METHODS AND CHALLENGES FOR VALUATION OF SOIL HEALTH BENEFITS

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What is ‘Soil Health’?

Soil health on rangeland is an integral part of the **ecosystem function**, and is defined as the capacity of a soil to maintain its function and flow of ***ecosystem services*** given a specific set of physical, chemical, and environmental boundaries.

http://www.sd.nrcs.usda.gov.

Healthy Soils as an Ecosystem Service

- Societal Benefits
  - What is more wildlife habitat worth?
  - What is the value of less soil erosion?
  - What is the value of a soil microbe?
  - What is the value of society “knowing” rangelands are being properly managed?

Value of Ecosystem Services on Public Rangelands?

- Non-Market Valuation Issues
- Undefined Linkages
- Value Extrapolation
- Historical Focus lies mainly on costs of projects

Torell, L. A., G. L. Torell, J. A. Tanaka, and N. R. Rimbey. 2013. "The Potential of Valuing Rangeland Ecosystem Services on Public Rangelands." *Western Economics Forum* 12 (1): 40-46.

4 Principles

- Plant diversity increases diversity in the soil
- Manage soils more by disturbing them less
- Keep plants growing throughout the year to feed the soil
- Keep the soil covered as much as possible

How to Implement on Rangelands?

- Extensively Managed
- Semi-Arid
- Few (if any) inputs
- Livestock Management

So what does this mean for soil health?

- Practices that potentially increase ***forage production*** – prescribed grazing, seeding, overstory removal
- Practices that potentially improve ***grazing distribution*** – fencing, water development

Soil Health and Ranching

- Forage productivity/Utiliz
- Soil erosion
- Translate results of variou practices into ranch effects

Why would Private Landowners Participate?

- Better availability of forage
  - Quantity
  - Quality
  - Timing
  - Drought

Soil Health and Economics on Rangelands

- Limited research for rangelands
- Mainly anecdotal evidence
  - Forage production impacted by:
  - soil structure
  - SOM
  - better nutrient cycles
  - microbial populations

Soil Health and Economics on Rangelands

- Really need to know:

$$\Delta Soil\ Structure \rightarrow \Delta Forage\ Quantity$$

$$\Delta Soil\ Microbial\ Community \rightarrow \Delta Forage\ Quality$$

- ***How*** do we change soils?
- And, over *what time frame* do these changes occur?

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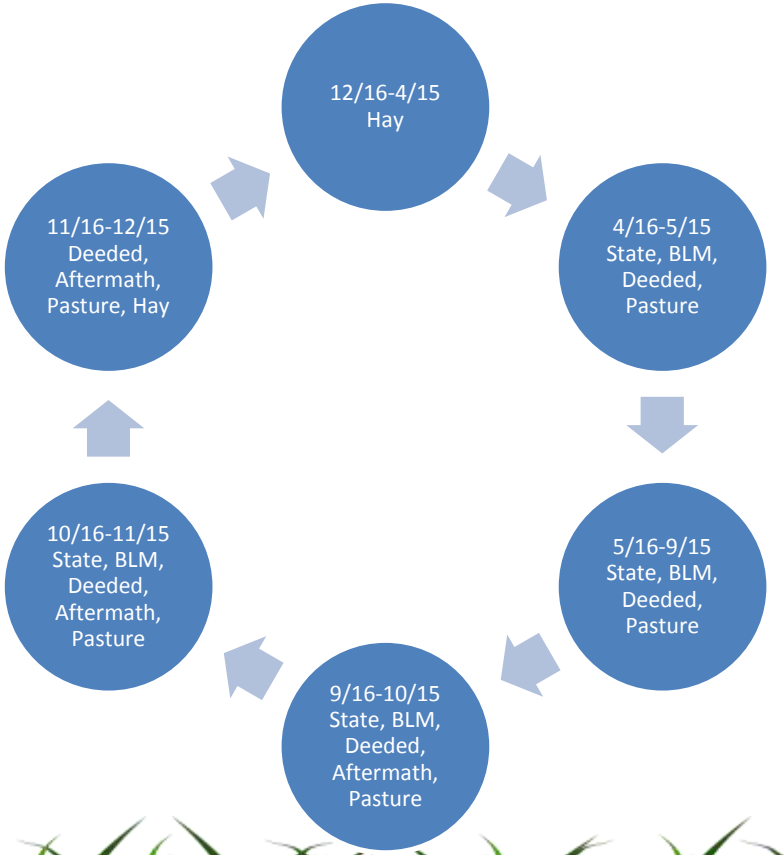
Need to Understand how the Changes Impact the Entire Calendar



- Cattle somewhere every day
- Yearlong operation
- Substitute feeds

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Caveats

- Improving forage quality or quantity in any given season *does not automatically mean* it is useful to the yearlong operation
- Have to balance supply of forage with demand for forage
- Forage ***VALUE*** may be more/less than current AUM lease rates

Value of an AUM?

- Value of lost public AUM's depends on amount and timing of loss
- If AUM's decrease, but are still flexible by season, can range for $13-$30/AUM/Year depending on amount lost
- If season of use is impacted, the range is

  $14-$50/AUM/Year

Torell, L.A., N.R. Rimbey, J.A. Tanaka, D.T. Taylor, J.P. Ritten, and T.K. Foulke. 2014. "Ranch-level economic impacts of altering grazing policies on federal land to protect the greater sage-grouse." University of Wyoming, New Mexico State University, University of Idaho, and the Western Rural Development Center. University of Wyoming Extension Bulletin B-1258. Available online at http://www. wyomingextension.org/publications/.

Time Horizon Matters!

- How long does the improvement to ‘Soil Health’ take?
- How long until this change translates to production potential?

Soil Health as an Investment

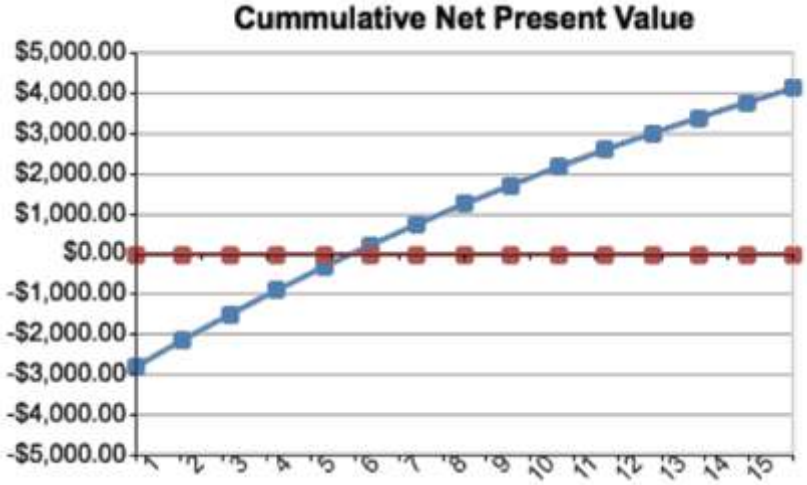
- If we expect producer to undertake practices aimed at improving soil health, they need to see some benefit
- Limited resources means this ‘investment’ has to compete against other uses of capital

Investment Comparison

- $100 Today > $100 Tomorrow
- Need to account for the Time Value of Money when comparing costs (occur up front and into the future) to benefits (occur in the future)

Net Present Value

$$NPV = \sum_{t} (Revenues_t - Costs_t) * \frac{1}{(1+r)^t}$$



Results

5 year NPV	$-317.83
10 year NPV	$2,175.48
15 year NPV	$4,129.05
Break Even Year	6

What's Improved Soil Health Worth?

- We propose a shock to the ranch productivity (increase in benefits over time)
- Ignore the costs
- Result is the 'Maximum Value' of a practice

What's it worth, and to Whom?

- We use a ranch-level model to show how private producers are impacted by changes
- If the Private Benefits < Costs, we would not expect many operations to implement practices
- If Private + Public Benefits > Costs, opportunity for Policy Intervention

Prioritization

- Where do the biggest potential gains exist?
- Which practices?
- Maximize returns to public investment

Questions?

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