Bioenergy Resource Assessment & NRCS

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Today’s Presentation

- RFS Background
- Biofuel Production “Ripple Effects”
- Resources Considered
- Need for Good Data
- How NRCS was and continues to be most helpful
- Conclusions

Fascination with Biofuels – Govt. Mandates

- US – Renewable Fuels Standard; 35 billion gallons (133 billion liters) by 2022 (20% of projected total consumption)
- EU – 5.75% by 2010; 10% by 2020; 25% by 2030
- China – 5% biodiesel
  - China has said it aims to use 200,000 tons of biodiesel by 2010 and 2 million tons (**2,057 billion liters**) by 2020.

Why? Energy Security & “Peak Oil” & Climate Change

How will these intersect with market forces, where exactly will the feedstocks come from, and at what price?

Scope – Petroleum & Agriculture

- The oilseed and fat market is only a small fraction of the oil industry
- IF ALL DOMESTIC FEEDSTOCKS WERE CONVERTED TO FUEL, **ONLY 8% OF DIESEL** COULD BE REPLACED
- IF ALL GLOBAL FEEDSTOCKS WERE CONVERTED TO DIESEL, **ONLY 10 % OF DISTILLATE** COULD BE SUBSTITUTED
  - **However, the entire world would go hungry**

The “Ripple” Effect of Biofuels Production

The primary

Others?

2nd, 3rd, 4th, etc. – order effects of biofuels production

EXUBERANCE

You're at a ten. We need you at about a seven.

Primary Biomass Resources

- Agricultural crop residues
  - corn stover
  - small-grain straws (wheat, barley, oats)
- Beef tallow, pork lard, and yellow grease
- Forest biomass resources
- Herbaceous energy crops (switchgrass, big bluestem)
- Grain and oilseed crops
  - corn
  - grain sorghum
  - canola
  - camelina

Additional/Secondary Resources

- Primary and secondary wood wastes
- Food processing wastes
- Processing wastes (cotton gin trash, walnut shells, etc.)
- Livestock wastes
- Biosolids
- Orchard and vineyard trimmings (apples, almonds, grapes, etc.)
- Marginal lands

Biofuels Resources – Land Use

- Limited "Crop" Acreage
  - Limited increase in land space and product yields
  - Sustainability Concerns

Increasing demand/production will put pressure on food and water supplies, prices, and sustainability

Pros and Potential 'Pitfalls' of Agricultural Crop Residues and Herbaceous Energy Crops

Ag Crop Residues →

- Seen as a "waste" product that must be dealt with in normal agriculture
- Sustainability concerns:
  - **Soil erosion**
  - **Soil tilth**
  - **Soil moisture**

Herbaceous Energy Crops →

- Generally competes with conventional agriculture or uses prairie
- Potential tremendous environmental benefits
  - Soil erosion reductions (>90%) which can potentially translate into improved water quality for rural communities, especially on marginal lands
  - Increased soil carbon – possible C sequestration payment

Need for Good Data

- A lot is riding on the new RFS
  - Feedstocks will need to increase dramatically under the new RFS
  - Proof of 8-10 dry tons per acre or dramatically increase the energy density per acre needs to be demonstrated on a larger scale
  - Food vs fuel debate
  - What will this do to the land base and the environment?

We need to get this right

Agricultural Crop Residue Removal

Sustainability Considerations

Residue Required for Erosion Control is a function of:

1) Type of Erosion (wind and/or rainfall (water))
2) Field management practices (tillage)
3) Soil type
4) Climate (rainfall, temperature, retained moisture)
5) Physical field characteristics (% slope, soil erodibility)
6) Crop and cropping rotation
7) Tolerable Soil Loss, T
8) Grain yield (bu/ac)

Tolerable Soil Loss, T

- Maximum rate of soil erosion that will <u>not</u> lead to *prolonged* soil deterioration and/or loss of productivity

How the NRCS Helped/Helps

- Offered that a soil type-by-soil type analysis would be best

- Provided programs to evaluate environmental parameters that are used everyday by their field offices

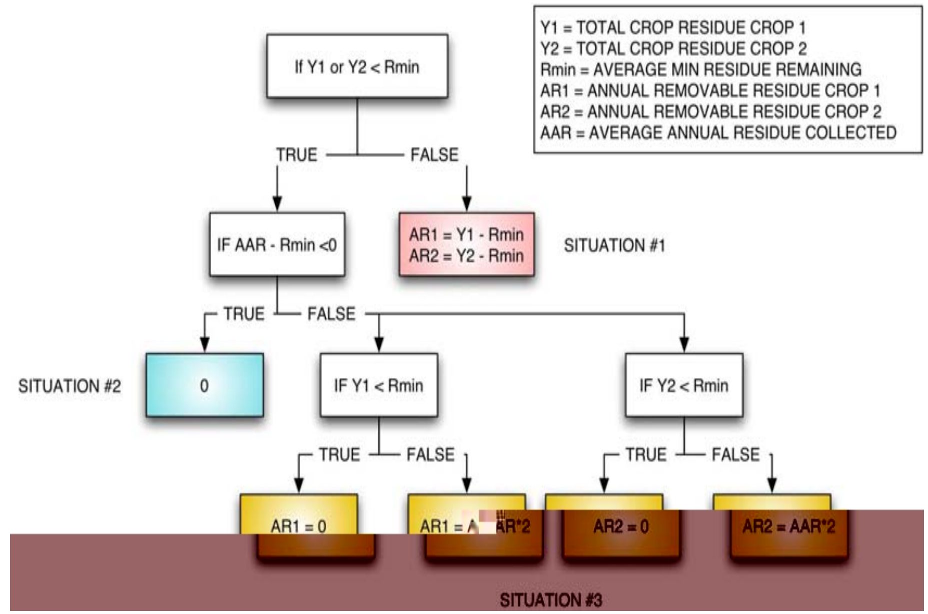
- Provided guidance on what will work and what won’t with farmers/landowners

Continuous Corn Remaining and Removable Residue by Individual Soil Type

State	County	Corn Yield (bushels/ acre)	Corn Residue Gross (tons/acre)	CT Corn Annual Average Residue Remain (tons/acre)	CT Corn Residue Remove (tons/acre)	MT Corn Annual Average Residue Remain (tons/acre)	MT Corn Residue Remove (tons/acre)	NT Corn Annual Average Residue Remain (tons/acre)	NT Corn Residue Remove (tons/acre)	SSURGO Acres	T	Soil ID
KS	ALLEN	92.88	2.20	**1.235**	0.962	**0.639**	1.558	**0.093**	2.104	8,258	5	1
KS	ALLEN	92.88	2.20	**5.992**	0	**3.598**	0	**1.683**	0.515	7,897	3	2
KS	ALLEN	92.88	2.20	**4.752**	0	**2.792**	0	**1.1**	1.097	216	5	3
KS	ALLEN	92.88	2.20	**6.869**	0	**4.178**	0	**2.161**	0.037	295	2	4
KS	ALLEN	92.88	2.20	**4.366**	0	**2.545**	0	**0.942**	1.255	38,544	2	5
KS	ALLEN	92.88	2.20	**4.391**	0	**2.561**	0	**0.952**	1.245	22,660	5	6
KS	ALLEN	92.88	2.20	**1.657**	0.541	**0.882**	1.316	**0.16**	2.038	689	5	7
KS	ALLEN	92.88	2.20	**3.905**	0	**2.252**	0	**0.768**	1.429	517	3	8
KS	ALLEN	92.88	2.20	**0.67**	1.527	**0.328**	1.87	**0.03**	2.167	1,921	3	9
KS	ALLEN	92.88	2.20	**0.889**	1.308	**0.446**	1.751	**0.051**	2.146	12,218	5	10
KS	ALLEN	92.88	2.20	**0.202**	1.995	**0.088**	2.109	**0.003**	2.194	98	5	11
KS	ALLEN	92.88	2.20	**2.806**	0	**1.569**	0.628	**0.419**	1.778	29,705	5	12
KS	ALLEN	92.88	2.20	**7.347**	0	**4.497**	0	**2.444**	0	1	3	13
KS	ALLEN	92.88	2.20	**7.731**	0	**4.755**	0	**2.683**	0	4,968	3	14
KS	ALLEN	92.88	2.20	**7.347**	0	**4.497**	0	**2.444**	0	1,477	3	15
KS	ALLEN	92.88	2.20	**6.861**	0	**4.173**	0	**2.156**	0.041	16	5	16
KS	ALLEN	92.88	2.20	**8.418**	0	**5.219**	0	**3.136**	0	12,559	2	17
KS	ALLEN	92.88	2.20	**6.433**	0	**3.889**	0	**1.916**	0.281	1,763	3	18
KS	ALLEN	92.88	2.20	**5.191**	0	**3.075**	0	**1.293**	0.904	37	4	19
KS	ALLEN	92.88	2.20	**3.418**	0	**1.947**	0.25	**0.602**	1.596	438	3	20

Multi-crop Analysis

Soybeans with Corn Residue



Situation #1 ***Both crops produce more residue each year than Rmin***

Situation #2 ***The average residue produced by both crops is less than Rmin***

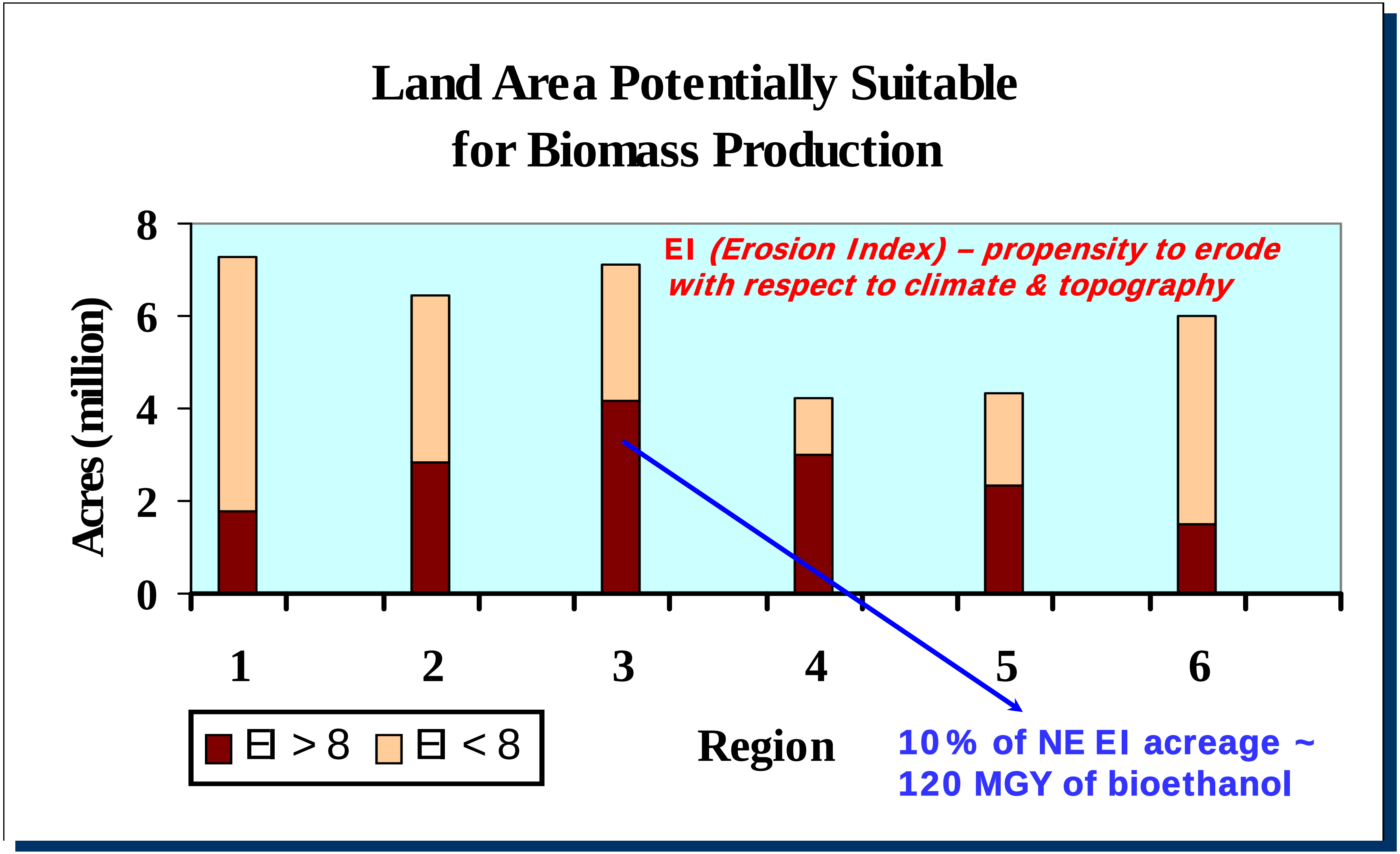
Situation #3 ***The average residue produced by the two crops is greater than Rmin, <u>but</u> one crop's residue is less than Rmin***

Switchgrass Yields – NE Kansas

Jefferson County, Kansas

Soil	Acres	Erosion Index	Max SWG	Min SWG
PAWNEE	100,805	**12**	11.0	1.3
SHELBY	46,837	**13**	11.4	1.3
OSKA	15,058	**37**	9.0	0.2
SOGN	8,174	**29**	4.5	0.0
VINLAND	39,462	**48**	6.2	0.0
KENNEBEC	16,988	**3**	14.9	1.5
READING	6,137	**3**	12.4	1.4
GRUNDY	28,986	**4**	11.7	1.4

Land *Potentially* Suitable for Biomass – Kansas



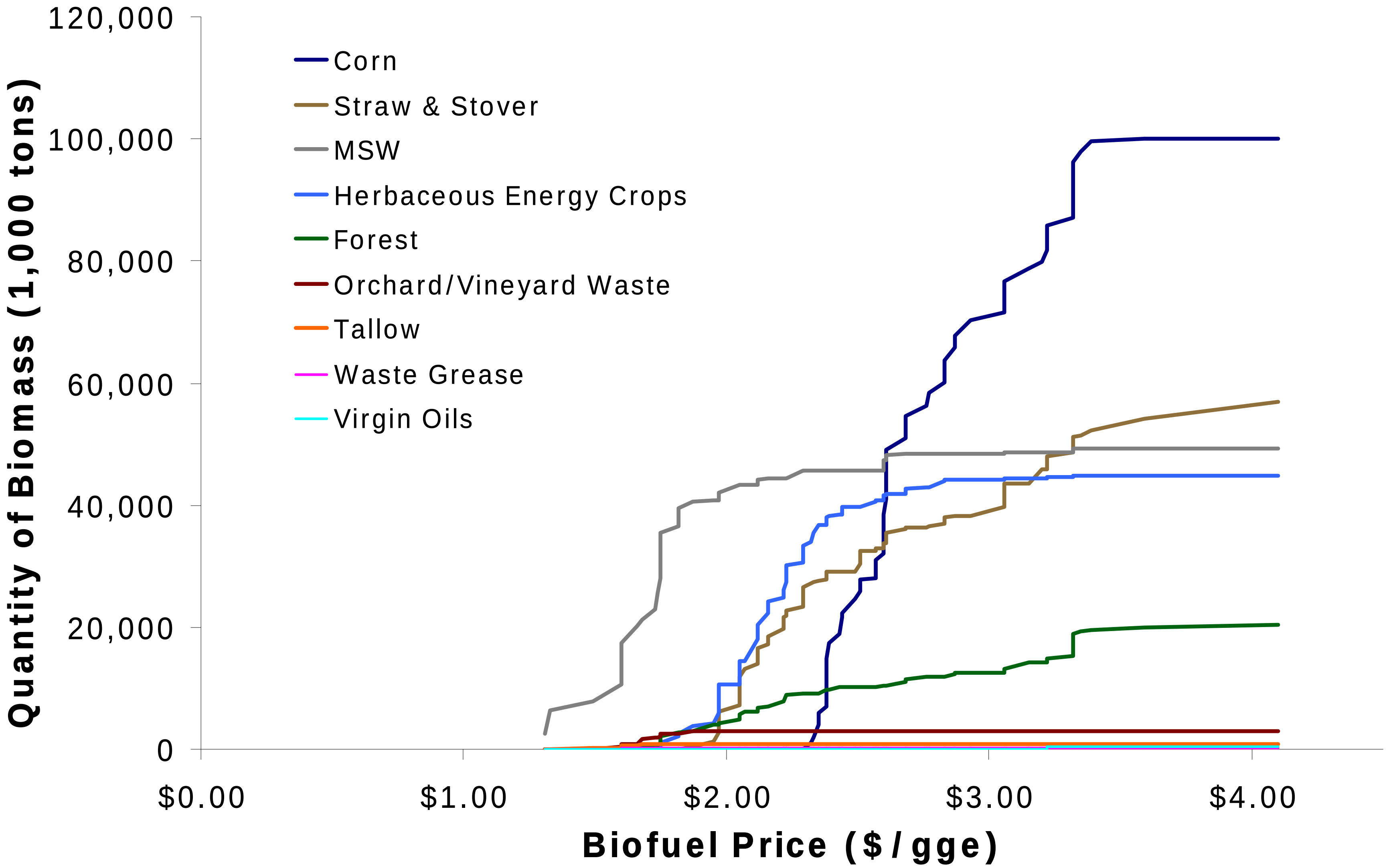
Jefferson County, Kansas (NE Kansas)								
County & Soil	Area (acres)	Erosion Index (EI)	Maximum Switchgrass Yield (tons/acre)	Minimum Switchgrass Yield (tons/acre)	Average Switchgrass Yield (tons/acre)	Average Annual C Sequestration Potential (tons/acre/year)	Total Switchgrass Production (tons) at 25% Penetration	Total Gallons of Bioethanol
STEINAUER	10	24.06	12.44	0.25	5.22	0.7158	13	956
KONAWA	692	11.13	11.63	1.29	5.72	0.7600	990	74,220
MARTIN	38,493	14.97	12.82	1.48	6.29	0.8098	60,501	4,537,612
PAWNEE	100,805	11.97	10.99	1.25	5.57	0.7469	140,442	10,533,114
SHELBY	46,837	**12.99**	11.43	1.27	5.44	0.7349	63,657	**4,774,296**
OSKA	15,058	**37.28**	8.98	0.17	4.07	0.6151	15,337	**1,150,307**
SOGN	8,174	**28.93**	4.52	0.01	1.76	0.4110	3,587	**269,003**
JUDSON	2,314	9.06	13.78	0.78	6.30	0.8111	3,646	273,423
VINLAND	39,462	**47.62**	6.16	0.01	2.59	0.4846	25,569	**1,917,694**
SIBLEYVILLE	3,173	15.10	7.84	0.14	3.34	0.5505	2,650	198,749
KENNEBEC	16,988	**2.97**	14.87	1.52	7.03	0.8753	29,862	**2,239,626**
GYMER	3,647	4.74	12.85	1.45	6.43	0.8223	5,862	439,639
WABASH	8,379	**3.93**	12.16	1.32	5.81	0.7675	12,163	**912,190**
EUDORA	7,675	7.63	10.71	1.18	5.34	0.7264	10,246	768,428
READING	6,137	**3.40**	12.45	1.43	6.24	0.8055	9,571	**717,827**
GRUNDY	28,986	**3.93**	11.72	1.40	5.89	0.7746	42,664	**3,199,816**
KIMO	4,400	3.40	11.59	1.26	5.62	0.7508	6,178	463,335
MORRILL	2,572	7.63	10.68	1.27	5.40	0.7320	3,475	260,624
HAIG	1,622	3.93	10.59	1.03	5.30	0.7229	2,149	161,199
WYMORE	320	6.68	9.85	1.10	4.98	0.6945	398	29,833
SARPY	1,404	5.48	8.70	0.96	4.48	0.6510	1,574	118,045

Possible Candidates for Agricultural Crop Reside Removal on these Soil Types

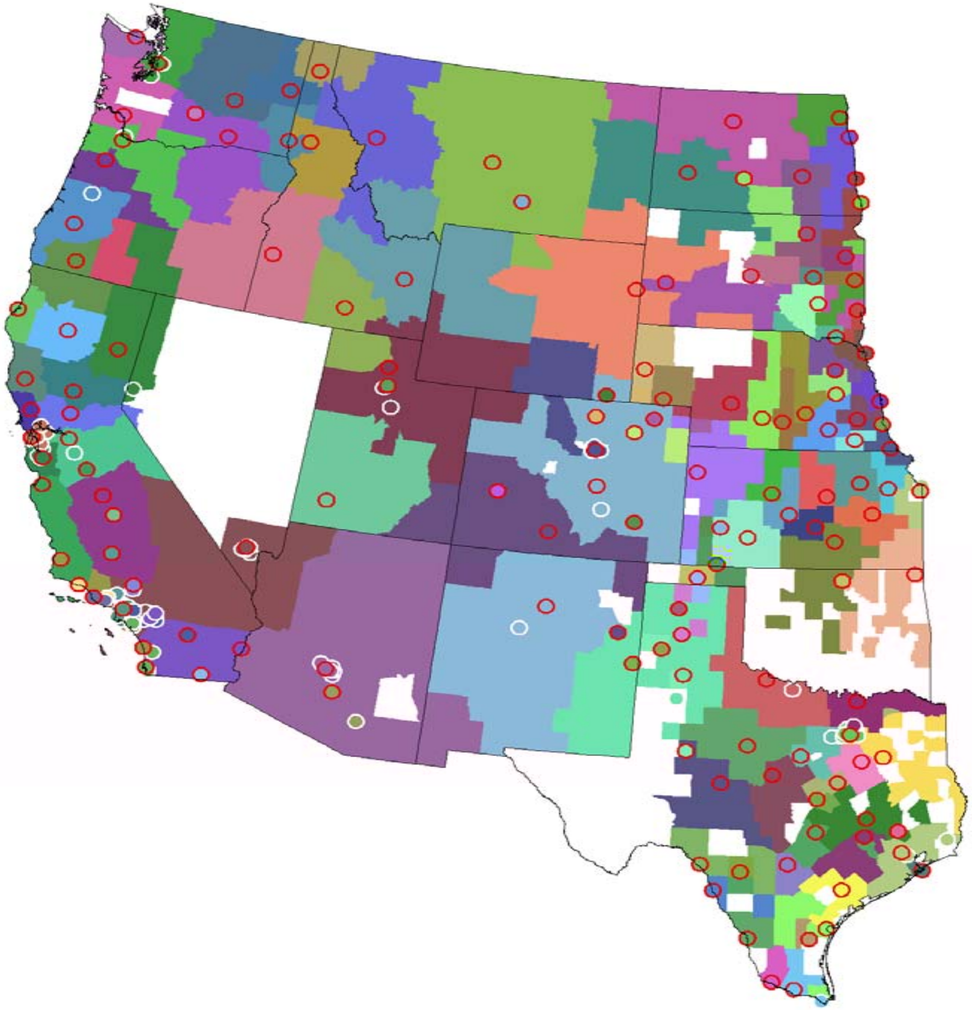
Begin Targeting Herbaceous Energy Crop Production on these Soil Types

Type of Biomass Consumed

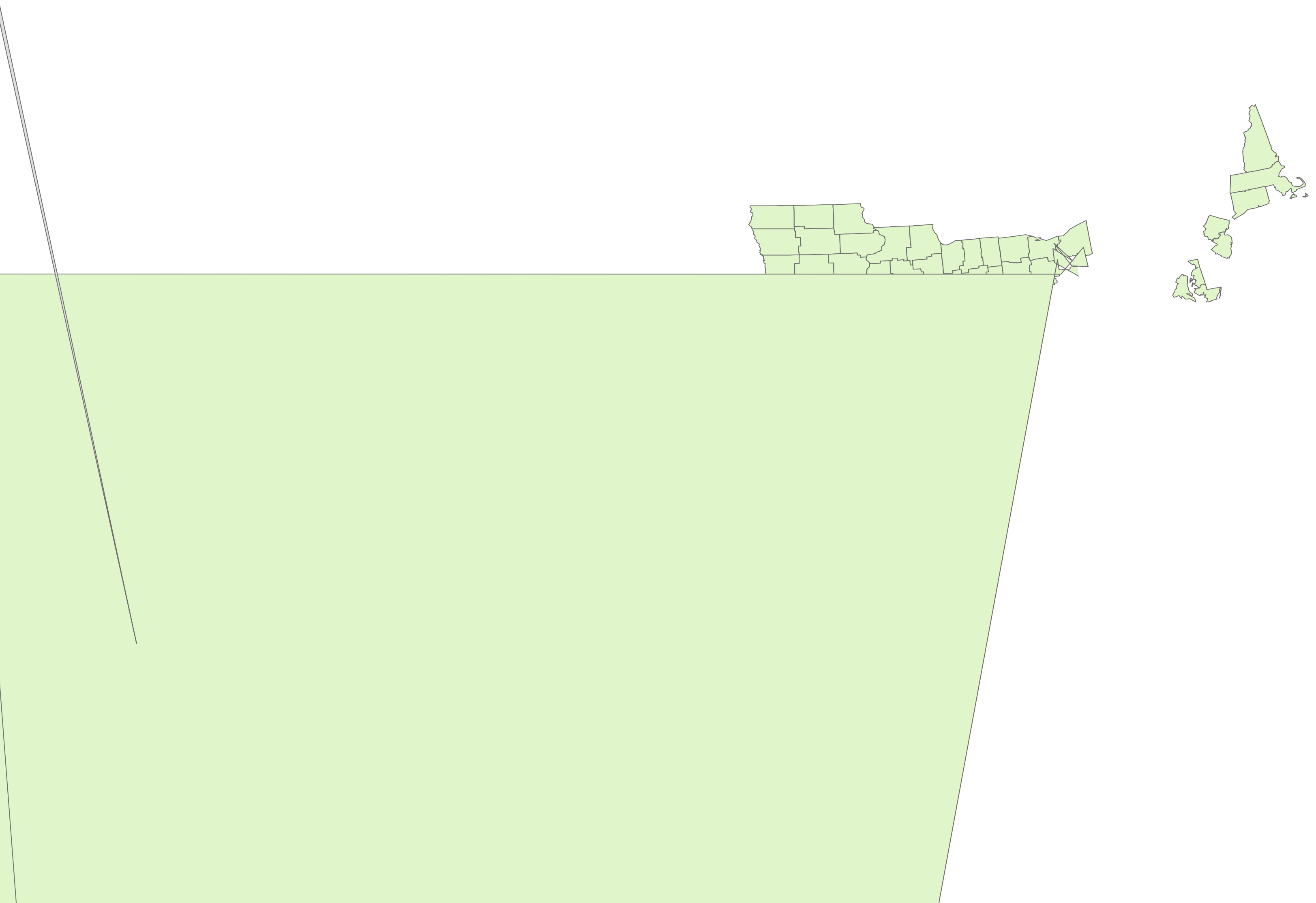
(Western Governors' Association Region)



$2.75 GGE



Another National Resource Assessment



Some Thoughts Regarding Resource Assessment & Biofuels Supply

- There is much we don’t know about sustainable biofuels production
  - long-term effect (+/-) on soil tilth
  - what is the “net” effect versus the current alternatives

- National studies are possibly o.k. to get an “order of magnitude” view, but all biofuels production (*like politics*) is local; need to evaluate all resources on a localized basis

Many studies conducted and many assumptions made and applied - **it's time to get "very real" about agriculture's role to sustainably provide the resource if the world intends to go down this path**

American ‘Dust Bowl’ – 1930s