Management considerations surrounding mechanical vs. hand thinning in the eastern hill country

WATER QUALITY
PROTECTION LANDS

BALCONES • CANYONLANDS • PRESERVE
Austin • Texas

The question is…

- Ultimately, “should we favor hand thinning over mechanical thinning, or leave economics as the decisive factor?”

- “Science can’t tell you what to do.”
  - Matt McCaw

- "… even when scientific research programs are explicitly designed to guide and facilitate restoration, the culture of science, heterogeneity of nature, and real-world complexities of implementing land management practices often limit the practical relevance of conventional scientific research…."– Cabin 2007

- "Our practices evolve from *modified scientific approaches* and the scientific literature. Results from experiments with non-optimal replication… nonetheless had value for management decisions." – DeSimone 2013

- Literature review (land mgmt plan + ongoing)
  - Severe soil compaction leads to poor plant production and poor storm water infiltration
  - Caution (modified techniques) can mitigate the compaction effects of heavy equipment operation on rangelands
    - Minimal disturbance to herbaceous veg
    - Small machines (@2.5-3.5 ton)
    - No turning in place
    - Single pass
    - Rain days – site access not permitted when soils are wet
    - Plant condition is good indicator of effects on soil
    - Sensitivity to compaction and ability to recover vary significantly based on soil type and extent of disturbance
    - Large wheel size: axle weight ratio reduces compaction, spreads weight
    - Drive on slash reduces compaction
    - Gaps: Formulas to quantify relationship between infiltration rate and compaction value. Formulas to quantify relationship between compaction value and recovery rate. All modified for climate variation and soil type. Lit generally doesn't deal with low/moderate compaction values

Ecological Intuition

Plant condition

Herbaceous community is largely intact

Disturbed areas are limited and able to recover

Effects described on ag + timber sites are much worse

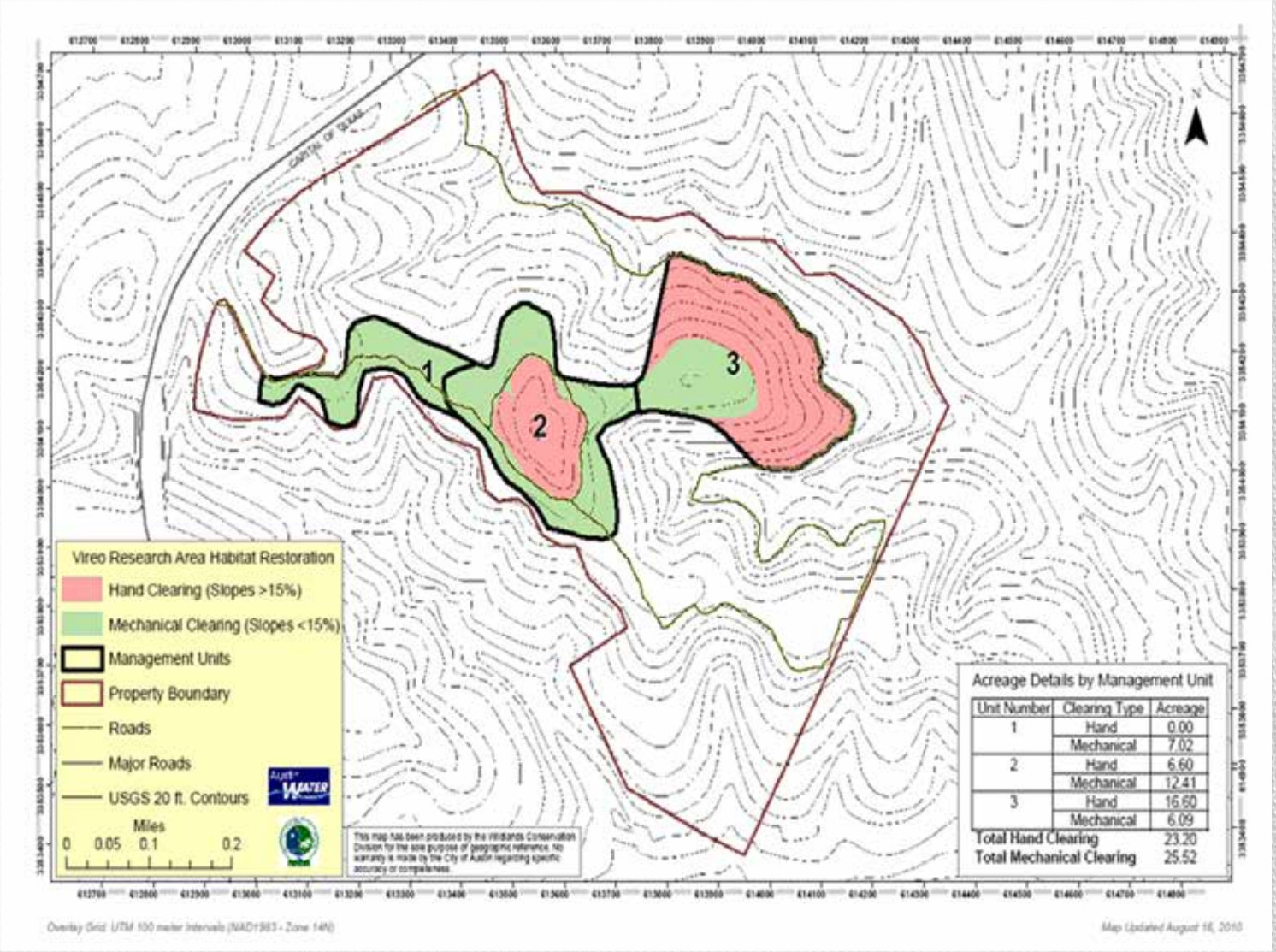
Work is subject to ongoing inspection and approval

Resilient plant community is prerequisite

“Quick and Dirty” data for restoration practice aka soft science

- Solution/decision oriented
- Practicality over statistical power
- Contributes to a working understanding
- Initially focused on land condition trend under mgmt. regime, not causation
- In a nutshell, looking at readily available data for red flags, which would indicate the need to drop everything and look closer.

- Observational case study: Vireo Preserve



Hand thinning (chainsaws and mulch removal), fall 2010


SEPTEMBER 2012 (CUT JANUARY 2011)


SEPTEMBER 2012

Mining data from existing monitoring regime

- Long term monitoring regime
- Scores of 800 ft long transects across 10 k acres of fee simple land
- 2 indices adapted for use here: ground cover and growth form

Transect	ac	Pre	PrjFin	Post	n	per pre	per post	change	ann pre	ann post	change	bare pre	bare post	change
LIBE 5-2	78	7/09	11/09	4/11	160	143	146	2%	7	3	-3%	1%	0%	-1%
LIBE 4-1	68	5/09	3/10	11/11	160	101	111	6%	43	21	-14%	13%	18%	5%
LIBE 1-2	58	11/10	12/11	5/13	160	104	89	-9%	7	35	18%	4%	6%	2%
LIBE 1-1	174	5/09	10/09	11/11	80	51	62	14%	20	16	-4%	21%	26%	6%
LIBE 5-1	105	7/09	11/10	5/12	160	78	68	-6%	20	60	25%	7%	3%	-4%
					Mean	95	95	1%	19	27	4%	9%	11%	1%
					St Dev	34	34		14.71	21.71		0.08	0.11	
					Delta			0.01			-0.52			-0.18

No Red Flags

Pre

Post

Mech vs. hand thinning: compaction test results from Vireo Preserve

	Hand thinned	Mechanically thinned
Number:	30	30
Mean:	84.8	205
Standard Deviation:	28.9	95.4
Variance:	834	9106
Delta:	4.14	
CI:	119	120
p-value:	0	
Conclusion:	p-val<sig level, therefore Ho is rejected. There is NO evidence that compaction is equivalent on mech and hand treated areas.	

Mech vs. hand thinning: compaction test results from Little Bear Creek Management Unit

	Hand thinned	Mechanically thinned
Number:	30	30
Mean:	112.7	133.8
Standard Deviation:	28.82	21.64
Variance:	830.6	468.4
Delta:	0.734	
CI:	21	21.33
p-value:	0.001	
Conclusion:	p-val<sig level, therefore Ho is rejected. There is NO evidence that compaction is equivalent on mech vs hand treated areas.	

Mech vs. hand thinning: compaction test results from Slaughter Creek Management Unit

	Hand cleared	Mechanically cleared
Number:	30	30
Mean:	88.5	77.83333333
Standard Deviation:	13.9673264	16.01095171
Variance:	195.0862069	256.3505747
Delta:	-0.763687076	
CI:	-18.46378096	-2.869552368
p-value:	0.004	
Conclusion:	p-val is < significance, therefore Ho is rejected. There is NO evidence that soil compaction is equivalent on mech vs hand cleared areas	

Summary of Findings

- Observational case study: Mechanical thinning can be devastating to project objectives. These effects can be observed with rough field estimates of herbaceous response (bare cover and perennial vs. annual cover) and soil condition (rock hard).
- Data Mining: Findings consistent with initial field estimates of adequate herbaceous response.
  - No clear indication that the amount of bare cover is excessive, increasing, or persistent following mechanical thinning.
  - No clear indication that root development is hindered following thinning (perennial cover vs. annual cover).
- Compaction test: compaction was severe on Vireo Preserve. Compaction on WQPL clay/rocky red clay sites were moderately different with inconsistent results; of the two sites, compaction has higher on mechanically cleared areas of one and hand cleared areas of the other.

Conclusions

- Severe compaction occurred on site following repeated/severe disturbance with heavy equipment. Differences in mean compaction values and standard deviation are consistent with literature on logged areas with decreased infiltration rates.
- Soil compaction values on sites that received mechanical clearing with modified techniques were not consistent.
  - Soil type?
  - Recovery time?
  - Prior land use?
- Not enough info to favor a thinning method, which continues to be determined by economics for now.

Communication

- "Bridging the Science-Practice Gap": Monitoring visits during implementation provide an opportunity to communicate how observable site conditions, relevant literature, and unobservable conditions (macroscopic, microscopic, historical and/or anticipated phenomena) are related to each other and project objectives.
  - Know your audience: maybe just tell them they won't get paid if they do it wrong…
- Remote/unmonitored sites: describe consequences of not meeting spec *in detail* prior to "bids due" date
- Mechanical may be risky: can the sites afford the risk if the financial incentives to use mechanical clearing are there?
- What are the neighbors doing?
- Looking forward:
  - Before/after/*way after* compaction tests

Questions?

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"I'll try to find some (examples) and bring them back to you."