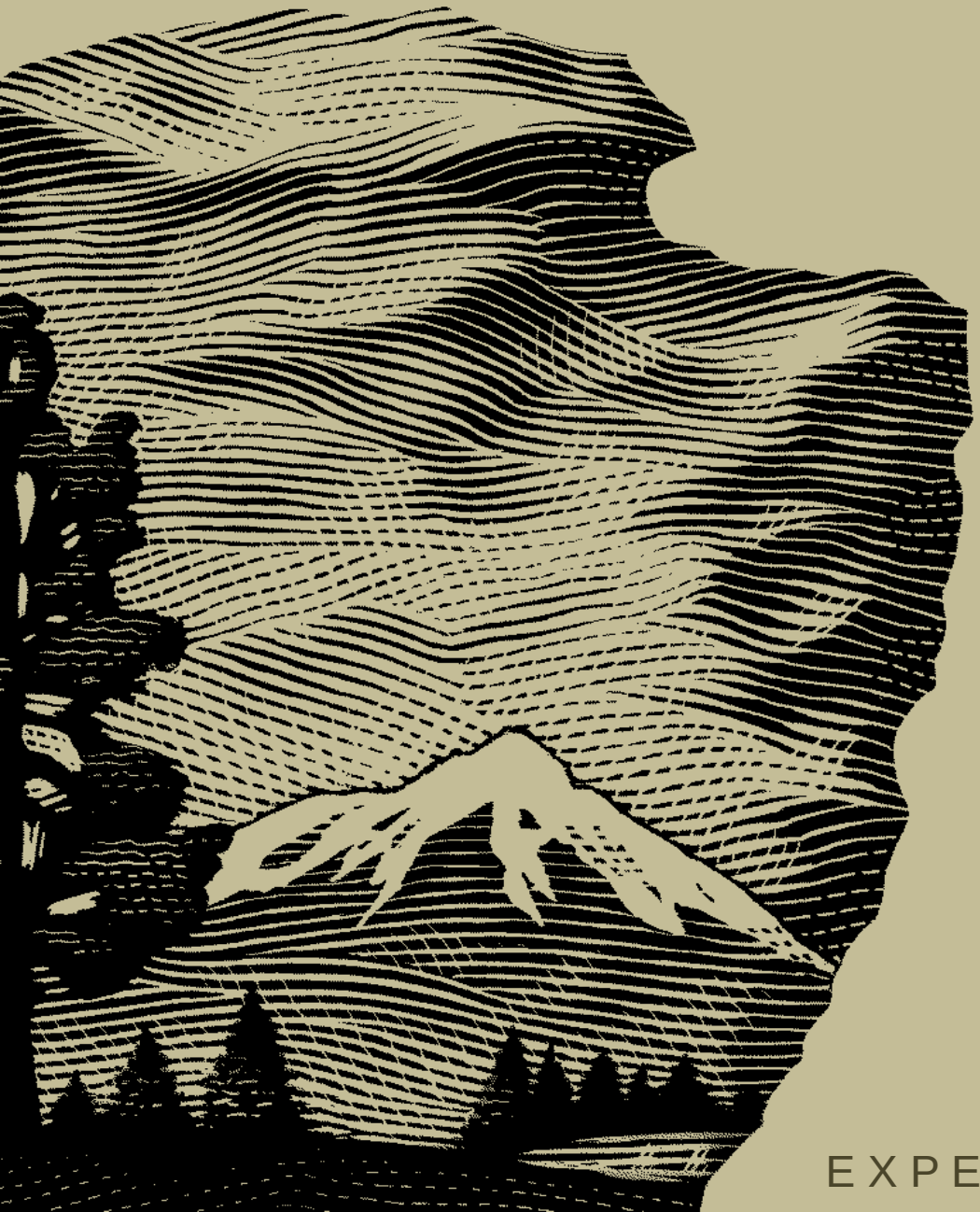
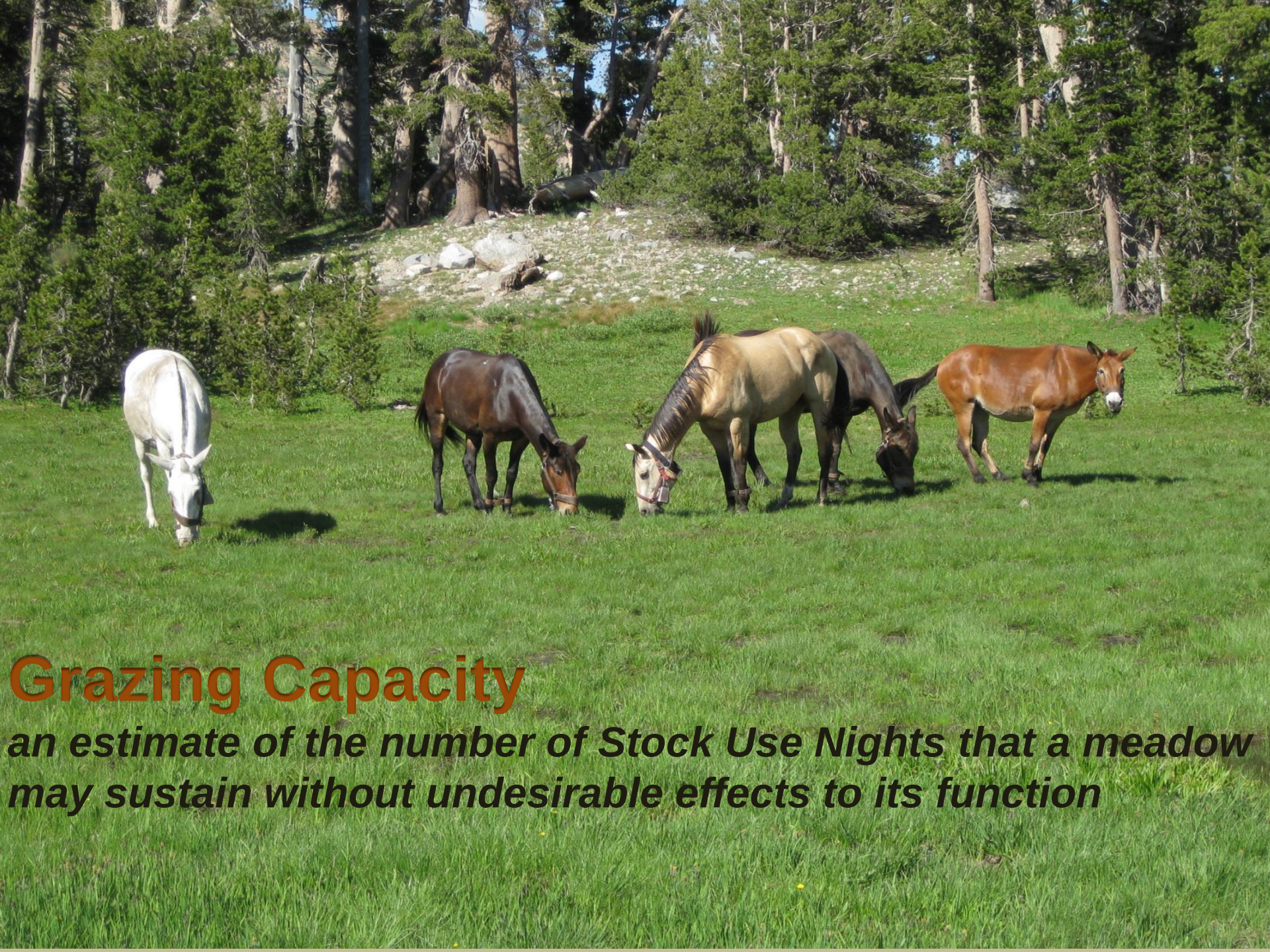
Yosemite National Park
Resources Management and Science



A Science-Based Approach for Determining Grazing Capacities for Management of Pack Stock Use in Wilderness

Joy Baccei
Plant Ecologist
Vegetation & Ecological Restoration
Resources Management & Science

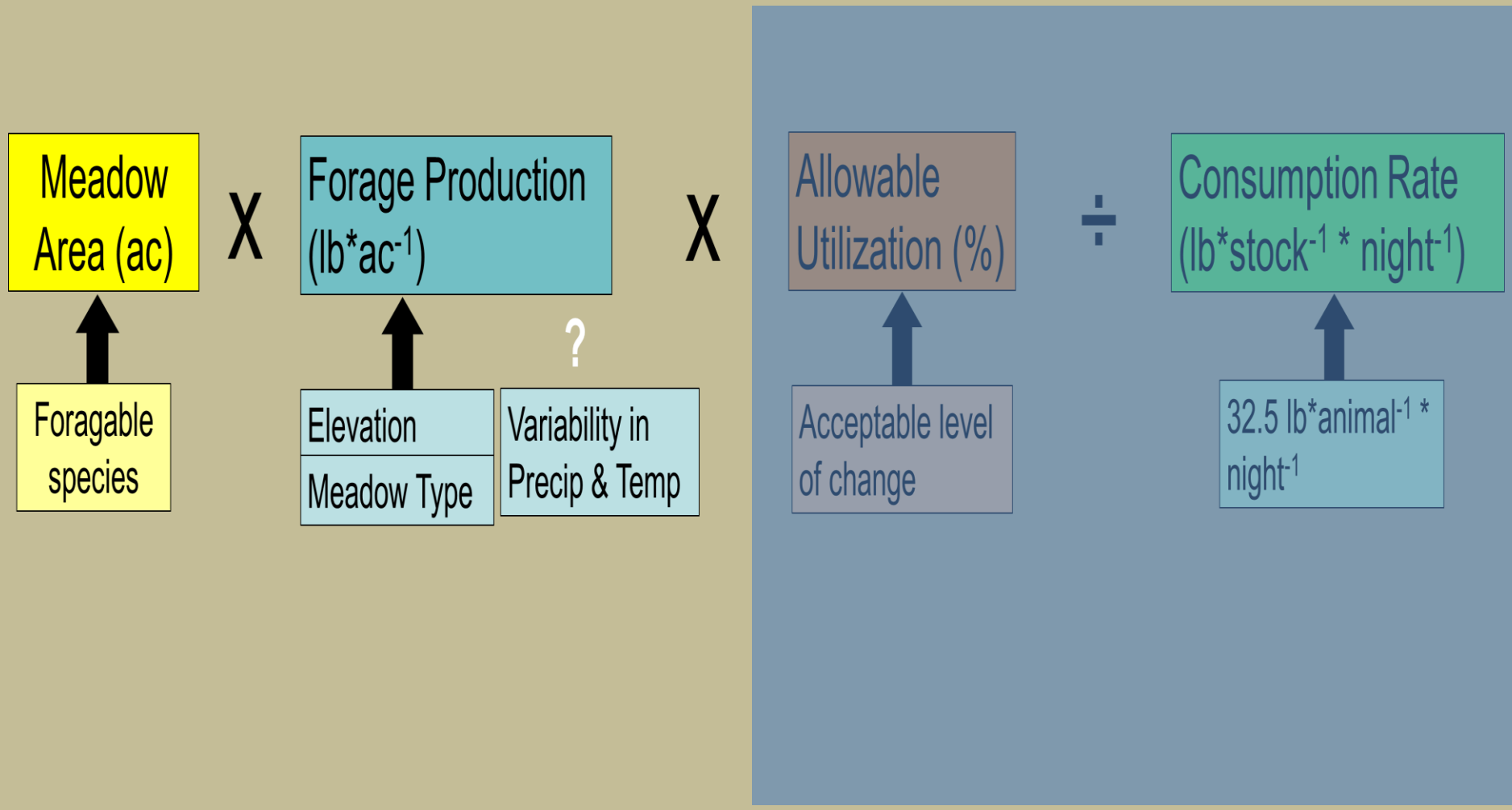
EXPERIENCE YOUR AMERICA



Grazing Capacity

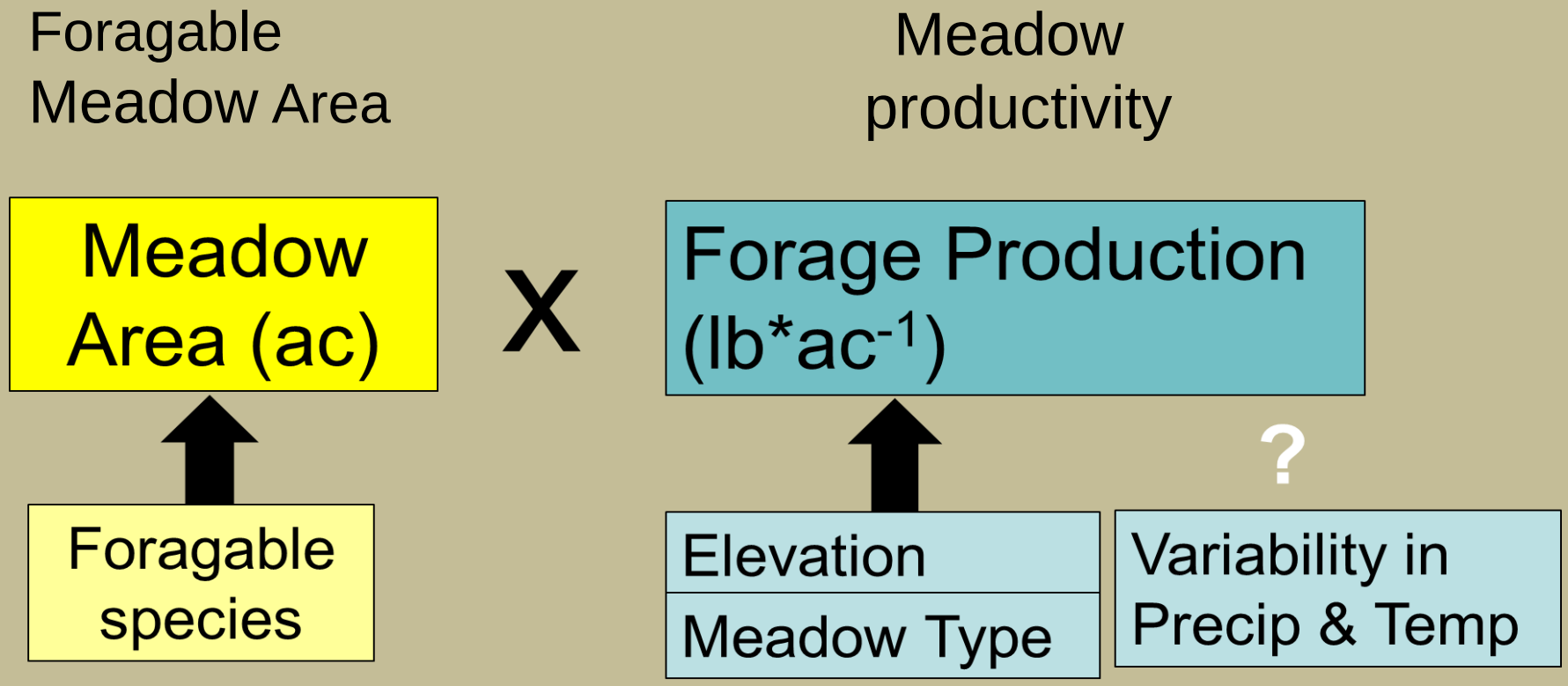
an estimate of the number of Stock Use Nights that a meadow may sustain without undesirable effects to its function

Grazing Capacity Model



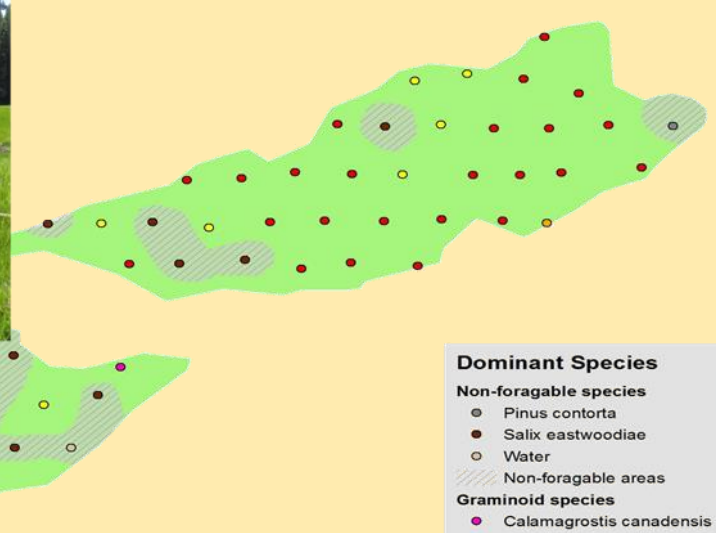
Jones et. al. 2016, Ballenger et. al. 2013.

Meadow Area & Forage Production

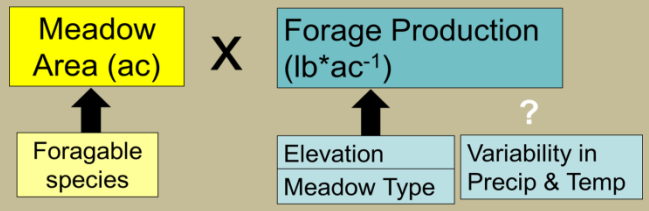


Meadow plant species & ecological field dataset

Sampled dominant plant species in study plots using a grid approach in over 50 meadows subject to grazing in Wilderness. Determined meadow elevation, area, and foragable area.



Meadow Area & Forage Production



Vegetation plots
—previously collected data
→Dominant Plants

Forage Species (graminoids; grasses & grass likes)

Non-Forage Species (forbs, shrubs)

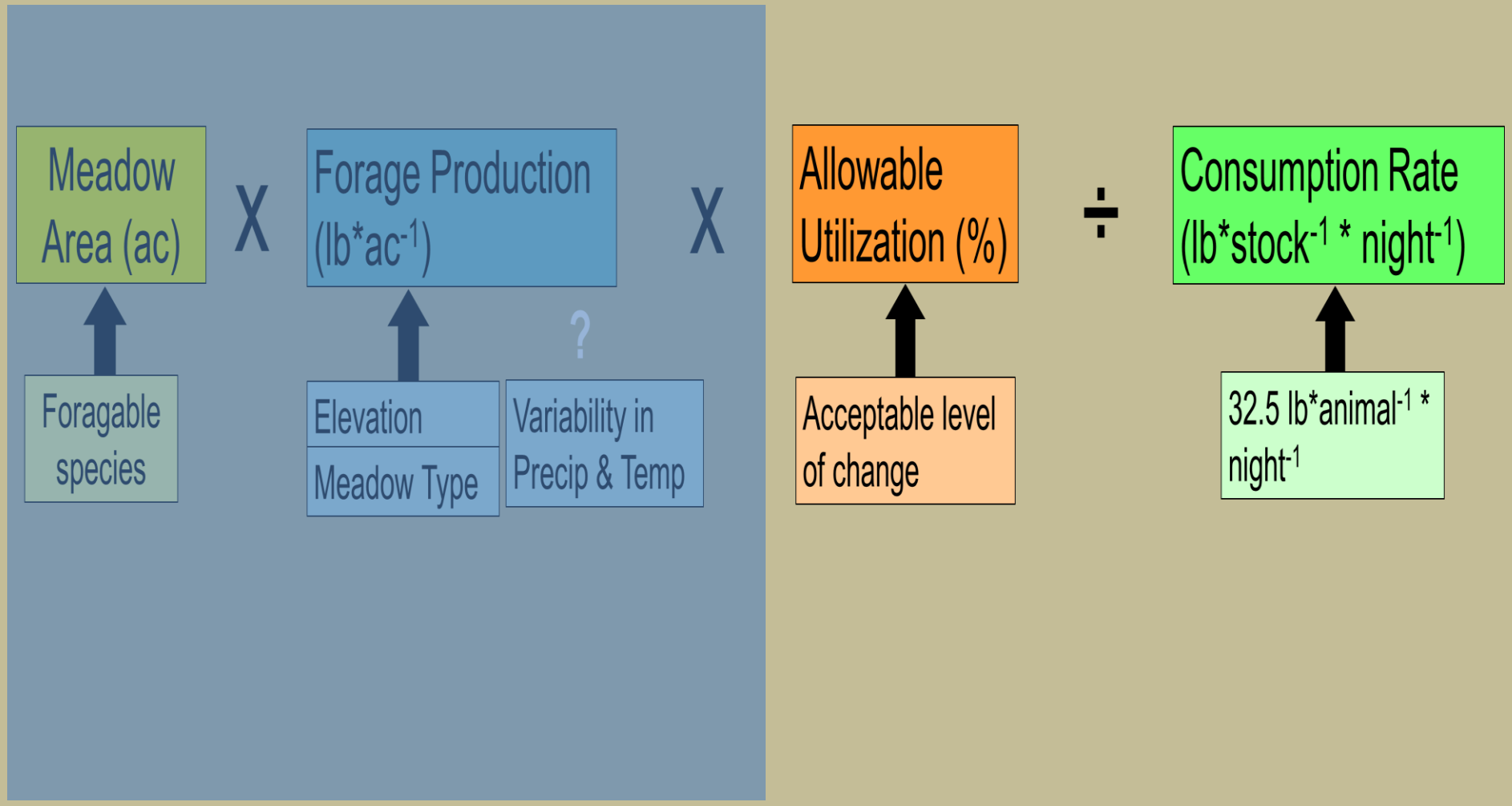
Forage Species	% gridpoints	area (ac)	meadow type
Moist grass *(D. cespitosa)*	25 %	9.1 ac	mesic
Wet sedge *(C. vesicaria)*	15 %	5.4 ac	hydric
Moist grass *(S. kingii)*	11 %	4.0 ac	mesic
Dry sedge *(C. filifolia)*	8 %	3.0 ac	xeric
	60 %	21.5 ac	mesic

Forage Production = 1,386 lbs/acre

Upper Lyell Canyon-South (36 ac)

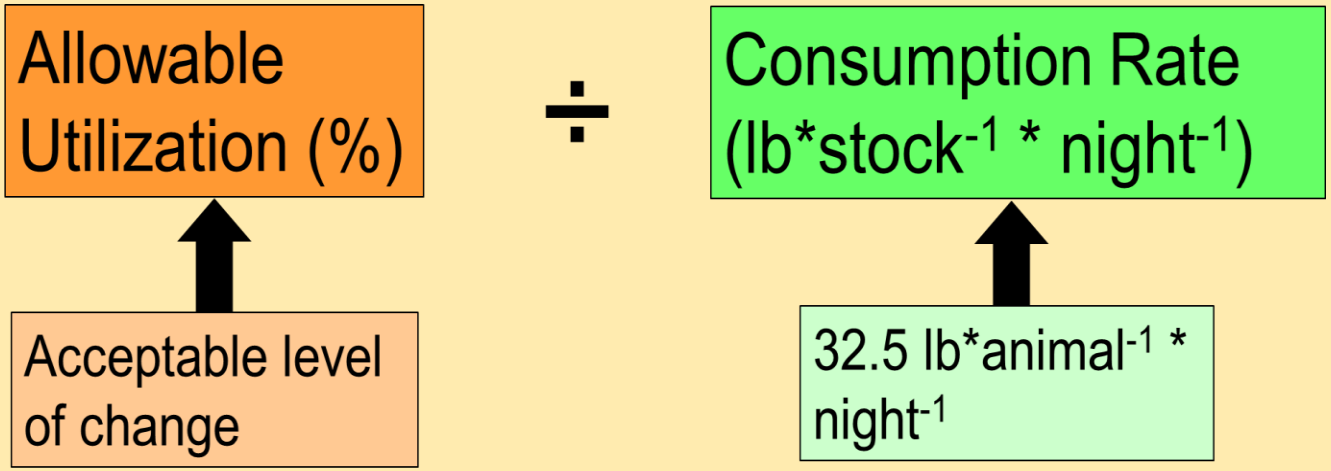
Ratliff et. al. 1987

Grazing Capacity Model



Allowable Utilization Rate (AUR)

AUR =



Ratliff et. al. 1987

Allowable Utilization & Acceptable Level of Change

Allowable Utilization (%)

↑

Acceptable level of change

How much?

(5%, 25%, 35%)

?

Relate Utilization % to "*acceptable level of change*" in ecologically relevant variables:

- productivity
- bare soil cover
- vegetation cover
- plant composition

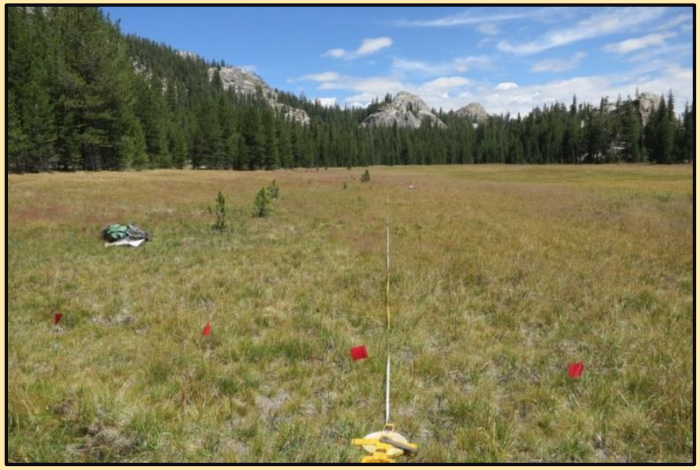
Cole et. al. 2004

VALIDATING THE GRAZING CAPACITY MODEL

Residual biomass monitoring

Measures plant productivity in paired, grazed vs. un-grazed plots to estimate forage utilization

1. Important monitoring metric for protecting meadow function from overuse
2. Used to verify if more allowable forage exists in the meadow or if the meadow has reached its capacity for that year



Preliminary Grazing Capacities

Meadow Name	Elevation (ft)	Meadow Type	Meadow Area (ac)		Forage Production (lb/ac)		Grazing Capacity (stock use nights)			Avg. stock use nights (2004-2015)
			Foragable	Total	GC Model	RB Monitoring	5%	25%	35%	
Smedberg-S	9,223	Hydric	4.6	11.4	1223	1511	13	65	90	48
Upper Lyell-S	8,977	Mesic	21.5	36	1386	1536	38	188	263	242

Preliminary Grazing Capacities

These results show that there is…

1. Good agreement between model-estimated and actual plant productivity (lbs/acre)

2. Estimated grazing capacities are within a reasonable range of average stock nights

3. Small meadows (foragable area) cannot sustain as much stock use nights

CONSIDERATIONS & NEXT STEPS

1. Make model relevant to a larger dataset
2. Refine model to include remote sensing data
3. Continue meadow monitoring
4. Get more consistent stock use night reporting

ACKNOWLEDGMENTS

REFERENCES

Ballenger, L. 2013. Pack Stock Grazing Capacity Calculations for Pilot Management Study of Upper Lyell Canyon, Yosemite National Park. Unpublished report.

Cole, D. N., J. W. van Wagtendonk, M. P. McClaran, P. E. Moore, and N. K. McDougald. 2004. Response of mountain meadows to grazing by recreational packstock. *Journal of Range Management* 57:153–160.

Jones, L. J., E. E. Dickman, and J. S. Baccei. 2016. Pack Stock Grazing Capacity for Wilderness Meadows in Yosemite National Park. Natural Resource Report NPS/YOSE/NRR—2016. National Park Service, Fort Collins, Colorado. In Review.

Ratliff, R. D., M. R. George, and N. K. McDougald. 1987. Managing livestock grazing on meadows of California's Sierra Nevada, Berkeley, CA

Preliminary Grazing Capacities

Meadow Name	Elevation (ft)	Meadow Type	Meadow Area (ac)		Forage Production (lb/ac)		Grazing Capacity (stock use nights)			Reported stock use nights
			Foragable	Total	GC Model	RB Monitoring	5%	25%	35%	(avg. 2004-2015)
Benson-NE	7,595	Mesic	0.7	0.7	2210	2500	2	12	17	118
Castle Camp	8,784	Hydric	4.6	6.3	1532	1468	12	62	87	27
Dorothy-NW	9,394	Mesic	6.8	14	1627	439	17	85	120	31
Hook Lake-N	9,384	Hydric	3.6	6.4	1192	1146	10	50	70	11
Jose's Camp	9,056	Mesic	5.7	10.2	1556	1418	16	79	110	19
Matterhorn-S	8,426	Xeric	7.1	22.2	1294	1391	31	155	218	117
Miller Lake-S	9,505	Xeric	1.3	8	1028	725	5	25	35	25
Upper Lyell-N	8,971	Xeric	7	19.3	1124	1691	12	61	85	34
Upper Lyell-S	8,977	Mesic	21.5	36	1386	1536	38	188	263	242
Smedberg-S	9,223	Hydric	4.6	11.4	1223	1511	13	65	90	48

UPDATING THE GRAZING CAPACITY MODEL

Remote sensing data

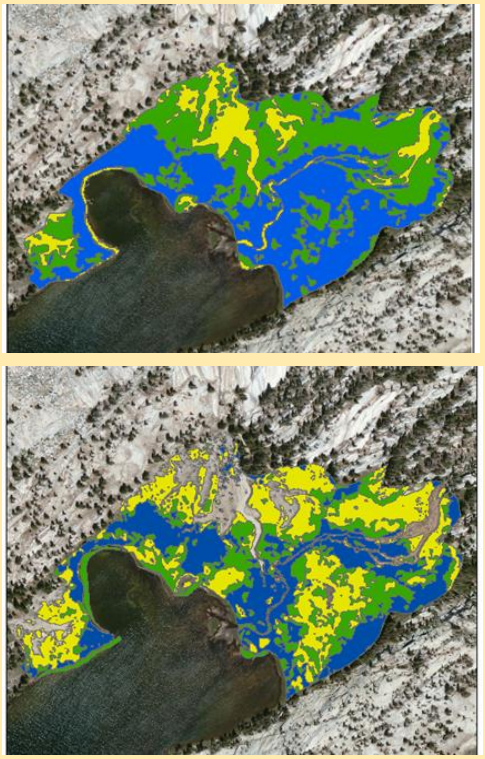
Correlation between plant productivity and remote sensing

Remote sensing data:

- *precipitation, temperature, elevation*
- *Normalized Difference Vegetation Index*

Correlation between datasets:

- *cost-effective alternative to field data*
- *Allow park-wide estimates of productivity and grazing capacities*



Comparison of hydric (wet)=blue, mesic (moist)=green, xeric (dry)=yellow areas for Emeric Lake meadow in a normal water year (2010, upper) and dry water year (2012, lower) using image classification of NDVI transformed NAIP aerial imagery.