

Valuing Soil Health Benefits for WY Ranchers

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Ranch A



From the Journal of Integrated Pest Management.
<https://seocontoh.co/11a6cce/journal-of-integrated-pest-management.html>

VS.

Ranch B



Bull Creek Ranch, Buffalo WY. <http://hallhall.com/ranches-for-sale/properties/bull-creek-ranch>

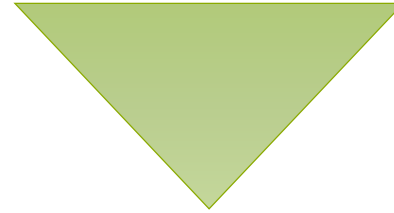
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Δ Soil Structure \rightarrow Δ Forage Quantity



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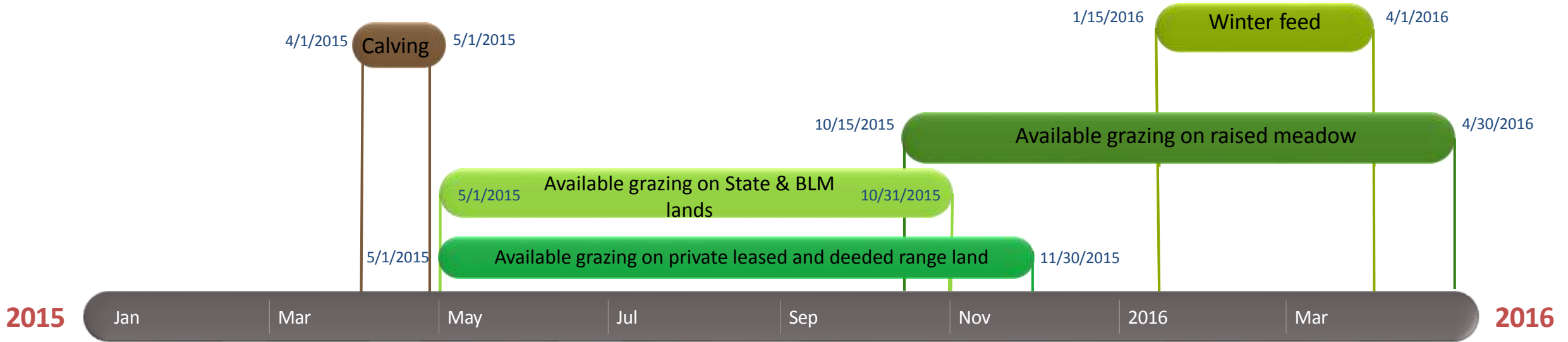
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2. Establish rancher benefit trajectories over time
3. Better understand policy's role to promote ecosystem services on private rangelands





10/15/2015
Weaning

10/31/2015
Livestock go to market and are sold

Ranch Calendar

Ranch Characteristics

		Units	Number of Units
Land Resources Owned	Deeded Rangeland	AUMs	1,076
	Alfalfa Hayland (w/aftermath grazing)	Acres	--
	Meadow Hayland (w/ aftermath grazing)	Acres	793
Land Resources Leased or Purchased	State	AUMs	538
	BLM	AUMs	3,756
	USFS	AUMs	--
	Privately Leased	AUMs	500
	Purchased Alfalfa Hay	Tons	1000
	Purchased Meadow Hay	Tons	1000
Livestock Resources	Brood Cows	# Head	590
	Replacement Heifer Yearlings	# Head	100
	Bulls	# Head	38

Table 1. Representative central WY ranch characteristics.

Ranch Efficiency Measures

Calf crop (calves born as % of Jan 1st cow inventory)	95%
Min cow replacement rate	15%
Max % heifer calves retained for sale as yearlings	80%
Bull replacement rate	25%
Cow-to-Bull Ratio	18:1
Calf death loss	4%
Cow death loss	2%
Bull death loss	1%
Steer calf sale weight	440 lbs
Heifer calf sale weight	390 lbs
Heifer yearling sale weight	800 lbs
Cull cow sale weight	950 lbs
Cull bull sale weight	1800 lbs

Table 2. Representative central WY ranch efficiency measures.

Quantifying Effects of Soil Health on Cattle Production in Central Wyoming

- Objective: Maximize Net Present Value of future stream of profits
 - Subject To:
 - Land availability
 - Time
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 - Soil health conditions on privately-owned rangeland



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 - Incorporate price variability
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KEY: Transform forage production to mimic increased soil health over time

The Model

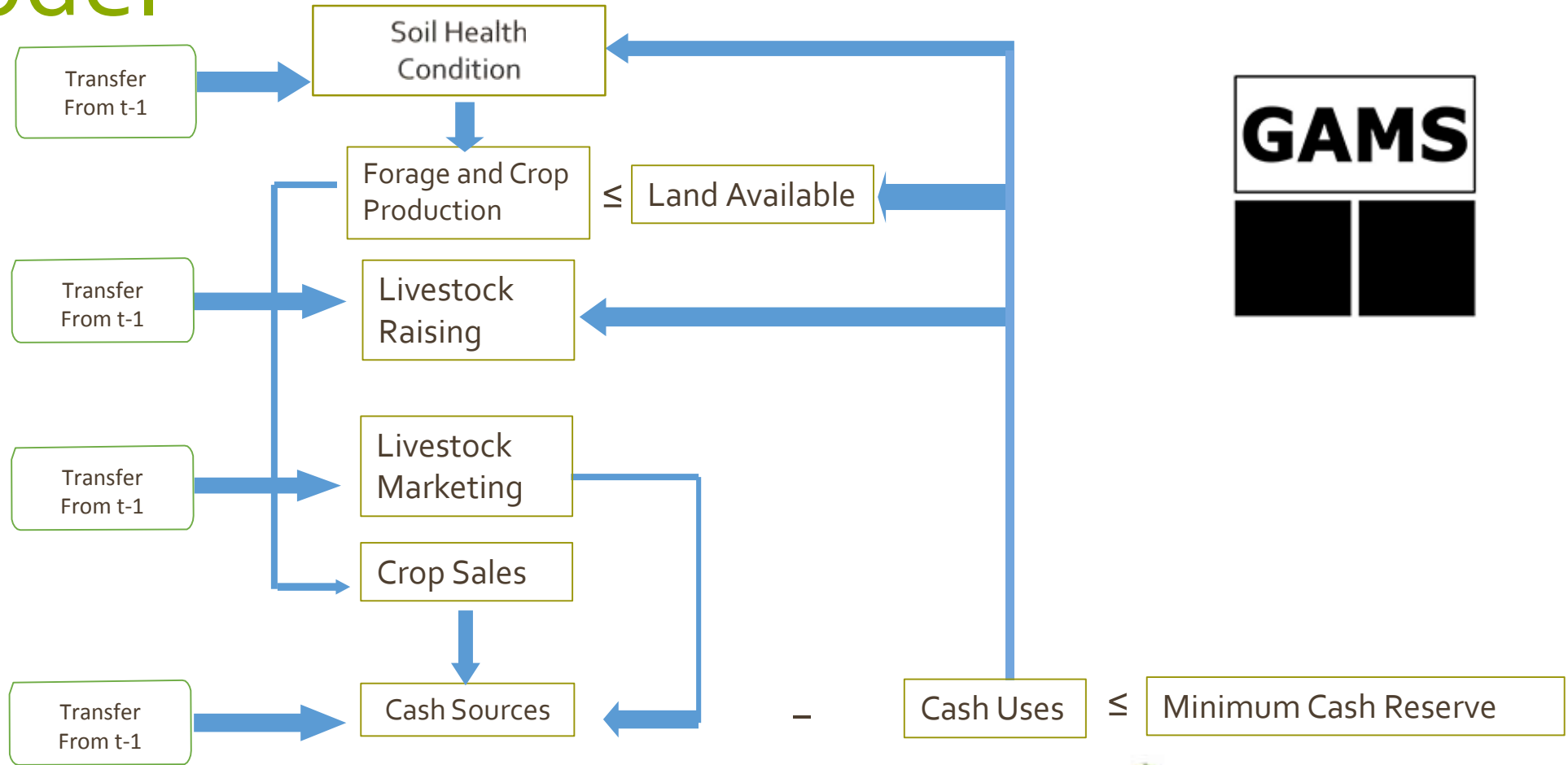


Table 3. MLP Model illustration adapted from Torell et al study.



Method for Modeling Forage Changes from Soil Health Variation

Static Models:

1. Soil health conditions producing 25% of forage capacity
2. Soil health conditions producing 100% of forage capacity

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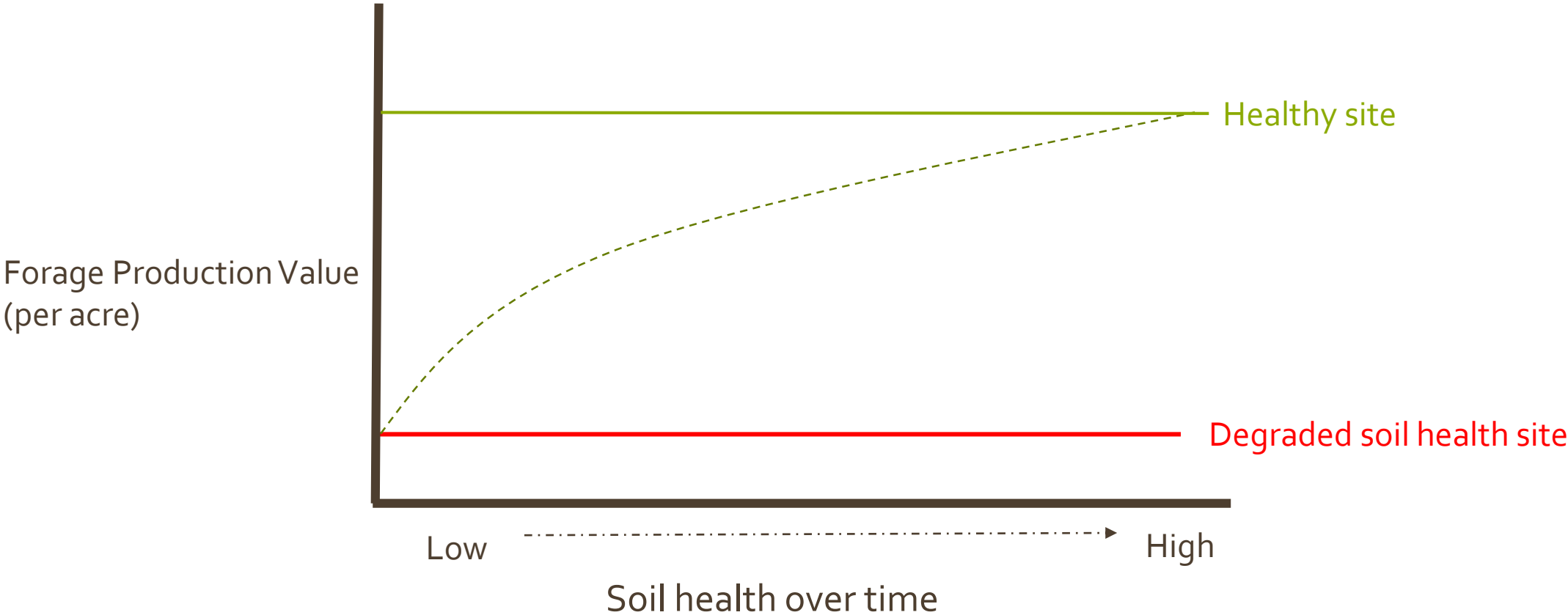
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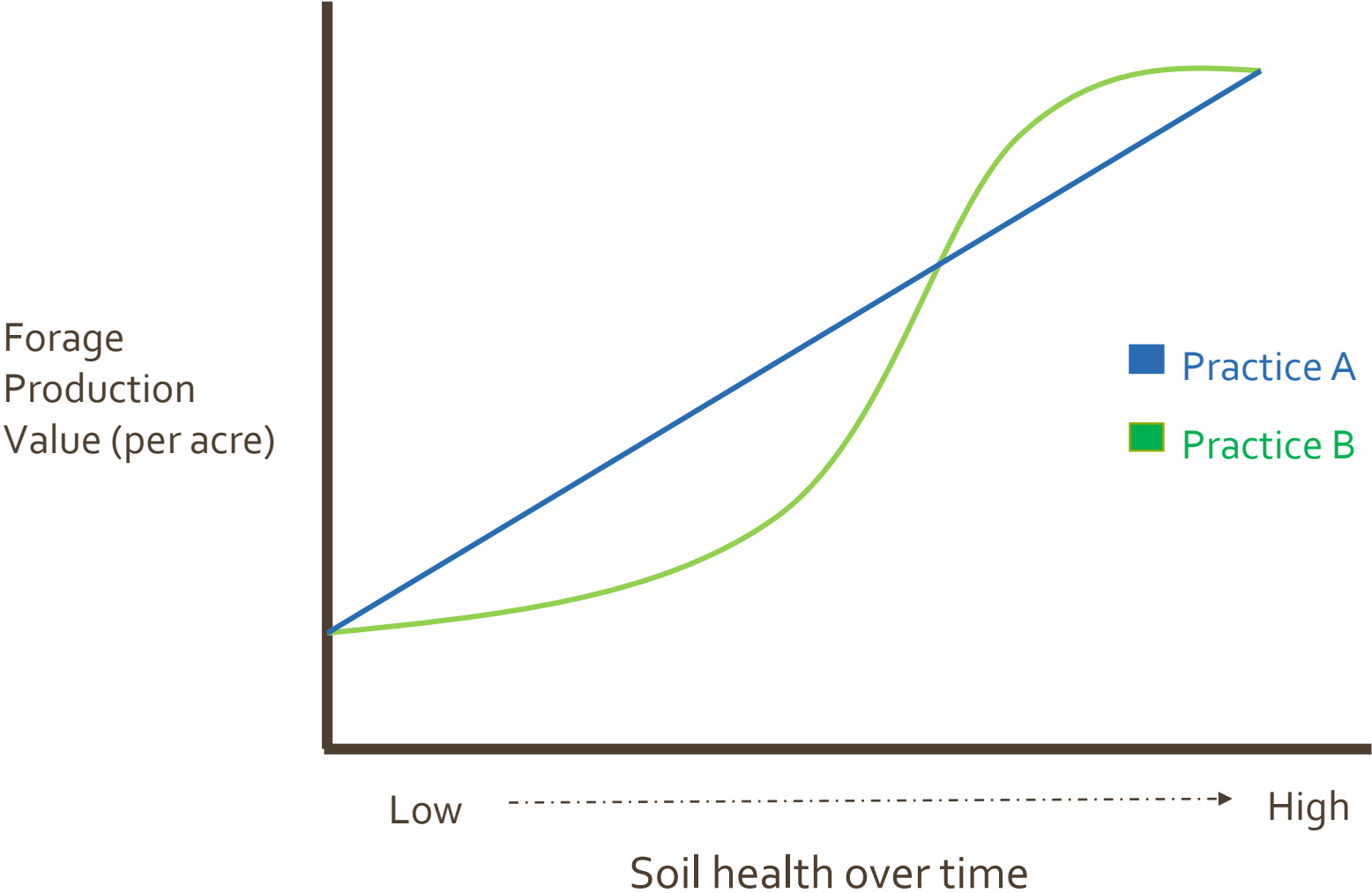
Dynamic Models:

3. Variable forage production based on **linear** soil health transformation
4. Variable forage production based on **logistic growth** soil health transformation
5. Logistic growth forage production from improved soil health conditions over 105 years (three 35-year horizons).

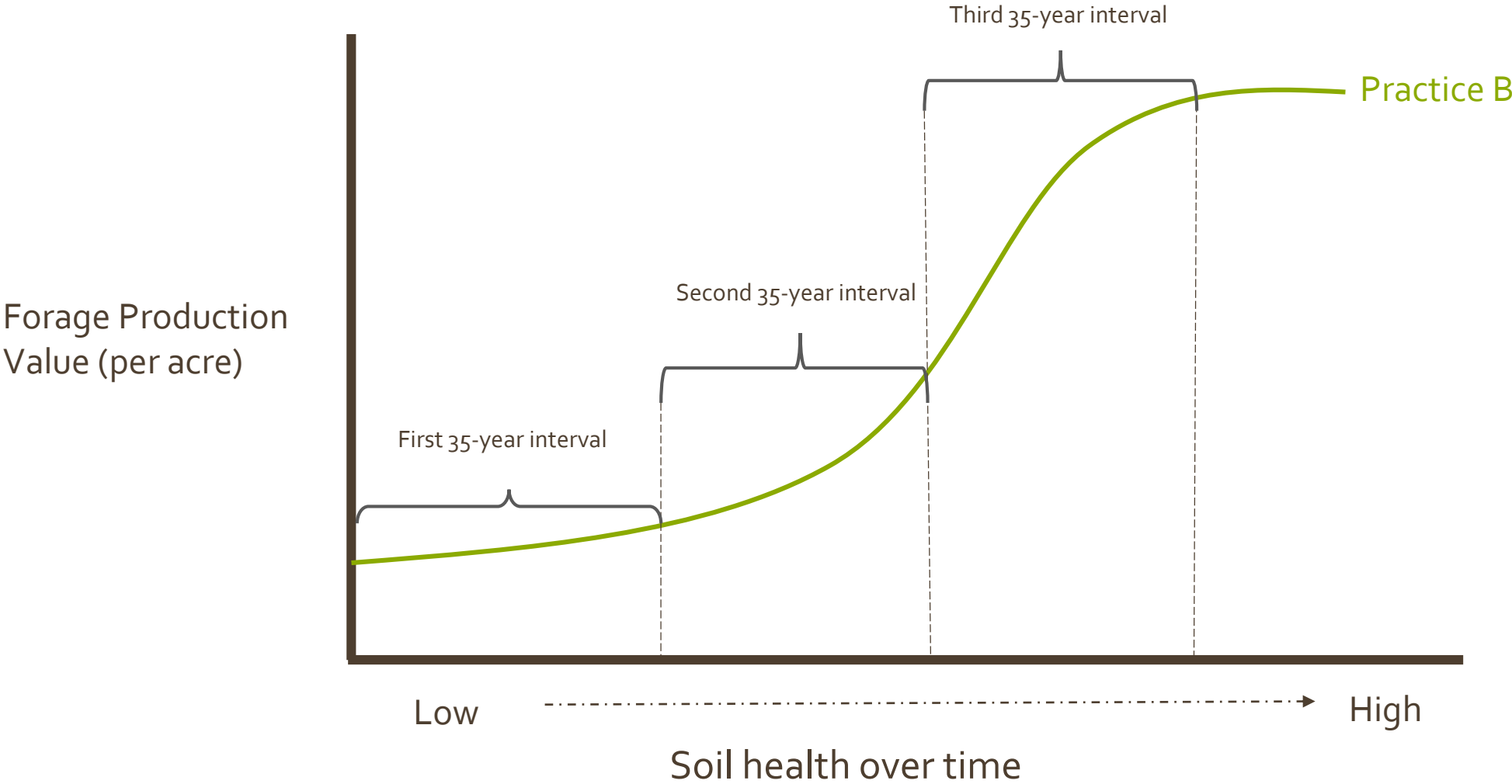
Static Models: Good vs. poor soil health conditions



Dynamic Models #3 and #4: Linear and Logistic Transformation



Dynamic Models #5: Logistic Transformation over 105 Years



Results

Main areas of interest in analyzing results:

1. Number of cows retained each year
 - Trends between cows retained and increased forage production
2. Annual Profits



Ice Slough (Fremont County, WY).

<http://www.flickrriver.com/places/United+States/Wyoming/Jeffrey+City/recent/>

Results



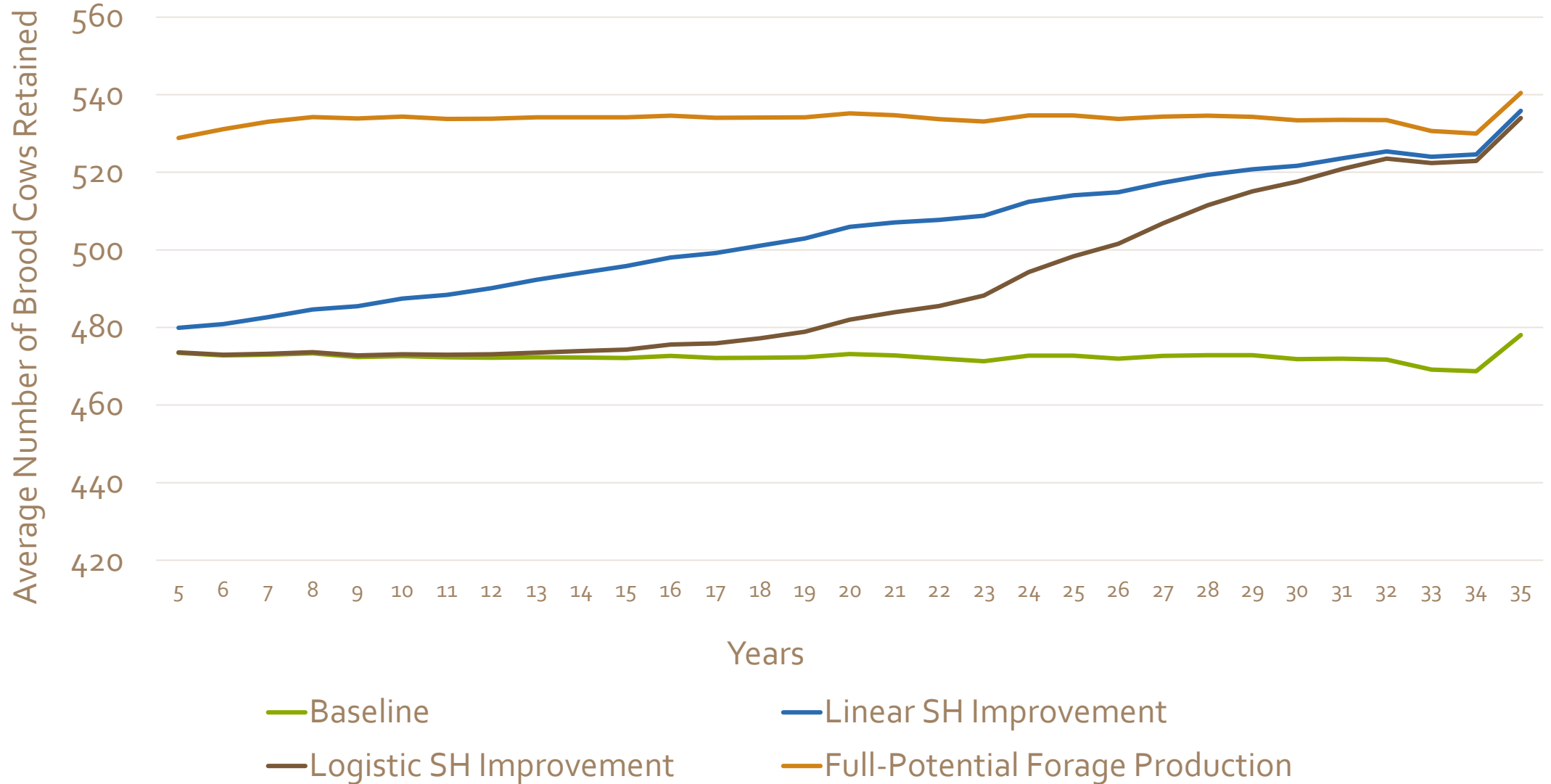
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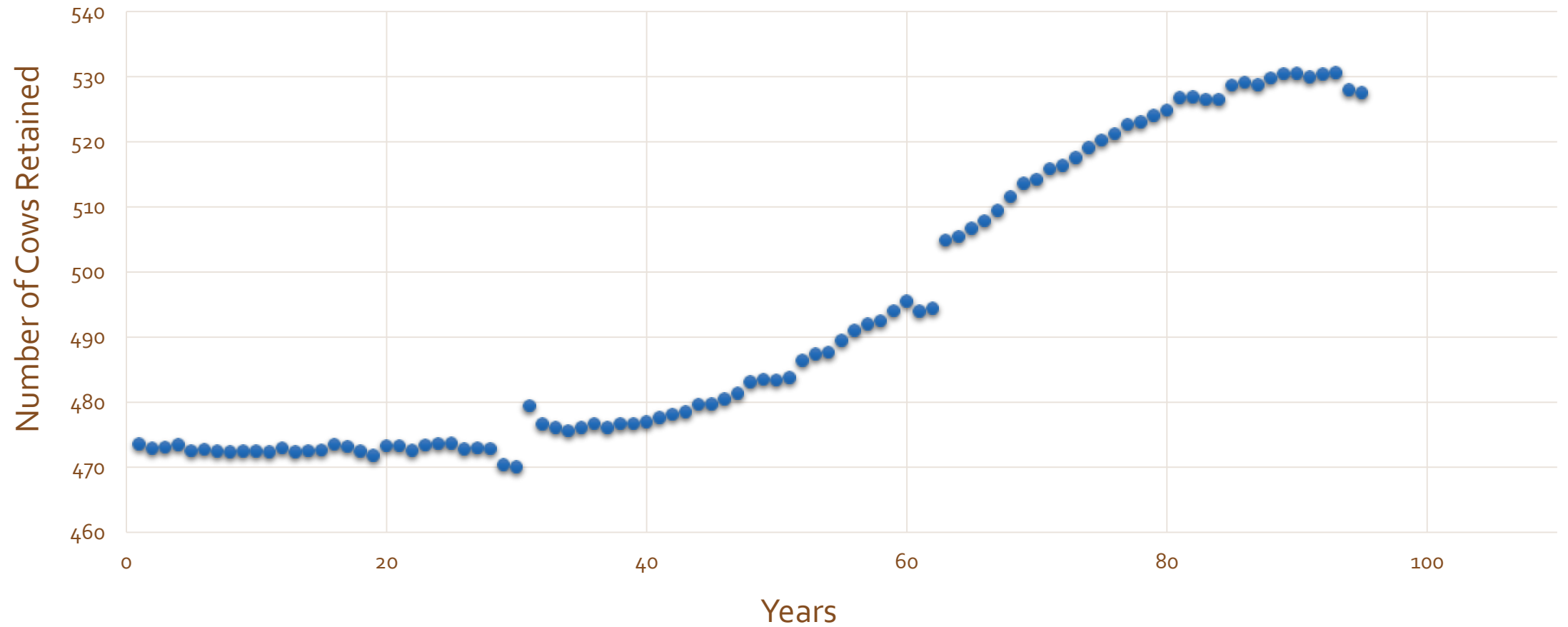
Table 4. SH Profit Contributions Over 35 Years

Minimum	\$	303,930.51
Average	\$	308,443.87
Maximum	\$	316,820.17

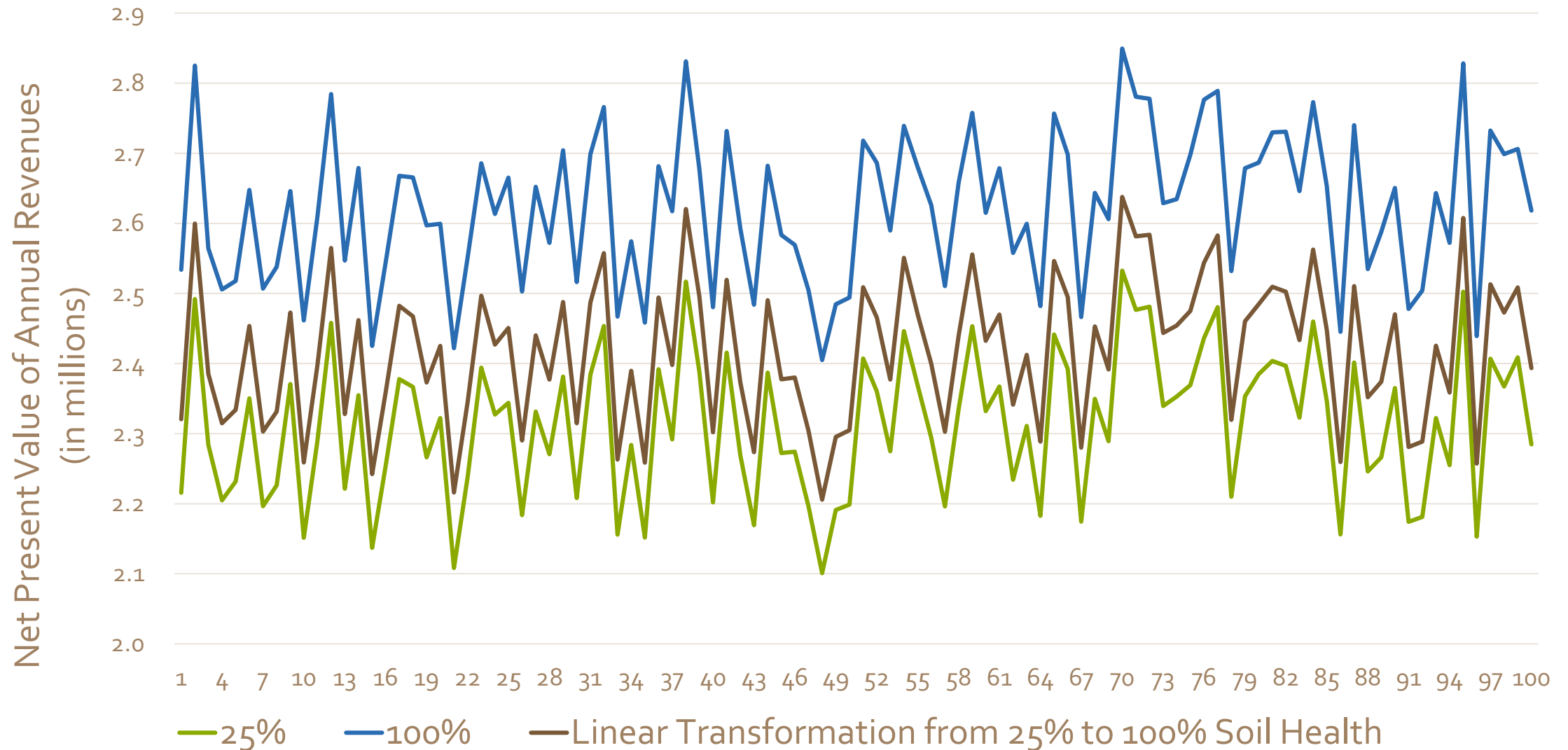
Effects on Annual Cow Numbers



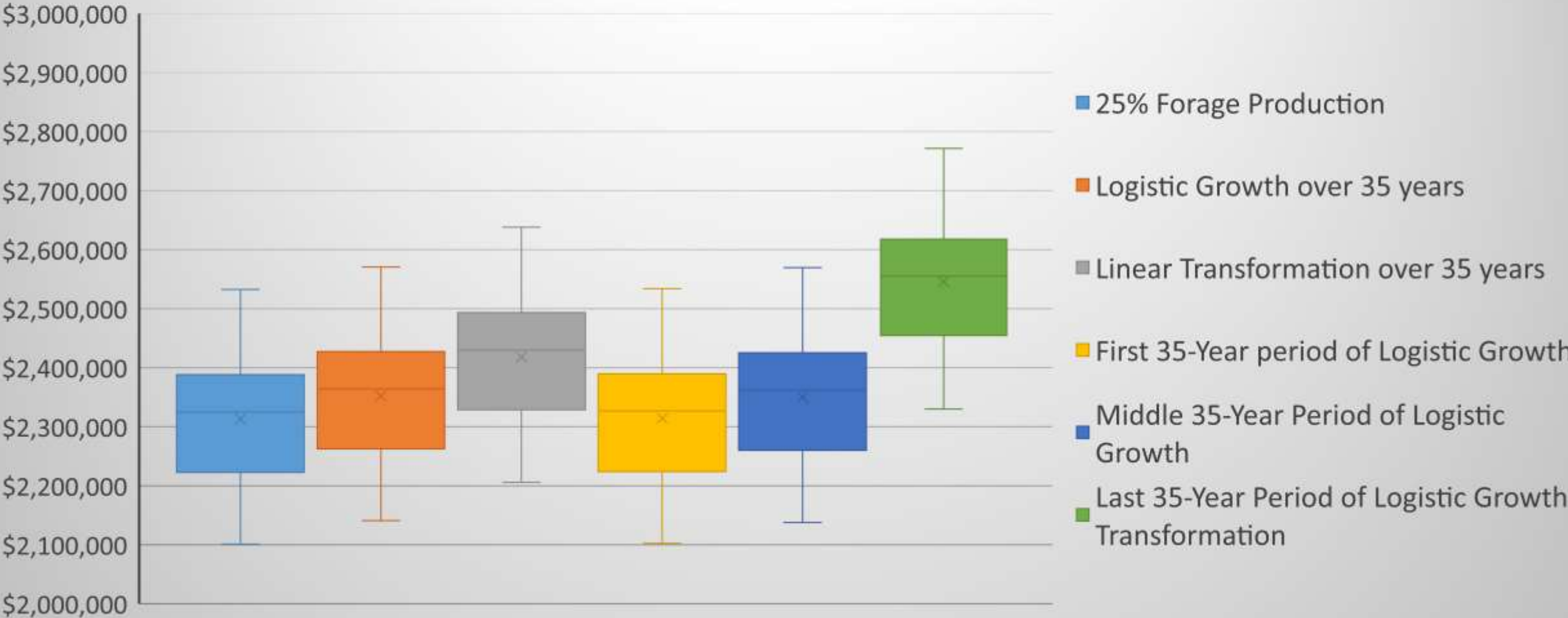
Annual Cow Numbers for Ranch Implementing Logistic Growth Soil Health Improvement Strategy



Effects on Total Profits over the Planning Horizon



Discounted Net Revenues Generated for Various Forage Production Scenarios

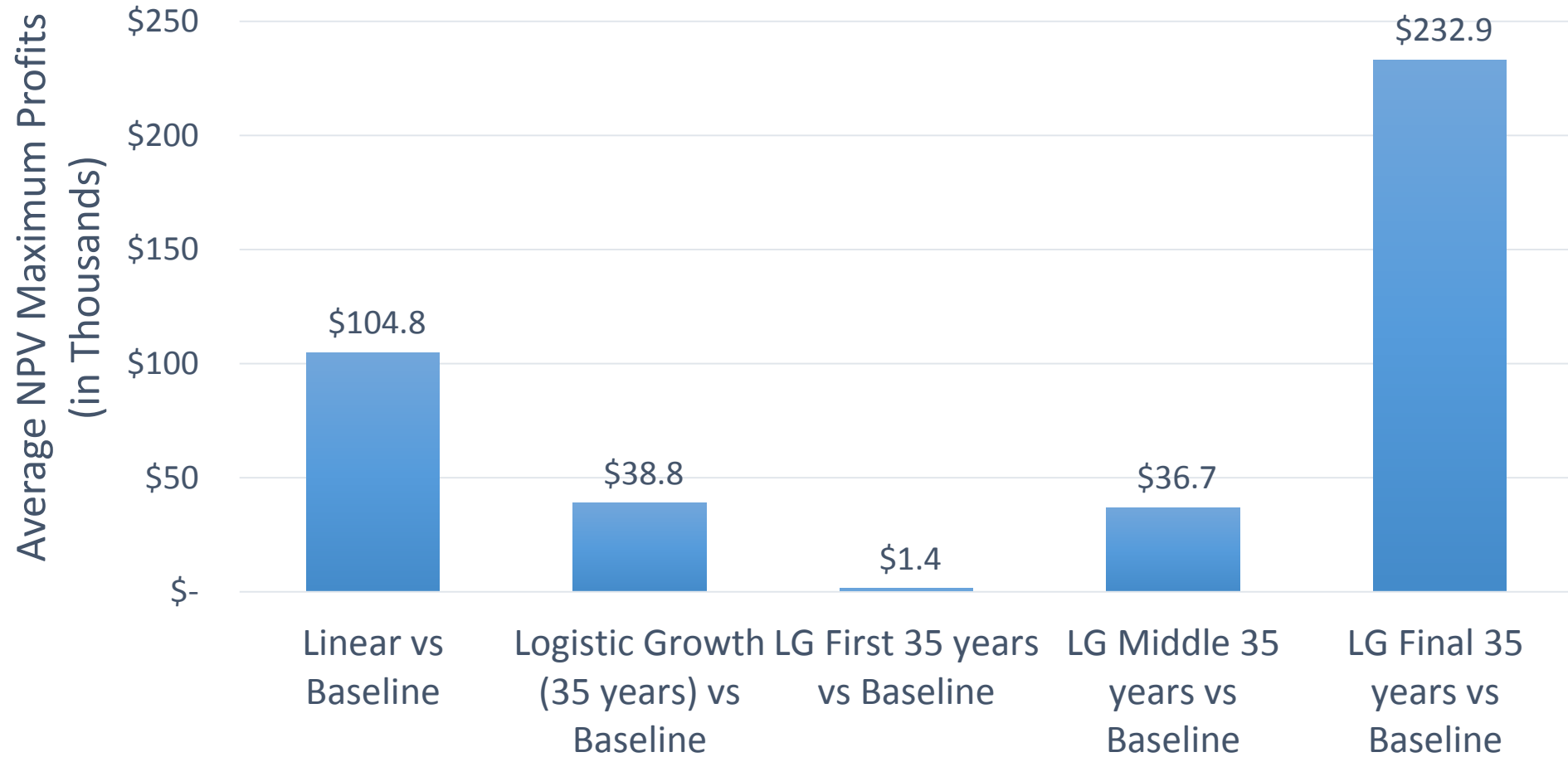


What do soil health practices on private rangelands mean for **ecosystem services**?



Rocky Mountain Region rangeland. <http://wp.natsci.colostate.edu/rmcmp/about/>

Differences between Static and Dynamic Models' Average NPV of Maximum Total Profits



Limitations

Only including rancher benefits as Gross Benefits

- Excludes aesthetic value and wildlife habitat
- Assuming there is no cost of implementing a practice

Don't take into account impacts from increased forage quality

NRCS programs are process-based rather than outcome-based



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Implications

Private landowner benefits are dependent on..

- Starting soil health conditions
- How practices impact soil health over time (functional form)
- Changes in soil health impact forage production over time

Public ecosystem service benefits not included in model

- Conditions exist when NRCS compensation necessary



Thank you! Questions?



Upper Green River Valley, WY. <http://www.doubledishpan.com/ranch.html>