



# DUST MITIGATION USING HOLISTIC MANAGEMENT

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**HELM**

Holistic Engineering and Land Management, LLC

# DUST MITIGATION USING HOLISTIC MANAGEMENT

**Prepared for:**

**2016 Dust Storm Workshop**

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# OVERVIEW

- **My Background**
- **Historic Conditions vs. Current Conditions**
- **Brittleness Scale**
- **Ecosystem Processes**
- **Land Management Tools (Dominant Practices)**
- **Current Issues**
- **Proposed Solution**

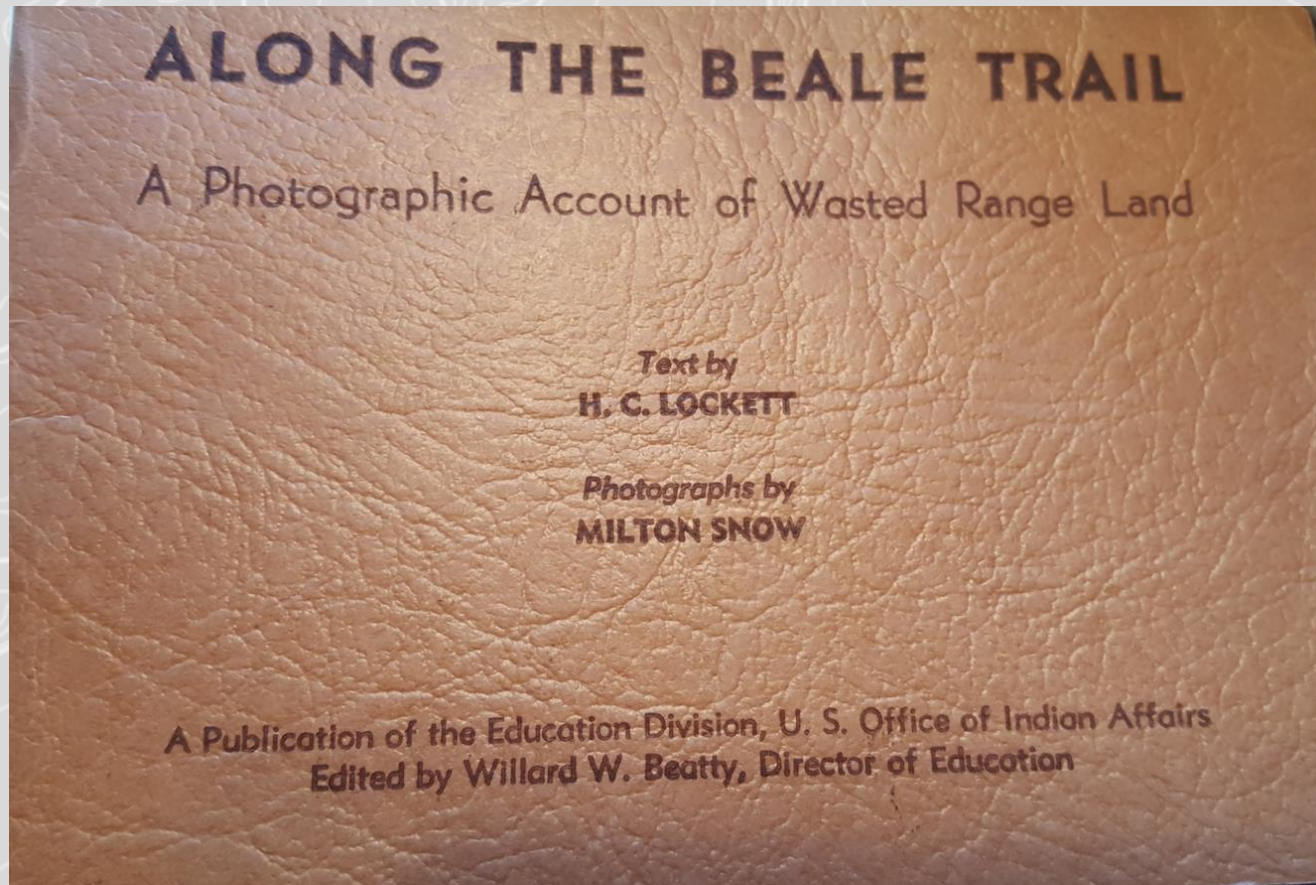
# MY BACKGROUND



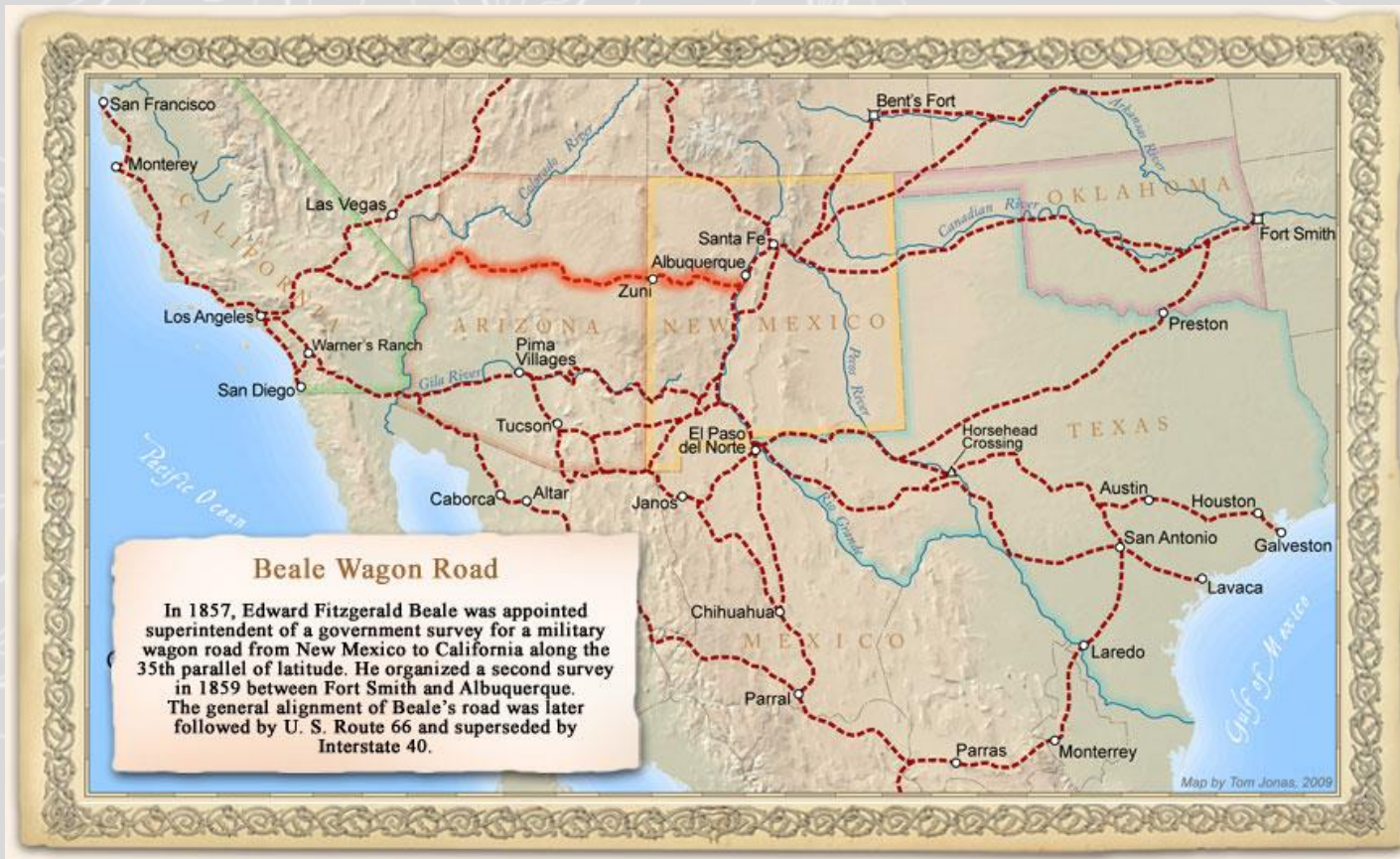
# MY BACKGROUND



# HISTORIC CONDITIONS



# HISTORIC CONDITIONS



# HISTORIC CONDITIONS

## ON THE PUERCO RIVER ARIZONA

### AS BEALE SAW IT IN 1857:

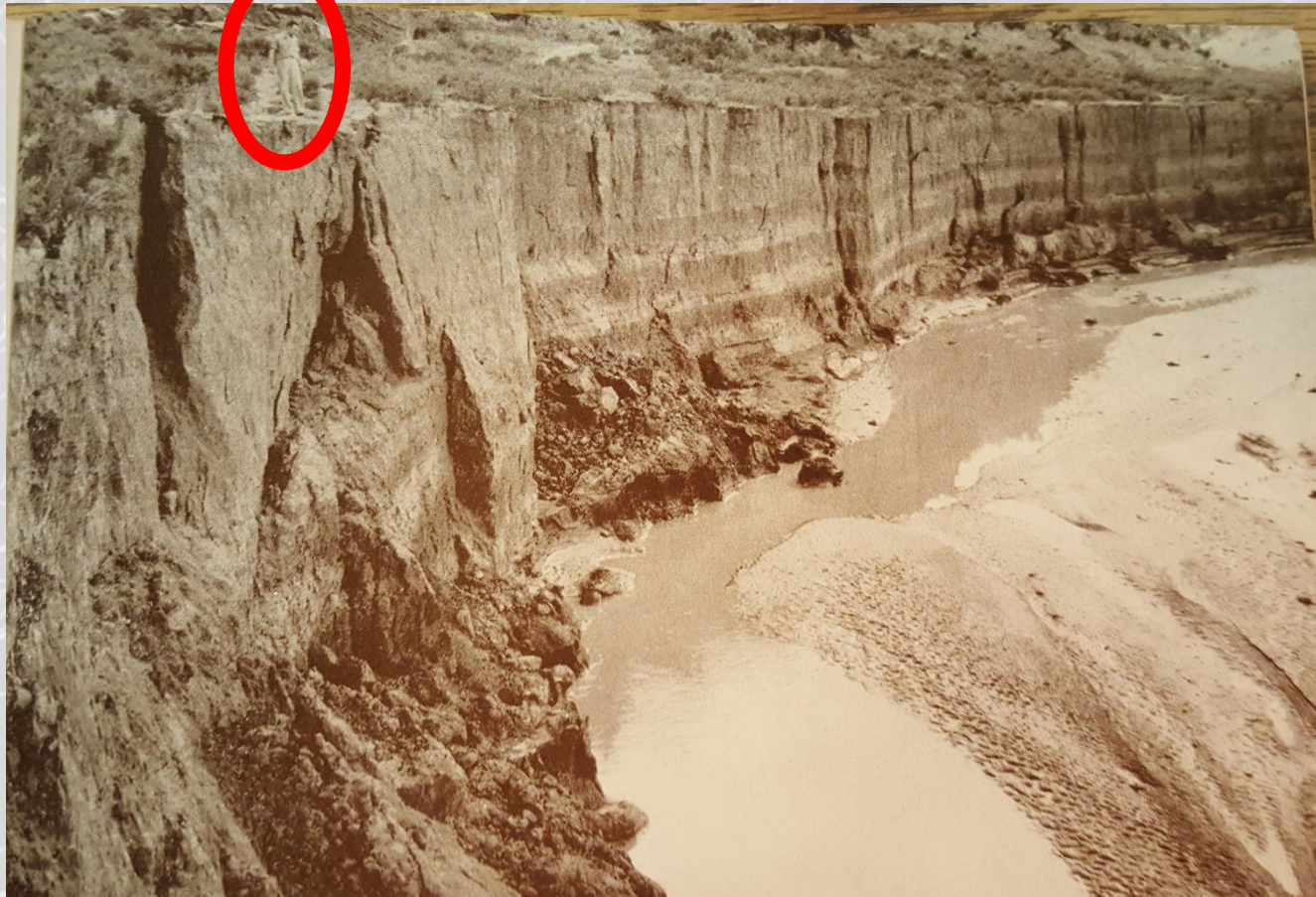
"On arriving at the banks of this river, we found no difficulty in getting down without locking a wheel."

### 81 YEARS LATER—THE PLACE BEALE DESCRIBED

Thundering walls of soil are dumped into the Rio Puerco with each flood of water. Once a small stream that could easily be crossed, the Rio Puerco has become a barrier cutting the country like a knife. When the grass was gone, the water carried away the soil. Each year more soil is lost. (Note the figure, upper left.)



# HISTORIC CONDITIONS



# HISTORIC CONDITIONS

## NEAR LEUPP ARIZONA

### AS BEALE SAW IT IN 1857:

"Today nothing has impeded our progress but the grass, and this trail, travelled by one large emigrant train, will make as firm and fine a natural road as could be desired."

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### 81 YEARS LATER—THE PLACE BEALE DESCRIBED

Grass impeded Beale's party, but dead Sacaton clumps made travel slow for the photographer. From six inches to a foot of soil have disappeared.

# HISTORIC CONDITIONS



# HISTORIC CONDITIONS

## Recent Schumacher Lecture

- A passage written by American zoologist William Hornaday in 1875:  
*The great herd along the Arkansas River through which I passed . . . was from my own observation not less than twenty-five miles wide and from the reports of hunters and others it was about five days in passing a given point, or not less than 50 miles deep. From the top of the Pawnee Rock, KS (heart of the dust bowl) I could see from 6 to 10 miles in almost every direction. This whole vast space was covered with buffalo, looking at a distance like one compact mass, the visual angle not permitting the ground to be seen. I have seen such a sight a great many times but never on so large a scale.*

# HOW DID WE GET HERE?

- “Ceteris Paribus”
- Scientific Method
- Education system
  - Medicine
  - Economics
  - Education
  - Ecology
  - Agriculture
  - Engineering
- Reductionist Science

# BRITTLENESS SCALE

## The Brittleness Scale



Total rainfall can be high  
or moderate and is reliable

Total rainfall low and/or  
erratic

# BRITTLENESS SCALE

Arid Southwest

## The Brittleness Scale



Total rainfall can be high or moderate and is reliable

Total rainfall low and/or erratic

# BRITTLENESS SCALE

- **Non-brittle environmental features**
  - humidity is not erratic and is distributed throughout the year despite volume
  - decay occurs rapidly
  - can take place without the presence of herbivores
  - involves small soil organisms that require constant humidity to survive.





# BRITTLENESS SCALE

- **Brittle environmental features (without herbivores)**
  - humidity is erratic
  - decay is slower
  - little to no soil organisms to break down organic matter



# BRITTLENESS SCALE

- **Brittle environmental features (with herbivores)**
  - humidity is erratic
  - decay is facilitated by herbivores
    - Plant material in contact with soil surface by trampling and dunging
    - Humidity is maintained in their gut despite atmospheric conditions
    - Their gut maintains a high composition of micro-organisms capable of breaking down plant material



# FOUR ECOSYSTEM PROCESSES

- **Water Cycle**
  - Movement of water from atmosphere to soil and back again
  - Effective: plants take full advantage of precipitation where it falls
  - Non-effective: >>> soil erosion | flooding | **dust**
- **Mineral Cycle**
  - Movement of minerals from above ground plants and animals and back to the soil.
- **Community Dynamics**
  - Development of communities of living organisms. More diverse = more stable
- **Energy Flow**
  - Energy from the sun through all living things via photosynthesis

# WATER CYCLE

Effective Water Cycle		Non-Effective Water Cycle
Definition – makes rainfall more effective despite position on the brittleness scale		Definition – wasted rainfall
Effective Water Cycle		Non-Effective Water Cycle
Low	Soil Surface Runoff	High
Low	Soil Surface Evaporation	High
Low	Drought Incidence	High
Low	Flood Incidence	High
High	Transpiration by Plants	Low
High	Seepage to Underground Reservoirs	Low
High	Effectiveness of Precipitation	Low

# WATER CYCLE

- **Soil Organic Matter (SOM) and Soil Water Holding Capacity**
- **On average 1% of SOM can retain 60,000 gallons of water / acre**

Soil Organic Matter 1.7%  
Next Day - Practically no infiltration



Soil Organic Matter 5%  
Next Day - Practically total infiltration

Adequate Infiltration: 13.2” in 6 Hours



# WATER CYCLE

*If Effective, Gives Rise to*

- Increased Community Dynamics
  - Insects, plants, birds, small animals
- Effective Mineral Cycle
- Increased Energy Flow

Results

- Reduced flooding
- Eliminates soil erosion
- **Mitigates dust**

# LAND MANAGEMENT TOOLS

## Land Management Tools

Fire

Rest

Technology

Living Organisms

Grazing

Animal Impact

# LAND MANAGEMENT TOOLS

Land Management Tools	Currently used
Fire	Fire
Rest	Partial Rest and Total Rest
Technology	Technology
Living Organisms	
Grazing	Overgrazing
Animal Impact	



# CURRENT ISSUES

## Partial Rest

- Occurs when grazing animals are on the land without the complement of pack hunting predators to maintain bunching herd behavior also called herd effect or animal impact.
- Results in little to no soil disturbance and no trampling of plant material into the ground.

# CURRENT ISSUES

## Overgrazing

- Occurs when plant gets severely bitten repeatedly during the growing season, which leads to its eventual death.
  - Plants exposed to animals for too many days and the animals are around to regraze as plants try to grow
  - Animals move away, but come back too quickly while plants are using stored energy while trying to grow
  - Plants exposed to animals immediately following dormant season

# CURRENT ISSUES

## Results of Partial Rest and Overgrazing



# LAND MANAGEMENT TOOLS

Land Management Tools	Currently used
Fire	Fire
Rest	Partial Rest and Total Rest
Technology	Technology
Living Organisms	
Grazing	Overgrazing
Animal Impact	

# LAND MANAGEMENT TOOLS

Land Management Tools	Currently used	Recommended Use
Fire	Fire	
Rest	Partial Rest and Total Rest	
Technology	Technology	
Living Organisms		
Grazing	Overgrazing	Holistic Planned Grazing
Animal Impact		Animal Impact

# PROPOSED SOLUTION

## Holistic Planned Grazing

- The essence of Holistic Planned Grazing is to be constantly matching the speed of animal moves to the physical rate of plant recovery.
- Plant and soil recovery time is a new and important concept in understanding the mystery of desertification and declining landscapes.
- Involves a structured orderly thought and observation process.

# HOLISTIC PLANNED GRAZING IN ACTION



# HOLISTIC PLANNED GRAZING IN ACTION





# HOLISTIC PLANNED GRAZING IN ACTION



# HOLISTIC PLANNED GRAZING RESULTS

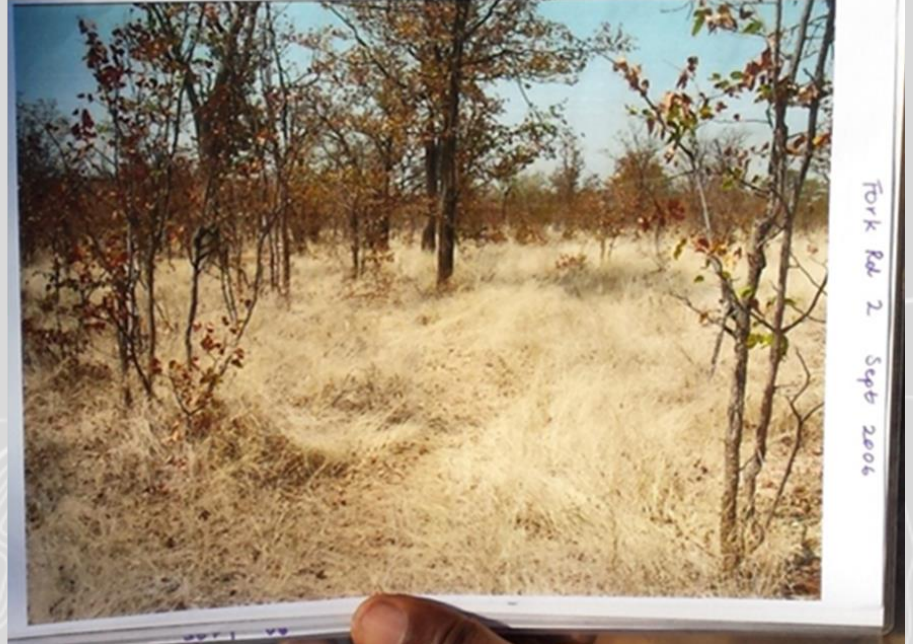


# HOLISTIC PLANNED GRAZING RESULTS

Partial Rest and Overgrazing

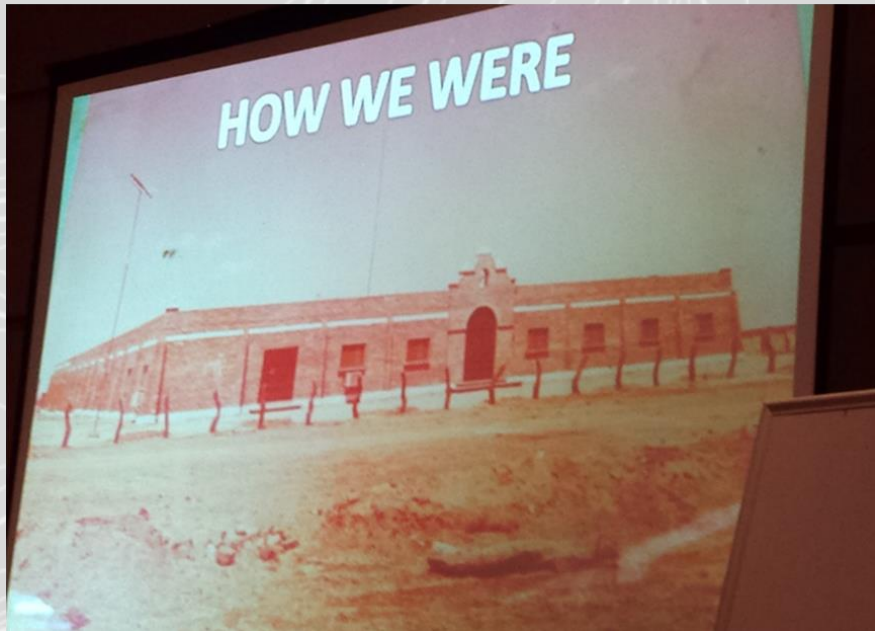


Holistic Planned Grazing



# HOLISTIC PLANNED GRAZING RESULTS

Partial Rest and Overgrazing



Holistic Planned Grazing



# CONCLUSION

- Arid Southwest is a Brittle Environment
- Current land management practices has caused desertification
- Desertification Symptoms
  - Excess Flooding
  - Soil Erosion
  - **Dust Storms**
- Holistic Planned Grazing
- Humidity is maintained in herbivores' guts
- Fix Water Cycle and Restore Ecological Processes
- On average 1% of SOM can retain approximately 60,000 gal of water/ac

# QUESTIONS

