Emerging Climate Change Issues: Health x Forage x Genetic Interactions

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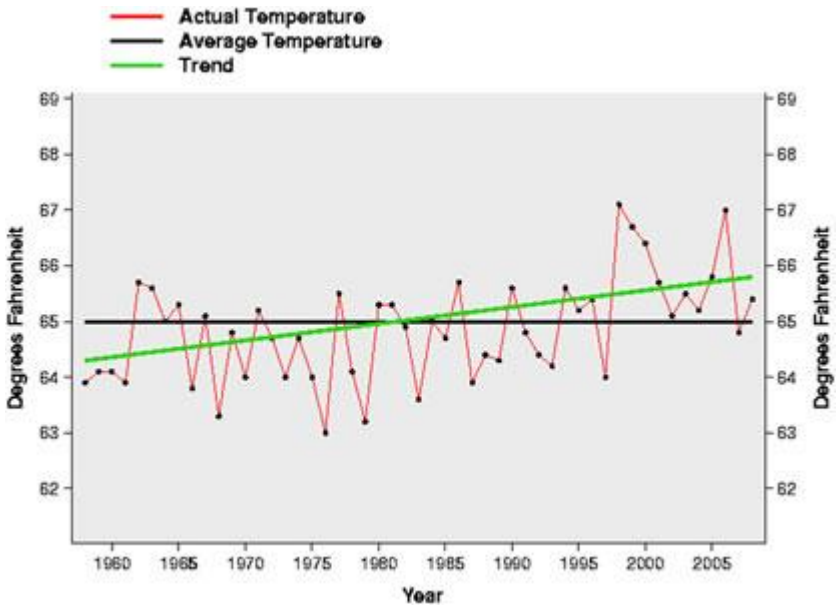
Introduction

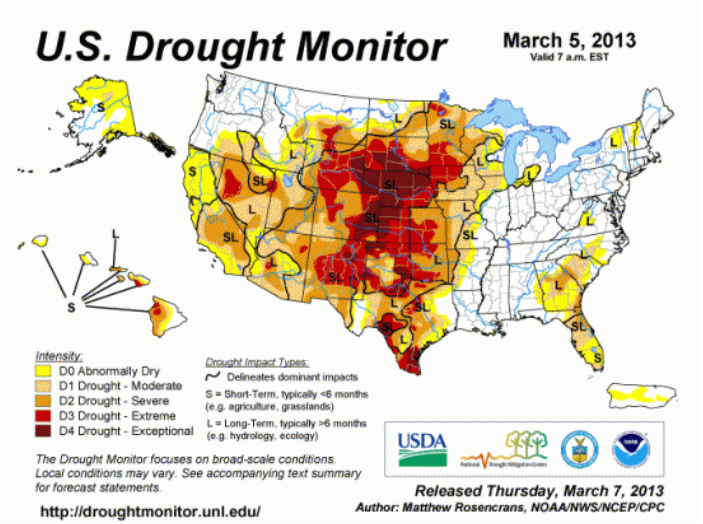
* Climate Change
* Impact on livestock health and production
* Impact on forages
* Genetic selection to combat climate change in livestock systems

Climate Change

* Changes in temperature - warming
* Changes in rainfall patterns
* More extreme weather events

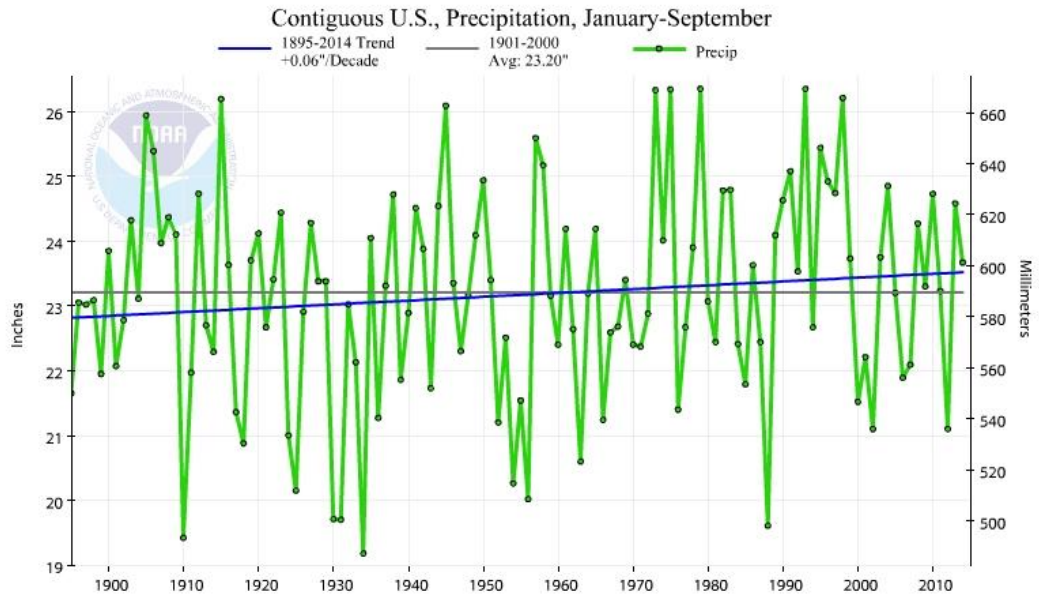
Indicators of Change





Drought

Flood



* Fecal pathogens
* Botulism
* Anthrax
* Mosquitos

Global Impact of Climate Change

* Climate change leads to malnutrition from crop failure (human and livestock) (Patz, 2005).
* Less diversity of species.
* More competition of species.

Impact on Livestock Grazing Systems

* Changes in pasture growth
* Changes in pasture composition – ratio of legumes to grass; warm to cool season
* Changes in forage quality
* Changes in rainfall
* Increased evaporation from soil and water

Impact to Animal

* Heat stress – reduced grazing/feeding, reproduction, growth to alleviate thermal load.
* Diseases and disease vectors – increase the rate of development of pathogens or parasites; increase their range; increase mutations.
* Suppressed immunity in response to UV radiation (Baylis and Githeko, 2006).

Examples of Climate Change related to Small Ruminants

* ParaBoss News December 2014 – All State Alert: State reports indicate that barber's pole worm is already becoming a problem in areas well beyond its usual locations.
* Climate change and the recent emergence of bluetongue in Europe (Purse et al., 2005; Guis et al., 2012); Schmallenberg virus (Gibbens, 2012).

Bluetonguesheep.blogshopt.com

Fescue Toxicosis in Sheep

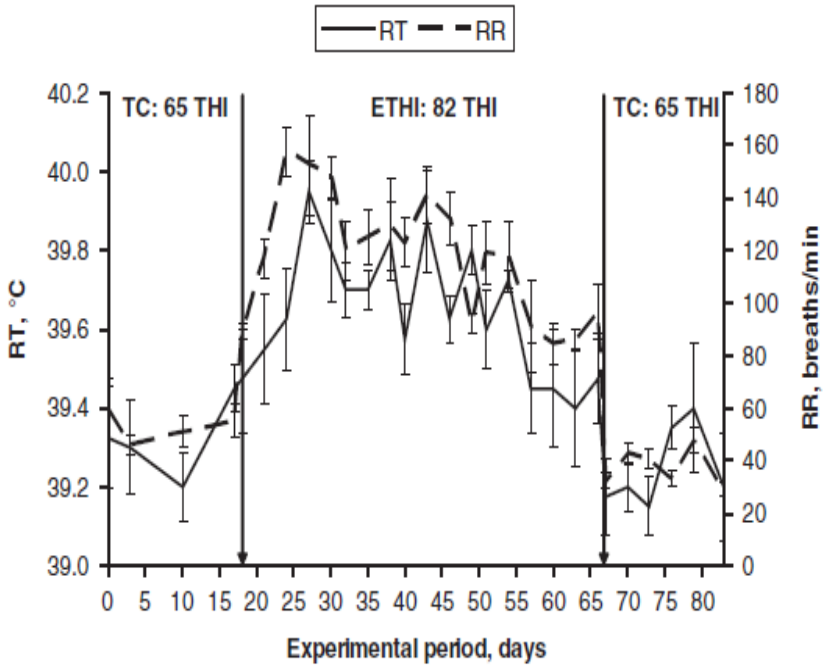
* October 2014 – 31% of lambs lost within 48 hours due to starvation; no milk production from dam.
* Ergoalkaloids were 1.63 ppm.
* No signs of fescue toxicosis ever observed in ARS ewes before this.
* However, more feet problems.

Genetic Selection to Combat Climate Change

* Identify traits that can be selected for.
* Anticipate the future.
* Use examples from the past.

Heat Stress

* Heritability – difficult to measure; more effective with higher THI (Ravagnolo and Misztal, 2000).
* Markers – Hsp70.
* Breeds – tropically adapted breed more tolerant.



Bernabucci et al 2010

Consider Hair Coat in Selection

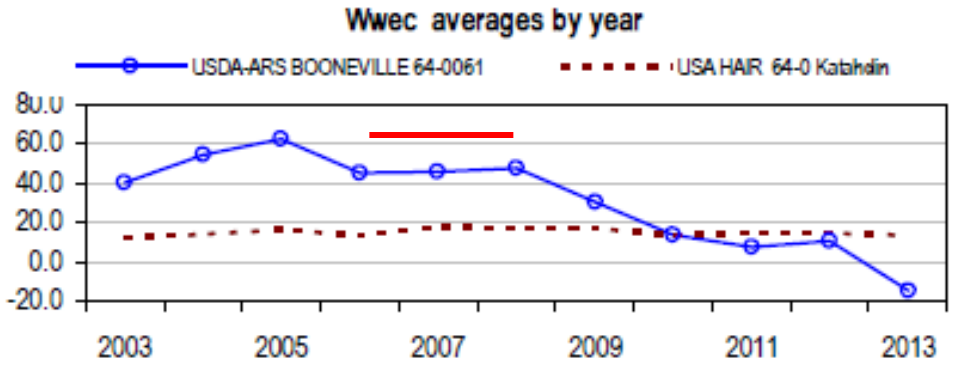
Selection for Other Stressors

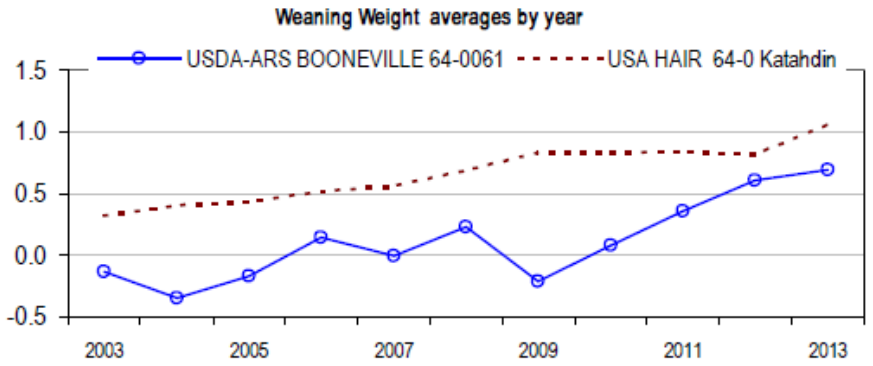
* Fescue toxicosis: Cattle producers may have selected for fescue tolerant cows. Rye grass staggers; heritability in sheep 0.43 (Bishop and Morris, 2007).
* Foot rot: heritability 0.30 (Raadsma et al 1994); Broomfield Corriedales selectively bred for resistance (Skerman and Moorhouse, 1987).

Gastrointestinal Nematodes

* FEC – as high as 0.5 depending on when collected (Notter et al.).
* PCV – heritability 0.4 (Albers et al, 1987).
* Dag – moderate heritability 0.24 (Bisset et al., 1992).

Selection for GIN Resistance – ARS, Booneville





Dry conditions

NSIP EBVs for Katahdin Breed

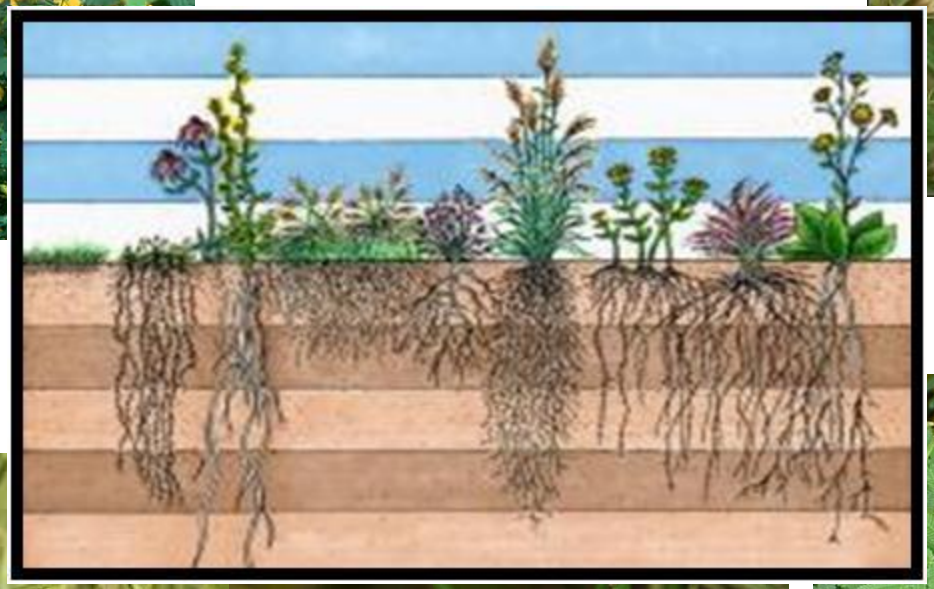
	BWT	MWWT	WWT	PWWT	PFAT	PEMD	WFEC	PFEC	PSC	NLB	NLW	
	kg	kg	kg	kg	mm	mm	%	%	cm	%	%	USA Hair
	0.0	0.7	0.0	-0.5	0.1		-46	-64		8	19	109.0
:	60	45	61	64			73	78		40	36	
	-0.3	0.7	-0.1	0.4	0.2		-60	-68		4	13	106.7
:	62	36	62	66			75	79		34	31	
	0.3	1.2	1.4	1.8			8	-11		12	22	111.3
:	60	43	60	63			72	77		38	35	
	0.2	1.2	1.1	1.4			-1	-14		12	22	111.3
:	60	43	60	63			72	77		38	35	
	0.1	-0.1	0.1	-0.1			144	145		19	18	106.3
:	59	45	59	62			70	74		39	36	
	0.2	-0.1	1.4	2.9			-8	-42		19	18	106.6
:	59	45	59	62			70	74		39	36	
	-0.2	0.6	0.1	0.7	0.2		-77	-89		3	13	106.7
:	61	41	61	64			74	78		37	34	
	-0.3	0.6	0.5	1.5	0.1		-82	-94		3	13	106.8
:	61	41	61	64			70	77		37	34	

Environmental Effects on Selection

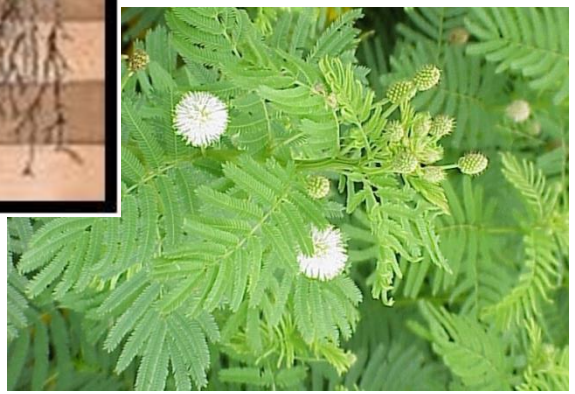
* Intensive or extensive management will benefit from selection for health traits.
* Extremes during selection must be present (high THI for heat stress; warm, humid conditions for FEC; etc.).

Native Pastures

* Reduce evaporative losses from soils.
* Increase soil health.
* Greater diversity in microenvironment.
* Greater diversity in wildlife, pollinators.
* More self-sustaining.




©2011 Jeffrey Pippen



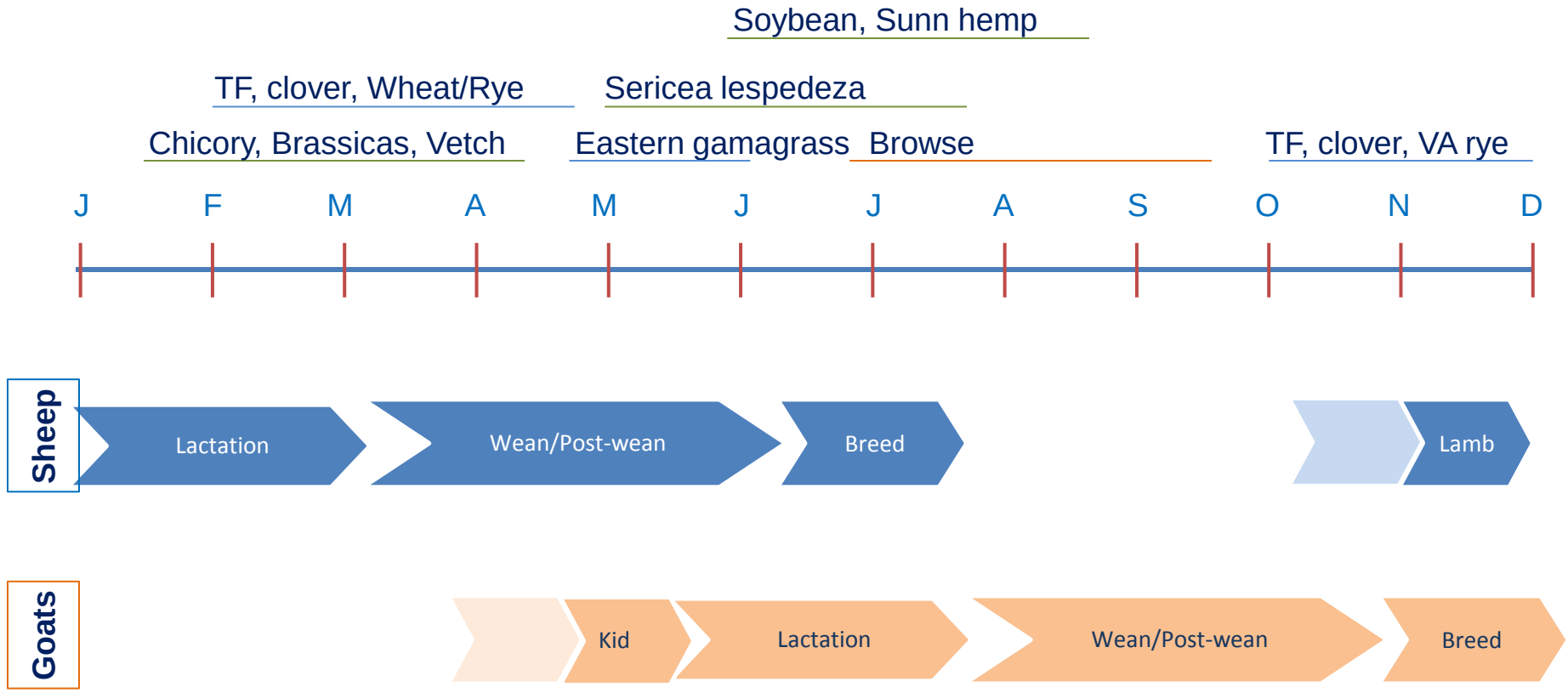
Goats: Selection to Climate Change

* Goats prefer a greater diversity of forages than sheep, more browse, less grass. Goats seem more tolerant of toxins than other livestock.
* Goats can tolerate internal parasites in a browse or native system. External parasites may still be an issue in humid climates.
* NSIP will be of value for selection indices with more numbers.

Southern Pastures that Tolerate Climate Change

* A return to the past.
* Native forages (legumes and grasses).
* Long rotations.
* Multi-species grazing.
* Integrate the animal into the system.

Matching production phases of sheep and goats to forages in West Central Arkansas



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Summary

* Acclimate the animal to the environment.
* Select the animal for a changing environment.