentary and igneous rock at that location. The whole stream starts there with some small tributaries feeding in. The floods continued on but not as bad. But I remember when we would wait 25 minutes for a flood to go by before we dare cross the channel with a horse for fear that it would wash the horse away. Figure 1 shows the Swallers Place, the show place of the valley. Figure 2 shows the top story of this house sticking out of the sand. There is 600 feet of track abandoned in this area that is still there under the sand. My father visited the fellows that lived in this house, and they were cooking in gumboots, standing up to their knees in water and only the firebox of the stove was out of the water. They slept in the upstairs where it was dry. Finally they had to move to the chicken house. They ejected the chickens but they didn't clean the chicken house. Figure 2 also shows the man who was responsible for much of the restoration in the watershed - ranger Jake Jock. He still lives in Pueblo. This is in the 50's when they started getting control of the upper watershed. Figure 3 shows the Rhodes Place. This is one of our most telling pictures. You will notice a cut here where they probably pulled some logs down here to build the house. Remember this blue spruce tree. It's very dead there isn't it. The railroad went through here. This is a 1923 picture.

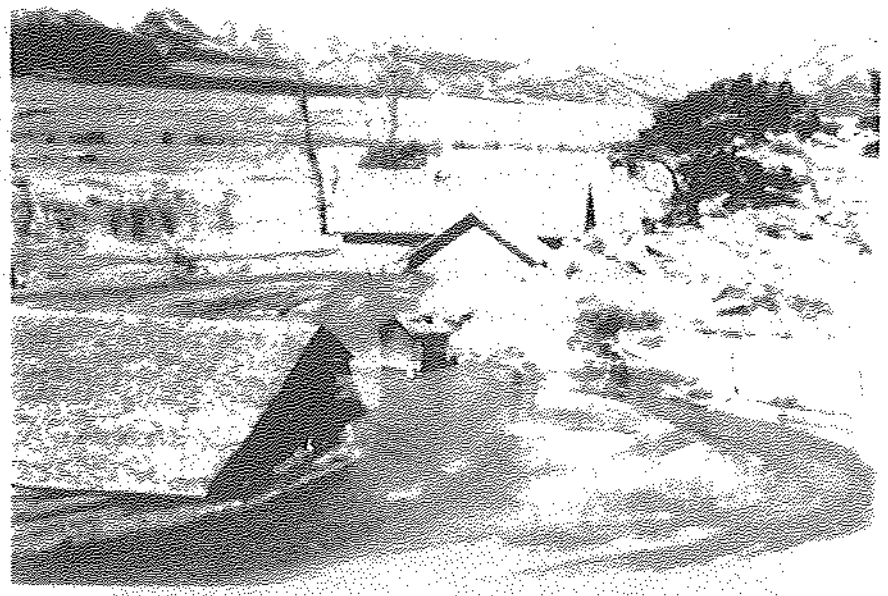


Figure 1 Swallers home place

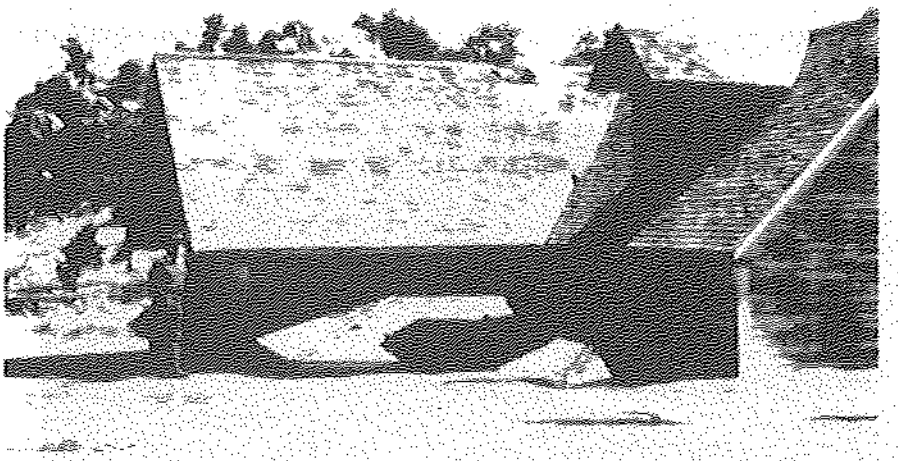


Figure 2 Swallers house partially submerged in sand with ranger Jake Jock who initiated watershed restoration

This railroad was abandoned before that. This cottonwood was dead. Cottonwoods were not native in this valley. There are a few quakes. Figure 4 shows how the area looks today. The houses are still there in the far left, in the willows. Where did that arroyo go? It's still there but obscured. Notice the vegetation. The blue spruce tree you saw indeed died. This is not it's son. It's the hole family. A bunch of the nuts got covered and there are 10 to 15 stumps to this one tree. This is a blue spruce bush instead of a tree. Livestock management and watershed improvements have made all the difference here.

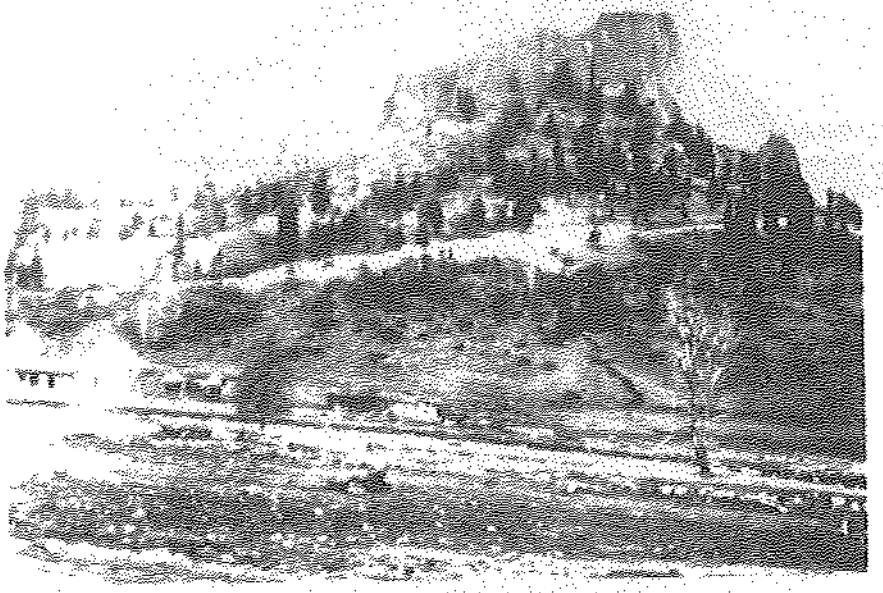


Figure 3. Rhodes home place showing early range and riparian condition.

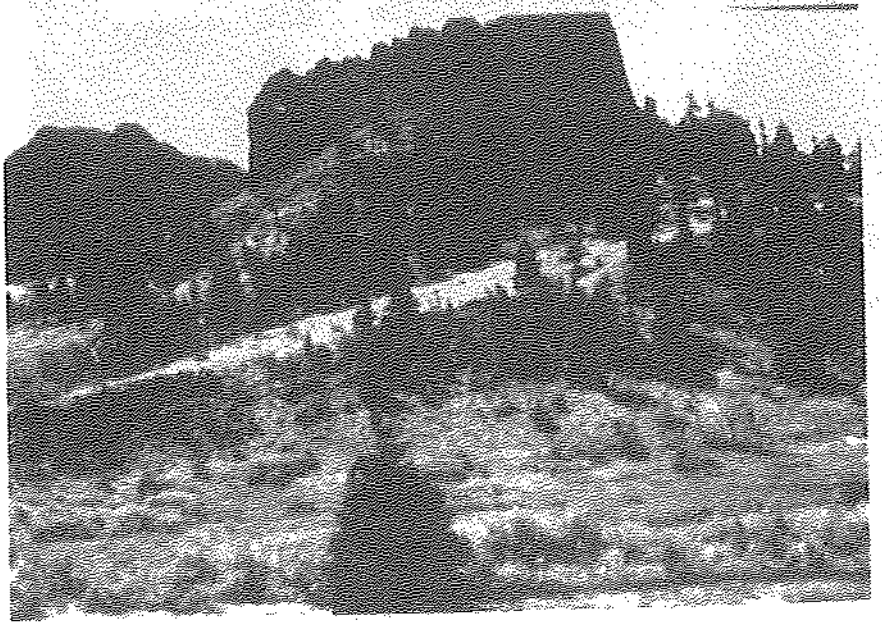


Figure 4. Rhodes place showing current condition with range and watershed improvements.

Figure 5 shows a closer view of the Trout Creek stream condition in 1933. Notice the siderocks that have been brought into this delta. Figure 6 shows the condition of the same area in 1954 with complete protection. Notice that the grasses and bushes are sparse. They are not knitted together well, but it is recovering. Figure 7 shows another view of the same area after the cattle were allowed back in. You can see the road, but the bushes are covering it. Here you can see a beaver dam now developing on the stream now. They open trails in the willows which allow access for fishermen.

Figure 8 shows Castle Rock Gulch during early recovery. When I was a boy, this was full of prairie dogs. This was the first place that Bubonic Plague was diagnosed in Colorado. After some protection efforts, the grasses began to come in. It looks almost like it was farmed. It is developing a little better all the time.

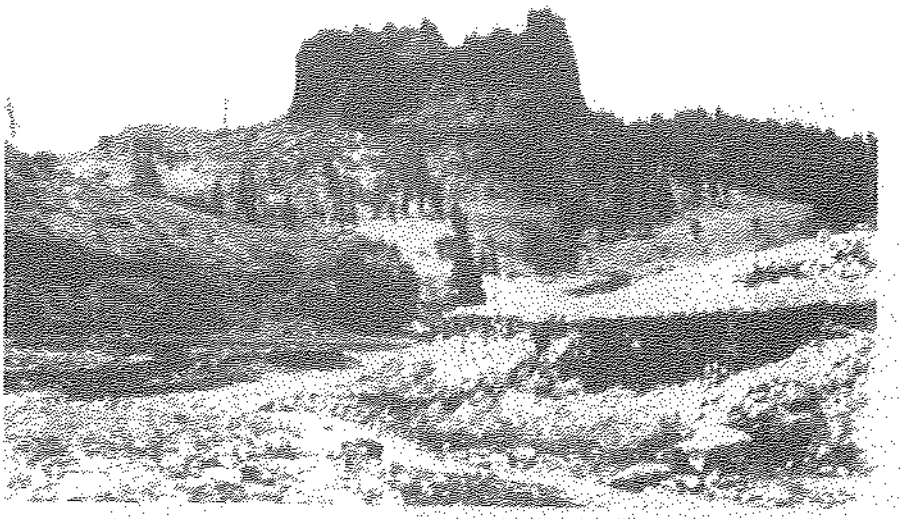


Figure 5. Trout Creek stream condition in 1933.

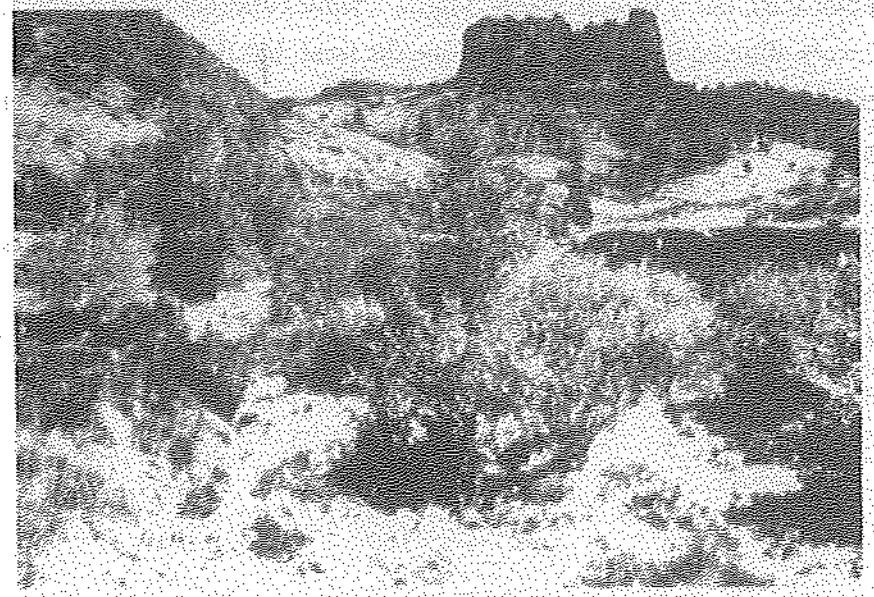


Figure 6. Trout Creek stream condition in 1945.

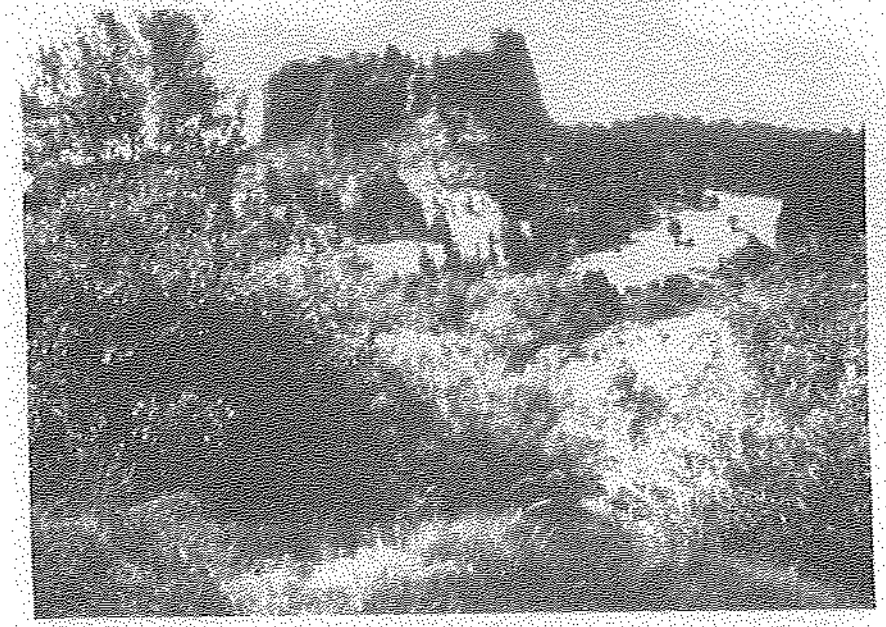


Figure 7. Showing present condition of Trout Creek with livestock use.

Figure 8. Castle Rock Gulch during early recovery.

Figure 9. Present condition of Castle Rock Gulch.

Today there are no prairie dogs. There are a lot of beaver and ground squirrels. Figure 9 shows the same area and it is coming along. This is the result of Jake Jock's work and livestock management. A little more brush is developing. In places where cattle couldn't get a drink, there are fish today. This is the head of the gulch.

We have watched the progressive improvement of Trout Creek over the years as things came back. A man came in and put in one dam with a caterpillar in the sand. Fortunately it didn't wash out and the beaver took up residence here. There were a few quakeys up on the hill which the beaver ate and made some more dam. This backed up a little water. But the thing that is amazing to me, if you put a dam here in the stream, you never know where that water is going to come out and make a meadow somewhere downstream. I doesn't matter how high the dam is, but somewhere downstream there will be a piece of ground show up with water. There is a definite progression and the rush meadows are going to be there. You can tell ten years ahead of time because some of the intermediate grasses will withstand some drought will come in first. I don't know what triggers this. But what amazes me is that we finally have beaver dams the full length of Trout Creek along with the sandbank willow and what is more amazing is that this year we have more willows than ever before. It is wall to wall willows. Not just in the channel, but clear up on the sides. I realize that it is coming back in and there is something triggering this. I realized yesterday in our T-walk study what it was. A flood triggered it. I don't know what it is in a flood that caused it. In another arm of this drainage that I purchased some years ago, we had a flood from 40 acres that flowed 300 cubic feet per second. It came down under the highway. The SCS measured the fall of the land and the width of the channel and estimated the flow to be at 300 cubic feet per second. This land where the beaver dams were took three or four days for the water to go down because it was retained by the beaver dams. It was only flowing a little bit. The current was down. But I believe this is what caused this great carpet of willows and it is at a point now where it will never wash out again. It is well controlled.

Use of Riparian areas by Land Birds

Frank Howe,
Utah Dept of Natural Resources

I would like to talk a little bit today about monitoring, but mostly management of riparian areas for nongame birds or breeding birds that use those areas. People have asked me what a landbird is. It all started with Neotropical Migrants. But we are looking at more than Neotropical Migrants. We are looking at all breeding birds in the system. They don't include ducks and shore birds. It is mostly land birds. In the West in Utah and pretty much in Colorado, riparian habitat makes up less than 1 per cent of the total land area. But we find that 75 per cent of the species in these states use riparian zones at one time or another in their life history. It may be for migration-migration corridors in the spring or the fall. It may be for winter habitat - thermal habitat or cover. A lot of birds come down from higher elevations into the riparian zone.

Today I am going to focus primarily on breeding habitat-that is what we have been looking at. If the breeding habitat is there in good health, it will be available for most other seasonal needs. How do birds see riparian habitat? I don't know. I am not a bird. But I have a feeling for what they see in riparian zones. This is one of the things they see in riparian zones quite often. This is kind of a classic riparian zone in Utah and I have seen a lot of similar areas in Colorado as well. There are cattle here. There is a fence there though it doesn't look like it is well maintained and there is a road right next to it. But in the back you do have a fairly well established riparian habitat. Will the birds see this as a riparian zone? Some of them probably do and this is probably prime riparian in some places in Utah where it is extremely arid. This implies that some birds use riparian areas differently than others. In an area like this where you have a would be riparian zone, you do have a few birds that use this. But you will have those same bird species and a lot more using a healthy riparian zone like this.

The Utah Division of Wildlife Resources in cooperation with a number of other agencies started monitoring breeding birds in riparian back in 1992. We have a number of folks who have participated in this. This is all through Utah Partners in Flight. We have a number of long term objectives. The monitoring part of this is that we are looking at bird population trends and habitat trends and seeing if we can come up with some correlation over the long term. These things take a while and what we have found is that in the short term we also came up with a lot of valuable information. The inventory of just what birds

are out there-we did not know in a lot of cases. We can also look at things like species richness and diversity, abundance and density.

A lot of what we are trying to do is get ahead of the curve. Only dealing with species after they become listed, is expensive and complex. So a lot of what we are trying to do is get a handle on them first when we have a lot more management flexibility. When we started in 1992, we had 31 sits. Since then we have actually monitored 40 sites. They are spread out all over the state. This area is Bonnieville Salt Flats. There is really not a lot of riparian zone to look at out there. We tried to locate one site in each of the 1:100,000 BLM map blocks. We use pretty standard methodology. We establish 10 survey points in each of these areas. The points are about 250 meters apart. We will count all the birds we hear and see in an 8 minute period. Then we estimate how far the bird is away from us and try to get some density estimates through that. We also measure vegetation to see if there are changes in vegetation which correlate with changes in the bird populations. A number of studies in the southwest have shown that if you lose riparian habitat, you lose about 50% of the aviafauna. We looked at riparian dependent species. Or those that rely on riparian as their primary or secondary habitat. Like Yellow warblers, they may breed in your local park, but their primary breeding habitat is riparian. We have detected about 200 species in these riparian surveys that we have done and about 46% of those are riparian dependent. This fits well with what a lot of the other southwestern studies are showing. About 60% of the birds we have detected in riparian are neotropical migrants. Neotropical migrants are those birds that nest in North America and migrate south of the Mexico border to spend the winter. This is a riparian restoration project in the Moab area. There are threats to migratory birds both on the breeding grounds and on the wintering grounds and along their migration corridor as well. Before we even have our 5 years of trend data, we can look at graphic with all the sites listed along the bottom, the green line is the state average of all these sites for species richness. We can look in here and say here is our Salt Lake City one cite and that one is doing pretty good. I wonder what the habitat looks like. Or we can go over here to the fish springs area and so oh yes, I wonder what is going on over there. So even before we get our trend analysis we are using some of this information to tell us some things and some things were real obvious.

For one, different bird species use different parts of the riparian habitat. This is a Warbling Vireo. The male is singing on his nest. They are one of the most commonly occurring species in riparian habitat. McGilverys Warblers are also a fairly frequently occurring species, but only where you have a well developed shrub layer. They don't like

those mushroom shaped shrubs that you see so often. They need to have real thick shrubs. This is a Fox Sparrow. Fox Sparrows have big, long toes. They get down underneath and kick around in the leaf litter. So what they want is good cover, but they also want a lot of leaf litter. They pick up the grubs and insects that live in those leaves. Hummingbirds like this Broadtail Hummingbird like flowers. Flowers grow down in well established ground cover. For woodpeckers old, dead trees are important. Common Yellowtroats like little, interspersed emergent wetlands. They like to nest in the cattails or the rushes, but they like to have those areas right along side the riparian zones. So they are all using different parts of the riparian zones.

Here is a good example of what a good, healthy riparian zone looks like. It has a well established canopy. Most of what we find around the West is Narrowleaf Cottonwood. We have a lot of Fremont Cottonwood around the southern parts of Utah and some into Colorado and then Populus deltoides over on the plains. Underneath you find you have a good shrub layer or subcanopy layer. The best thing to have in the subcanopy layer is the same thing that you have in the canopy layer. You want to have regeneration. You see a lot of areas that have these big gallery cottonwoods, but they don't have anything coming underneath. Twenty to thirty years down the line you will have nothing but grass out there. Because all those trees will eventually die and there will be nothing to replace them. Also willows are real common in those areas. We have seen Guiers Willow, Sandbar Willow, Dogwoods and rose in these areas. Then down on the ground cover you have even a wider variety of plant species. You will find grasses, sedges, a number of wildflowers. Another real important feature of riparian habitat is water. A lot of birds are coming in just to get the water, especially in real arid areas.

Birds use a number of different food sources in riparian habitats. They key in on things like gooseberries, hawthorn, chokecherries, seeds that they get from the ground and flowers. But the most important food that they get from riparian is insects. Almost all birds feed on insects during the breeding season because of the high protein that they can get from this source. It helps them to build their eggs and maintain their high energy metabolism during this time when they are feeding their young. Also they feed their young almost exclusively insects so that they can grow rapidly.

Another important feature that we frequently overlook is what is adjacent to the riparian habitat. Because healthy riparian habitat depends on healthy adjacent habitats. There are

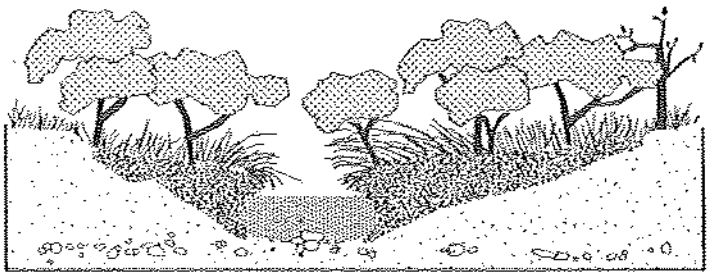
a number of bird species that live in the riparian zones and go out in adjacent habitats to feed.

How do you manage riparian zones to make them better for birds? Birds are a substitute for biodiversity. First you have to consider the uniqueness of the site. Consider the history of the site. Is it broken? Why is it broken? What can you do to fix that particular thing. What are the threats that affect that particular site? Consider the soil, hydrology, the landform and the natural vegetative community. Natural function is the key to long-term success in managing riparian habitats. But natural function takes a long time to replace and there are some stopgap methods that you can use to help bring birds back into an area. I am not suggesting that you use stopgap measures instead of addressing the natural function, but in addition to it. Those are things like nestboxes. It is pretty hard to get old, decadent cottonwoods into a riparian zone in a hurry. But you can put nestboxes into those areas to attract the woodpecker sweet. You can also do plantings. You may have to do plantings under irrigation until the roots of the plants get down to the water table. But those things are good options. Manage for diversity. The more diversity of vegetation you have in an area, the more diversity of birds and biodiversity you will have in an area. But don't get too carried away. I come from the midwest and one of the things that always amazed me, was that in all of the little state management areas which were surrounded by thousands of acres of corn and they would plough up the native grass and plant corn for foodplots. So look around and see what is happening around the area you are trying to manage. A lot of these areas don't need low, open areas because the birds can often go just down across the fenceline and find those areas.

We like to talk a lot about connectivity with riparian habitats. Riparian zones are probably naturally fragmented. You see how streams are naturally fragmented. You see how streams naturally meander back and forth. They cut out large chunks of cottonwoods and they go on and deposit material farther down stream. But the more connectivity we can have in these areas, the better it is for the birds. Also connecting the riparian zone to the adjacent habitat is very important. This is a strange area right now in that it is an area that is being mitigated for wetlands. These were wet meadows. There was probably not any riparian in here to begin with. It was probably too wet for the cottonwoods to become established. But what I want to show right here is that you have this little strip of riparian back here and look how nicely it runs back into the adjacent uplands. There nice shrubs running up to the uplands. So the connectivity to the adjacent habitat is important.

Cheetgrass affects what goes on in adjacent riparian zones. So managing adjacent uplands against cheetgrass is important to riparian health. This is an important area for agencies and private landowners to work on together. No one wants to see cheetgrass there.

Different birds like different birds like different parts of the riparian. I you want woodpeckers, you are going to have to have old, decadent cottonwoods or boxelders or something similar. If you want bullocks Orioles, they like gallery cottonwoods. If you want MacGillivray's Warblers, they like a very thick expansive shrub layer. Hummingbirds want flowers in the ground layer. Willow Flycatchers want willows. But don't expect to have woodpeckers if you want to manage for willow flycatchers. Again, the more diversity you can have in an area, the more species of birds you will find in an area.



Southwest Colorado Landsat Vegetation Classification Project: An Interagency Remote Sensing Project

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INTRODUCTION

The Southwest Colorado Interagency LANDSAT Vegetation Classification Project is an interagency effort to produce a general level vegetation map for the southwest quarter of Colorado. The 20 million acre project, initiated and coordinated by the Montrose District Office of the Bureau of Land Management(BLM), includes watersheds in the Colorado, Gunnison, Dolores, Rio Grande, and San Juan River drainages. The primary objective of the project is to develop a comprehensive vegetation map in a GIS format, with a supporting database. A secondary objective is to enhance interagency cooperation. The data that would result from the project will function as a base data layer to which detail layers such as riparian vegetation will be added later.

BACKGROUND

By the mid 1980's the Montrose District had begun to use Geographic Information Systems for storing and analyzing data. By 1990 many layers of data, such as streams, big game habitat, land ownership, endangered species habitats, roads and other facilities, were in the system. Vegetation coverage was a major missing element in the spatial data. Traditional methods of mapping and sampling vegetation are costly and beyond the funding and workload capacity of the office. The BLM's Remote Sensing Branch, at the National Applied Resources Science Center(NARSC) in Denver, was contacted in 1992 to see if the use of satellite data would reduce the cost to manageable level. Even with the lower cost of satellite based vegetation mapping, there were still insufficient budgetary resources. The growing emphasis on ecosystem management, rising concerns about community growth issues, and the characteristics of satellite based digital data lead us to expand our proposal to include more than BLM managed lands.

In October of 1993, the Montrose District Office proposed an interagency vegetation mapping project to a variety of federal and State agencies. Agency representatives quickly reached a consensus that a seamless dataset of the current vegetation was needed, and that they would

participate. A Memorandum of Understanding was developed to facilitate the project, and the sharing of the original LANDSAT data among the cooperators. By August of 1994 the Memorandum of Understanding was signed by BLM, U.S. Bureau of Reclamation, U.S. Park Service, U.S. Natural Resources Conservation Service, U.S. Fish and Wildlife Service, National Biological Survey, U.S. Forest Service, and the Colorado Division of Wildlife.

During late 1993 and early 1994, in a series of interagency work group meetings, the project cooperators agreed upon a project area illustrated in Figure 1. The project area stretches from the Utah state border east to the Continental Divide, and beyond to include the San Luis Valley, and from Bookcliffs north of Grand Junction, south to the New Mexico state line. Included within the area are three BLM Districts, four National Forests, four National Park Service Areas, and two national wildlife refuges. Cooperators further agreed to partition the data into the twenty-eight major watersheds that fall within the project boundary. This would provide an ecosystem basis for partitioning the data into manageable pieces. Cooperators agreed that the data should be available to all participants in an electronic geographic information system(GIS) format.

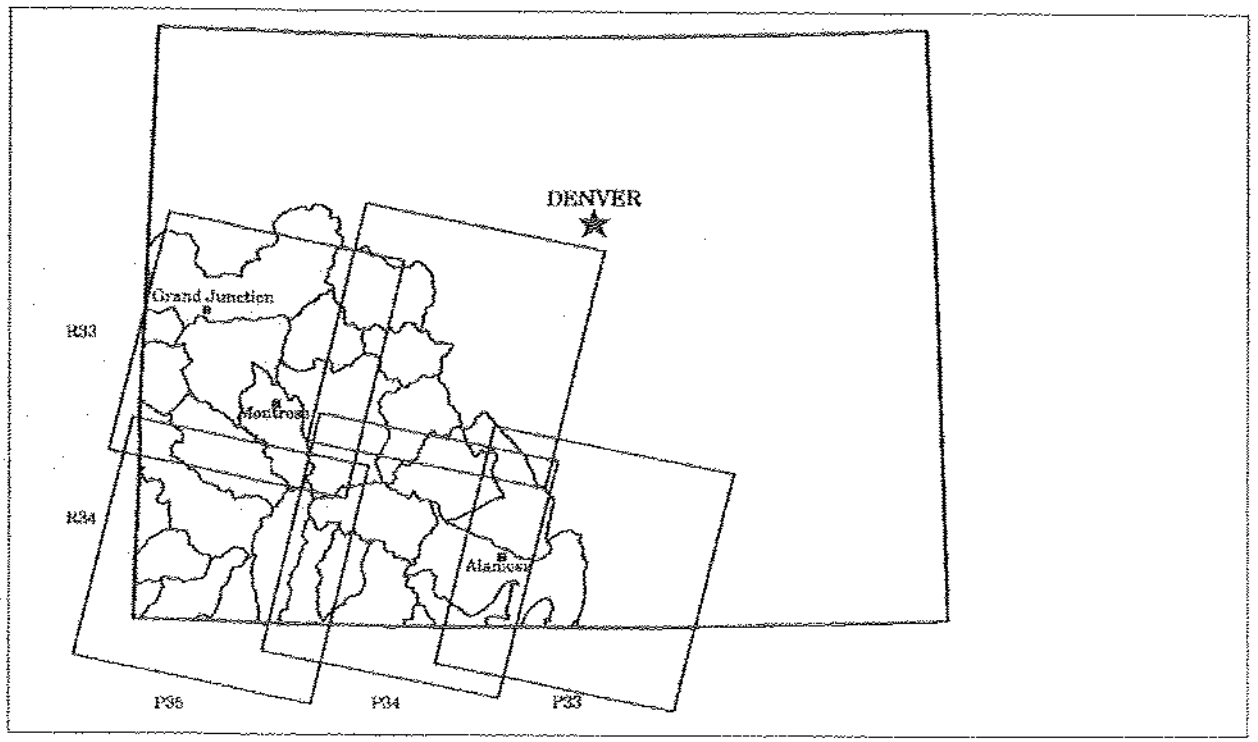

Figure 1 Project Area, showing major watersheds and LANDSAT TM scenes

To provide quality control and consistency in data analysis, the cooperators agreed to use the BLM remote sensing contractor at the NARSC in Denver to complete the work on the project. Further information about the technical aspects of project analysis can be obtained from the author, or from Allen Cook or Suzie Noble, TRW contractors, at (303)236-6391.

PROJECT OBJECTIVES

Two major phases of the project were identified, each with different objectives.

Phase one: This segment consists primarily of acquisition of LANDSAT Thematic mapper data and development of that data into a GIS vegetation data set, with supporting databases, and the final report which will include the metadata files.

Phase two: This portion of the project is aimed at adding detail to the original data, archiving the data and its related databases, and long term updates of the information.

PROJECT PROGRESS AND STATUS

Phase one began immediately after the October 1993 interagency meeting. Project cooperators formed an interagency subcommittee to develop a vegetation classification system that meets their needs and is compatible with other classification systems already in use. In 1994, NARSC completed a project plan that detailed the data needs for the project, costs, watersheds involved, methodology, and deliverable products. Data for the project was purchased in 1994 and included spring and fall satellite data(primarily 1993 dates) for each of the five satellite scenes required to cover the area. Multi-seasonal data helps sort out confused classes of vegetation and fill gaps in the original data resulting from cloud cover. Project costs were originally estimated at $115,000, excluding the cost of field verification. Preliminary classification of the data, for all 28 watersheds was completed in late 1994 by BLM's Remote Sensing contractor at NARSC. An unsupervised classification was used to process the data. Basically, this uses a computer to analyze the satellite data and place statistically similar data into like classes or categories.

To make sense of these classified images, a representative number of sites for each class, or type of vegetation, will be visited to collect data. A standard field form was devised to facilitate consistent data collection. At each representative site, specific information is collected about the general vegetation type(i.e. tree, shrub, grassland, etc.), physical characteristics of the site, estimated aerial cover provided by each of the dominant plant species(by layer), and a GPS

location. GPS data allows the field data location to be exactly located on the planet, correctly placing it within the classified imagery data. GPS locations also make repeat site visits possible for future monitoring of change, or the collection of more detailed data if needed. Each verification site is photographed, and the photos will eventually become part of the computer database. Existing high quality vegetation cover data, such as that available in the Gunnison Basin and San Juan National Forest, will be incorporated directly into the database for this project.

Priorities were assigned to all the major watersheds by the interagency workgroup, and during the summer of 1995 field verification of the data began on the highest priority watersheds. The BLM contractor at NARSC enters all the site data into the database and all site location information into GIS. Using this information we are able to assign community names to the computer identified vegetation classes. In all cases the minimum cell size of 25 meters by 25 meters(about one eighth of an acre), dictated by the satellite data, is retained. Communities smaller than the minimum size on any axis may not be detected reliably with LANDSAT data. Consequently, other data sources must be used to map small communities such as riparian and wetland systems. In the Uncompahgre Basin Resource Area we have established a comprehensive GIS coverage and database of our stream and riparian systems. This will allow us to begin to superimpose this level of detail on the satellite based vegetation data. Yesterday, in a paper presented at this conference, Bob Welch provided you with a glimpse of the riparian/stream data we have available for this use.

To date, we have completed data collection and analysis on three watersheds; the Uncompahgre, San Miguel, and Upper Dolores. Data has been collected on ten others. We anticipate having at least two more watersheds complete by the end of the calendar year. An example of the statistics generated for the Uncompahgre River watershed is displayed in Illustration 1. The accuracy assessment for the Uncompahgre River watershed is shown in the upper right corner of the illustration. Each watershed when completed, will have an accuracy assessment rating. Currently the accuracy rating for the San Miguel watershed is 86%, and the upper Dolores has not been developed. More details about the composition of individual plant communities is available in the accompanying database for cooperator use.

In addition to the original cooperators, the Environmental Protection Agency, North Fork Habitat Partnership Program, Pitkin County, and Rocky Mountain Elk Foundation, have either helped in data collection or provided funding to help in the field verification efforts.

We are estimating the final cost of the project at $400,000. This cost provides a user ready GIS product with full documentation for **two cents per acre**. None of the other vegetation inventory methods commonly used by land management agencies approach this low cost, especially if all costs in computerization of the data are included.

ILLUSTRATION 1

UNCOMPAHGRE RIVER WATERSHED Accuracy Assessment= 81%

CLASS NAME	ACREAGE	DESCRIPTION
Urban/Built Up	5,796.8	Includes housing developments and yards
Agriculture	109,659	Hay meadows, annual crops, orchards
Riparian	10,831.6	Cottonwoods, willows and sedges on river corridors
Grass/Forb	77,889.7	wheatgrasses,ricegrass,fescue,etc.
Shrub/Brush	100,768	Predominantly sagebrush, includes saltbrush and greasewood
Deciduous Woodland	134,729	Mostly gambel oak, some serviceberry and mahogany
Mixed Woodland	1560.5	PJ-oak mix some mahogany and serviceberry
Barren	45,768.1	Less than 10% vegetation cover
Alpine Meadow	14,831.3	Dominated by alpine forbs
Water	1879.9	Lakes and major rivers
Pinyon/Juniper	113,008	Varying densities of PJ, mixed with sage and other species
Englemann Spruce/Fir Mix	47,345	Dense stands of spruce/fir, douglas fir at some sites
Spruce/Fir/ Aspen Mix	25,038.7	
Ponderosa/Oak	7195.8	Open pine/oak; grass understory
TOTAL	720,667	

SUMMARY; WHERE DO WE GO FROM HERE?

How will we use this information to help in managing the nation's resources? In the early 80's I met a government biologist from a third world nation who was using LANDSAT data as a habitat inventory and monitoring tool. At the time I was struck by the fact that we were not effectively using our own technology. As a biologist, I have long awaited the data, and the analysis capability that this project will provide. At last I can get a complete picture of the vegetation composition of wildlife seasonal ranges. I will no longer be working in isolation, with data on BLM managed lands only. We will be able to rapidly assess the positioning of key community types across the landscape in relationship to the needs of wildlife and human development issues. This will help determine if we are preserving the right plant communities, in the right places, to allow animal populations to interact across the landscape. The ability to better analyze cumulative effects of actions like timber sales will be greatly enhanced. Issues similar to this have been identified during public meetings held by San Miguel County for the San Miguel Watershed Plan, and in some cases the need for this specific data has been specified. If we consider this data to be a baseline, then, for selected areas, we can use older or newer satellite data, processed with the same methodology, to quantify the rate and location of change. This change data will provide a basis for managers and planners to do predictive modeling in a GIS format. The result will be a more informed public, and better resource decisions.

In those areas where issues demand greater vegetation detail, the base vegetation data, when combined with GIS soils data, will stratify vegetation for further sampling. This will save time, enhance automation of the detailed data, and remove some human biases from the sampling and mapping process.

Because of this project, another interagency project, covering the southeast quarter of the State has been initiated. A new Memorandum of Understanding has been created to facilitate statewide satellite based vegetation classification coverage. For those interested in more information on the southeast project or the Statewide MOU, contact John Carochi in the BLM Canon City District Office, at (719)269-8500.

Stream Health Assessments Using the Thalweg-Watershed Area Link (T-Walk) Approach to Advanced Warning

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The Rocky Mountain and Southwestern Regions of the U.S. Forest Service have adopted a standard set of definitions for Stream Health. This set, and the underlying legal framework, is the basis for evaluating project and watershed cumulative effects, as required by the Clean Water Act (CWA) and the National Environment Policy Act.

The goal of the Clean Water Act is to restore and maintain the physical, chemical, and biological integrity of the nation's waters. The biological integrity is a summation of diversity, productivity, and ecosystem stability. Stream Health determinations are based on a stream's existing physical, chemical, and biological condition, measured against its own long-term natural conditions.

The fundamental elements of Stream Health have been included in the law itself. The following list, derived from the U.S. Code, provides the scope and foundation for watershed and water resource monitoring and assessment.

* Key species, natural temperature and flow patterns... [33 USC 1314]
* Concentration and dispersal of pollutants through biological, physical, and chemical processes and any related changes in the diversity, productivity, or stability... [33 USC 1314]
* Factors related to rates of eutrophication; organic material accumulation; and inorganic sediment accumulation... [33 USC 1314]
* Dissolved oxygen conditions needed by location, species, and activity (hiding cover, propagation, food supply, reproduction)... [33 USC 1311]
* Effects of road construction, use, and maintenance on the biological character or flow, reach, and circulation... [33 USC 1344]
* Factors needed for restoration of the natural chemical, physical, and biological integrity... [33 USC 1314]
* Effects on hydrologic cycle and storm runoff... [33 USC 1314]
* Accurate assessment and comparison of existing condition to the water quality objectives to be met... [33 USC 1314]

Stream Health

It is clear from the legal elements of CWA that useful Stream Health analysis has to be based on biological integrity and not on just physical or chemical parameters. In addition to degraded habitat (the focus of this presentation), the introduction of non-native species, overharvest, and/or the fragmentation of habitat also play a major role in the loss of biological integrity. Given this complexity, the Stream Health definitions used by the Forest Service have evolved over several years in cooperation with the Environmental Protection Agency (EPA), State water quality agencies, and other federal resource agencies. The final result has two analytic scales: DIVERSITY, as an integration of ecosystem diversity and stability, and PRODUCTIVITY, as a ratio of existing (or expected) productivity compared to the long-term natural productivity.

> Robust Stream Health is defined as: Comparable to the best situations unaltered by humans. All regionally expected species for the habitat and water body size, including the most intolerant forms, are present with a full array of age and sex classes. The trophic structure is balanced. Numbers and biomass of organisms, or productivity, are at least 90% of long-term natural (reference) conditions. This is considered to meet the goal of the Clean Water Act.

The other classes - Adequate, Diminished, Impaired, Precarious, and Catastrophic - represent increasing loss of Stream Health and are based on the condition of a stream compared to its reference condition; that is, compared to Robust Stream Health. A separate brochure entitled "Stream Health - a definition and assessment perspective" provides complete definitions and is available at this conference.

Thalweg-Watershed Link (T-Walk)

The deepest part of the channel is called the "thalweg." The condition of the thalweg results from the interaction of stream physics and channel materials. The interactions are complex and driven by a host of factors including soils, geology, climate, human use, wildlife, topography, hydrology, vegetation, and natural disturbances. All of these can have profound effects on Stream Health factors such as pool depths and substrate. The "Watershed Link" phrase acknowledges the stream's dependence on watershed processes and conditions.

A watershed focus is also essential in order for the Forest Service to meet its reporting obligations to the State for the biennial water quality reports (Section 305b and 319). These reports include problem analyses of current trends, quantification of waterbody health, a risk assessment for particular watersheds and activities, a summary of watershed damage control programs, and a summary of water quality improvement actions.

There are many ways to monitor Stream Health. The tool introduced here is called T-Walk (Thalweg-Watershed Area LinK) and is accepted by the Forest Service as a suitable method for determining Stream Health. However, the concern is not so much with determining Stream Health as it is in preventing the conditions that reduce Stream Health. Since it is generally cheaper to stay out of trouble than to get out of trouble, the primary focus for T-Walk is on **advance warning** of upcoming problems so project activities can be modified before major costs for restoration (and litigation) have been incurred. In that context, T-Walk deals mainly with the physical processes that start with the land and end up in the stream.

T-Walk uses a 700 foot (200 meter) stream reach to characterize both habitat and substrate. Characteristics such as Tarzwell Substrate Ratio (a measure of fish food), thalweg depths, bank stability, bank vegetation, riffle insects, pools, and instream vegetation are all directly interpreted in light of Stream Health.

With emphasis on advance warning and physical processes, not all of the legal elements have been included. For example, T-Walk does not check for compliance to State water quality standards or identify changes in natural temperature or dissolved oxygen patterns. Not does T-Walk directly measure effects within the biological and chemical systems such as organic accumulation and eutrophication.

T-Walk contributes to the overall objectives of water quality management by providing a system of evaluation and formal notification about Stream Health, adverse impacts, cost liability for restoration, proposed remedial action, and follow-up monitoring. Technical perspective is based on ecological integrity, rather than a parameter list, and incorporates influences of stream physics, channel materials, sediment deposition, and storm runoff characteristics.

New President's Message

Larry MacDonnell

This conference focused on what we now know about the extent and condition of Colorado's wetland and riparian areas. In terms of land area they account for a small part of the state. In terms of use they are extremely important.

As an organization, the Colorado Riparian Association is dedicated to maintaining and enhancing these valuable parts of the Colorado landscape. Especially in a state like Colorado with limited rainfall and with water resources that are asked to serve many different purposes, wetland and riparian areas are critical as sources of habitat for an exceptionally large number of plant and animal species. They play an important role in protection of stream water quality. They are important for flood management. They are also highly desirable locations for roads, housing, agriculture, grazing, and recreation.
In many cases these uses are not compatible. All too often, particular uses have eliminated or greatly impaired other valuable and important uses. Sometimes we simply didn't understand what we were doing. Sometimes we didn't think it mattered. We are beginning to know better.

One of our challenges in this state is to take better care of these very special wetland and riparian areas -- to do what we can to make existing human uses respectful of ecological and natural system uses, to restore heavily impacted areas, to protect especially sensitive areas. There are lots of good reasons to do so.

Urban areas have rediscovered the attractiveness of these areas, often turning them into parks or recreational areas. They are recalling that riparian areas are floodplains, potentially valuable as a means of absorbing at least some of the impacts if allowed to receive flood waters.

Those interested in water quality recognize the buffering functions of "the thin green line" -- such trapping of sediments or other water quality-impairing additions to water sources.

Those concerned with ecology focus on the exceptionally important habitat provided by such areas, both for plants and animals.

As the number of people living in Colorado continues to expand, the challenges for assuring that the wetland and riparian areas of the state serve these essential and high valuable functions will increase. The pressure on these limited areas for land development already is extraordinary.

Fortunately, large areas of the state remain in agricultural, ranching, or public land use. Much progress has been made in management of riparian lands involved in these uses in recent years. At the same time, many towns and cities also are paying special attention to riparian and wetland areas -- often investing considerable sums to restore these areas and make them attractive for recreational uses.

Much remains to be done. CRA has been an active advocate for the importance of maintaining healthy, functioning wetland and riparian areas. We have gone through an internal process to consider what, if anything, we as an organization want to add to our efforts to put on conferences such as this one and to produce our newsletter, the green line, quarterly. During this coming year we want to expand this process to include others working on these issues. Towards this end we will be creating an Advisory Group.

I look forward to this opportunity to serve CRA as its president. I plan on being an active president, putting in as much time as I can to move ahead our various objectives. Ultimately, the success of an organization like CRA depends on the commitment and participation of its members. We need to expand our membership. We also need to get more of our members actively involved in our activities. We need to do the things we commit to as well as we possibly can. These are things I intend to work on during the coming year.

Membership Application

The Colorado Riparian Association is a group of landowners, resource managers, organizations and people interested in promoting the awareness of the values and long-term benefits of proper management of Colorado's thin green line-its riparian areas.

Please join us now to help support our efforts to communicate the importance of riparian areas to those who need to know!

Student/Sr Citizen/Low Income	$15.
Individual	$25.
Friend	$35.
Benefactor	$50.
Organization*	$150.
Lifetime (individuals)	$200.
Lifetime (organization) *	$1200.

*Entitles organization to designate seven individuals to receive benefits, newsletter, and with the exception of voting rights and holding office.

Name _____

Address _____

_____

_____

Phone _____

I'd like to help on the following committee(s):

__Nominating __Membership
__Info'n/Educ'n __Program
__Awards __Newsletter

Please mail this form with your check or money order to:

Colorado Riparian Association
2060 Broadway, Suite 230
Boulder, Co. 80302