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FOUR DECADES OF UNDERSTANDING WATERSHED DEGRADATION AND OUR REHABILITATION OF THE CARRIZO VALLEY RANCH

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Today I will begin with a few comments that may be in conflict with what some of you think. I have a philosophy about watershed rehabilitation that I want to share with you. I will also show you some slides of our rehabilitation work done on the Carrizo Valley Ranch.

Most of us in New Mexico have recently realized that our most important natural resource in New Mexico is water. We can no longer afford to allow the deplorable conditions of our watersheds to continue. This entire state is a watershed. The subtle invasion by water hungry plants, especially at higher elevations where we get the most precipitation, is robbing our aquifers, streams, and rivers of that life giving resource. Mesquite, sagebrush, piñon, juniper, ponderosa, and other invaders of our grasslands and mountain meadows are using up to half of our annual

precipitation. Not only are our watersheds only partially productive, but erosion caused by an overpopulation of these water hungry plants has polluted most of our streams in New Mexico with silt.

Until recently, our focus has been on water planning, water transfer, water conservation, water adjudication, and water banking rather than water production. If our watersheds continue to deteriorate, water production will decline while demand continues to accelerate. There is an example in Lincoln County, where I live. Our population has increased 59 percent in the last ten years. The wells are drying up simply because there are too many straws in the glass and our watersheds continue to see a buildup of a large number of small trees that are using the water that should be going to the aquifers. Another example of the vegetative change and its effect on watersheds is the Pecos River. The flow of the Pecos River has decreased 30

percent since 1937. The decrease in water flow in the Pecos River is now 1.2 percent a year.

Watershed deterioration began over 100 years ago with the influx of excessive numbers of livestock into the Southwest as well as homestead requirements that worked east of the Mississippi but were ridiculous here in the West. The cycle of fires that controlled tree and brush populations was interrupted because of the lack of fuel. The early part of the 20th century saw the beginning of fire suppression that became increasingly efficient. Most of the potentially beneficial fires were suppressed before they could perform their thinning function. As a result, the western United States is living with very dangerous and unhealthy forests that are subject to disastrous wildfire. Water that should be going into our aquifers is being used to grow ladder fuels and other small trees that cause these conditions.

So how do we rehabilitate our watersheds so they function properly again? First we must know their pre-settlement or climax condition and use that as a guide. We may never achieve that climax condition but at least we can move in that direction. Journals kept by the first explorers in the Southwest referred to open forest, savannas, and grasslands. These, of course, were maintained by frequent, low intensity fires. We must bring back the predator that controlled tree and shrub populations by using prescribed fire where it is safe, and perform the necessary thinning required to have a healthy watershed. Unfortunately, the explosion of home building in fire prone areas has made it very difficult, if not impossible, to conduct even a fuel reduction prescribed burn.

In areas where prescribed fires cannot be used, such as in piñon/juniper thickets that will not burn anyway, we are using mechanical thinning methods. I have found that the soil disturbance caused by mechanical treatment is exactly what is needed. And if reseeded using native species immediately follows dosing and piling of piñon/juniper, a productive watershed replaces a biological desert in two years. Of course, it has to rain to accomplish this.

Thinning ponderosa mechanically can best be done by sawing the tree close to the ground, removing the usable logs and burning a year or two later; however, we must solve the problem of marketing the small diameter trees. We got the 'cart before the horse'. Currently, money is provided for different organizations, Forest Service included, to do the thinning, but we haven't developed a market for the

small diameter trees. We've got to develop that before that sort of thinning process becomes economically viable.

Historically, fire swept through our southwestern grasslands, savannas, and open woodlands about every seven to ten years. If you have any questions about that, the University of Arizona has a research center that provided us with the information. Lightning caused fires usually occur in the spring or early summer after a dry winter and spring, and control the tree and shrub populations. Piñon and juniper seeds are spread across our grasslands mostly by birds, coyotes, domestic livestock, and wildlife. Consequently, seedlings are becoming established at an alarming rate where no trees grew before. Selective herbicides are available and are efficient and economical if used while seedlings are young.

Riparian areas comprise less than two percent of our southwestern ranges and forestlands and if continuously grazed by livestock or game, especially during the growing season, riparian vegetation may disappear. However, if the watersheds above continue to support an increasing population of trees and shrubs, the risk of losing riparian vegetation and other benefits becomes very real during dry years. Watersheds and riparian rehabilitation must go hand in hand. Most of our watersheds in the Southwest need immediate attention. To achieve a functioning and sustainable watershed, we must get involved as individuals through county, state, and federal processes. We may be required to subsidize some rehabilitation processes such as the disposal of small diameter trees, but the need will only become greater if we continue to postpone addressing the deplorable conditions of southwestern watersheds.

We have overlooked our most productive watersheds, those in the higher elevations of New Mexico where we get the most precipitation. The problem with these watersheds is that they are under federal management and that management, up until just recently, has been basically custodial. Thus, we have a problem with the state's water being used by the federal land management agency to grow ladder fuels. That's pretty simple and needs to be corrected. For instance, prescribed burning in my area is talked about a lot, but very little of it is done. Now I would like to share with you what I have learned about watersheds in the piñon/juniper and ponderosa ecosystem.

You will see a better exhibit than I have of the invasion of water hungry plants in our rangelands and

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forest when Hollis Fuchs speaks to you later in the conference. Figure 1 is an example. It shows Fort Stanton, which is east of Capitan and established in 1855. Figure 2 shows Fort Stanton as it is today. It is almost covered by piñon/juniper. Interestingly, you can see the Fort in the picture that was taken in 1880 when it had been in existence for 25 years. They probably kept the horses right around the fort and you can already see the young trees establishing themselves because the horses probably kept the grass too short to burn or fires were put out easily.



Figure 1. Fort Stanton - 1880.



Figure 2. Fort Stanton - Today

Another example that Hollis will show you is Nogal Mesa (figures 3 and 4). Our ranch is just to the right of the four step Carrizo Mountain, which is northeast of Carrizozo. You can see what is happening to the aquifers. They are probably not getting recharged at all in that area. Figures 5, 6, and 7 refer to what I talked about concerning the spread of seed by birds, coyotes, domestic livestock, and wildlife. Figure 5 was taken a little south and west of Santa Fe.

You can see one-seeded juniper, and Figure 6 shows alligator juniper. Figure 7 shows alligator juniper in the Lincoln County area. The meadow at the bottom of the photo is the one I rode over 30 years ago. There wasn't a tree in that meadow at that time and now, because we have had some wet years in the 80s and there has been no fire there, within 25 years there will be a solid canopy of alligator juniper.



Figure 3. Nogal Mesa - Circa 1900



Figure 4. Nogal Mesa - Today



Figure 5. One-seed juniper.



Figure 6. Alligator Juniper.



Figure 8. Juniper roots.



Figure 7. Alligator Juniper.



Figure 9. Piñon/juniper roots affect herbaceous growth 40 feet from their trunk.

Figure 8 is an example of a juniper root system. I have done a lot of research on root systems. You can see from Figure 9 how the root system affects the growth of anything 40 feet from the trunk. This area is on Mr. Tinsley's forest permit. The piñon/juniper roots take all the nutrients and water from the herbaceous species that grow there and end up either completely eliminated or the sheet erosion that occurs around them leaves them on a pedestal, totally unproductive, and they don't protect the soil at all. We can sum up by saying that a solid canopy of piñon/juniper will cause tremendous erosion. Sheet erosion leads to gully erosion, and of course, you know what this does to downstream ponds or downstream flow.

Subdivisions in our area are making things very difficult for prescribed burning. Considering the square footage that is roofed over and paved over, you get a much faster runoff that requires more grass or herbaceous growth below to hold the soil. Add to this the fact is that it is impossible to do any controlled burning in those areas. We are trying to interest people

in conservation easements to try to protect some of the open space in Lincoln County before it becomes completely impossible to burn and a deteriorated watershed continues to worsen. We all know why our water production is decreasing—it is because we are getting almost a solid cover of piñon/juniper and ponderosa, at least in my ecosystem. We can also see mesquite and shinnery on the east side and sagebrush on the west side of the divide, both doing the same thing.

Where are we going to end up? I have mentioned the 30 percent decrease in water flow in the Pecos River. Another interesting research fact is that 100 six-inch diameter juniper trees per acre will use 9 inches of precipitation a year. That is probably one-half to two-thirds of our annual precipitation. Woody species are much less efficient in water use, when considering production of biomass. Rooting depth is also quite interesting. A lot of research was done on this at Los Alamos. While digging a trench to bury some radioactive material, they decided to do a study on roots. Figure 8 shows the depths they found for juniper roots.

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They found the average root depth for Ponderosa pine to be 15 feet, 21 feet for piñon, and 80 feet for one-seeded juniper. I don't know how they dug a 200-foot ditch without it caving in, but you can see the depth and how they get the water that normally percolates into the aquifer.

What has caused this? When this country was settled, the first livestock were introduced by the Spaniards who settled mostly in the Rio Puerco area and along the Rio Grande. Later, the big movement of livestock into New Mexico came from Texas and Oklahoma where the precipitation was much greater. These folks brought livestock in the kinds of numbers they were used to running, like 10 acres to the cow. The damage started with those excessive numbers. They also didn't realize the value of rotational grazing. They left the animals on the land year round. The worst problem was the land claiming procedures in those days. If you had the water, and you could control that water, then you were in command. But if you did not graze off the land around water for several miles, someone else would come in and claim the water saying that you were not using it. Consequently, the sheepmen and cattlemen who came into this country back in those days were really their own worst enemies because they had to be. Their priorities were their scalp, of course, their families, schools, homes, livestock and their property lines. Those things came ahead of their concern for the land. The land was there to use and graze and that is what they did.

Fire suppression began in earnest about 1910 and the story is very interesting. In 1910 we had about three million acres burn in the Northwest. In a very short period of time, the fire killed 80 or so firefighters and it was a pretty good wake-up call for what could happen. It was a dry year, the conditions were perfect, and it was a natural fire. The tragedy forced people to figure out a way to stop those fires. The knowledge brought to this country came from Europe where there was a no-fire policy. During WWII, many people were worried about the Japanese setting our western forests on fire with balloons and flares, and they did that on a small scale. After the war, we had a lot of airplanes available and they increased the efficiency of fire suppression.

Basically, in my opinion, what happens today is that fires that start on the kind of day that allows them to burn without getting away, can be put out and are being put out. The fires that cannot be controlled are the fires that start when the humidity is low, around 10

percent, wind is 60 mph, and it is 70 degrees. That is what happened in Cerro Grande and the fires in Lincoln County. Until we correct our overgrown forests, these fires will continue to occur. I think the participants who went on the Cerro Grande tour were told how much money it will cost to rehabilitate the area. It is a lot cheaper to prevent an uncontrolled fire with the right kind of prescribed burn than to rehabilitate an area after the fire has occurred.

Smokey Bear was found very close to where I live and I don't talk very complementarily of Smokey, which is not very popular in Capitan where the Smokey Bear Museum is and where Smokey is buried. Smokey has a purpose to teach children to be careful with fire. But concentrating only on fire suppression and not on using fire management has been a mistake and now the U.S. Forest Service realizes that.

Figure 10 shows how the country I live in looked in the 1950s. Years of too many animals and drought resulted in a monoculture of blue grama, broom weed, cholla, and piñon/juniper. With a little help from Mother Nature, and a little help from us by controlling the water hungry plants that have caused a lot of the problems, we have the sort of situation depicted in Fig.11. Of course, you can get any country to look good after a good year, but most of my property had a solid canopy of piñon/juniper and now we have a very productive watershed.



Figure 10. Results of year-round grazing - 1950s.



Figure 11. Results of rotational grazing and vegetation management.

We must familiarize ourselves with our pre-settlement conditions in order to bring back those conditions. We must use prescribed fire, mechanical, or chemical treatments. We must market the off-take. We must find a way to pay for this. I paid for my watershed rehabilitation with the sale of fire-wood, posts, and vigas from the ponderosa. The management that follows watershed rehabilitation is tremendously important. It must be a holistic approach to livestock, wildlife, aesthetics and recreation. Rotational grazing is what I feel is the most important part of grazing management. We use mechanical, chemical, hand treatments, and prescribed fire to obtain a productive watershed. I have spent many hours on dozers. I believe in piling and burning piñon/juniper. If you do not burn it, the birds land on the dead limbs and spread the seeds. Once the dozer work is complete, you need to get in there immediately with some seed and the wind will cover the seed. You don't need any special equipment, I do it all by hand. If you get a little rain then you get the sort of response shown in Figure 12. I do a lot of this in those solid canopy areas where I have created a kind of cul-de-sac for wildlife. I burn the dead trees to kill the green trees; I can usually get four to five green trees with every dead one if I plan it right. The results are not very attractive, but notice the difference in the soil condition in the picture in Figure 12. We are not losing soil now. We have a solid turf. We do not have tree roots down deep that are sucking out water that should be going into the aquifers. Back in the 50s and 60s, we did a lot of anchor chaining to speed up the control of piñon/juniper. But we didn't know what we were doing and we did it all wrong. The piñon/juniper problem is increasing. Some people say that 60 million acres exist in the West and 20 million acres in New Mexico. We get thickets with a solid canopy where no grass can grow and the watershed deteriorates. In my opinion, we need to come up with a method to deal with the piñon/juniper problem so that we can move faster in our watershed rehabilitation. Currently, the expansion of piñon/

juniper in that particular ecosystem is faster than the control method.

We did an experiment with a chain in the Lincoln National Forest above my place. You can see what is happening on Figure 13. You get immediate results from water storage and water infiltration. On this particular project, we chained it once, put in a little seed where we could get around, just to carry a fire later. We got an immediate response. It was necessary to chain the other way to make sure the kill was good and it was chained with an "edge" in mind for wildlife. This chaining was done in the spring. The following spring we did the burning. Figure 14 shows the way it looked after the burning. The Forest Service went into shock over this because it did look a little tough, but they went right back in there and threw out the grass seed. Figure 15 shows the area two years after the initial chaining. As I said before, we went from a biological disaster to a productive watershed in two years. We were lucky to get some rain that gave us this response.

Figure 12. Prescribed fire - piñon/juniper thicket after fire. Dozer push against live trees followed by fire and reseeded.



Figure 13. Mechanical chaining; water storage; infiltration.



Figure 14. Prescribed fire; post burn.

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Figure 15. Prescribed fire; final results. Two years following chaining and burning.

You can see the tree line in Fig. 14. All the water that fell was absorbed by the trees or ran off into the gullies. One of the things people don't realize is that when snow falls in that solid canopy, much of it evaporates before it even hits the ground. Many storms in this country are followed by a dry wind, and humidity is so low that the snow evaporates. I have seen snow-drifts where you would think the snow would melt into the ground below, but the wind would dry it out so much that there was hardly any moisture left.

Another thing you should realize, and I didn't until just a few years ago, is why fire is a friend to grass and an enemy to brush or trees. Fire is friendly to grass because when grass grows, it grows from a crown at the surface or beneath the ground surface. Heat travels up so the fire burns over the grasslands and the grass is not damaged. Trees on the other hand grow at the ends of their limbs. Their buds are at the ends of the limbs, so when the fire hits the tree, it kills the tree. In the case of alligator juniper, it has a sprout zone below the ground so it really doesn't react the same way. It will come back after the fire unless it is really stressed.

Figure 16 shows a tree that was pulled in 1957 and this photograph was taken three or four years ago. You can see even the smallest limbs are still there. Junipers do not decompose. The birds come and land on the dead tree and drop the seeds. And then, of course, that is a perfect seedbed for that plant to come up. The next Figure (17) shows the same plant after I put a little herbicide on it. I think there were eleven one-seeded junipers under that old dead bush. You can see from Figure 18 how the birds have come from a one-seeded juniper area and have flown over this open land and dropped those seeds. If you will look along the fence line beside the highway, or under a power line you will

see lines of these one-seeded junipers where the birds have stopped and landed on the fence or power line or flown across a meadow. The problem is that as we get more junipers, we get more birds, and if we get more birds, then we get more junipers. The thing you have to remember in watershed rehabilitation is that it is an ongoing process. You cannot clean it up once and then leave it. It will come right back.



Figure 16. Pre-herbicide; birds perch on dead juniper and drop seeds.



Figure 17. Post-herbicide.



Figure 18. Post-herbicide; birds fly across open ground and deposit seeds.

Hand grubbing is about the only way I can get rid of the ponderosa seedlings to keep an open woodland. I use a Pulaski to get the smaller ones. I use tree pruners or a light chainsaw to get the larger ones. We do our burning at night in the ponderosa. It's not as affective but it's also not as dangerous. We are very careful. It won't kill all the trees, but it will at least thin them out. Figure 19 shows what we try to obtain after a couple of burns. It has not been reseeded. The seeds were already there. That used to be an open grassland or savanna. You can tell all the trees are young trees. They have come up since settlement.



Figure 19. Prescribed fire; ponderosa pine. One year after ponderosa pine night burn.

Figure 20 illustrates the kind of data the tree ring data research center puts out. It indicates that this tree came up around 1650 and died in 1978 or 1979. There are no fire scars on that tree, from 1900-1979. That backs up statements that I made about fuel not being present and that fire suppression had occurred. The data offer concrete evidence that we had low intensity fires every seven to ten years in the Southwest. We have not had fires in most of our woodlands and most of the piñon/juniper areas in the last 120-130 years. You can see why we have disastrous fires once they get started. If the weather is right, there is no stopping them.



Figure 20. Tree ring data; western forests burned about every ten years.

Figure 21 shows a fire that occurred just above my place in 1994. It started with lightning in the ponderosa. The interesting thing about it was that it burned down through the canyons populated with ponderosa. I learned the only way to burn piñon/juniper thickets is to preheat them. This happened. As long as that fire was moving up hill, with the wind, piñon/juniper burned. As soon as it topped out and started down the other side, it burned out. I guess the lesson is that piñon-juniper eco-systems must have a little help to get them to burn when they become a solid canopy with no understory at all.



Figure 21. Wildland fire; Patos Mountain Fire - July 1994.

Figure 22 shows a transition zone right above my fence between the ponderosa and the piñon/juniper. The fire was hot enough to bake the soil and it killed everything. I think they call that a stand replacement fire. We have a few sprouts from the alligator, but otherwise everything is gone. They flew in there and seeded the area and it is absolutely beautiful now. It does need another fire to get rid of that dead and downed timber. Although that would help a lot, it is probably not going to happen. Figure 23 shows an area over by Ruidoso after the Cree fire. Those pines are less than 120-130 years old. The area was more or less an open woodland or probably a ponderosa savanna. The area was seeded and it responded.



Figure. 22. Wildland fire; stand replacement fire; Patos Mountain.

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Figure 23. Post-treatment or follow-up.

One of the last things to consider in watershed rehabilitation and maintenance is the effect of off-road vehicles. In my area, we have a tremendous problem with four-wheeled drive vehicles, especially during hunting season. If it happens to snow and melt or rain during hunting season, and if the Forest Service does not have enough people to enforce the regulations, people will go where they want to go. We have a lot of interest in road hunting. Figure 24 is a picture taken in Nevada on BLM land that allows dirt bike races. The thing that worries me is that I read the other day that we are selling 1,500 SUVs a day in this country. In Santa Fe, there are almost as many SUVs here as there are in Ruidoso. People who own SUVs are going to try them out. We must have some sort of limitation on where these people can go in their SUVs. We need some recreation areas of course, but we must keep the SUVs from going wherever they want because the damage from those vehicles is permanent.



Figure 24. The New West - recreation and tourism; ORV explosion on public lands across the West.

Some of our marketing methods include selling vigas and firewood to the Texans or Californians who move to Ruidoso. That allows us to pay for the rehabilitation work we do. We used to sell a lot of fence posts also, but most use steel posts now.

Grazing is so important in watershed rehabilitation. I ran into Alan Savory in Rhodesia back in the 60s. Although Alan and I have had some disagreements, I think Alan has done more for land management than any other person in history because he has made us think about what we are doing and realize that we must manage our watersheds properly. I have tried short-duration grazing. It is such a wonderful way to handle the livestock. I am not a follower of some of Alan's original methods using the wagon wheel. I simply fenced my place off into different pastures according to topography and water. I have seven paddocks that I rotate during the summer. Each paddock gets six weeks rest, normally. If the growing season is more active, in other words if we get continuous rain and I get good growth, I'll rotate the cattle a little faster, but basically, we follow one week in the paddock with six weeks rest.

The type of animal you put on the land should suit the climate. We never tried the cape buffalo; I guess we decided they would be hard to work in the chute. We settled with the Alpine Black cattle on the Carrizo Valley Ranch. They are three-fourths Angus, one-fourth brown Swiss. The cattle are black, absorb the heat during the wintertime, don't have udder problems, don't have eye problems, and are highly marketable.

An ancient Chinese philosopher, Yu Chin, had all this figured out in 1600 BC so we are not breaking new ground. He said, "To preserve your rivers, protect your mountains."

To give you an example of watershed rehabilitation, look at a picture I took back in the 50s (Figure 25). We had had an unusually heavy snow winter, and we had some runoff the likes I'd never seen in the Carrizo Canyon before. I took a picture of the canyon so I could remember what it looked like with water in it. The junipers were right down to the canyon's edge and there was nothing but white boulders in the bottom. Figure 26 is a picture of the same area that was protected from grazing in the growing season for just a few years. Recovery has been fantastic.



Figure 25. Carrizo Canyon after an unusually wet winter during the 1950s.



Figure 26. Riparian after protection during the growing season.

I get a lot of silt from the forest above me and that has built up a wonderful riparian zone with tremendous riparian vegetation. We've tried to plant cottonwoods in there but the bucks like to polish their horns on them, so it was not very successful. I did put willows in there and they flourished, and the day before yesterday we put in some beaver. Putting beaver in is probably something I'll regret, but on the petroglyphs in the area, there are beaver drawings that were made before 1450, so I know there were beaver there. In any case, watershed rehabilitation and riparian enhancement must go hand in hand.

Lastly, I once had a stud horse that kept cooling himself over snowdrifts by sitting on his butt all the time and that is kind of where we have been for the last 30 or 40 years (Fig. 27). I like to use that as an example of something we cannot continue to do. We must get up and get things going through the legislature or by

other means. We must use our influence. We must make people realize our watersheds are going downhill every day and water demand is going up everyday, and that doesn't take into account the debt we owe Texas. We must do something about these watersheds and I'm especially glad that this water conference is about watersheds because that is what we must be talking about. I appreciate the opportunity to come and talk with you about these things. I'll be glad to answer any questions and I am going to be here all day today and tomorrow morning.

Thank you very much.

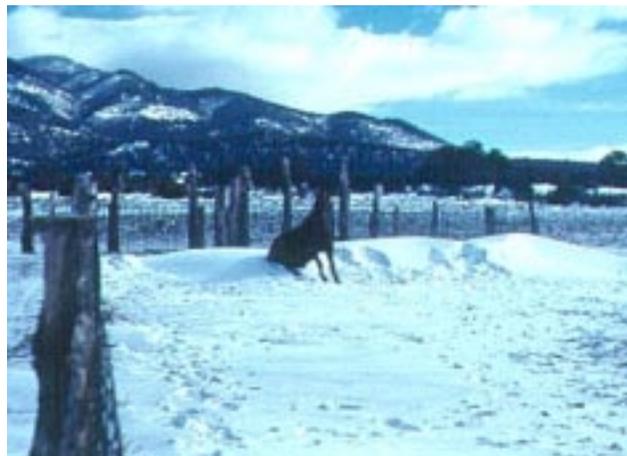


Figure 27. We can no longer afford to sit and watch continued watershed deterioration.