

# The Bigger Ecological Picture

## Watershed and Forest Land Conservation Planning

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Maybe my little bit of an accent (or little much of an accent) still betrays that I'm actually a Dutchman. I've lived here ten years, ten-and-a-half years, came out here exactly 11 years ago this weekend to check out northern New Mexico and maybe a potential job, although I was more interested in actually going south and working in Guatemala or the Andes. But I ended up in New Mexico with the Forest Trust, in Santa Fe, as a community forester. I worked there for four years and spun off my own business called A Common Ground/Community Landscape Planning. I've worked with several of you who are here. Then since 2000, 2001, I started as executive director of Earth Works in Santa Fe, and I'm going to explain to you what we've been doing with Earth Works for the last five to six years (see Appendix G), because I started as a consultant for a big watershed program south of Santa Fe. My background is in landscape architecture, and I focused on forest ecology, soil and water conservation, and rural development, so I'm kind of an "environmental planner," you could say.

Earth Works Institute--what are we, actually? We're a non-profit environmental organization focusing on education and

adaptive research for conservation of natural resources--in some cases, cultural landscapes as well as recycling of waste streams. This is our recent statement. So an enormous focus for us is really education, developing models of natural systems. Natural systems design helps us live more in tune with our environment.

One of our projects is the Galisteo Watershed Restoration Project. Earth Works Institute started ten years ago and is headed by Leslie Barclay, who is now president of the board. When she came out to New Mexico about 15 years ago, with a ranching background from the East, she bought a ranch in the Galisteo Valley, south of Santa Fe. She soon discovered that the best use of this ranch would be to use the ranch and the chain of open space areas. She had been on the boards of many land trust organizations nationwide, conservation groups, and she saw her dream come to fruition by using this ranch as a learning ground for all the people in the Santa Fe area to know more about land restoration, open space management, and sustainable ranching. The ranch still is an incubation site, you could say, of the Earth Works Institute. We have a series of projects there focusing on

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watershed restoration, septic waste management, and utilizing water for irrigation in areas where we've eradicated salt-cedar tamarisk. We also have managed grazing activities there, permaculture activities, a garden/greenhouse, and alternative building techniques--off-the-grid buildings with solar and wind power.

Besides this ranch, we've gradually spread out around into the Galisteo watershed, because certain problems of erosion and stream-bank degradation on the ranch clearly came from beyond this ranch. It was important to look at a watershed scale to see how this ranch, and the work we were doing at this ranch, was actually impacted by the bigger watershed, or what the mutual relationship was between the ranch and the bigger watershed. Then, beyond the work that we're doing with the watershed, we have technical outreach and community development projects in New Mexico, where we're working at this moment with the Navajo Nation on erosion control, field monitoring and utilization of wood projects built from forest restoration projects where we try to revitalize local economies and build hogans, which is their traditional type of dwelling, ceremonial or practical.

So Earth Works' focus today is on the Galisteo watershed as an example of forest- and watershed-based planning. This context of land conservation

and natural--resources conservation might explain how watershed planning could support open space planning and conservation easements and vice-versa. We could have chosen many goals for restoration of land. We talked to a lot of people, all with different opinions about what the landscape should look like. What do you restore it to? Often, you cannot go back in history. What does restoration really mean?

Well, restoration is a broad term. Scientifically, it means something very specific, and I won't go into that now, but a lot of people have some idea of this so we kept the word restoration. Actually, what we're doing is rehabilitating landscape processes--like how water flows, how it infiltrates in the land, how biological activity in the soil can be regenerated--and sponsor the land, or foster new plant growth. We're really focusing on the processes. But that is so scientific that we couldn't actually get a lot of people behind that. We had to find a goal that related more to people, so we found a goal that everyone agreed on--to establish a working landscape. We don't want to lock it up. We don't want to make it a preserve or wilderness area. This working landscape should reflect people's sense of stewardship and caring for the land. Really, we want to see not just the restoration of the land itself, but the restoration of people's land ethic. We thought that if we

could see how the land ethic is being reflected by people changing their behavior toward the land--by having conservation easements, by doing restoration work, by rerouting their driveway, by catching their water from their roofs, by planting trees, by protecting wildlife, by recycling their trash, or whatever--then we have signs that we can measure. Then we can go back to the grantees or government organizations that fund us and say, "We can track how many people, or how many acres, are gradually being restored." And it's important, for funding purposes, but also for motivating people. Because over time, we can start mapping--with conservation easements, open space areas or wilderness corridors--where these areas are. Our people are gradually getting it, that it's not too late to do something in this landscape to preserve certain values, whether they are visual values, ecological values or functional values, like water infiltration, etc.

That led to developing a series of strategies over time. And it also related to this goal of having a working landscape. Over time, we realized that grant funds alone could not, in the long process, support the landscapes that we were rehabilitating or protecting. We had to generate, gradually, mechanisms that would pay for themselves. For instance, showing people that by infiltrating water into their land or by repairing

the soil, that they would need to invest less in erosion control, or in planting more trees or grasses or redoing their well in 20 years.

Other economic incentives of a working landscape might be that we could use grazing, like we're doing experimentally, to create open space areas or backyards where we have too many weeds or fire-prone vegetation. With that, we can maybe prolong the life of the working landscape because of certain ranchers or operations that make money in the watershed and thus tie in conservation with economic activities in the watershed.

The second element of this is really people sense, meaning you can educate people, and you can develop models that inspire people. And then, you see that reflected in these strategy components, because most of those have something to do with education or transfer of knowledge, of changing people's way of thinking or their behavior. It's, as I call it, the CCDEE approach. It's a Collaboration, a partnership, of Community organizations, Demonstration restoration projects, education and outreach, Economic incentives (to mention just a few), and then, eventually, open space acquisition and conservation Easements, legal designation and regulatory protection.

All the watershed projects nationwide are focusing on the latter two also, but those are the

more complex ones, and it's often important to start with the ones that I listed at the top.

You probably know what a watershed is. It's basically a drainage basin of surface water. It can be as small as a little arroyo, or it can be an entire valle, in which different arroyos, different canyons, are nestled into each other. Basically, everyone lives in a watershed, whether it's a small drainage off your property or the bigger valley behind your house. Or from there the river, canyon or valley that you're in, and from there, eventually of course, the watershed of the Rio Grande. Technically, it's an area where snowmelt and storm-water runoff collect in one drainage or river and from there empty into a bigger one like the Rio Grande or a lake.

Consider the Galisteo watershed. It is about 730 square miles, or 460,000 acres. It's a third of Santa Fe County and the western part of Sandoval County. The eastern part is San Miguel County. The entire Galisteo Creek, from Los Alamos, goes down to the Galisteo then west to Santa Domingo Pueblo. It's about 45 to 50 miles long. Elevations range from about 10,000 feet in the Sangre de Cristo Mountains to 5,000 ft. in Santa Domingo Pueblo, so you have roughly an idea of the topography of this landscape. There are a few hills--all of them are volcanic ridges that developed in the last couple of million years. They

are striking features, but they also do a lot to this landscape in that the hydrologists will look at which way the water is going and coming from, and it's created certain very interesting features like alluvial fans growing out of the Galisteo watershed. Those are basically fan-shaped areas where a lot of sediment has deposited in the last 10,000 years, and actually where water can very well infiltrate, and it's in those locations that you see the pueblos and the more contemporary villages. We've just learned that even villages like Madrid have to do with water--it's built on an alluvial fan. Also, these villages--Galisteo, Cañoncito--all have small alluvial fans, which made it possible for people to settle there.

There were about eight or nine major pueblos in the Galisteo valley. In the total area including the La Cienega area outside the valley, there must have been about 12 or 13 pueblos in the 1200s to 1300s. Thousands and thousands of people, and we are just at the beginning of discovering how important it is. Some archaeologists say that the Galisteo valley can be compared with the Chama basin.

Why use watershed-based planning is one of the questions Ernie wanted me address. It's important to realize that actually, watersheds are actually self-contained ecological units. Everything that we experience, or many of the things that we're experiencing on the land, has

something to do with containment in the watershed, in the valley. Things like runoff, infiltration, water storage in the soil or in the sediment, sedimentation itself, plant dispersal and also wildlife habitat are often contained within a watershed, within one basin. It means that if we do something like mining, forestry, construction, road building or grazing, that it most often has a direct and immediate effect on the ecology. And all of these processes that are happening at a watershed scale, they can go up and down. I'll show you a few examples. It's not just that if you do something higher up in your watershed that the effects are felt downstream, it's also the other way around. Also, if you build something down in the watershed, what you're doing there might affect people and land and creatures upstream, uphill.

Therefore, land conservation and rehabilitation responsibilities often fall within watershed boundaries. Once we start thinking watershed, we can organize ourselves based on watersheds. In this country, we're not used to doing that. But I'm from a country where, since the development in the 1300s, people have organized themselves based on watersheds, partly because it was a certifiable strategy since 50 percent of the land was partly underwater. Development was organized in around the threat of major floods, so it was really important to know exactly

where the water would come up from the sea or river--where you would get flooding but also where, in dry years, you wouldn't have enough water. So, very early, they started building dykes, dams and islands, connecting them over time--not just in the Netherlands but also in northern Germany and Scandinavia. Eventually, the entire coastal landscape, as large as from Maine to New York City has been developed, where an area about 50 to 100 miles inland is completely contained and organized on a watershed basis. That's just the Netherlands. Germany has similar processes. A rather new country, New Zealand, is completely planning its landscape on a watershed basis.

There are a lot of benefits to community-based planning on a watershed basis. Actually, tomorrow, and as a primer, we have convinced Santa Fe County Planning to work with us and the Santa Fe Conservation Trust, the organization of Ernie's colleagues in Santa Fe, to think through the process of what it would be to do community-based planning on a watershed scale. If I would come back two weeks from now, I could report on where we are with that. So tomorrow something really exciting is happening in Santa Fe. We're looking at taking that watershed as a model for planning--both urban and open-space planning in Santa Fe County.

Watershed health, as I just

mentioned, has upstream and downstream consequences. If water runs down and erodes the channel, it can erode over a little edge. Then that edge, the depth of that edge, gradually travels up the creek, so the creek moving from below to the top is getting deeper and deeper. The water and soils are leaching down, or are flowing down, into the soils, over the soils and into the creek more rapidly. We begin to notice the destruction of soil strata, basically the disintegration of soils--clay soils are especially susceptible to that--and eventually lead to desertification.

Other problems are flooding. Flooding happens if there's a barrier in a landscape and then the flood basically starts there and moves up. It's not that the flood spreads from that point. Weed dispersal is another thing. Dispersal of seeds by birds and other activities can move up in the valley rather than down. Downstream effects of course are erosion. Heavy water flow over terrain also spreads downward over the landscape. Sedimentation of course--any dirt that's picked up by storm runoff--picks up dirt and deposits it somewhere else down slope. Sedimentation can be a problem if banks of sediment are created in washes where the normal flow of the creek is hampered and has to go around. What happens is that it starts gnawing and undercutting these banks, and the banks collapse, not only when it flows in

the summer but also now, with frost-heave. You can often see around this time--February, March, April--a lot of banks collapsing. Frost-heave alone causes the banks to loosen and collapse.

Water pollution, of course, is something that happens mostly from the top to the bottom. Weed dispersal can happen downstream, as well, if it's weeds or seeds that are dispersed downstream by water. In Hawaii, they understand the principles very well. Land ownership and land management strategies were almost synonymous to each other, and a three-tiered land ownership/land management strategy was in place under the monarchy that existed until the late 1800s. It was the concept of *ahupua'a*, a feudal land-tenure term meaning "from the mountain to the sea." People were given a strip of land that included both mountain and beach, and they were expected to protect its ecological diversity. Nowadays, if you go to Hawaii, you can see why that is so important, because the sea is red from the sediment and from the volcanic materials and soils that are washing down. The *ahupua'a* concept is no longer being followed there. Management is being split up from the top of the mountain to the ocean by any number of landowners. It's very important to consider how essential it is to manage a stream from the top of the watershed to the bottom--to

relate the different factors and processes within that landscape to each other--and really create watershed health.

There are several approaches to watershed planning methodologies. We are following a very well-established one in the Galisteo watershed. You generally start with identifying what the main problem is--for instance, loss of soil or loss of water-infiltration capacity, or maybe the absence of a land-stewardship ethic. From there, you go down to a list of issues like goals, establishing what you really want to do--educate people, fix the land, whatever. Drainage basin inventories can be as all-encompassing as the entire Galisteo watershed. You can then focus on specific watersheds within that basin--detailed studies for areas that are particularly important to work on. Watershed concepts include looking at your options, the goals for an area, a watershed plan, issues of education, specific farm or site conservation plans that might include conservation easements, implementation of on-the-ground practices and, of course, administration and monitoring. Actually, administration and monitoring should not be at the tail-end. Often such functions should take place all at one time, up front, and it's a cyclical process. If you do it well, then your data-gathering for baseline in monitoring is actually tied into the entire process of goal establishment to detailed stud-

ies. It saves a lot of money to do it that way.

The EPA, which is one of the largest funders of watershed-restoration projects in this country has developed a program called the Watershed Restoration Action Strategy, which requires that all projects that are funded through the EPA (that's the U.S. Environmental Protection Agency), must write a document that addresses this strategy. In New Mexico, the program is managed through the state environmental department called Surface Water Quality Bureau. We have such a grant, and we have invested nearly half a million dollars with our state watershed funds. This brass document summarizes a little more of what really goes into community-based watershed planning. They place public outreach and education up front. Next comes problem identification--based maybe on outreach and education, action planning, monitoring, finance.

How can these strategies be used to effectively work in watersheds and tie in to land conservation? I mentioned them briefly before--collaboration and partnership. Before you start thinking about conservation easements beyond your property and trying to work with neighbors or a small valley or even with the Land Trust here, it's very important to think about collaborating with others. Other land owners--whether public or private--are often

involved in land conservation. You might be able to do something on your property and the neighbor's property, but once you realize that the landscape is bigger--like Leslie Barclay did ten years ago with Earth Works--you realize that it is important to start looking at the bigger drainage area. And then you realize that it's necessary to deal with many different entities and stakeholders, even if they don't own land. People can be interested in the area for a variety of reasons--some may want to use the area for birding, others may wish to do off-road ATV driving, and still others may have prospects for mining or urban development there. So it is important to start figuring out who the potential supporters are and who can help you bring your idea to reality. Then you can strategically start to collaborate and form certain partnerships that make your deal a strong one for the future.

Related to that is the second point of community organization. There are many people who are not organized, who you cannot reach directly through collaborations. Therefore, you must figure out how you can reach them in a different way--maybe through school projects or by visiting residents in a community location where they normally come together. Maybe they have recreation areas where they hang out, or maybe they have water-association or road-association meetings where you can go visit. Try to

get them involved and see what their stake might be in what you want to achieve with your group.

From there, you might try small demonstration restoration projects, because there's nothing as powerful as showing people on the ground what can be done. You could consider in-stream restoration techniques using induced meandering, planned grazing or restorative grazing techniques. Grazing can be a great demonstration if it is managed. That means, if you also remove the animals and give the land a deliberate period of rest. Better even if you herd your animals from site to site, concentrating them for very short-duration, high-intensity grazing cycles, and then keep them off each site for at least a year, never grazing there again within the same season.

Those are just some techniques. There are many others that are really nature-based--based on natural processes or natural materials--that are relatively cheap and replicable for anyone who is interested in that.

**Education and outreach.** Bringing people to the site to even identify what the problem is and to talk about it in the field. "Do you see the same thing as I see? How do you look upon it?" Because everyone's values are different. The color may be the same, but people evaluate how it affects them or affects the land or affects them in the future in different

ways. From there, you can start to understand how different people look upon the landscape, and how they value it, and that feeds back into how you can better organize your community and collaborate with each other and make each other understood across boundaries of different interest groups or agencies. Then over time, you also have to monitor what you're doing. I think that in itself is an education tool. Then you can organize specific workshops--train each other in these techniques.

**Economic incentives.** We often don't do enough about them. Fortunately, land trust organizations can work. And laws have changed in the last year to increase incentive to combine, for instance, conservation easements and open-space management with restoration practices.

**Land acquisition and management.** Private initiatives, such as conservation easements or restoration work, can be matched by government agencies. The state, the BLM or counties can pass bonds or specific regulations that acquire land for open space, or conservation of archaeological sites for instance, or water infiltration zones. It's very important to find out how they fit into the network.

**Finance.** Once people have invested a lot in the landscape, it's important to have regulatory protection and enforcement. That's a problem here in New

Mexico, because we don't have enough of that. We make a lot of good laws, but we need rigorous enforcement to make sure that we all do what's good for the land and for the land of our children.

I will run very quickly through these objectives. Basically what we tried to accomplish with the Galisteo watershed was to create model sites, create replications of these techniques, provide a place for continuous learning for schools and landowners, and establish a watershed association. We're almost there.

Finally, of course, find compliance. Restoration techniques address issues of flash-floods, stream erosion, water pollution--with mostly sediment, dirt and accumulation of sediment banks--and a need for vegetation management. Either there was too much dead vegetation, too many weeds, or there was no vegetation at all.

So let's look at some demonstration sites. Cañoncito, the northern part of the watershed, is in the piñon-juniper zone, just down from the ponderosa pine belt. We have problems with erosion up on the piñon-juniper hills. We used induced meandering for creek restoration, because the creek had gradually incised--cut in to the landscape--and we wanted to stabilize the stream banks so that roads and homes wouldn't fall into the creek. The problem was that the railroad that crosses there was smack in the mid-

dle of the creek bed, with the result that the creek could no longer flood after snowmelt or summer storms. That led to the point that the creek started just grinding down into the landscape. Just upstream a mile or two, there are areas where the creek has cut in as deep as 50 feet into the landscape. At this point now, we've repaired over half a mile of stream in this part of Galisteo Creek.

About 12 years ago, the creek gently moved left and right in its bed. And then as of 1997, it started cutting into the landscape deeper and deeper, narrower and narrower. It was also partly caused by gullies to the side, mostly driveways and areas that were cleared for homes, or for horse meadows in the hills. We repaired them in this way, by using local rock and field rock. We used one dump truck filled with imported rocks to make little cascades and catch all that water from those gullies and driveways, to make swales to infiltrate, so it wouldn't run across the road and into Galisteo Creek. We thinned the piñon and juniper woodlands to create more grass cover, and we achieved all that by just channeling the water, thinning out the piñon and juniper, mulching the land.

The creek was beautiful, but it was not healthy. The beam was put across to make sure that ATV drivers wouldn't go up and down the creek. We put these things in--little dams, only a foot, foot-and-a-half

high. And we used things called baffles--they're triangular areas, no bigger than four of these tables here--where water would be slowed down if it hits these pylons and would, of course, move to the area where it's not obstructed. In doing that, the creek is being nudged left and right--it starts to meander. If it meanders, it slows down; if it slows down, it drops sediment, and after a year or after one season, you couldn't see these things anymore. They were covered, and the creek bed had come up a foot.

So we're restoring and adding to this all the time. With that, then the water can seep into the banks. You can see from one season to the next, our banks can hold more water and support more vegetation. The creek is more concentrated and flows in a way that's more controlled over the landscape, reinvigorating the bosque.

In an area 20 miles south, in the center of the Galisteo watershed, a huge alluvial fan was built. That's why, in 1600, it was already a sheep-shearer's area. And in the 1840s, at 25 miles from Santa Fe, it was the nearest horse-grazing area for Fort Marcy in Santa Fe. It was the closest area to water 100 horses or more. We need to reshape the gullies, because the creek had cut into this landscape 25 feet or more. There was a lot of runoff on kind of perched meadows. We needed to stabilize slopes and do some head-cut control. What we did

not do, of course, is the general, standard contractor's approach, which is just to shape everything up. The problem then is that you never know where the water is going. So we wanted to maintain the undulating shapes of the landscape, which also helps concentrate water flow from the meadows down to the creek. Then you can concentrate your erosion-control areas in those valleys where the water will go down, and it's a lot cheaper, and it looks much better (see Appendix G).

