



**El Colegio
de la Frontera
Norte**

Hydrological restoration of degraded grasslands in arid and semi-arid communities



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Restauración hidrológica de pastizales degradados en comunidades áridas y semiáridas

Hydrological restoration of degraded grasslands in arid and semi-arid communities

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El Colegio de la Frontera Norte

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RESUMEN

Vivimos en el Antropoceno. La superficie completa de la tierra ha sido impactada por la actividad humana y nuestro uso del suelo. En este contexto, la mayoría de los pastizales en zonas áridas y semiáridas tienen procesos de degradación. Este trabajo describe los cambios provocados por la antropización del paisaje en pastizales del norte de México y Suroeste de Estados Unidos, y la forma como se comporta la hidrología de ellos ante diferentes intensidades de precipitación típicas de estas regiones. Se explican algunas causas principales del deterioro de pastizales en zonas semiáridas, se identifican estrategias sistemáticas de atención a esas causas, y se presentan varias técnicas concretas de intervención en el paisaje que ayudan a la restauración de estos ecosistemas. Estas técnicas incluyen la restauración de trayectorias de flujo históricas, el drenaje de caminos con bordos de desvío, la colocación de hileras de postes para restaurar riberas erosionadas y de represas de una roca para la restauración de pequeños tributarios con procesos erosivos. Se documenta fotográficamente los efectos de estas intervenciones en el paisaje. Las intervenciones y pautas de manejo que se presentan permiten mejorar la hidrología de los pastizales y conservar el recurso suelo, reduciendo la vulnerabilidad de las comunidades a sequías e inundaciones.

Palabras clave: pastizales desérticos, manejo de agua pluvial

ABSTRACT

We live in the Anthropocene. The entire surface of the earth has been impacted by human activity and land management decisions. In this context, most of the grasslands in arid and semi-arid regions have degradation processes. This work describes the changes caused by the anthropization of the landscape in grasslands of northern Mexico and the Southwest United States and how their hydrology behaves when faced with different rainfall intensities typical of these regions. It explains some main causes of the deterioration of grasslands in semi-arid zones, identifies systemic strategies to address these causes, and presents several concrete landscape intervention techniques that can help the restoration of these ecosystems. These include the restoration of historical flow paths, road drainage with rolling dips, post vanes to restore eroded stream banks and one rock dams for the restoration of small tributaries with erosive processes. The effects of these landscape interventions are documented photographically. The interventions and management guidelines presented in this paper can improve grassland hydrology and conserve soil



**Appropriate treatments for
transforming the cycle of
drought, erosion and flooding
into watershed health**

Pre Colonial Grassland



The Light Rain





The Modern Range

Vegetation type conversion
from grassland to shrubland
Plus major changes to drainage network









The modern watershed- the roads add a whole new drainage network







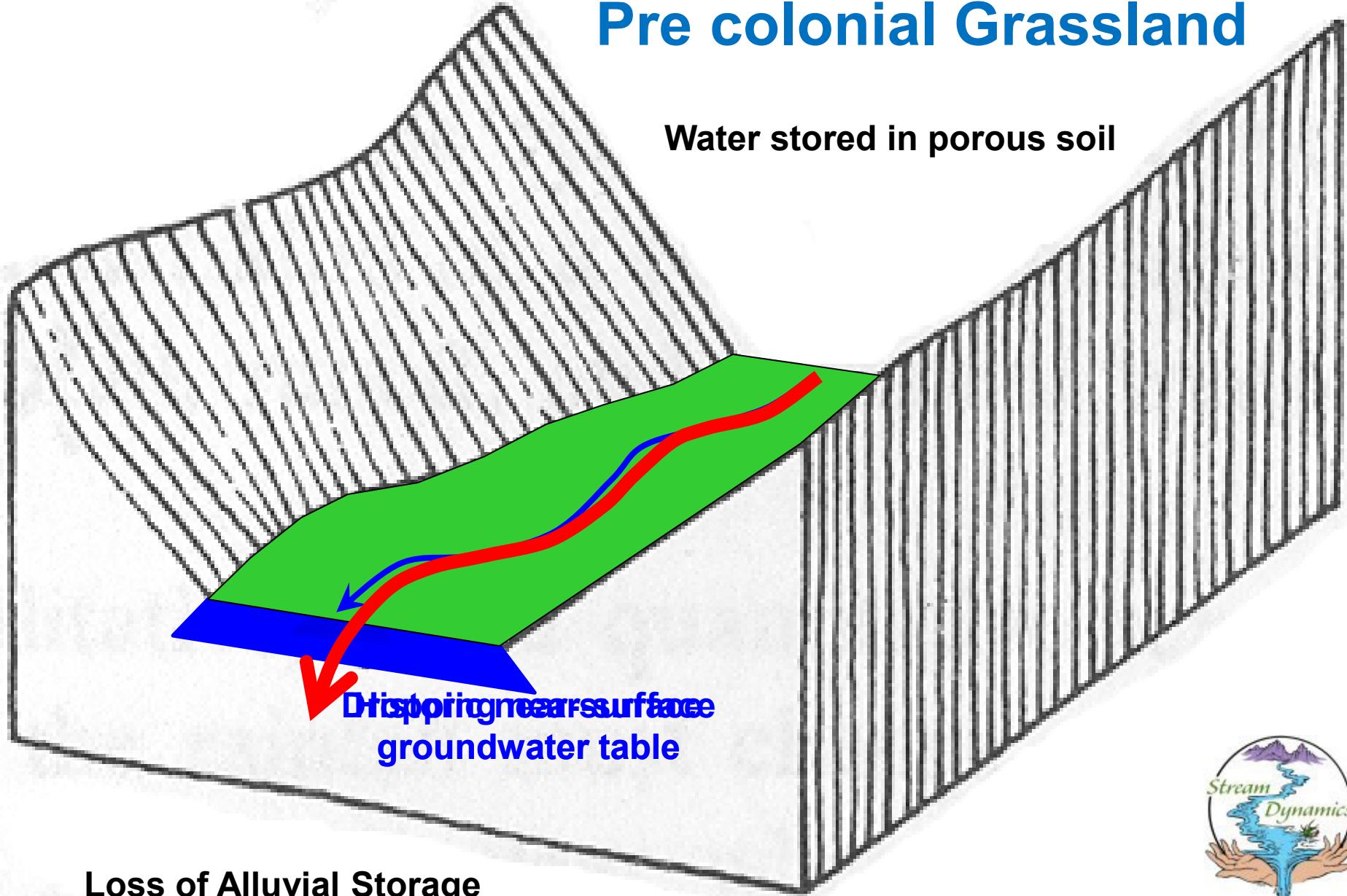
A nice Rain



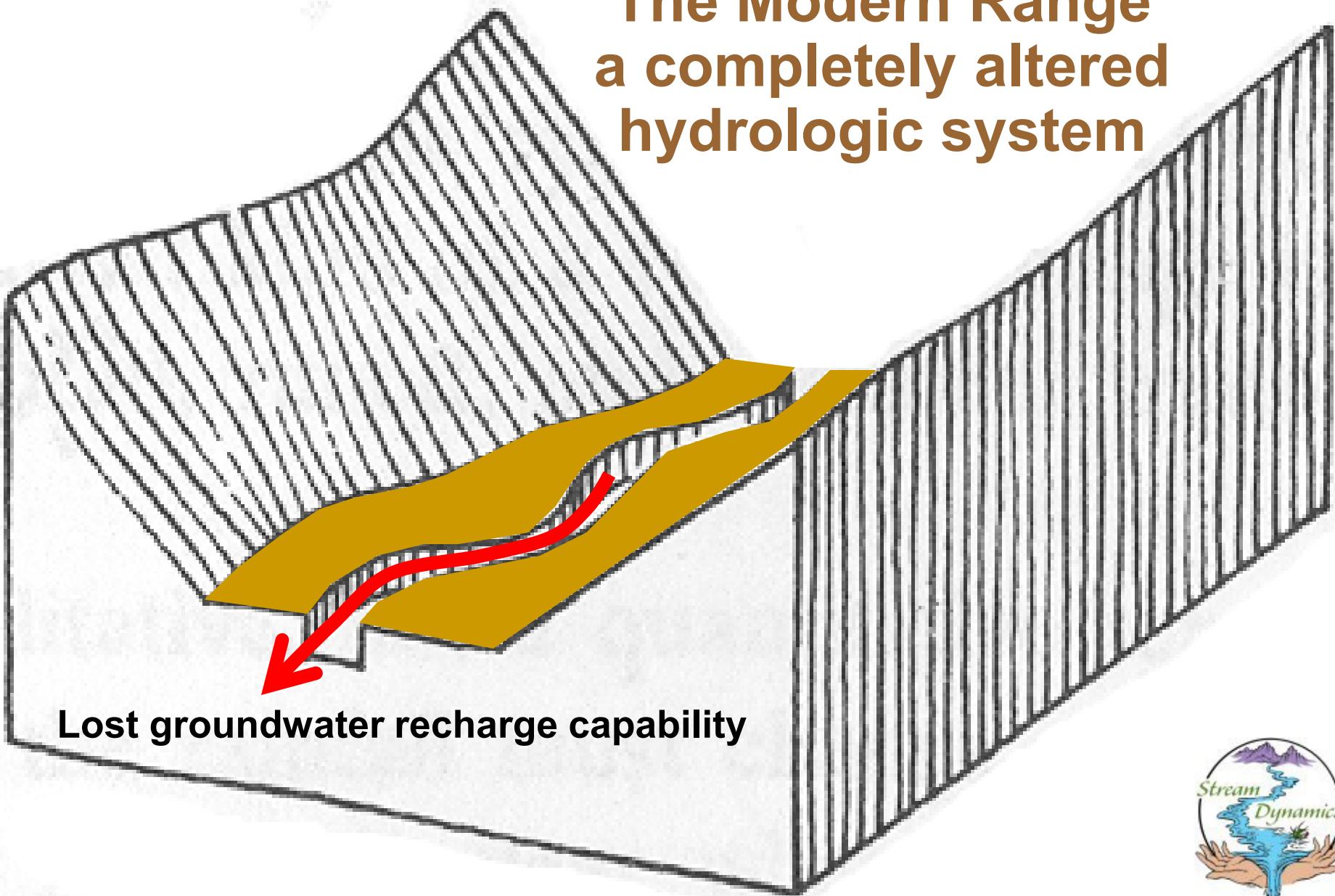


After the Rain

Pre colonial Grassland



The Modern Range a completely altered hydrologic system





reservoirs in New Mexico evaporate more water than we use





Evaporation from dirt tanks can be up to 10 feet per year and amounts to 64% of the water budget for this type of infrastructure.

- Natural Resources Conservation Service





Flood – Healthy Watershed

Grazing and hoof shear
destabilize stream banks





The Modern Range and Flood





historic wetland



Watershed Unraveling

Surface Runoff

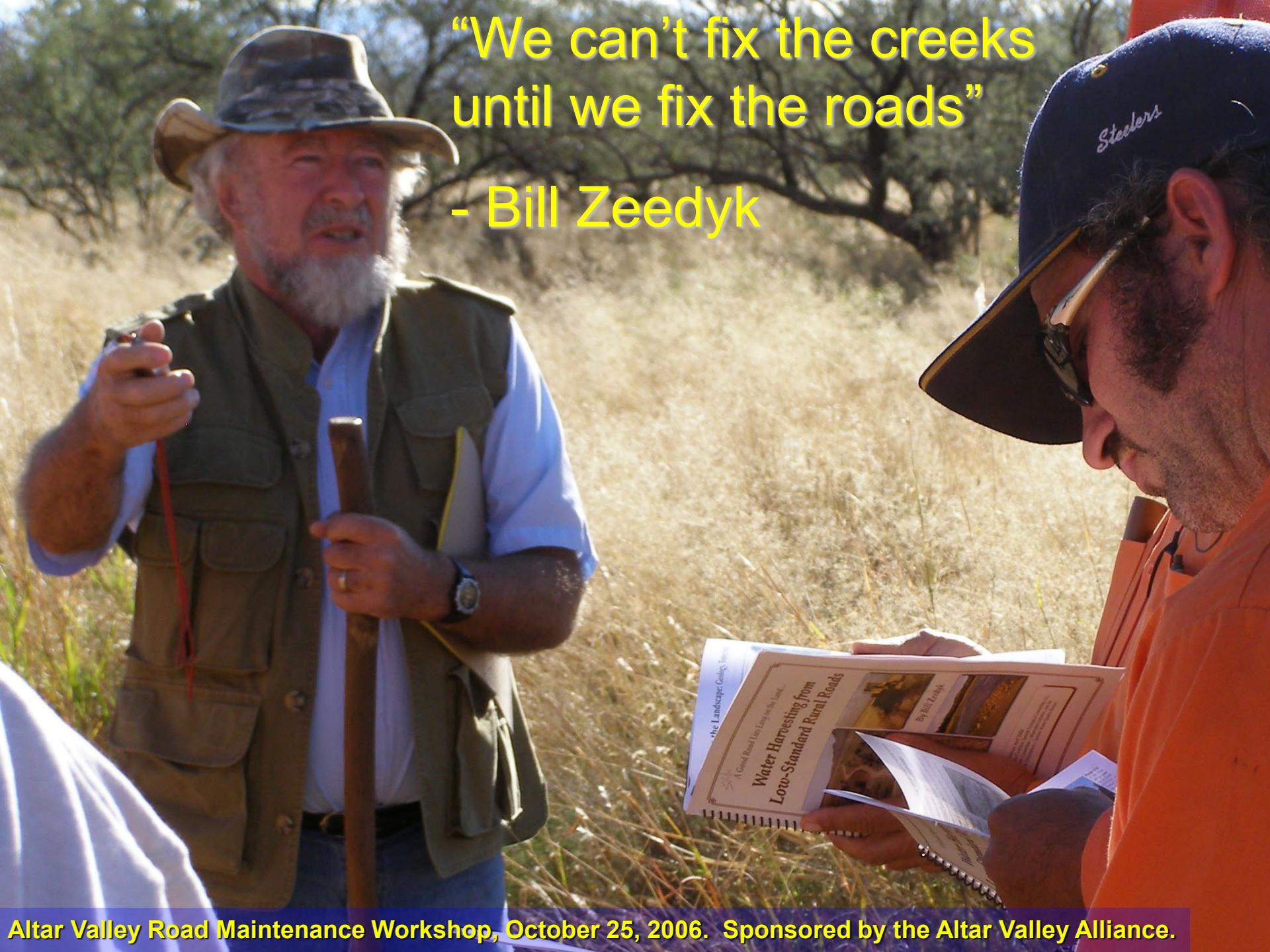
Channelized flow



The Good Year





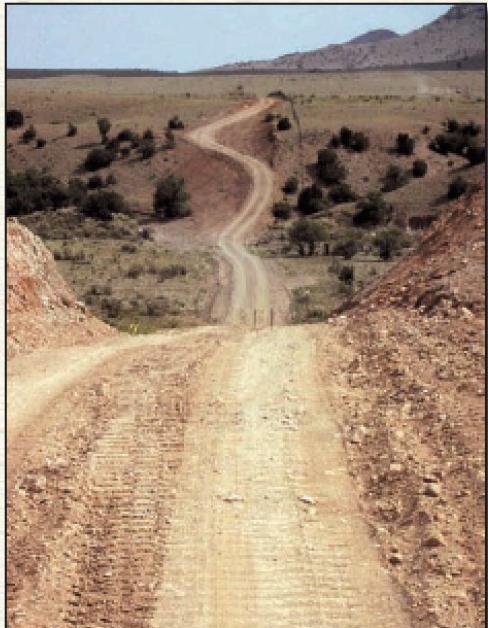


“We can’t fix the creeks
until we fix the roads”

- Bill Zeedyk

A Good Road Lies Easy on the Land...

Water Harvesting from Low-Standard Rural Roads



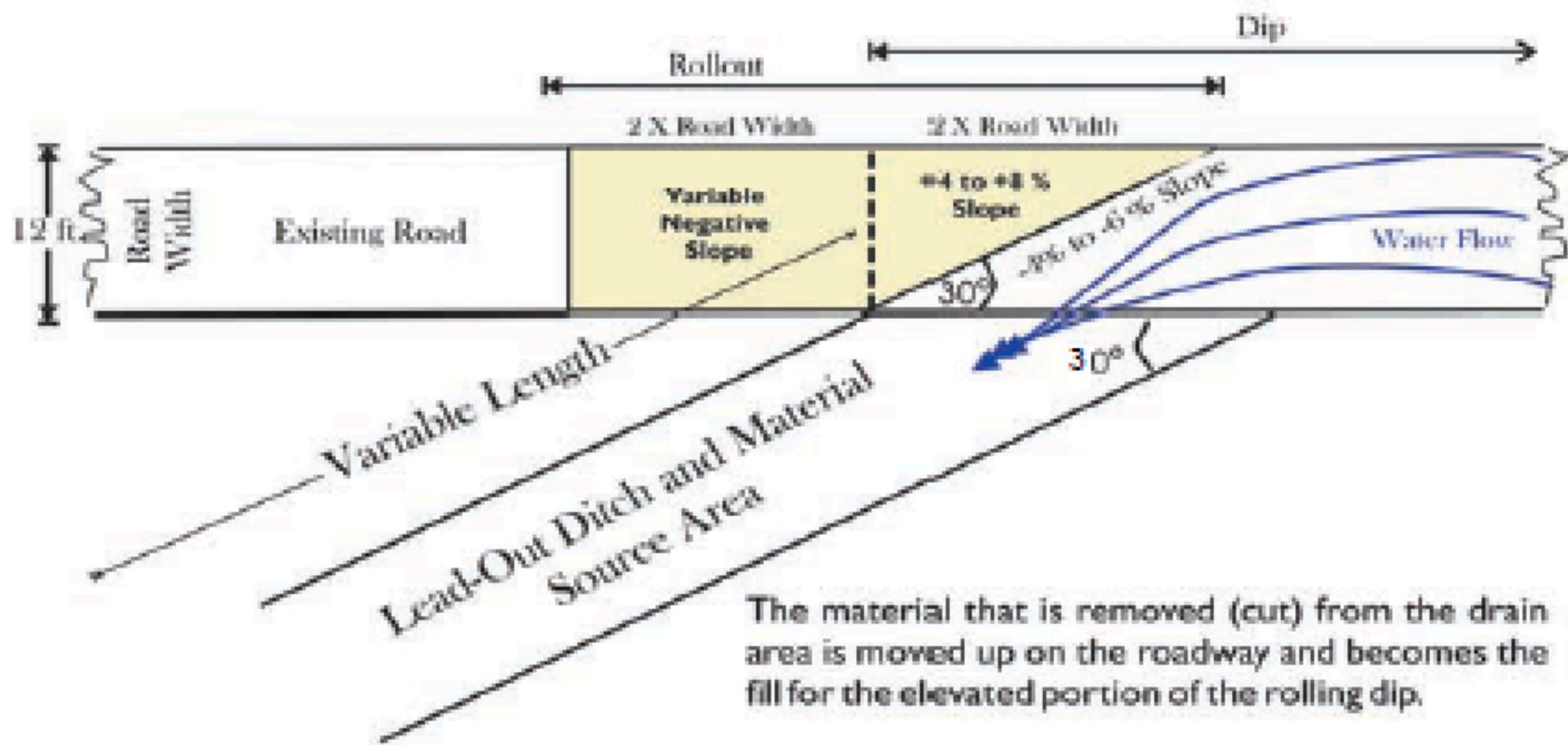
By Bill Zeedyk



First Edition: April 2006

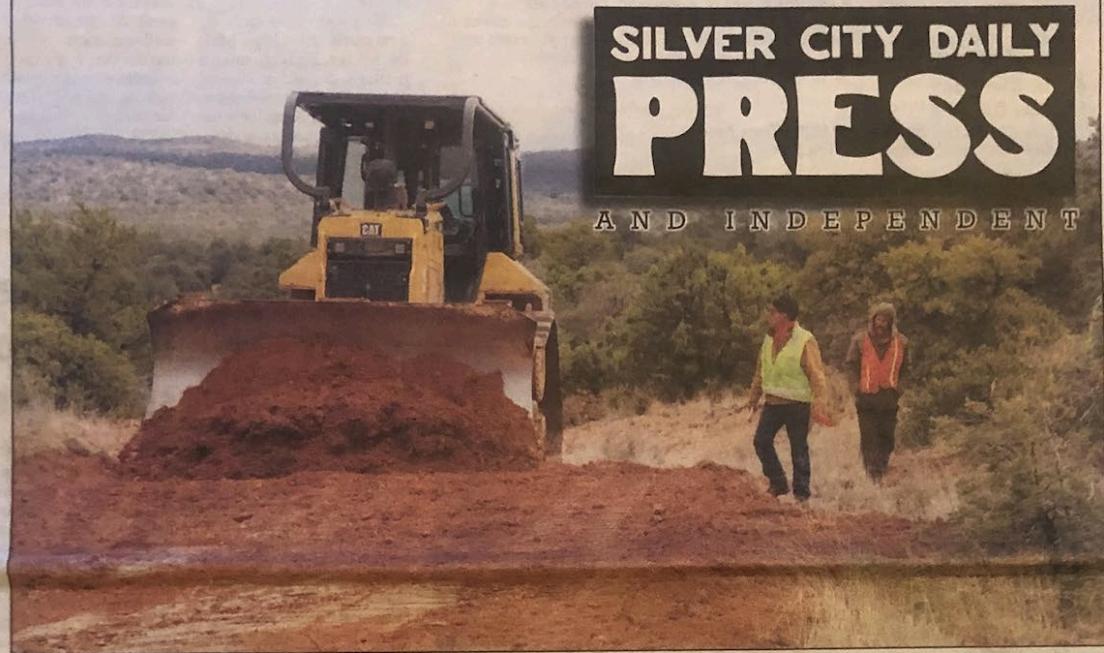
A Joint Publication of The Quivira Coalition, Zeedyk Ecological Consulting, LLC,
The Rio Puerco Management Committee – Watershed Initiative, and the
New Mexico Environment Department – Surface Water Quality Bureau.

Rolling Dip (Plan View)



SILVER CITY DAILY PRESS

AND INDEPENDENT



(Press Staff Photo by Juno Ogle)

Steve Carson, second from right, and Josh Neumann watch as Rafael Acosta of the Forest Service operates a bulldozer to construct a rolling dip — a technique of managing stormwater runoff on roads — during a workshop Tuesday on a forest road about 30 miles southwest of Silver City.

'Rolling dips' aim to save roads, rainwater

By JUNO OGLE
Daily Press Staff

A company that implemented harvesting stormwater runoff on Silver City streets is taking the concept to the area's dirt roads, offering a workshop this week for road crews from Grant County, the U.S. Forest Service and the Las Cruces District of the Bureau of Land Management.

With a grant from the New Mexico Environment Department in 2015, Stream Dynamics began working with the town of Silver City to create curb cuts and basins to capture storm runoff and decrease erosion in the San Vicente Creek watershed, while also decreasing flooding and wear and tear on streets.

This week, the company is conducting a workshop to apply rainwater management techniques to dirt roads that will accomplish the same goals. The cost of the workshop is being split among Stream Dynamics and the agencies.

Van Clothier, owner of Stream Dynamics, brought in his men-

tor in road surface water management, Steve Carson, owner of Rangeland Hands of Santa Fe, to teach the four-day workshop. Carson has traveled all over the Southwest teaching techniques to manage surface water on roads. He said he's worked on more than

1,000 miles of roads, building about 9,000 drainage structures.

The workshop here combines infrastructure maintenance with watershed health, Clothier said.

"When you do that, you get the water off the road to the right places in the landscape, and you don't

have to come back and fix it all the time," he said.

On Forest Service Road 4091Y, just off N.M. 90 about 30 miles southwest of Silver City, about 16 members of road crews from the

ROLLING DIPS Page 14

Bayard seeks a new clerk – again

By HUGH J. REMAR
Daily Press Correspondent

Monday night's Bayard City Council meeting marked the final one for City Clerk-Treasurer Gabriel Ramos, who has served the city since last year. Ramos' last day in his role as clerk will be March 31.

At their March 11 meeting, the council selected Martha Salas to assume the role of clerk after Ramos' departure, but in the following weeks, Salas made the decision to accept a different role. Consequently, the position of clerk remains vacant, and the search for a new candidate remains ongoing.

Mayor John L. Ojinaga made a

proclamation Monday declaring the week of March 18 as Devahnie Madrid Week.

Madrid, a wrestler at Cobre High School, "dedicated herself through the sport of wrestling," the proclamation reads. "The city of Bayard is duly proud of Devahnie Madrid for her hard work and dedication."

Madrid finished the 2024 season with a 13-win, 9-loss record. She earned fifth place in the 2024 girls' state wrestling tournament and was the first female student to place in the girls' NMAA tournament for Cobre High School.

District 28 state Sen. Siah Correa

Hemphill, a Democrat, addressed the council during public input to summarize her work in the district. Much of the senator's discussion focused on successes in the Legislature, this year's session of which lasted 30 days and was tasked primarily with passing a state budget.

Of note, Correa Hemphill mentioned significant funding for wastewater systems improvement in Bayard. The \$959,752 is for construction of wastewater system improvements to repair and replace broken and outdated equipment and deteriorated infra-

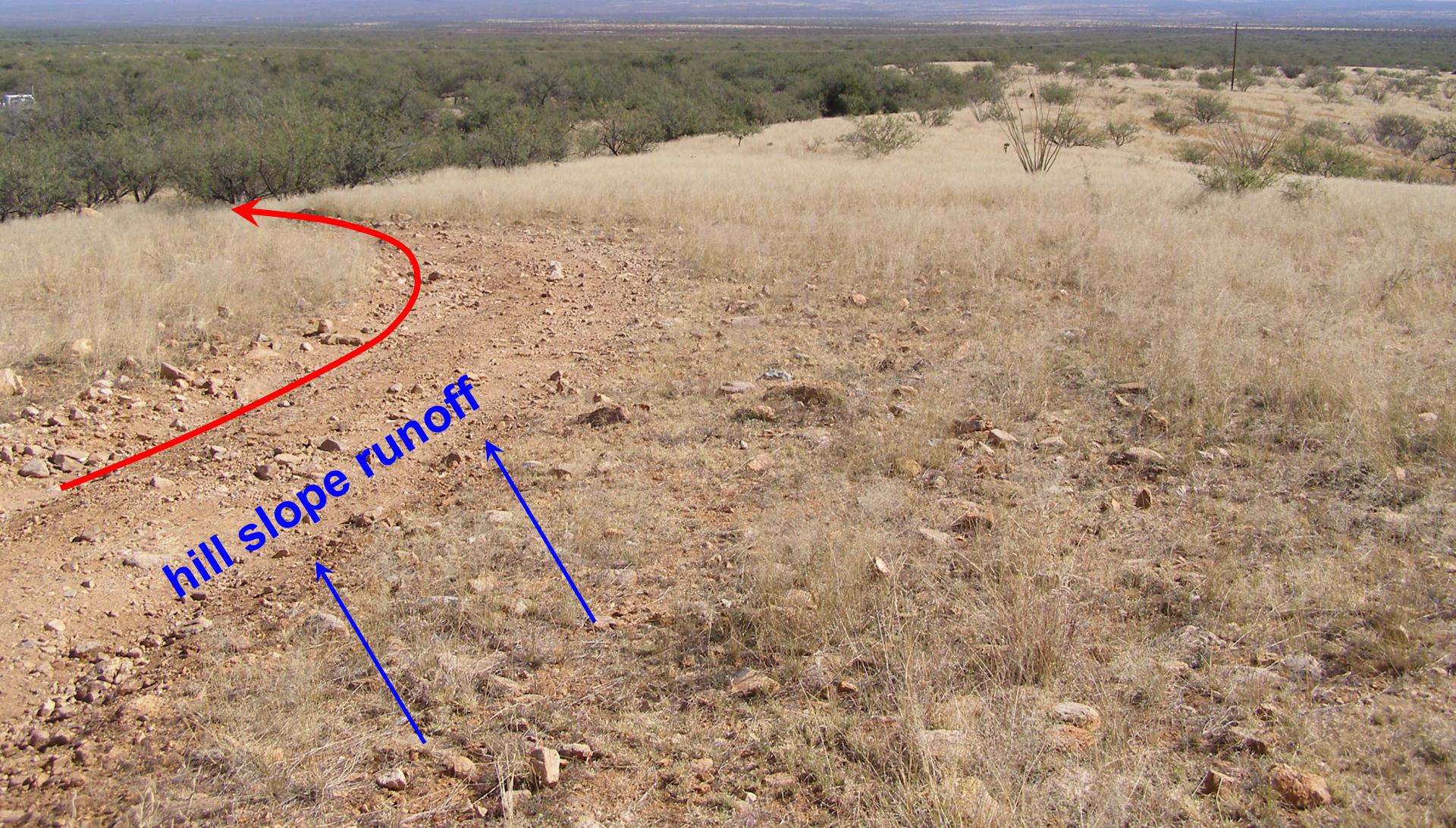
BAYARD Page 15



Keep the water in its watershed!



Problem: a rutted road captures hill slope runoff, eroding the road surface on the steep hill below, while increasing sediment and flooding in the arroyo.



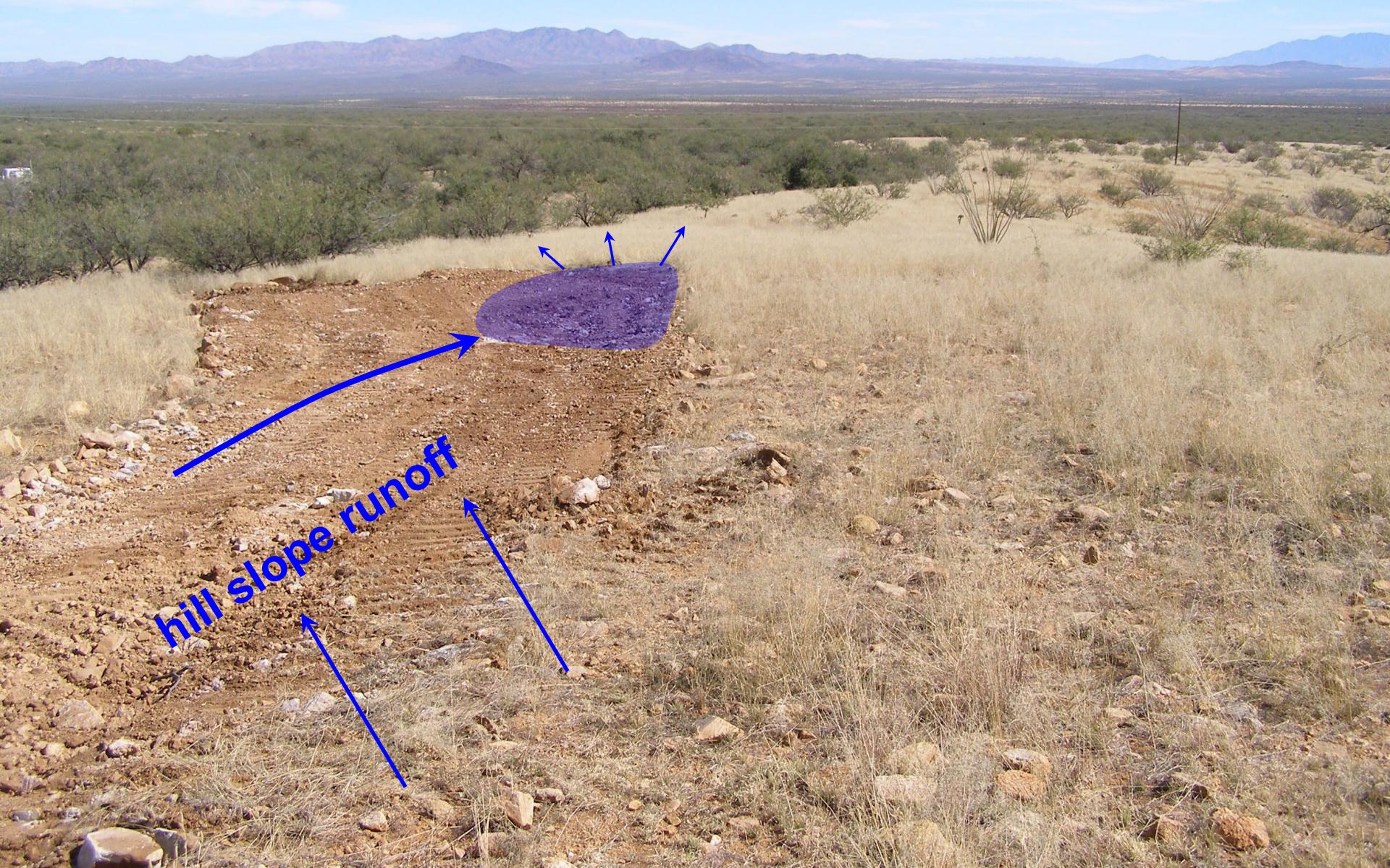
Solution: Material is moved from the desired basin location to build a rolling dip in the road.



After final shaping, the basin is seeded with native grass.



Water is now directed off the road and harvested by the grassy hillside.



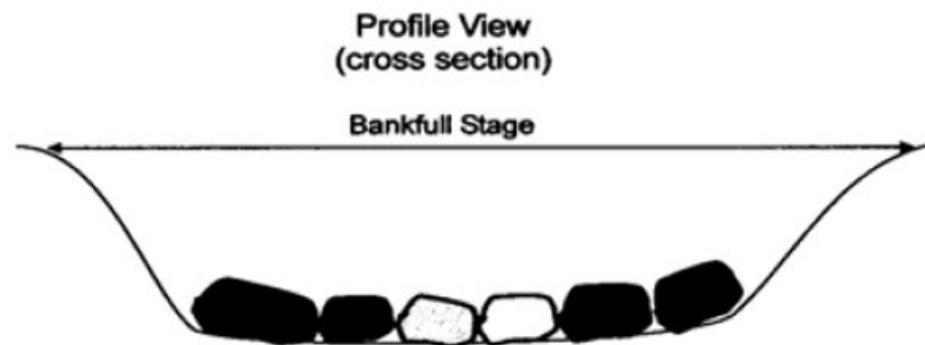
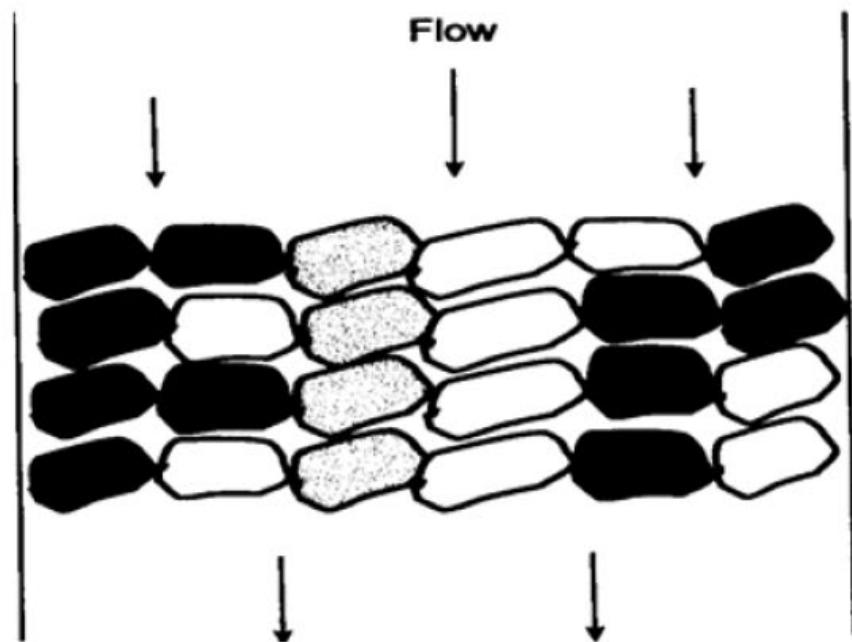








One-Rock-Dam



from An Introduction to Induced Meandering, by Bill Zeedyk





Sept 4, 2009



Sept 4, 2009 12:57 pm



Sept 4, 2009 4:35 pm



Aug 22, 2019



Peterson
Valle Buena Vista

8 19 04

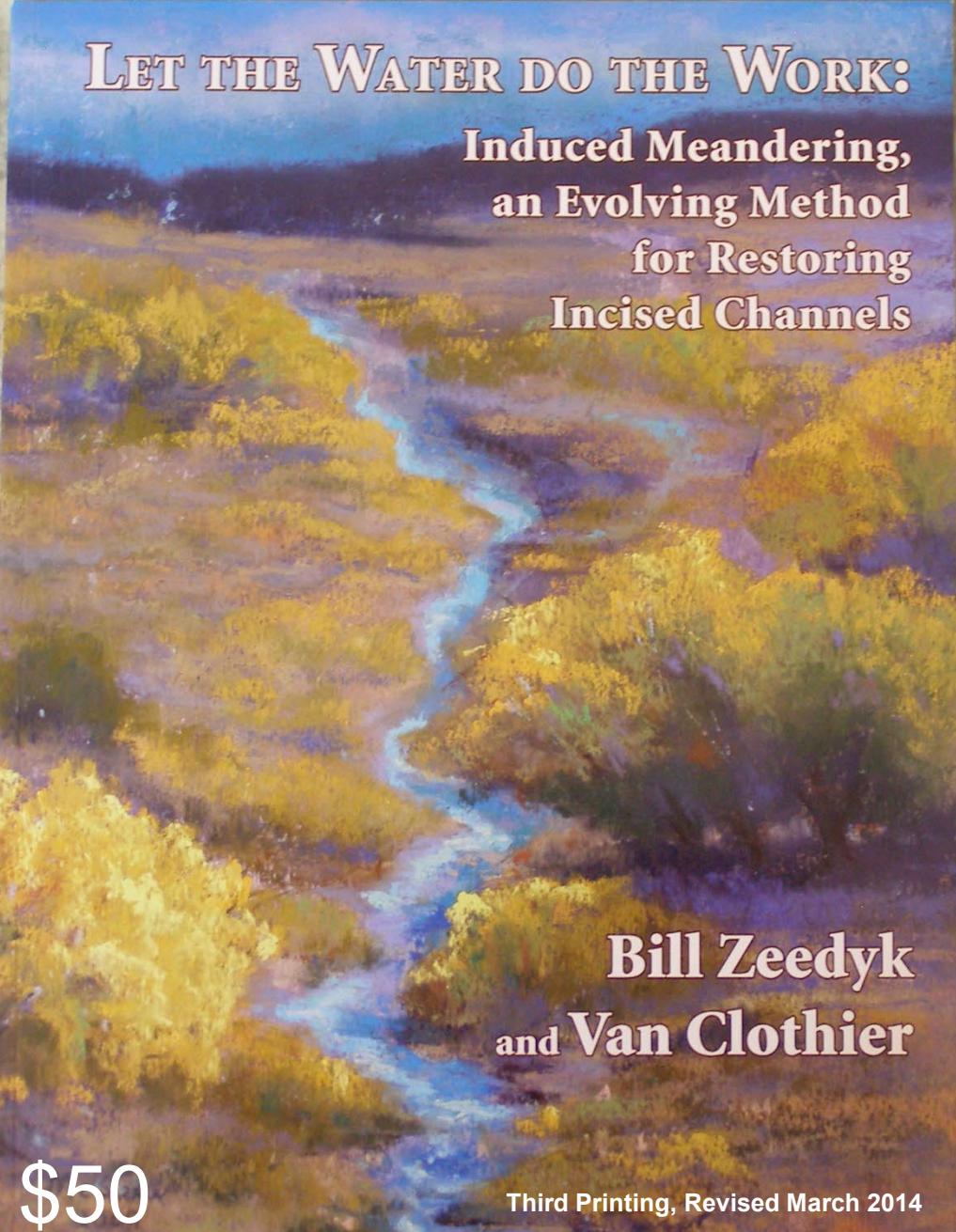


9 15 04



The new grass facilitated by the contour cobble mulch,
or "Media Luna" has been exploited by cattle





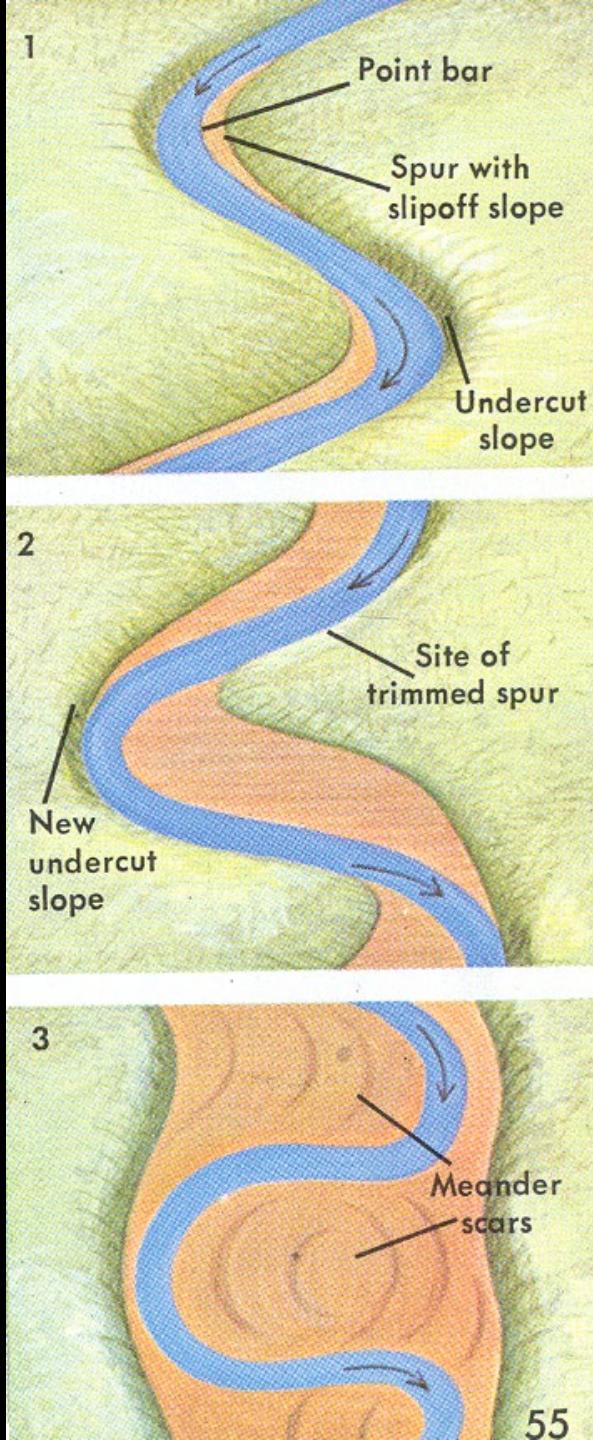
LET THE WATER DO THE WORK:
Induced Meandering,
an Evolving Method
for Restoring
Incised Channels

**Bill Zeedyk
and Van Clothier**

\$50

Third Printing, Revised March 2014

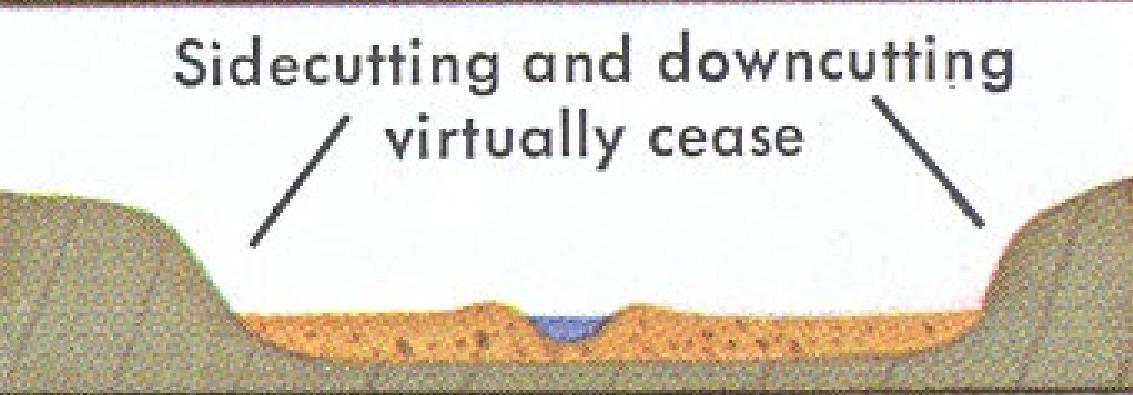
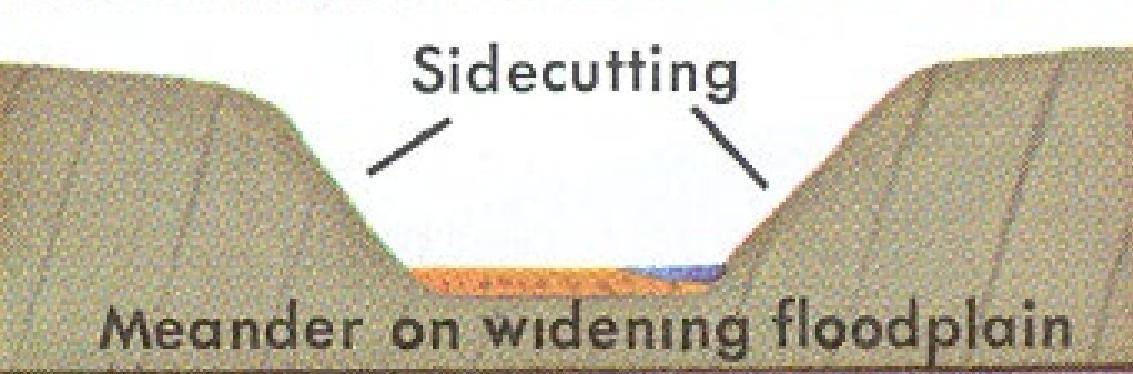
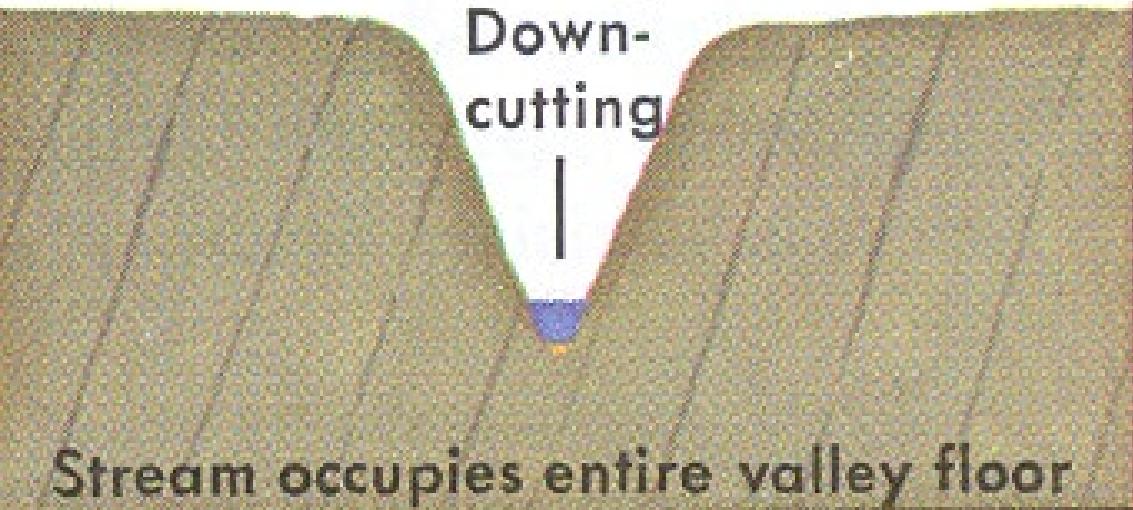
Available at
www.streamdynamics.us



Natural Channel Evolution

- Narrow Gully incised into historic floodplain
- Erodes terrace cut banks during floods
(once grade control is established)
- Eventually develops floodplain
(at a lower elevation than historic floodplain)

Transverse profiles



Post Vane
cross section

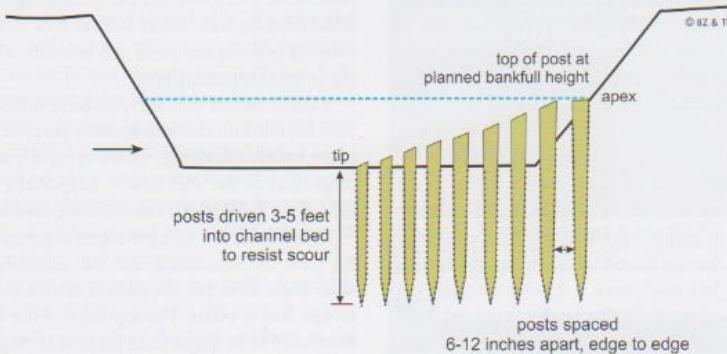


Figure 5-9. Post vane cross section schematic (Adapted from Zeedyk 2003).

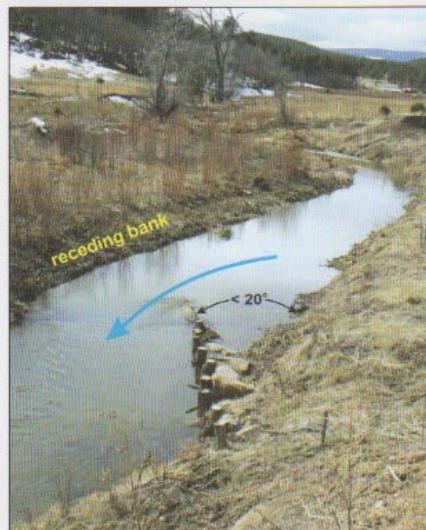


Photo 5-10. A post vane, manually installed, on perennial Manueitas Creek, San Miguel County, N.M. Note that the opposite bank is beginning to recede.
(Photo by Tamara Gadzia)

Post Vane
plan view

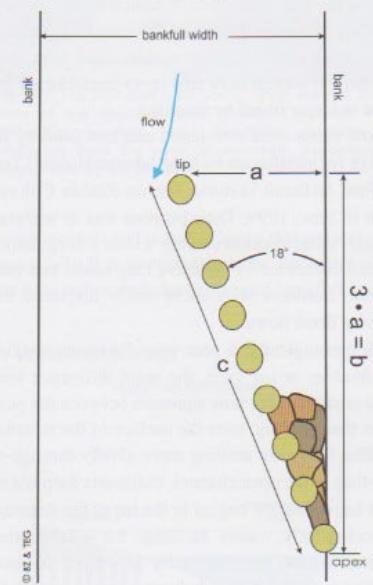


Figure 5-10. Post vane plan view schematic. Optional: fill apex with 1.0 ft diameter rock (Adapted from Zeedyk 2003).



Oct 13, 2005



Aug 27, 2006



Aug 27, 2007



Aug 28, 2010



March 24, 2006



Aug 27, 2007



Aug 28, 2010



Feb 2, 2009 pre-treatment



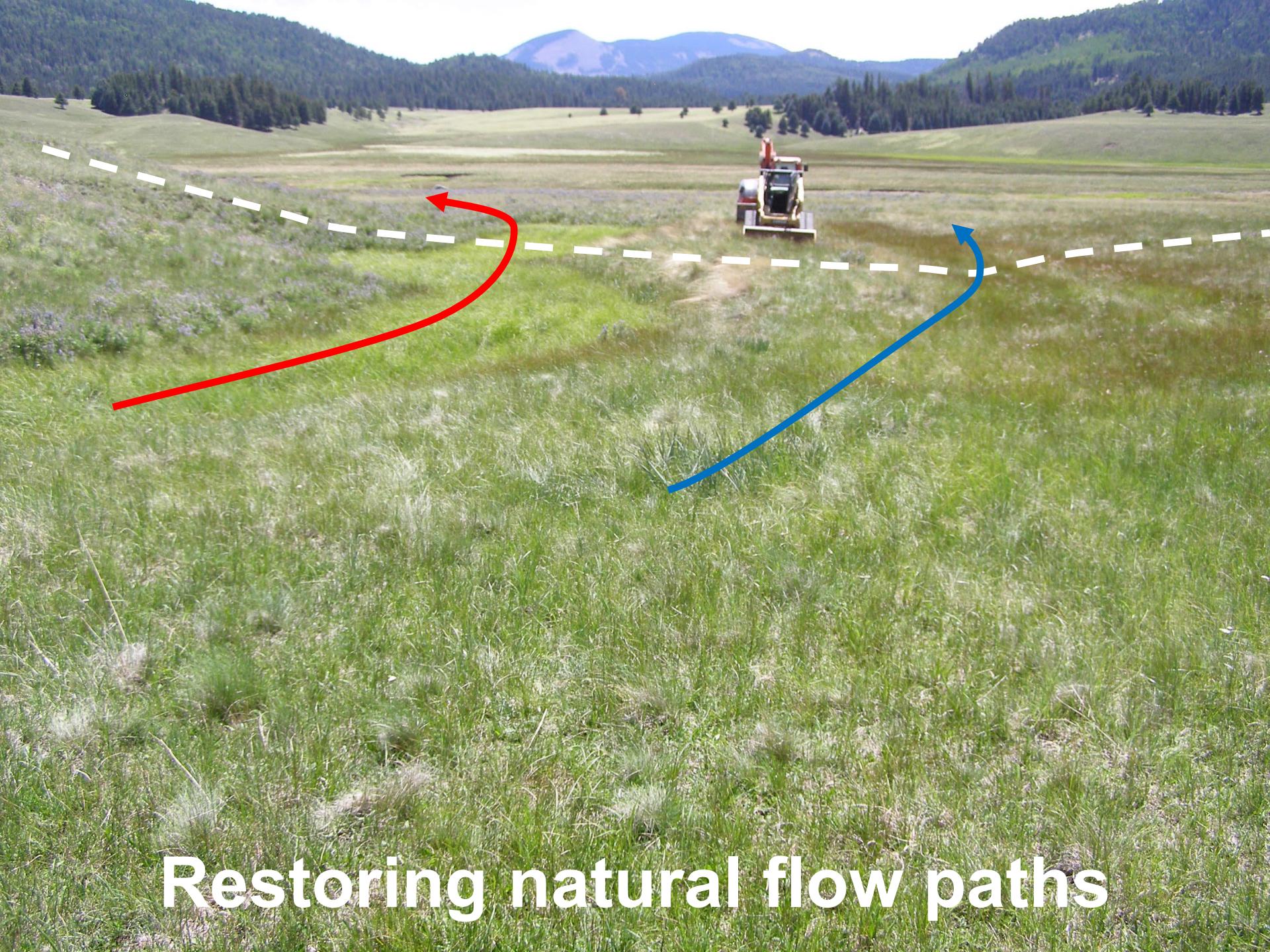
June 29, 2009 post-treatment

La Jencia Creek XS-2139.5 treatment site

A willow thicket was planted to prevent a headcutting overflow channel from capturing the stream. This planting survived a bankfull flow the first season and did its job perfectly – note the flood debris collected on the new plantings.



Detail of intensive willow planting

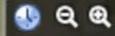


Restoring natural flow paths









8/29/2011

2004

2014

August 29, 2011

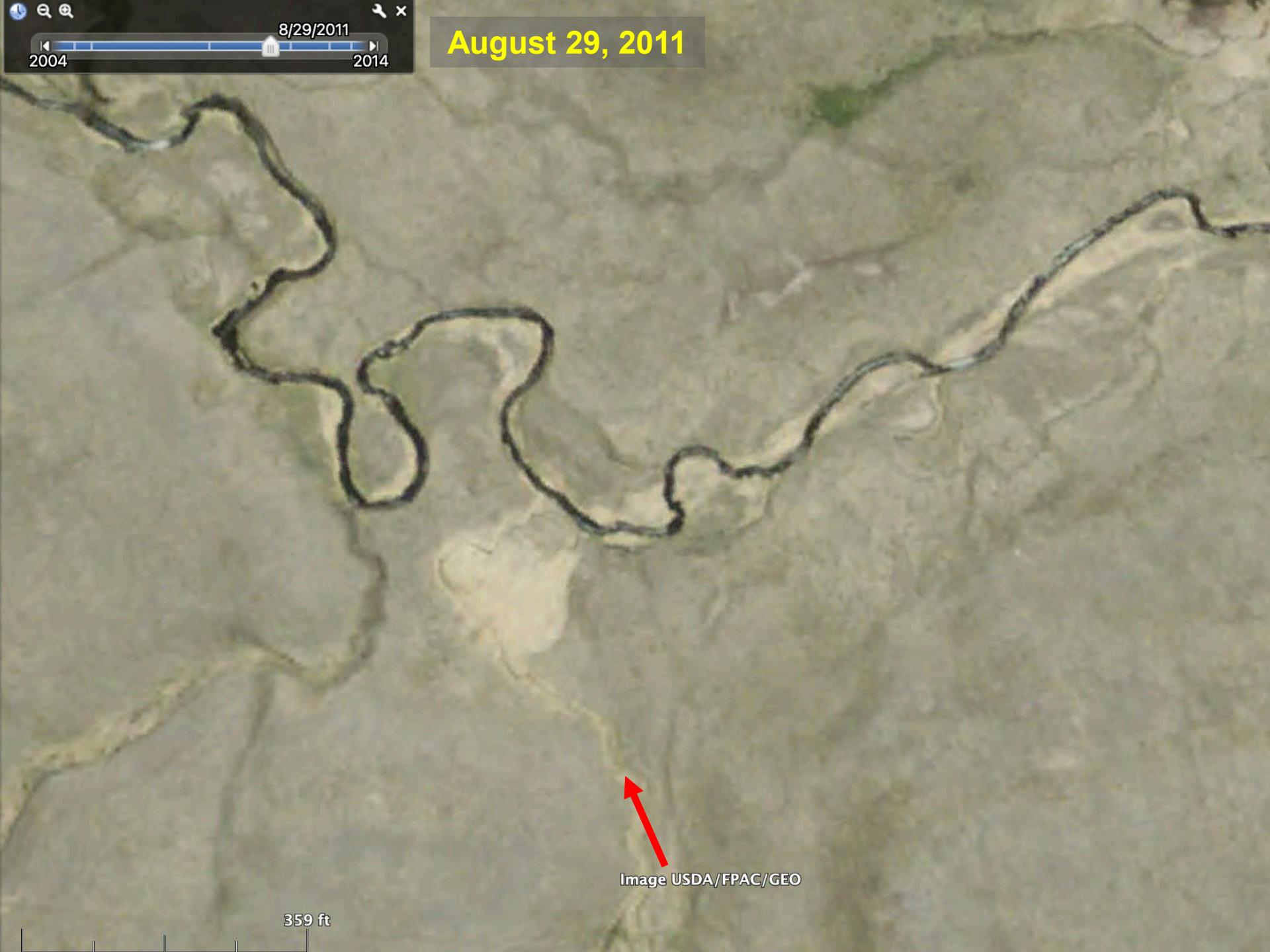


Image USDA/FPAC/GEO

359 ft



May 29, 2012

359 ft

To restore the Precolonial Grassland

Squarely address the root cause of degradation

Watershed sensitive road drainage

Many small check dams

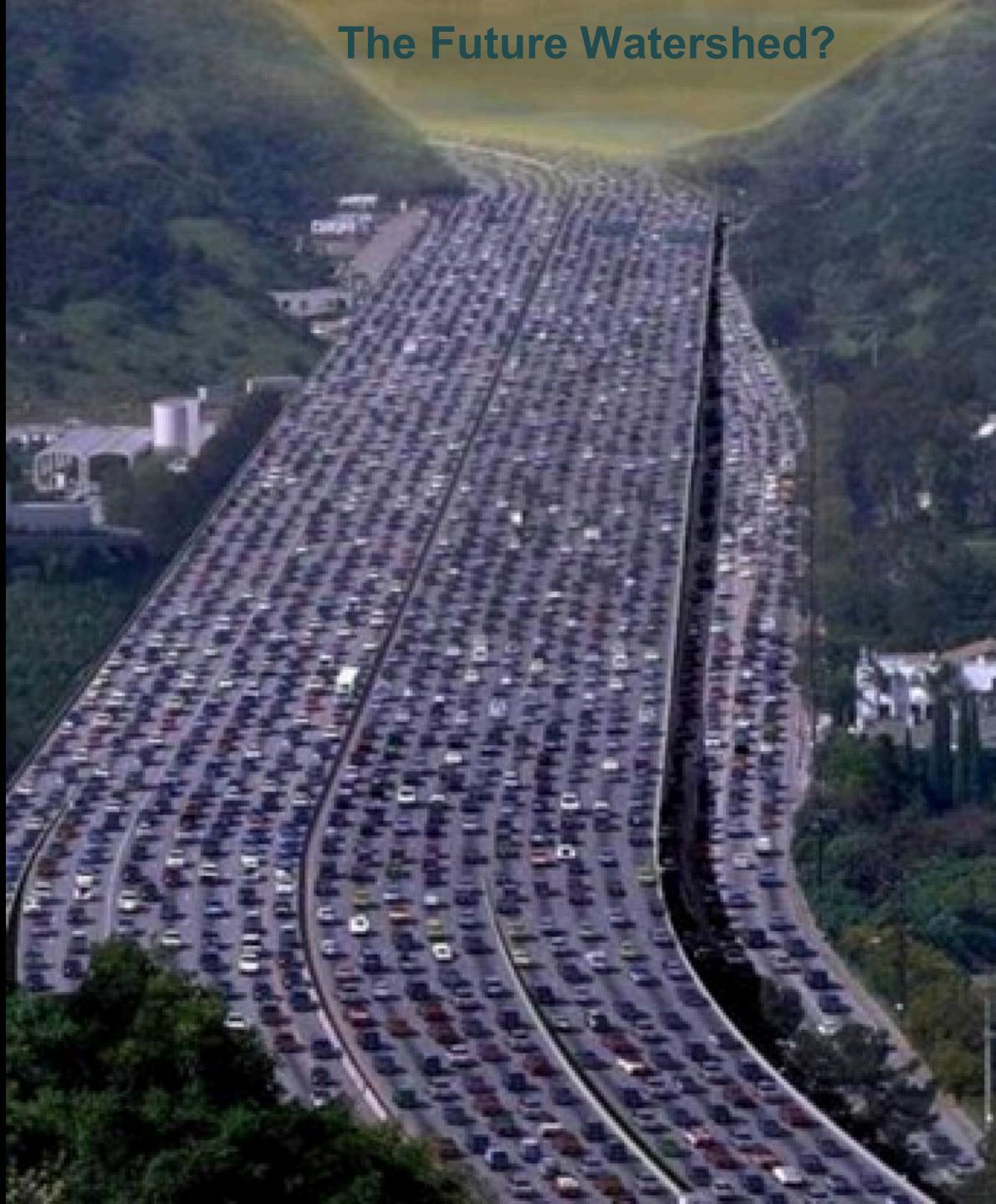
Restore Predators

Restore Beaver

and

Let the Water Do Its Work!

The Future Watershed?



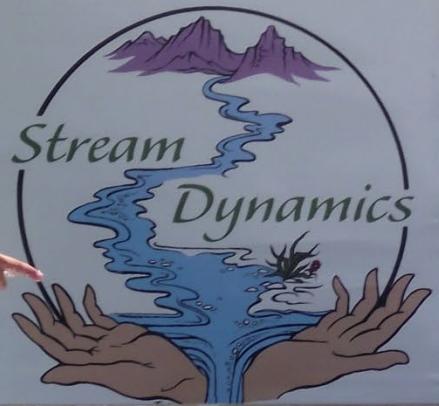














First National Congress of Rainwater Catchment Systems

Primer Congreso Nacional de Sistemas de

Captación de Agua de Lluvia

8-11 de Noviembre 2017
Guadalajara, Jalisco

**Encontrando el equilibrio en el uso del suelo:
la transformación del ciclo
de sequía, erosión e inundación
en salud de cuenca**

Van Clothier y Ana Córdova

Stream Dynamics, Inc. y El Colegio de la Frontera Norte