Rehab'ing Land Rehab

Tony Hartshorn | soildoc@gmail.com
Dept. Land Resources & Environmental Sciences

Mine Design, Operations, and Closure Conference
May 8, 2019

Habitat

Habitat Home
Access & Planning
Conservation Areas
Ecosystems
Habitat Permits
Maps & GIS
Restoration & Enhancement

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Red Dog Mine Biomonitoring Studies

The Red Dog Project is a biomonitoring project required by the EPA permit for the mine's wastewater discharge. Our biomonitoring project includes sampling of streams affected and not affected by the mine. Data on water quality, periphyton (algae), aquatic invertebrates, and fish are components of the study. Monitoring also covers an assessment of the Arctic grayling spawning migration into North Fork Red Dog Creek, metals concentrations in adult and juvenile Dolly Varden, and a population estimate of Arctic grayling in the mine's freshwater reservoir. Yearly surveys are conducted to evaluate the performance of culverts and bridges along the road that connects the mine to the port. From 1999 through 2003, a biomonitoring program was conducted at a number of new sites potentially affected by future hard-rock developments and exploration for gas resources. Annual reports are prepared to summarize information collected and to compare these data with previous years' results.

Related Links

Outline

1. Brief history of Land Rehab
2. State of the Project
   - ▶ Financial resources
   - ▶ Personnel
   - ▶ Field destinations
   - ▶ Urgency (RCP8.5)
3. Where to next?

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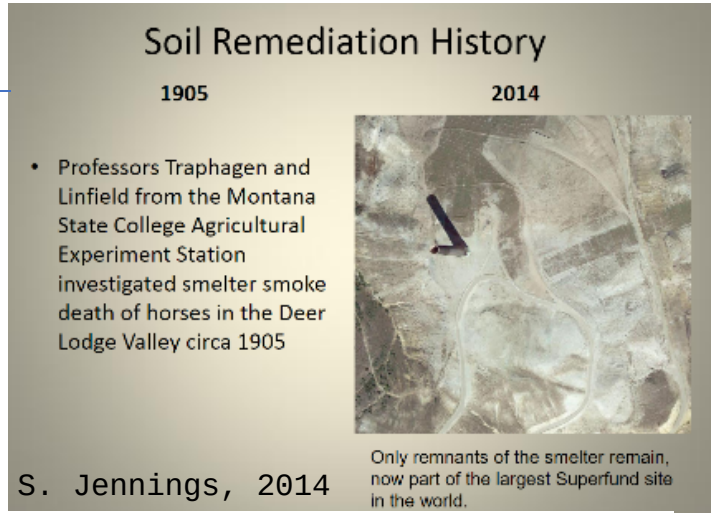


M.S. Montana State Univ-Bozeman, Abused Land Rehabilitation, 1997

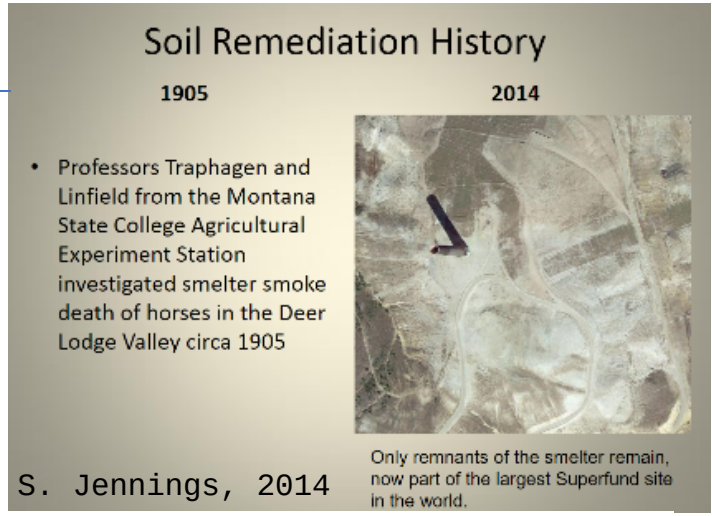
Reclamation Research Group, LLC
March 2006 – March 2012 • 6 years 1 month
Bozeman, Montana

Environmental research and applied service provider to State and Federal Agencies with emphasis on revegetation of disturbed land, Superfund sites. Montana State University spin-off founded March 2006, merged with KCHarvey Environmental April 2012

Outline

1. Brief history of Land Rehab

Frank Traphagen era, MSU's 1st chemistry & natural sciences teacher (and manager of the 1899 football team, which shut out UM twice that year [5-0, 38-0])



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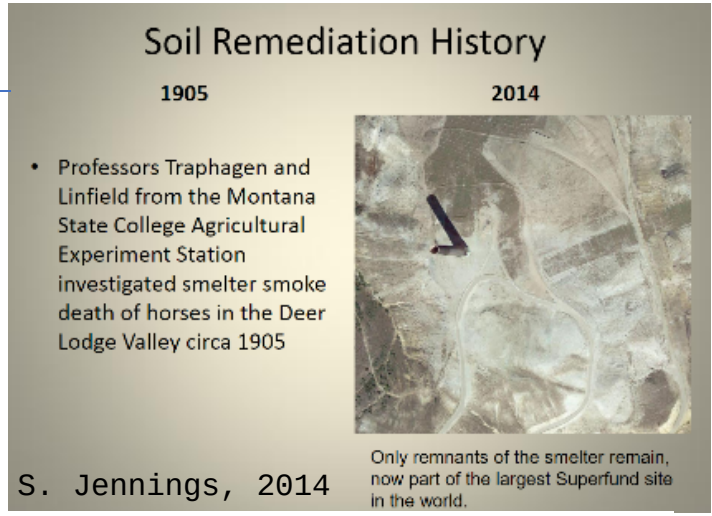
Professor Frederic Bloomfield Linfield (July 17,1866–September 24,1948) came to Montana as a Professor of Agriculture for the Montana Agricultural Experiment Station in 1902 after serving ten years with the Utah Agricultural Experiment Station. Linfield was named Director of the Montana Agricultural Experiment Station in 1904 and served in that post until his retirement in 1937, a total of 33 years. Linfield began a dryland farming research program in 1906 after a buggy trip around the state to learn the concerns of Montana's producers.

Linfield was the principal of the School of Agriculture short courses from 1903 to 1907 when the School was reorganized by Linfield and President J. Hamilton to offer a three year course of study with classes held six months of the year. Linfield was appointed as the first Dean of the School of Agriculture in 1913 and remained Dean until his retirement in 1937, a total of 24 years. The School was reorganized again in 1922 to offer unit courses in specific departmental topics. Group courses in diversified farming, livestock production, and tractor grain farming were offered from 1929 to 1933.

The History of Linfield Hall

Construction of the building began in the autumn of 1907 and was completed on September 16, 1908. Fifty students



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FISHING THE WEST WITH UNCLE FRANK
1987

Outline

1. Brief history of Land Rehab

Frank Munshower, Doug Dollhopf, Dennis Neuman et al.

Stuart Jennings

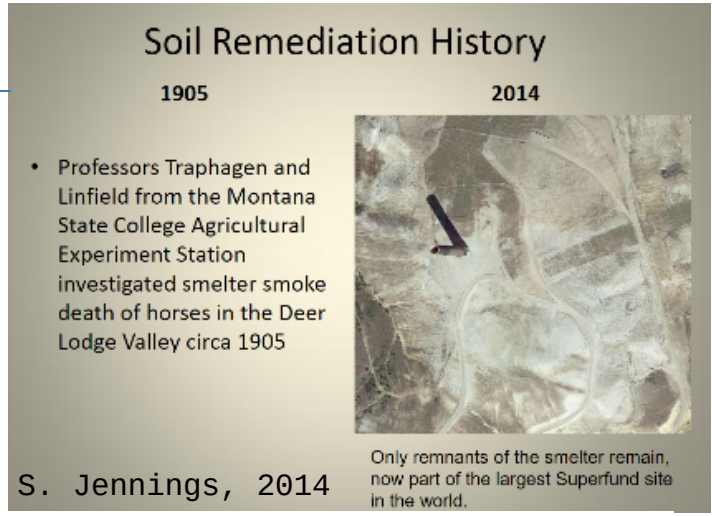
Lifetime of hunting: Mounts of 100-plus animals fill trophy room

By RON TSCHIDA - Chronicle Staff Writer Feb 26, 2000

Even if you're expecting it, even if you know before you arrive that Doug Dollhopf has one of the most extensive big game trophy collections in Southwest Montana, the sight of more than 100 mounted animals and heads in one room leaves you a bit slack-jawed.

Dollhopf, 52, has made five monthlong safaris to Africa. The 1,400-square-foot, vault-ceiling trophy room at his home a few miles west of Bozeman is a menagerie of taxidermy specimens from that continent and from all over North America.

Dominating the room is the head mount of an African elephant, which with its 10- foot "ear span" seems poised to fly Dumbo-like from the wall.



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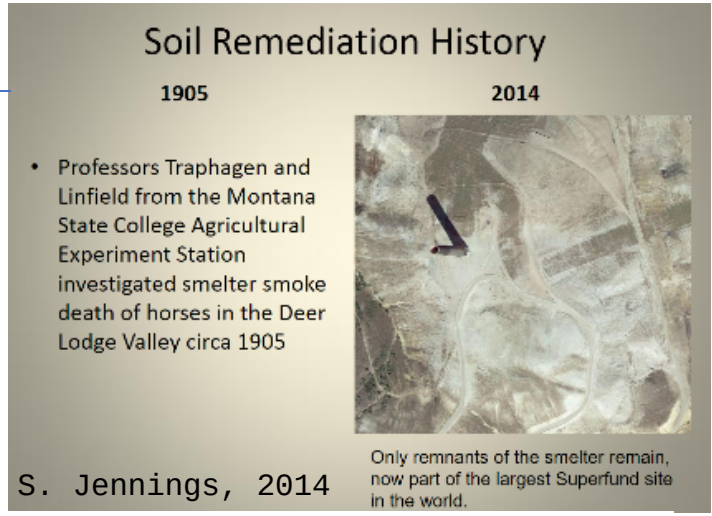
Stuart Jennings

Stuart Jennings
President and Founder, Edaphix, LLC
Bozeman, Montana
Environmental Services



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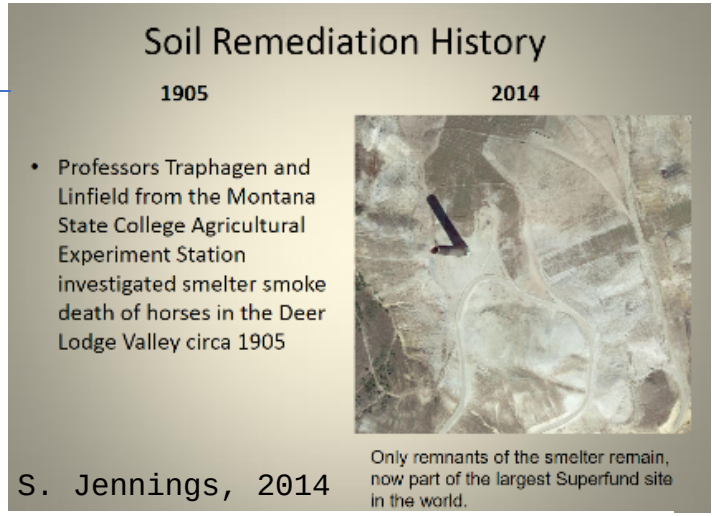
#soilculture
Soil Interrogation Lab



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   - ►Urgency (RCP8.5)

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   - Person
   - Field d
   - Urgenc

Let's not forget that it was not so long ago that A.K. Bailey was a graduate student who collected 465 cm worth of sediment cores (~15.3 feet; n=8) from around Milltown Dam (July 1974) and then discovered elevated metals (she did not measure for the metalloid arsenic). Here is her unpublished thesis.

It took until March 28, 2008 (video link) for that dam to be removed. And as you will learn from our guest lecturer, Diana Hammer, the Milltown State Park opened summer of 2018.

Bailey 1976: 18

Table 3: 24

Range and Average of Heavy Metal Concentrations in the Sediment Cores

Core #	Zn (µg/g)	Cu (µg/g)	Mn (µg/g)	Fe (µg/g)
1	334-399 (362)[b]	13-20 (16)	225-278 (249)	21,280-25,000 (23,160)
2	984-4,932 (2,505)	1,073-3,477 (2,283)	534-649 (583)	24,000-33,860 (30,180)
3	<dl[a]-163 (48)	<dl[a]-39 (11)	300-464 (392)	14,680-20,580 (18,320)
4	293-1,578 (739)	50-767 (314)	368-2,608 (1,118)	10,540-27,200 (17,850)
5	527-1,820 (919)	148-855 (476)	589-2,890 (1,175)	15,350-33,450 (23,100)
6	617-1,710 (1,117)	94-565 (312)	472-1,826 (1,146)	15,540-31,870 (23,650)
7	829-7,907 (4,915)	1,341-7,927 (4,927)	475-1,402 (1,020)	29,630-43,280 (39,510)

[a] <dl=less than detection level.

[b] Average concentrations in parentheses.

Last sentence:"These catch basins for pollutants [like Milltown Dam] possess potential dangers to the environment."

Here you go. Sorry for the delay!

Unexpected Challenges of Trying to Restart a Land Rehabilitation Program
Tony Hartshorn

Abstract: Woody Allen once claimed showing up is 80% of life (bit.ly/80showingup). What if you built a land rehabilitation (LR) program and no one showed up?

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S	T

Anaconda Brockman fieldtrip

Apr 20, 2013–Apr 14, 2019








ENSC460 Soil remediation fieldtrip to Anaconda
04/18/2015 11:28


ENSC460 Soil remediation fieldtrip to Anaconda
04/18/2015 11:28


Top of a 30-foot thick section of copper tailings (orange), overlaid by Milltown Dam sediment (dark)
04/18/2015 11:32


A couple feet below the town of Opportunity's newest playground, you'll find an orange layer—of tailings. These tailings could have 1% Cu, 0.4% As, 0.2% Zn, 0.1% Pb, and 74 mg/kg Ag based on samples further downstream near Warm Springs.
04/18/2015 14:30

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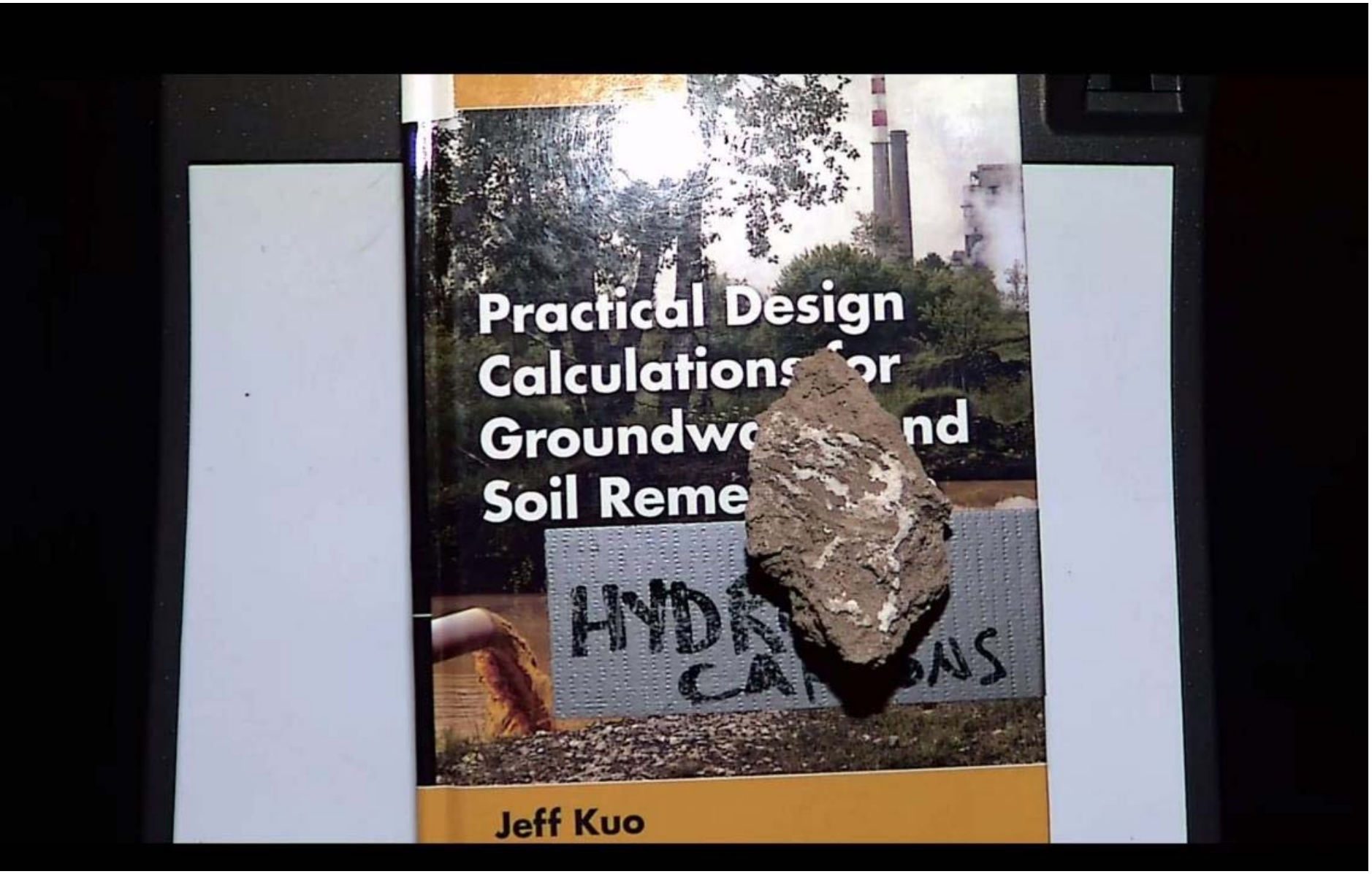
Official Site of the A-Salted Plant Remediation

MgCl2 Assault and Gypsum Remediation on Peas


https://sites.google.com/view/backyardsoilremediation/blogs
Apps
WebEx
BioRAFT
ref
MBMG
ASHLOR
MTmiMarks
PowerAnalysis
SoMEotR
Lib
PB
C?
dirtmap
AGBK$
Sign In
Nouns
MONTANA STATE UNIVERSITY
Soil Remediation
Home
Blogs
Data
Blog Posts
To view each set of blog posts, click the appropriate link below:
Blog 1: The "Why?" behind our experiment.
Blog 2: What we wish we'd done differently.
Blog 3: First do no harm.
Blog 4: Practical design calculations.


Practical Design
Calculations for
Groundwater and
Soil Remediation
Jeff Kuo

Compost for Hydrocarbon Contamination

by Charlie Gurgel

In the Kuo text there is a distinct lack of practical design calculations covering soil and groundwater remediation techniques related to erosion, salt, metal, and hydrocarbon contamination. The last of these, hydrocarbon, is what this bioassay project was investigating. For now we'll assume that our remediation technique of applying compost was successful to apply further, and that 400 grams of compost should be applied for every liter of spilled hydrocarbon insult.

The most important consideration in designing your project is understanding that the application of compost depends on the spread of the insult. That is, the greater the volume of soil the contaminant has reached, the lower its concentration will be. Based on this, you can determine how to apply your remediation. The two factors that should be estimated before attempting your remediation are the amount of contaminant that was released, and the volume of soil that it has seeped into. Using these figures you know how much compost to acquire and to what degree it should be mixed in.

Suppose that your client had a large scale spill of 200 liters of hydrocarbon and you must determine how many 4 kilogram bags of

YouTube

Search

http://bit.ly/OilNMicrobes

Oil N Microbes Final

Unlisted

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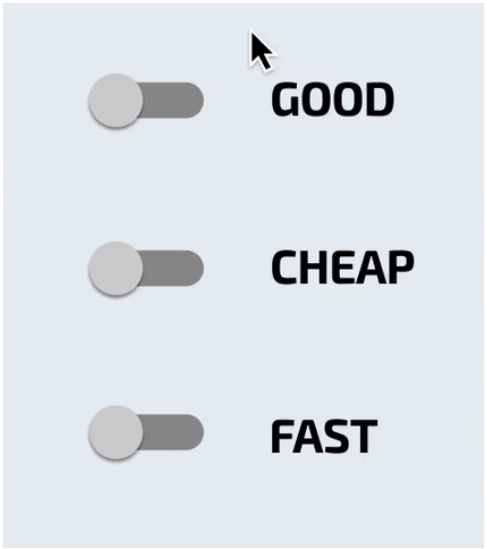

My introductory soils and soil remediation enrollments have averaged ~225 and ~27 the last 7 years, respectively, about 1.4X historical enrollments (2007-2012). I have run the graduate field course formerly known as "Uncle Frank's [Munshower] fishing trip" twice, but with three students each time, one-third 2007's enrollment.

How can we increase the field course enrollment?
How can we improve student competencies?

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How can we increase the field course enrollment?
How can we improve student competencies?
Are you listening?

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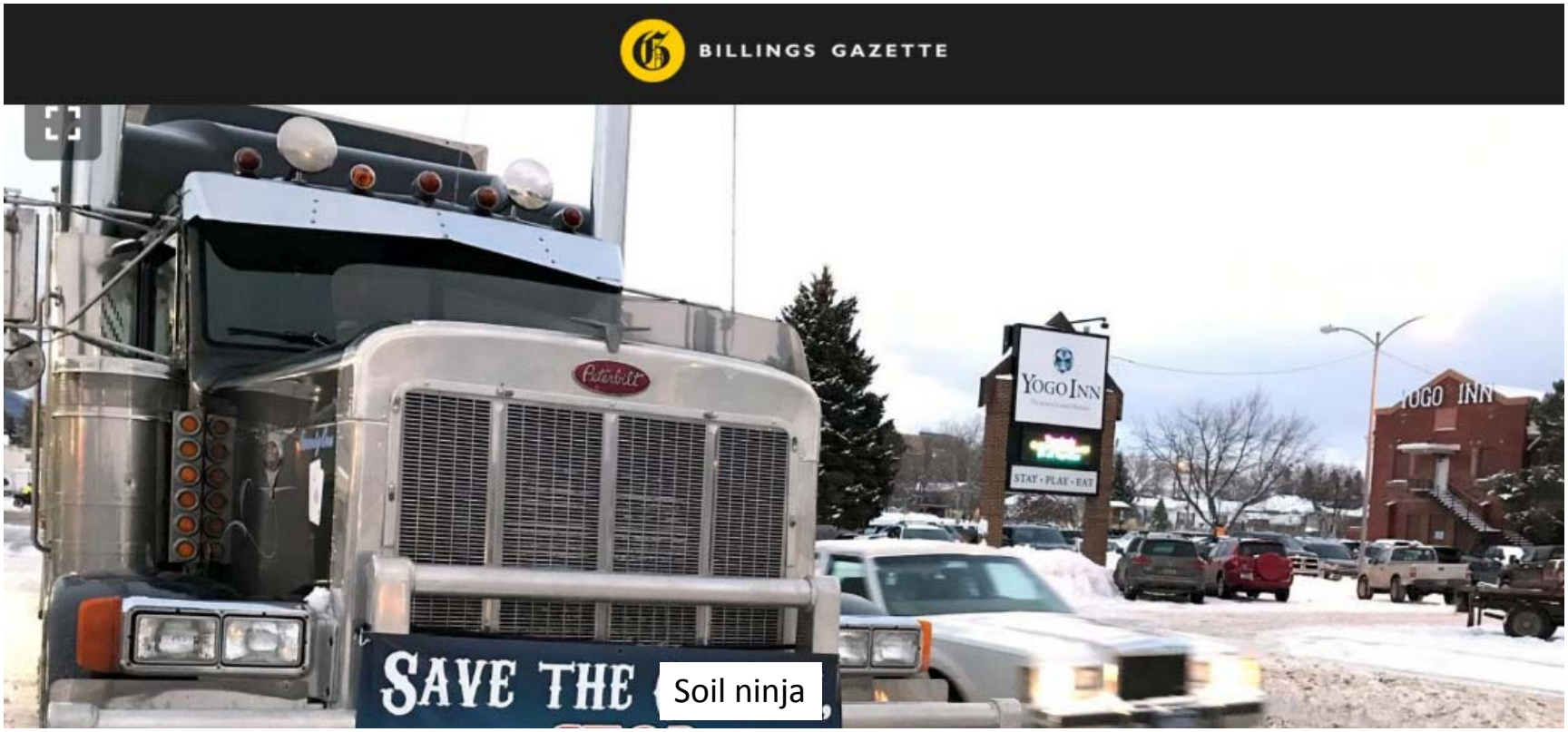
https://billingsgazette.com/outdoors/rural-heart-of-montana-confronts-change-at-lewistown-conference/article_818aa84c-7494-549e-8598-0e3dae942ddc.html



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Save the date

Filling a Void: *Growing Montana's Restoration Workforce*

A Workshop on Education and Training for the Restoration Economy

WHEN: Thursday, Oct. 2, 8:30 a.m. - 4:30 p.m.

WHERE: Montana Tech, Student Union Building, Copper Lounge, Butte, Mont.

COST: Free, but registration required Online @ www.dnrc.mt.gov AFTER SEPT. 1 or call(406)444-2074

Abandoned mines, degraded roadways and unhealthy forests pose a growing threat to the lands and waters Montanans cherish. Restoring damaged landscapes creates new opportunities for businesses, healthy animal and plant communities

https://wayback.archive-it.org/499/20080908191541/http://dnrc.mt.gov/Restoration/pdfs/flier.pdf

Growing a Restoration Workforce

A Workshop on Education and Training for the Restoration Economy

October 2

Location: Montana Tech, Student Union Building -Copper Lounge, Butte, MT

Registration: Free but required. http://dnrc.mt.gov or 406-444-2074

DRAFT AGENDA

8:30 **Refreshments** (hosted)

9:00 **Welcome** – *Pat Williams, former Rep., U.S. Congress, Montana, 1979 - 1997*
Overview – *Tom Palmer, Information Bureau Chief, Montana Fish, Wildlife and Parks*

9:15 **Successful Restoration Settlements: Creating Jobs and Mending the Environment** – *Mike McGrath, Attorney General*

9:30 **Restoration Workforce Needs in Montana** *moderated by Tom Palmer, FWP*
Panelists offer a brief summary of their organizations restoration projects, including current efforts and future needs in Montana. A moderated discussion will follow, in which panelists will discuss the range of skills workers need to be successful candidates for restoration activities. Panelist will also identify skills and expertise the workforce is

3:00 **Problem-Solving Work Groups-** *introduced by Mary Sheehy Moe, Deputy Commissioner for Two Year Education*
Participants can choose from two basic work groups to propose short-term and long-term education programs to develop the restoration workforce. Work groups will propose plans for advancing restoration education and training in Montana. Participants are to identify the course or program content and connect each program's content with "the gap" it fills.

Work Group 1: *New* Formal Programs - *facilitated by Mary Sexton and Joe Lamson, Director and Deputy Director, DNRC*
Identify and propose specific academic classes and apprenticeship/training programs for preparing workers in prioritized restoration fields. Make suggestions for delivery format (MUS classes, condensed, online, OTJ) and delivery location (schools, training facility, online, conferences).

Work Group 2: Interdisciplinary Restoration Education - *facilitated by Mary Sheehy Moe*
Identify how *existing* restoration classes and training programs can be used for cross-training. Can existing programs be provided in condensed, online, or traditional formats among MUS schools; Can cross-college training be built into curriculum; Can classes be offered for MUS students and technical schools; How do existing programs reach professionals and skilled workers? Make suggestions for delivery formats and locations.

4:00 **Summary of Work Group Proposals** - *Presented by each work group*

4:30 **Next Steps -** *Mary Sheehy Moe and Tom Palmer*
Closing Statements – *Hal Harper, Chief Policy Advisor, Governor's Office*

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Signature Brian Schweitzer

Date July 10, 1980

SPRING WHEAT YIELDS ON TWO CONTRASTING ARIDIC ARGIBOROLLS IN NORTHCENTRAL MONTANA

by

BRIAN DAVID SCHWEITZER

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Soil Science

Approved:

D. A. Nielsen
Chairperson, Graduate Committee

Hayden Ferguson
Head, Major Department

Michael Malone
Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

www.umt.edu/crmw/Downloads/Restoration%20Study%20Overview.pdf

Natural Resource and Environmental Restoration in Montana

Case Studies in Restoration and Associated Workforce Needs

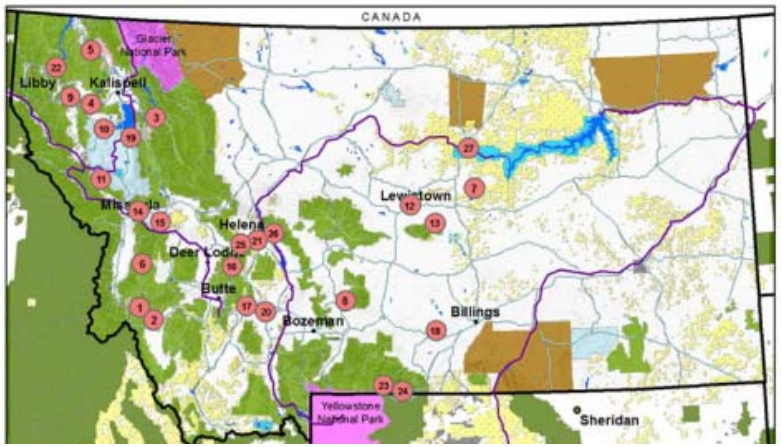
August, 2012

A Report by

Larry Swanson and Hayden Janssen

O'Connor Center for the Rocky Mountain West[1]

The University of Montana



http://www.umt.edu/crmw/Work/default.php


What have we learned since
1532?
Tony Hartshorn
Montana State University
soildoc@gmail.com #soilculture
480.406.1277
06/03/2016 08:29

Table 2: Material intensity for renewable energy technologies

Technology		Aluminium	Copper	Cobalt	Lithium	Manganese
Batteries [t/GWh]	Li-ion	220	220	124	113	406
	Li-S	220	220		411	
EVs [kg/vehicle]						
Solar PV [t/GW]	c-Si	32,000	4,000			
	CIGS	32,000	4,000			
	CdTe	32,000	4,000			
Wind [t/GW]	PMG	560	3,000			
	Non-PMG	560	3,000			

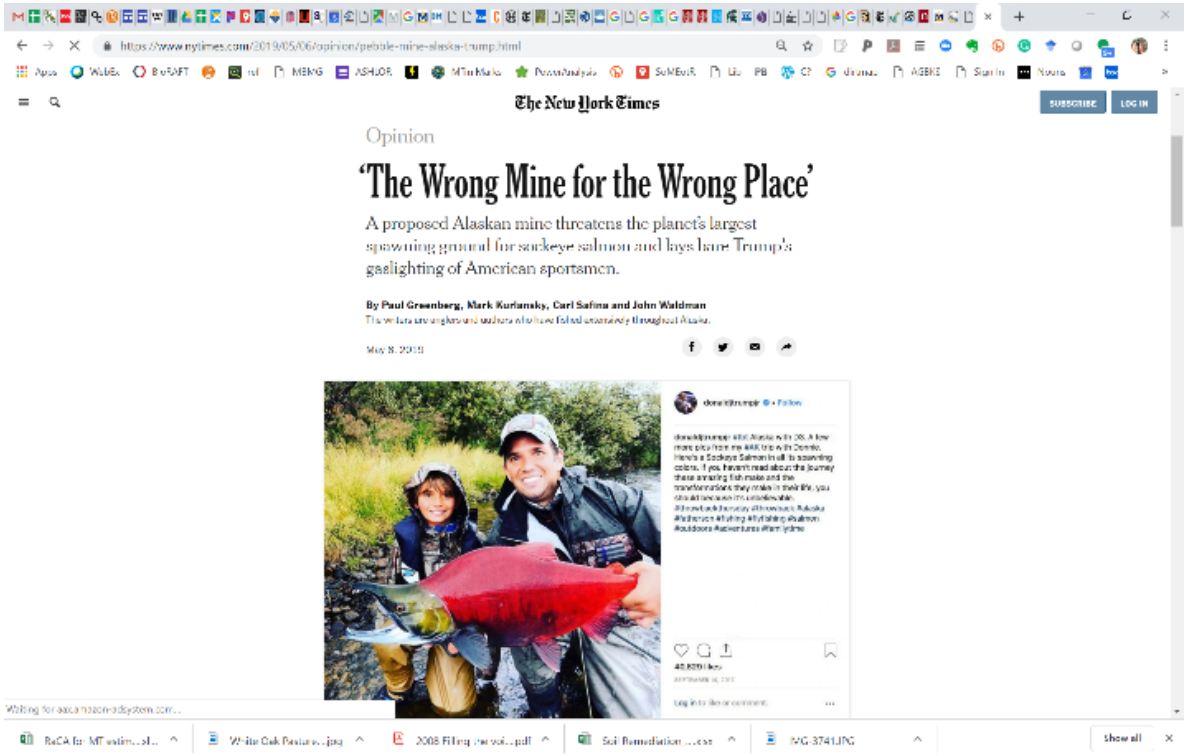
Earthworks 2019

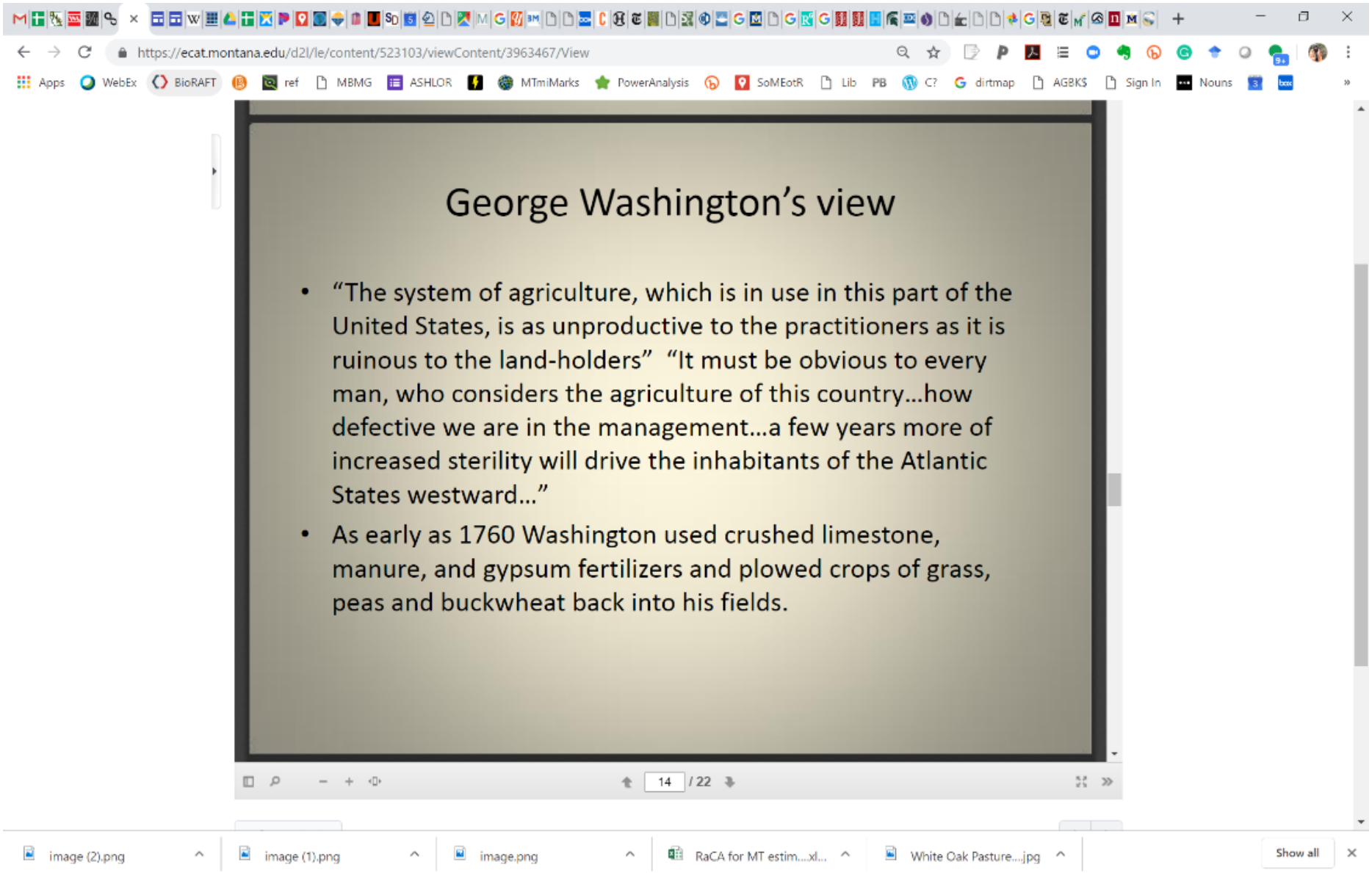
1st session at MDOC 2019

- Hawai'i Wildlife Fund v. County of Maui (9th circuit→ going to SCOTUS)
- Upstate Forever v. Kinder Morgan Energy Partners (4th circuit→ SCOTUS)
- 6th circuit???
- Green New Deal translates to more copper mined in next 15 y than has been mined
- Land Tenure to go against Mining Law… claims→leases May 9 ("if this suit is successful, it will change the mining industry fundamentally [in US]")
  - SASB: sustainability standards for mining sector
  - GSI: sustainability standards for mining sector
    - governance

https://www.epa.gov/pfas/epa-drinking-water-laboratory-method-537-qa

https://www.nytimes.com/2019/05/06/opinion/pebble-mine-alaska-trump.html

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Apps
WebEx
BioRAFT
ref
MBMG
ASHLOR
MTmiMarks
PowerAnalysis
SoMEotR
Lib
PB
C?
dirtmap
AGBKS
Sign In
Nouns
George Washington's view
• "The system of agriculture, which is in use in this part of the United States, is as unproductive to the practitioners as it is ruinous to the land-holders" "It must be obvious to every man, who considers the agriculture of this country…how defective we are in the management…a few years more of increased sterility will drive the inhabitants of the Atlantic States westward…"
• As early as 1760 Washington used crushed limestone, manure, and gypsum fertilizers and plowed crops of grass, peas and buckwheat back into his fields.
14 / 22
image (2).png
image (1).png
image.png
RaCA for MT estim....xl...
White Oak Pasture....jpg
Show all

ENVIRONMENTAL SENSORS BIOB 491

Design, Build and Deploy in the Field

FLATHEAD LAKE BIO STATION

SUMMER SESSION 2019

at University of Montana's Flathead Lake Biological Station

June 24 – July 5, 2019

- Engineering and Ecology Students! Learn innovative methods in sensor data and prototyping techniques.
- Design, build and deploy: advanced sensors including O_2, CO_2, pH, T, PAR, and turbidity; data loggers and controllers; and real-time networks—on a shoestring budget!
- Collaborate in the SensorSpace Lab to solve real world problems.
- Take this immersion-style course for grad or undergrad credit.

Instructor:
Dr. Cody Youngbull
Research Professor, Physicist

Here's what 2018 summer students had to say–

"We made our own sensors and deployed them: Real-time reporting to the Web, dO_2 Sensors, Data Loggers, dCO_2 Sensors and pH Sensors."

"I now understand processes I'd never have learned outside this course. Even without experience in embedded systems, it was easy to follow along."

Scholarships available! Small class size!
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Students from across the US!
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UNIVERSITY OF MONTANA

SENSORSPACE

Get out here!

Flathead Lake Biological Station, U of Montana, 32125 Bio Station Lane, Polson MT 59860-6815 USA on the east shore of Flathead Lake
voice 406.872.4500– email fbs@fbs.umt.edu – web fbs.umt.edu – www.facebook.com/umfbs – webcams fbs.umt.edu/webcams