Remembering Soil Conservation Practices under Limited Water Conditions

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New Mexico Western SARE
Sustainable Agriculture Conference

All About Discovery!

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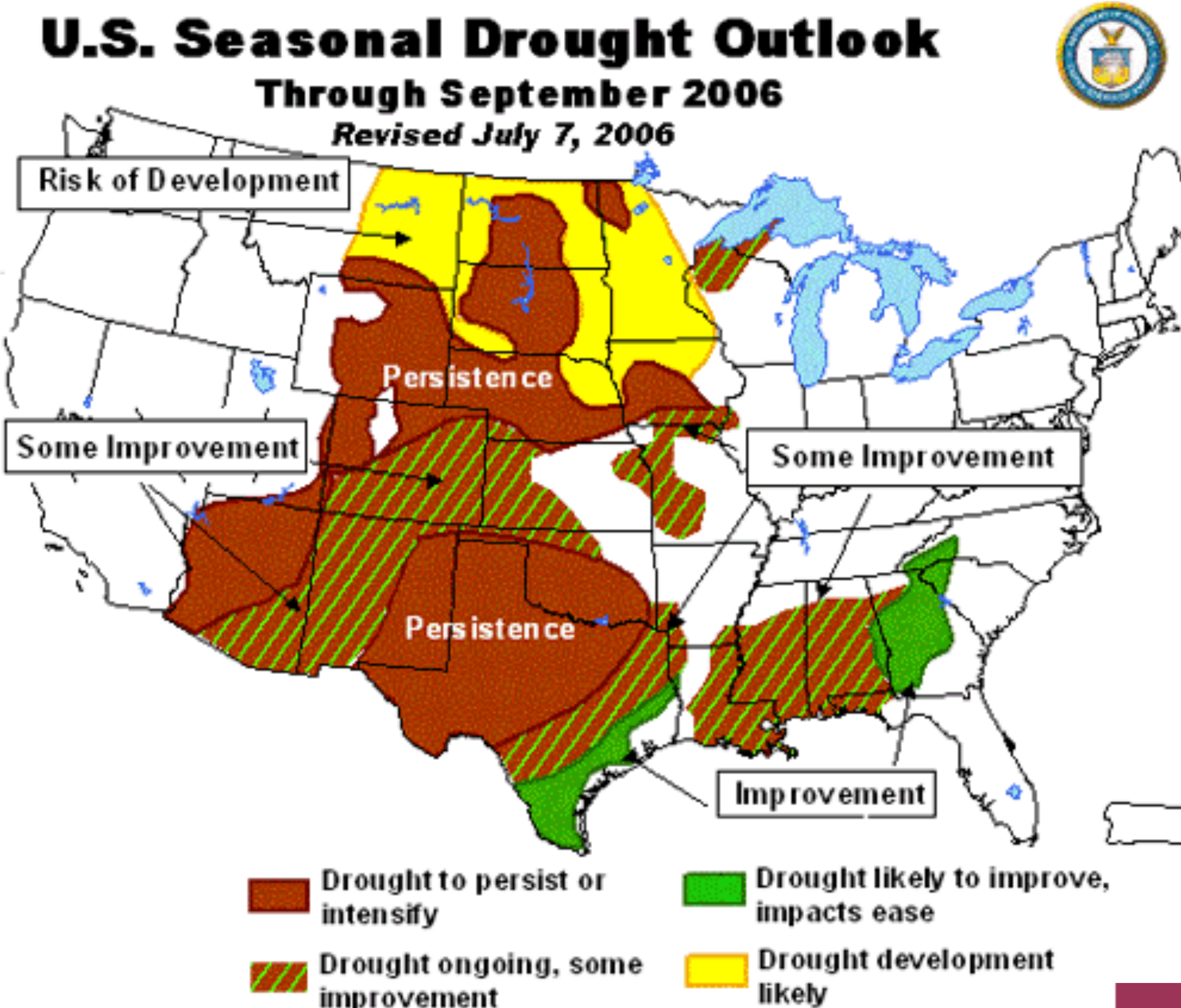

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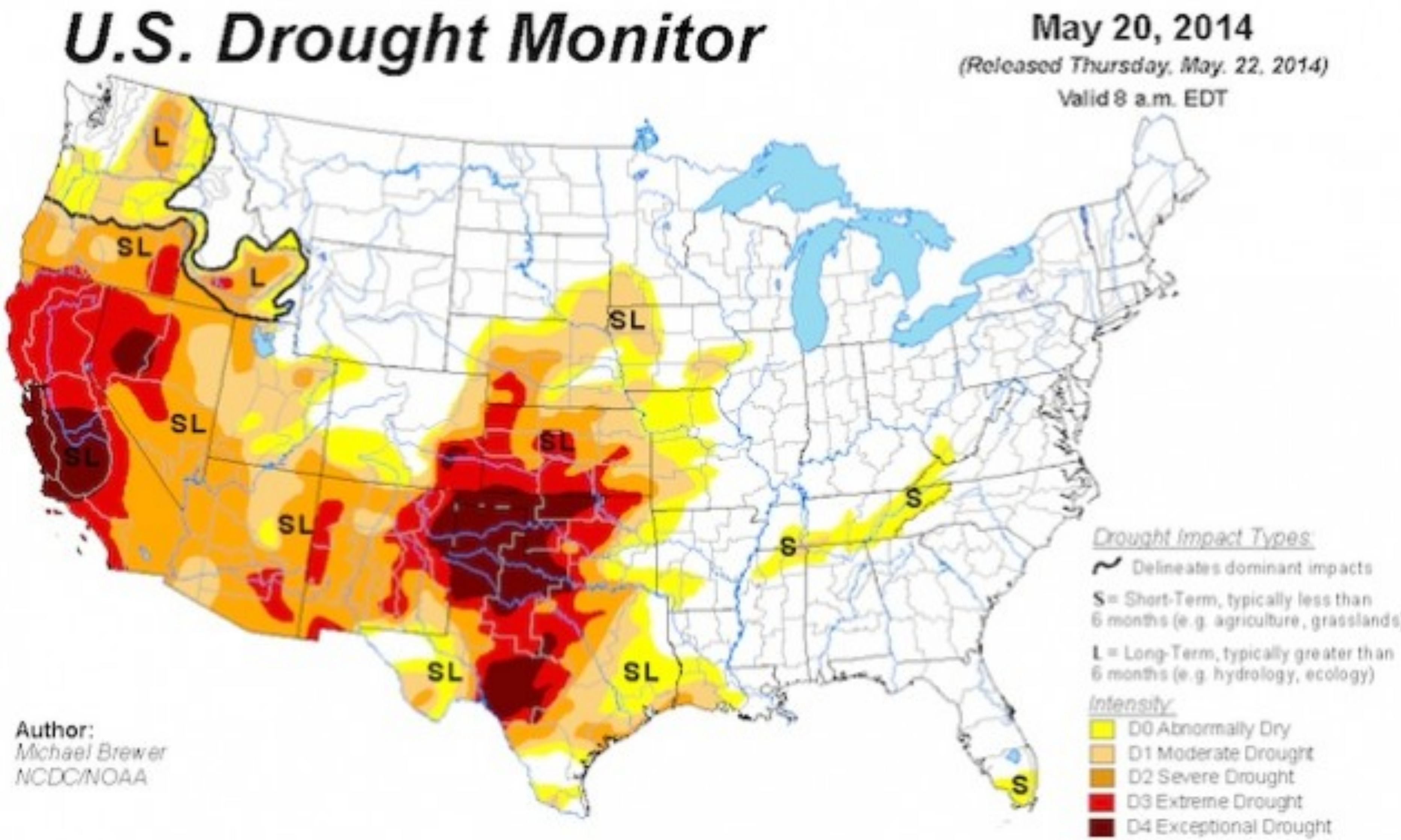

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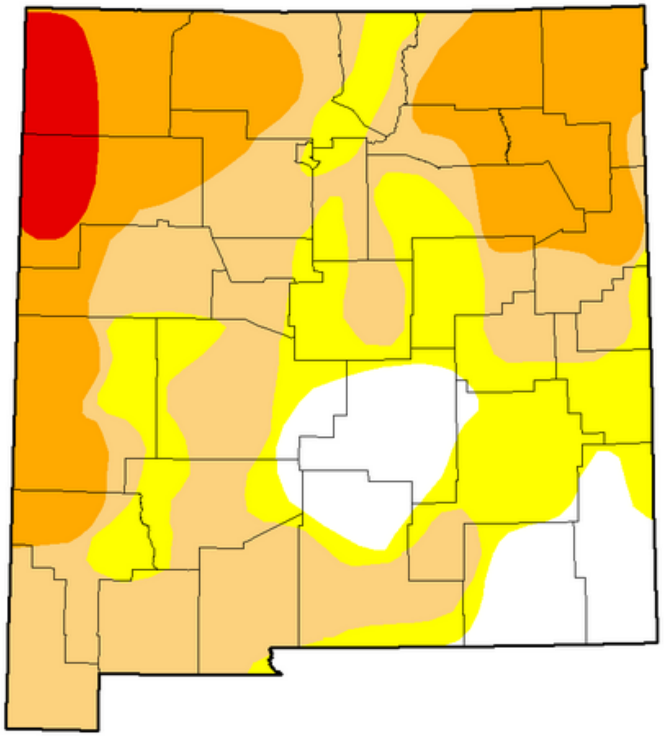
U.S. Drought Monitor

New Mexico



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December 9, 2014

(Released Thursday December 11, 2014)
Valid 7 a.m. EST

Statistics type: Traditional (D0-D4, D1-D4, etc.) Categorical (D0, D1, etc.)

Drought Condition (Percent Area):

Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	2014-12-09	12.01	87.99	64.92	29.10	3.70	0.00
Last Week	2014-12-02	12.01	87.99	64.92	29.10	3.70	0.00
3 Months Ago	2014-09-09	2.63	97.37	69.85	39.85	6.97	0.00
Start of Calendar Year	2013-12-31	0.39	99.61	75.21	32.68	3.96	0.00
Start of Water Year	2014-09-30	16.70	83.30	62.57	30.04	8.08	0.00
One Year Ago	2013-12-10	0.08	99.92	76.91	36.30	3.96	0.00

Population Affected by Drought: **1,477,408** View More Statistics

Intensity:

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying **text summary** for forecast statements.*

Author(s):

Anthony Artusa, NOAA/NWS/NCEP/CPC

What Happens with no vegetation?

January 12, 2013, wind advisory

- Gusts were up to 65 mph in a corridor from northwest New Mexico to southeast Kansas across the Texas and Oklahoma panhandles.

Wind Erosion


SHARE THE ROAD
STOP

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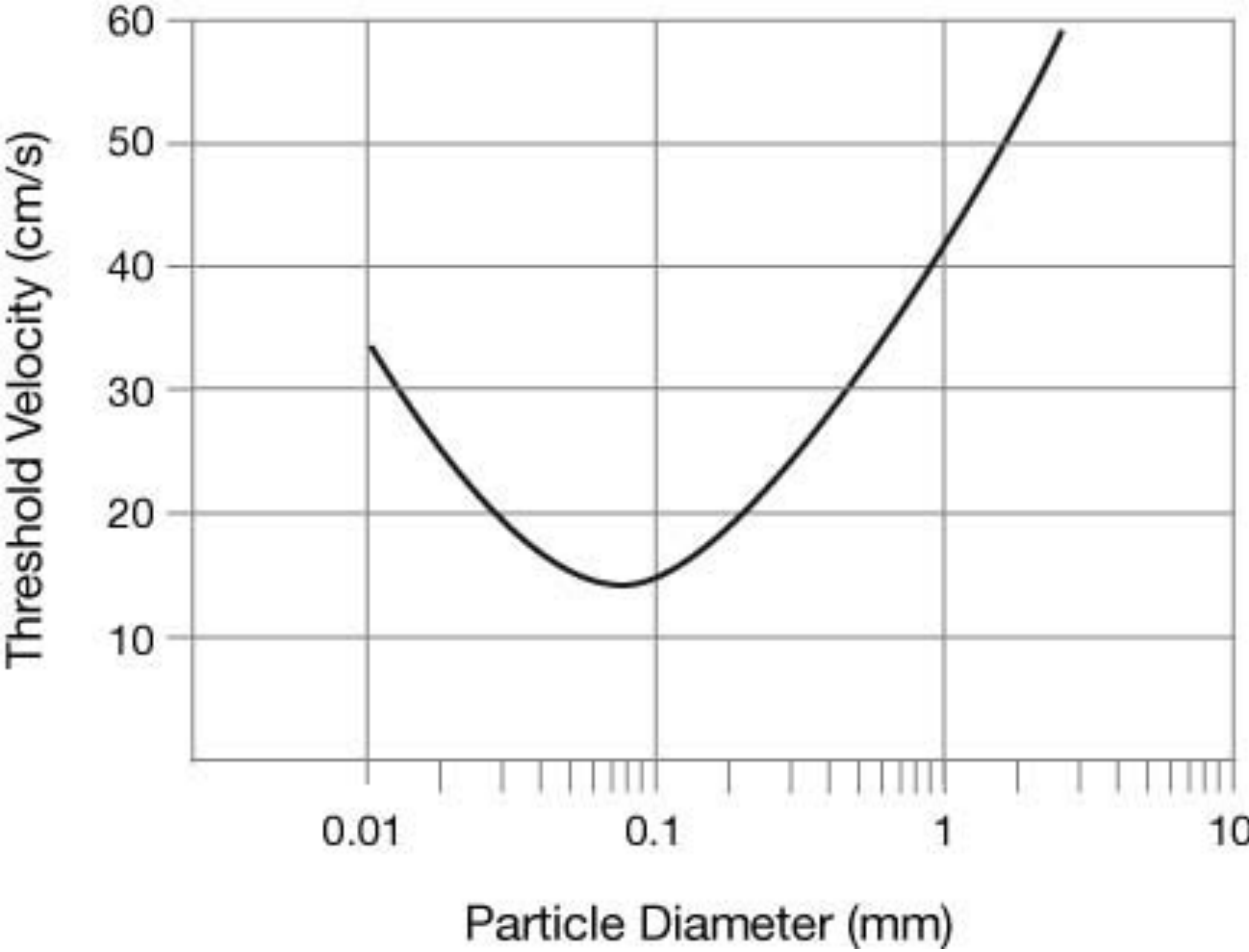
Causes of Wind Erosion

- Bare Erodible Soil

Insufficient cover

Causes of Wind Erosion

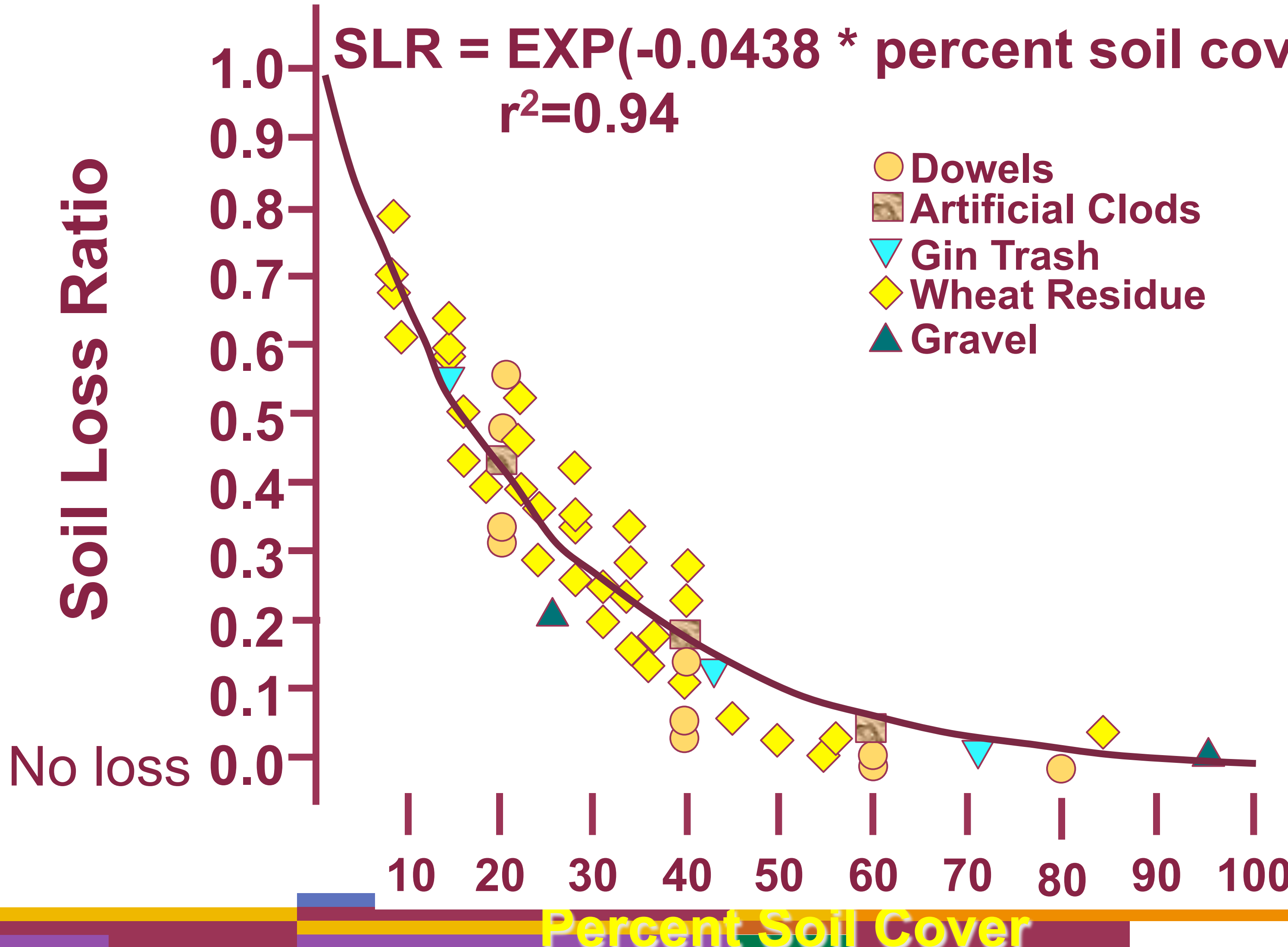
- Wind velocities exceeding threshold velocity



Effective Erosion Control Techniques

- **Maintaining non-erodible soil cover**
- **Crop Residue Management**

Effect of non-erodibles on soil loss



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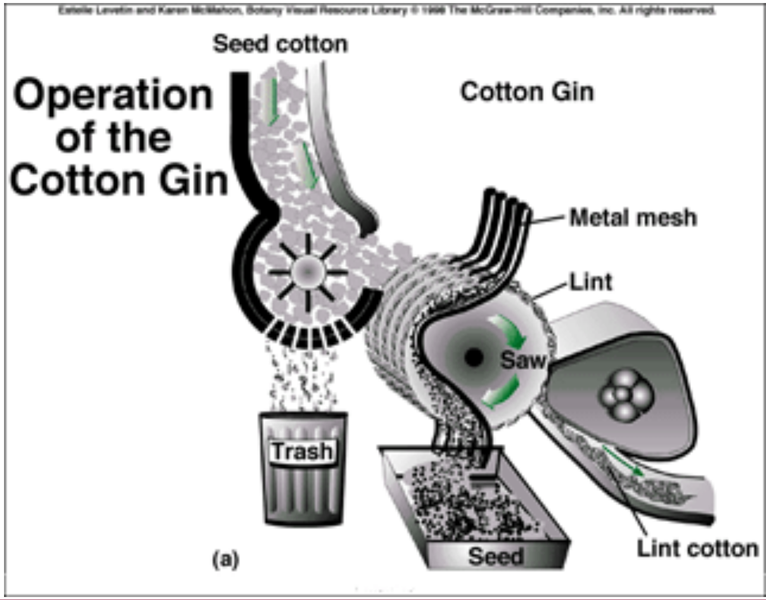
Bilbro, J.D. and D.W. Fryrear, 1994. AJ 86:550-553

Non-Erodibles for the model

- Dowels (mimick of standing plant matter)
- Artificial clods (water stable aggregates)
- Gin Trash
- Wheat Residue
- Gravel



Bilbro, J.D. and D.W. Fryrear, 1994. AJ 86:550-553

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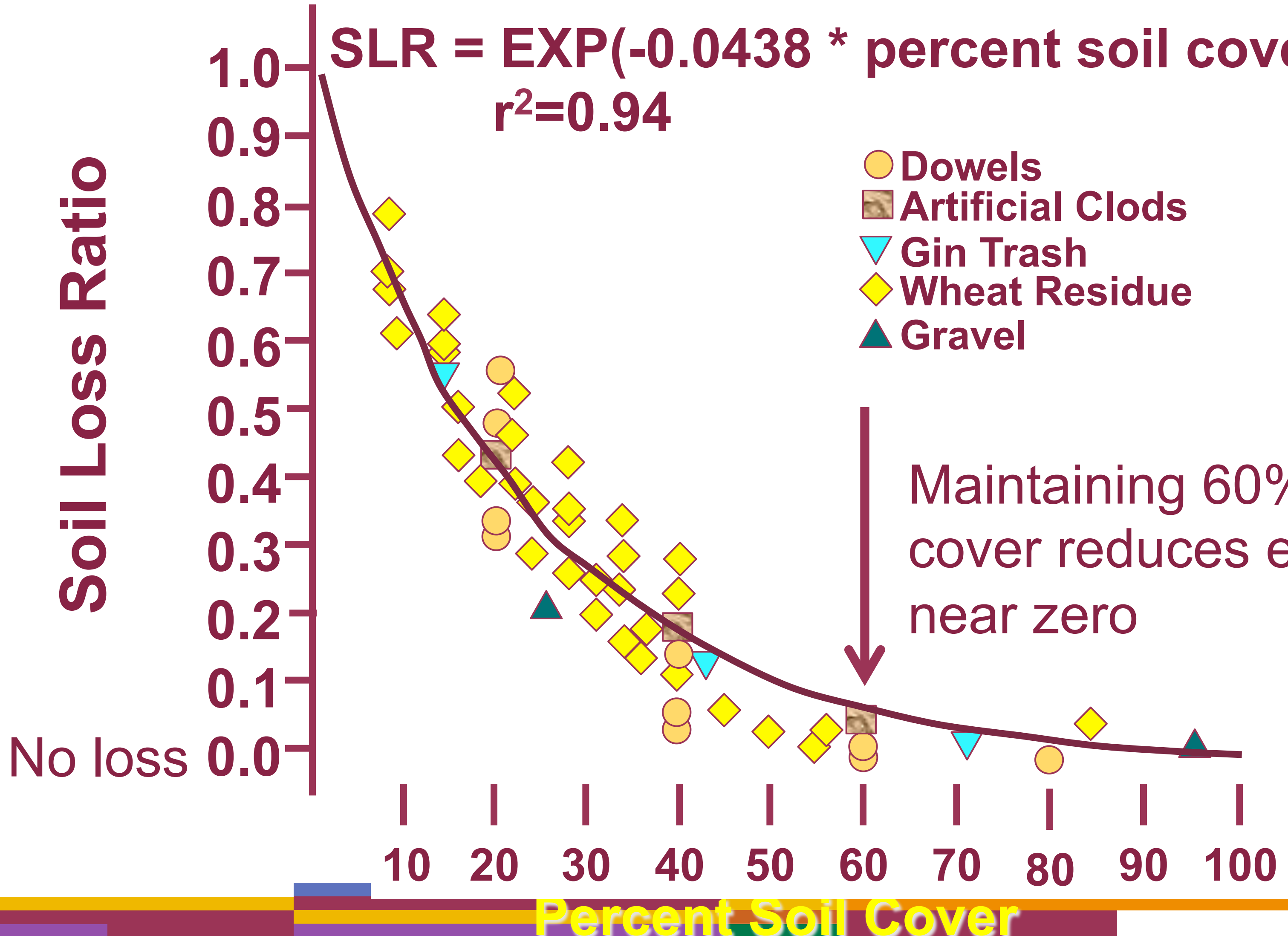

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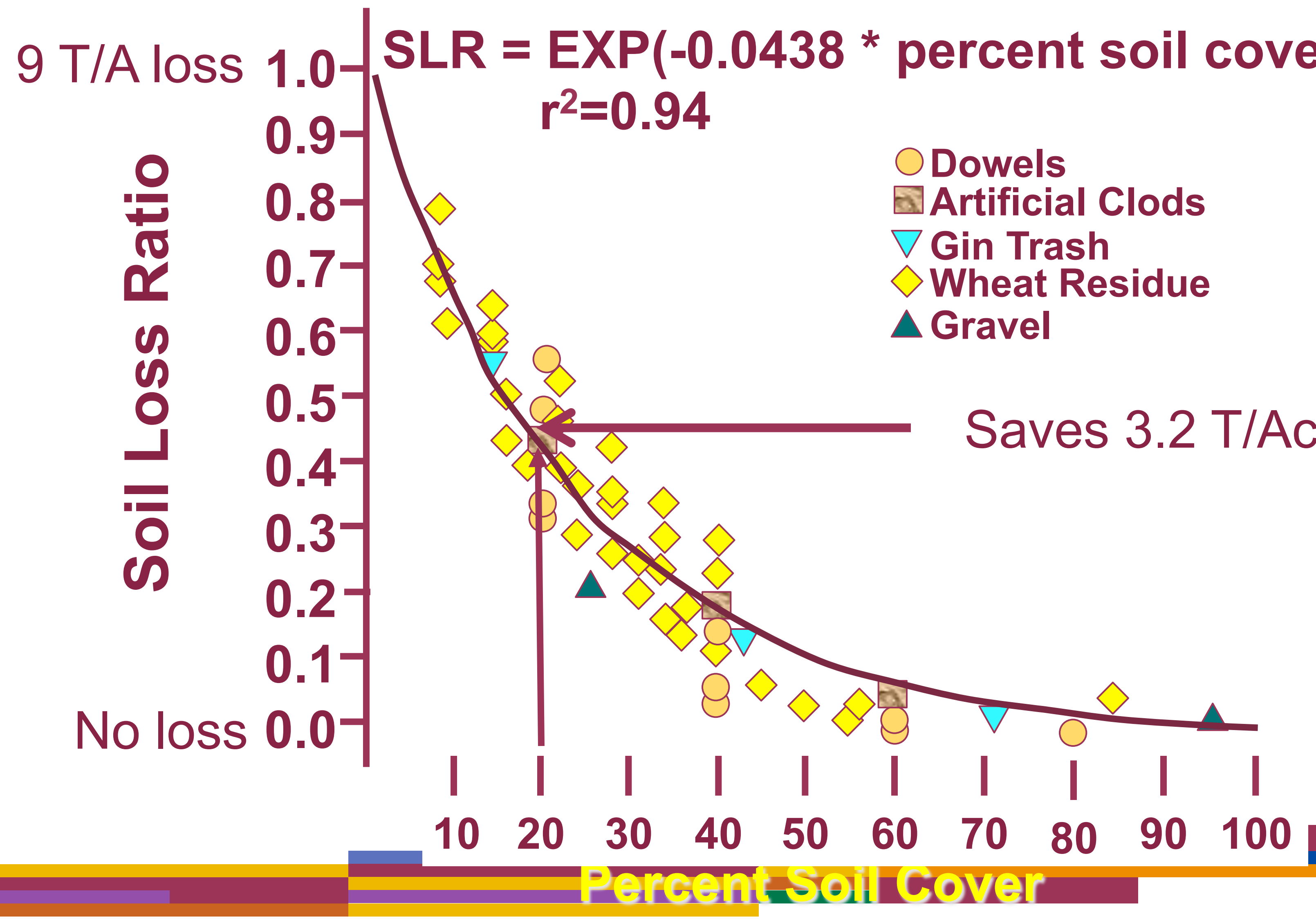

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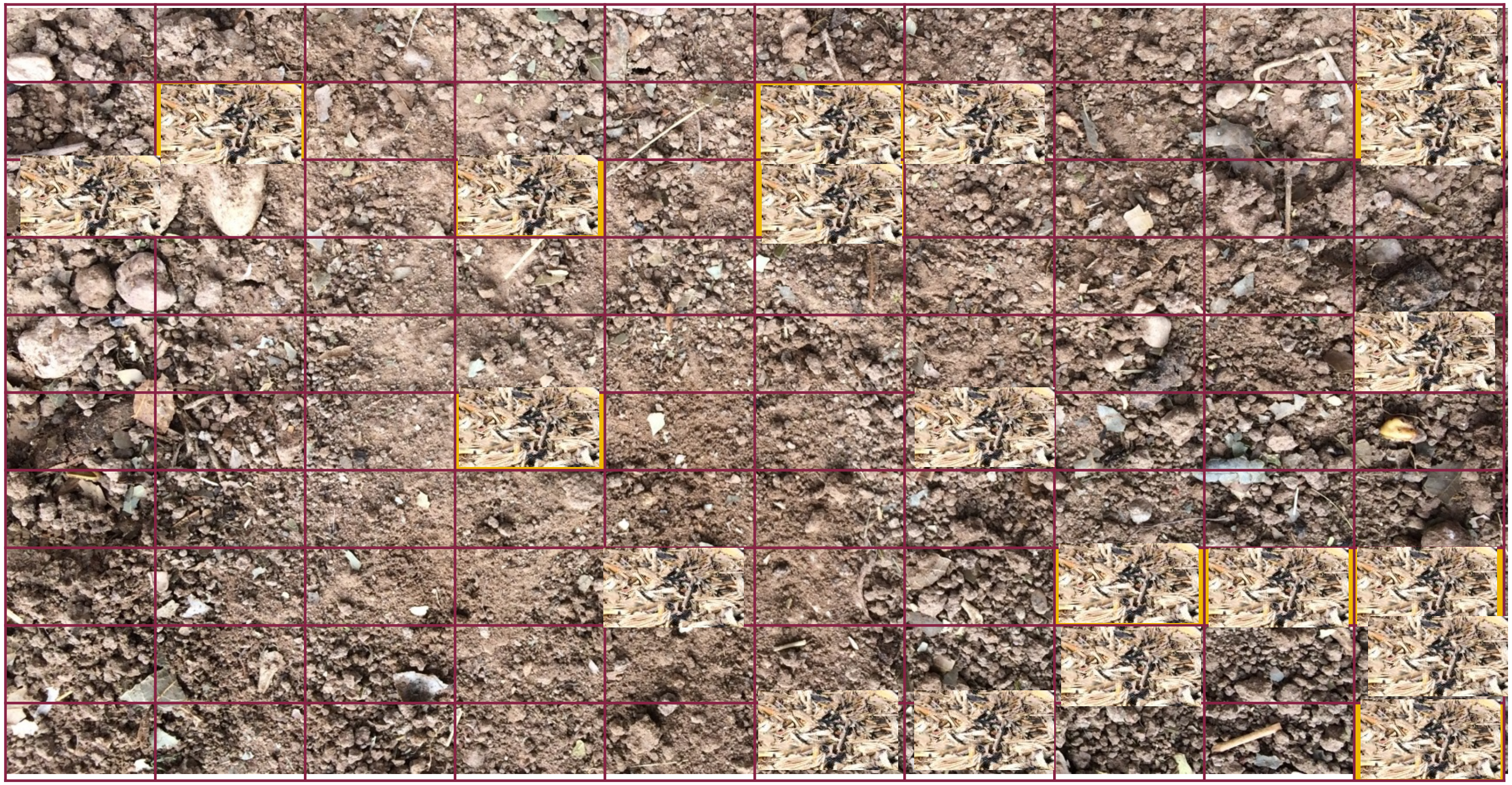
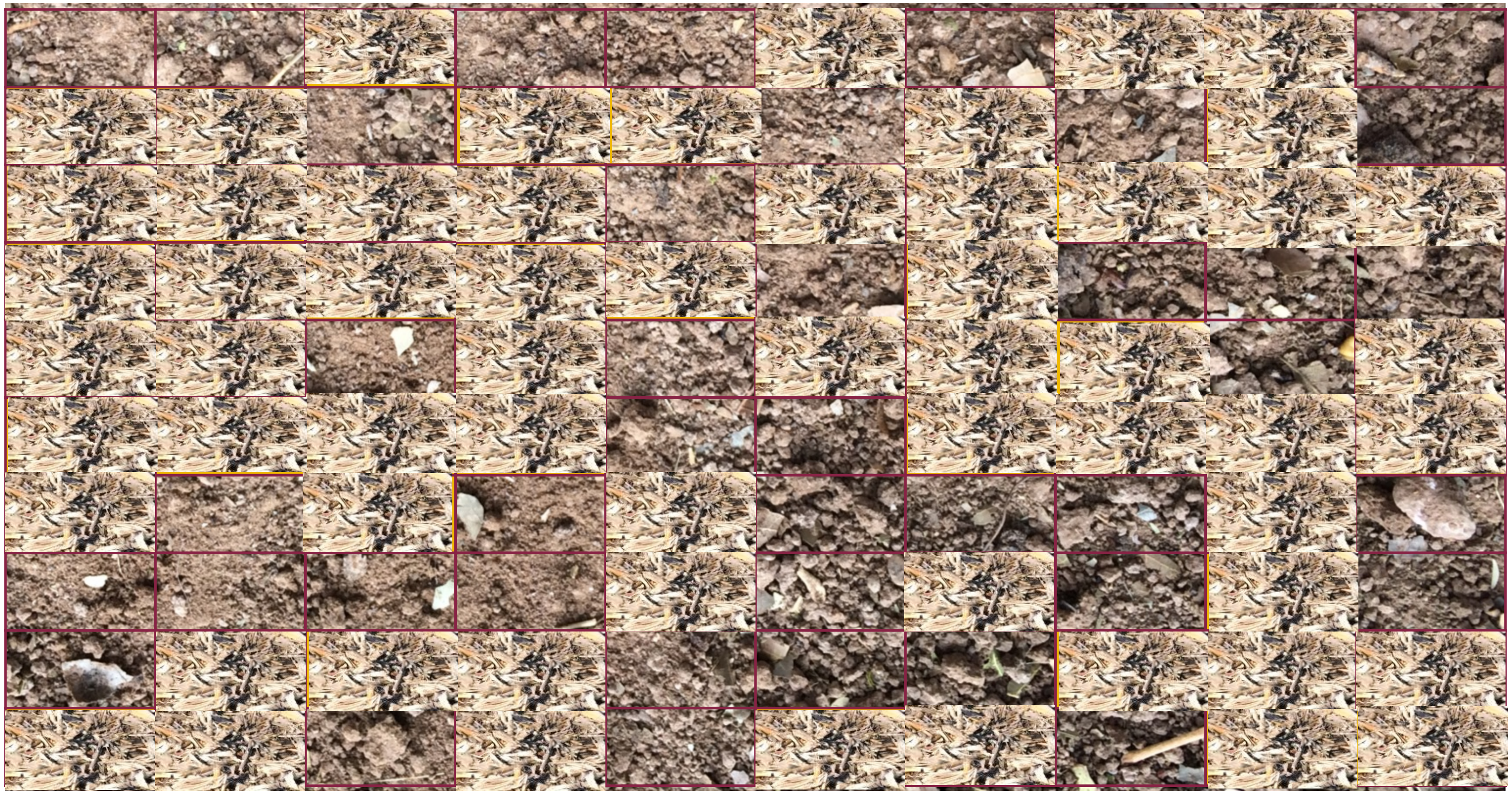
20% Cover



60% Cover




Crop Residue Management
Standing wheat (terminated)
Cotton
New Mexico State University
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Gravel and aggregates

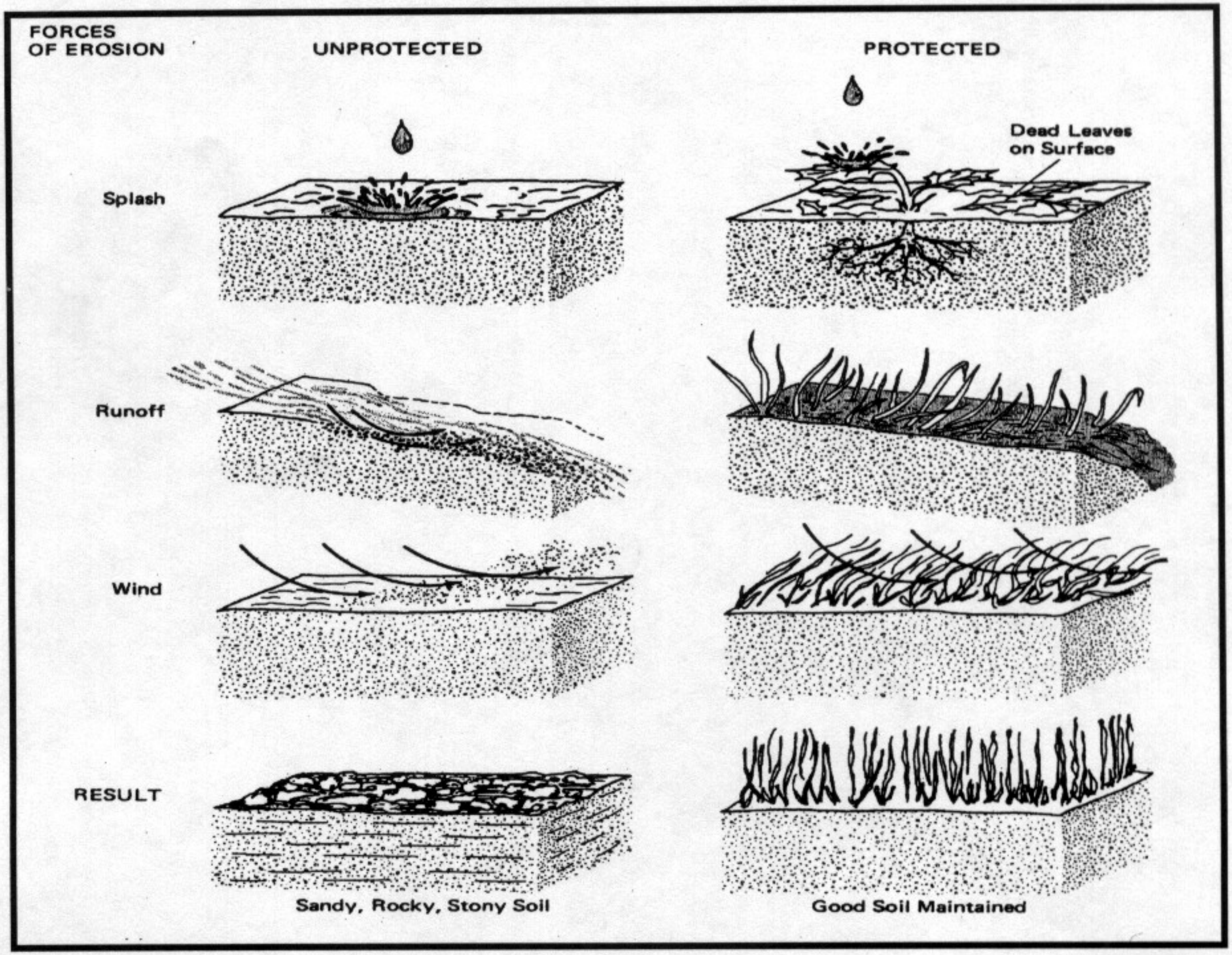

Figure 3. Vegetation effects on reducing soil erosion. (From Nebel 1981 as used by Holechek et al. 1998)

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Standing Residue – Finding the Best
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Function of Height (H), Density (D), Surface Area (N), Wind Velocity (V)

Bilbro, J.D. and D.W. Fryrear, 1994. AJ 86:550-553

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Soil Loss Ratio (SLR)

$$SLR = \exp(-28.44 \times (H^{0.729} \times D^{0.711} \times N^{0.608})/V^{2.427})$$

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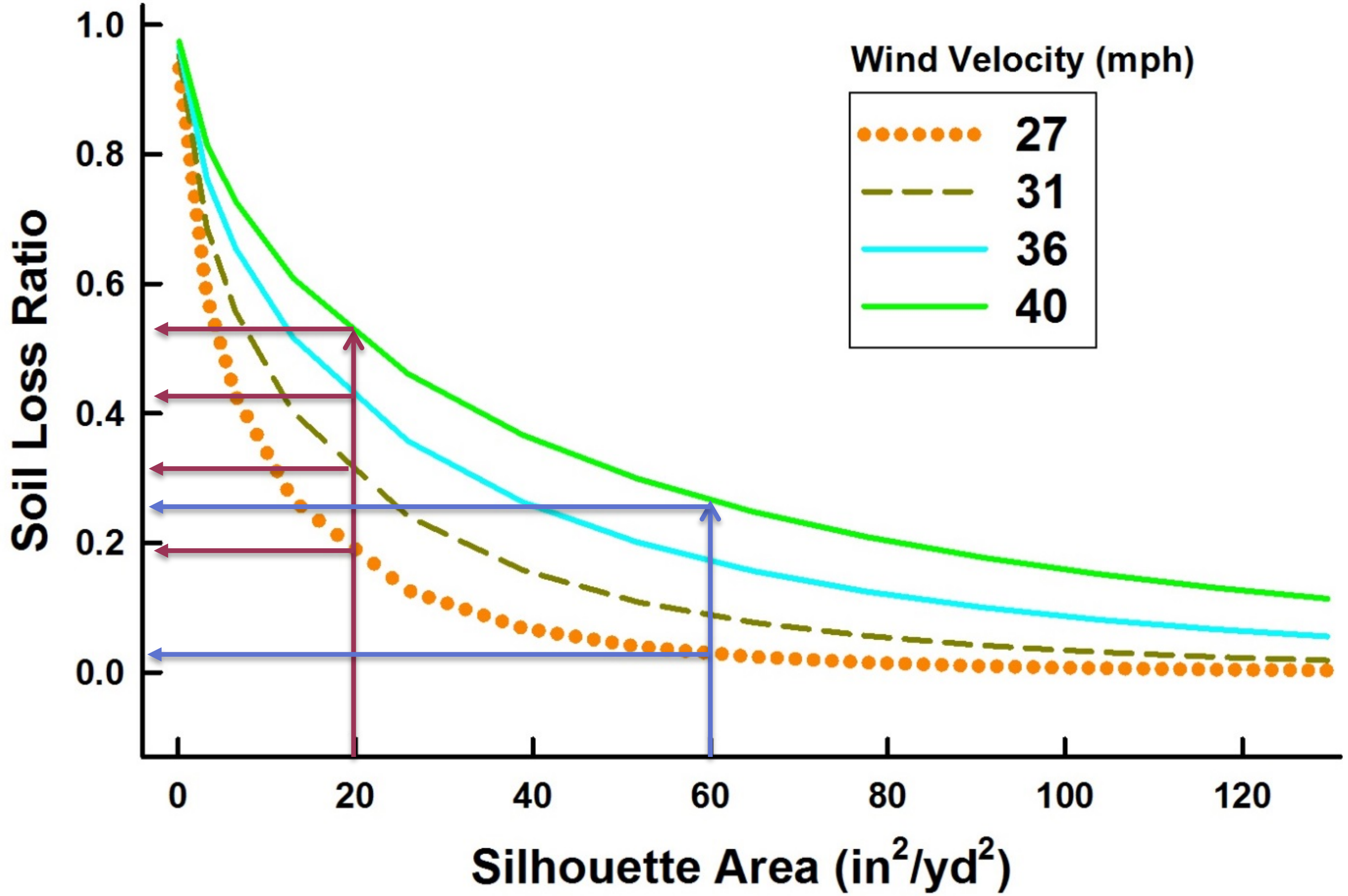
Bilbro, J.D. and D.W. Fryrear, 1994. AJ 86:550-553

Since H, D, and N are similar authors substituted the plant Silhouette area (S) for H, D, & N

$$SLR = \exp(-28.44 \times (S^{0.6413})/V^{2.423})$$

Bilbro, J.D. and D.W. Fryrear, 1994. AJ 86:550-553

Predicted Soil Loss by Silhouette Area



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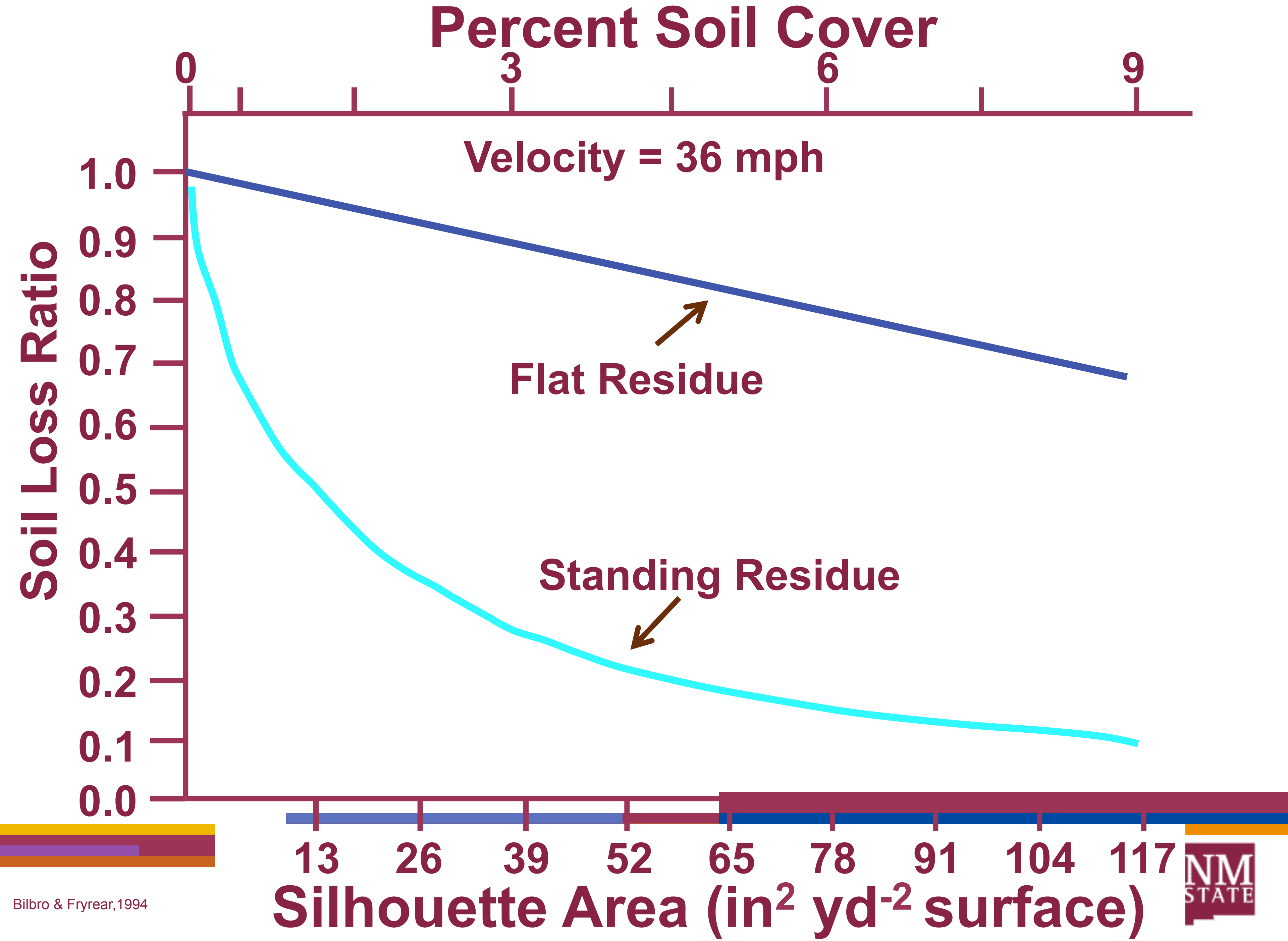
Silhouette Area (S)

- Plant Height (H)
- Plant Density (D) (population per unit area)
- Surface Area (N)


Photo by John Idowu


Percent Soil Cover
0
3
6
9
Velocity = 36 mph
Soil Loss Ratio
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Flat Residue
Standing Residue
13
26
39
52
65
78
91
104
117
Silhouette Area (in^2 yd^{-2} surface)
Bilbro & Fryrear,1994
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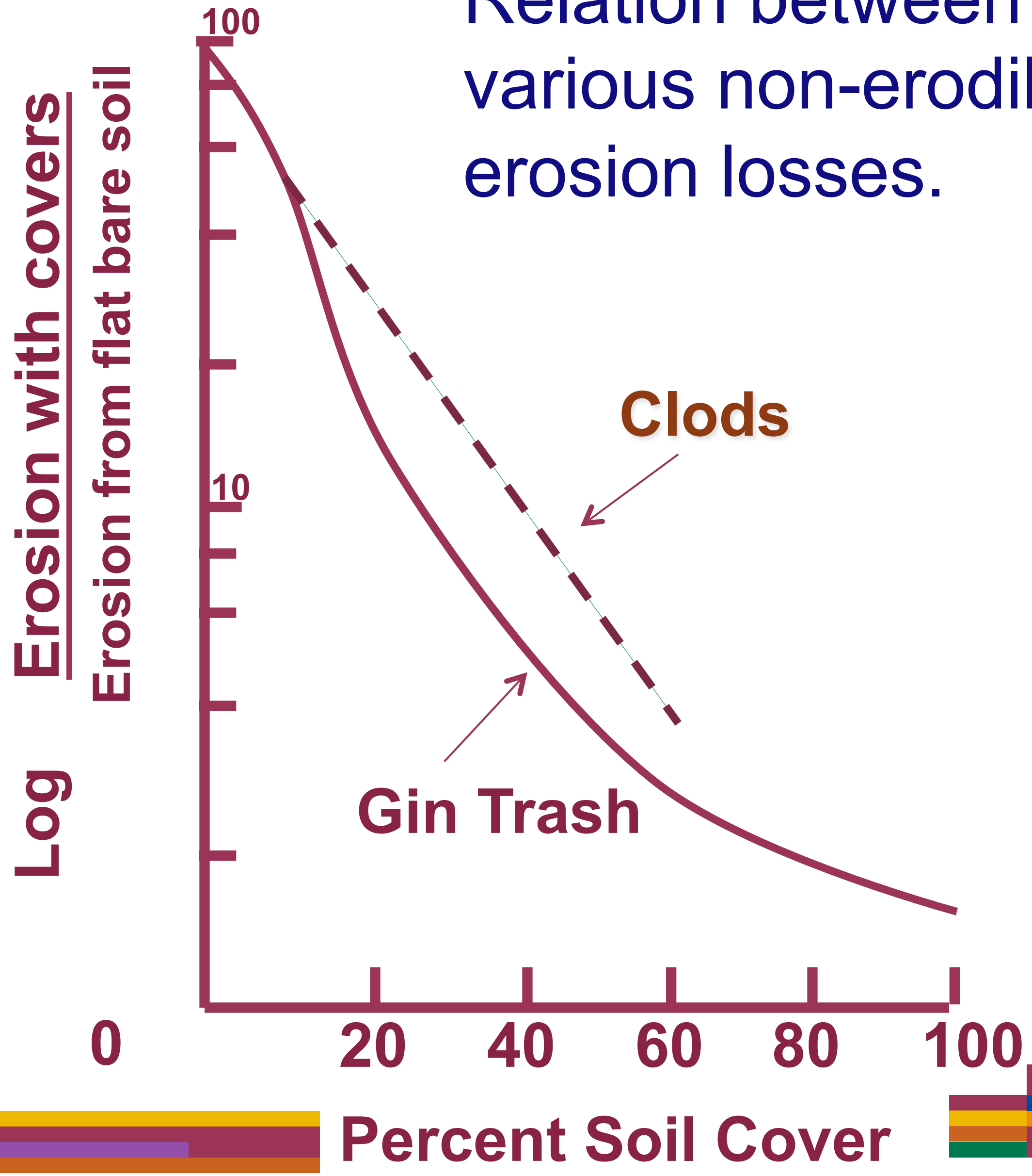
Relation between % soil cover with various non-erodible material and wind erosion losses.



Wind Erosion – Roosevelt County

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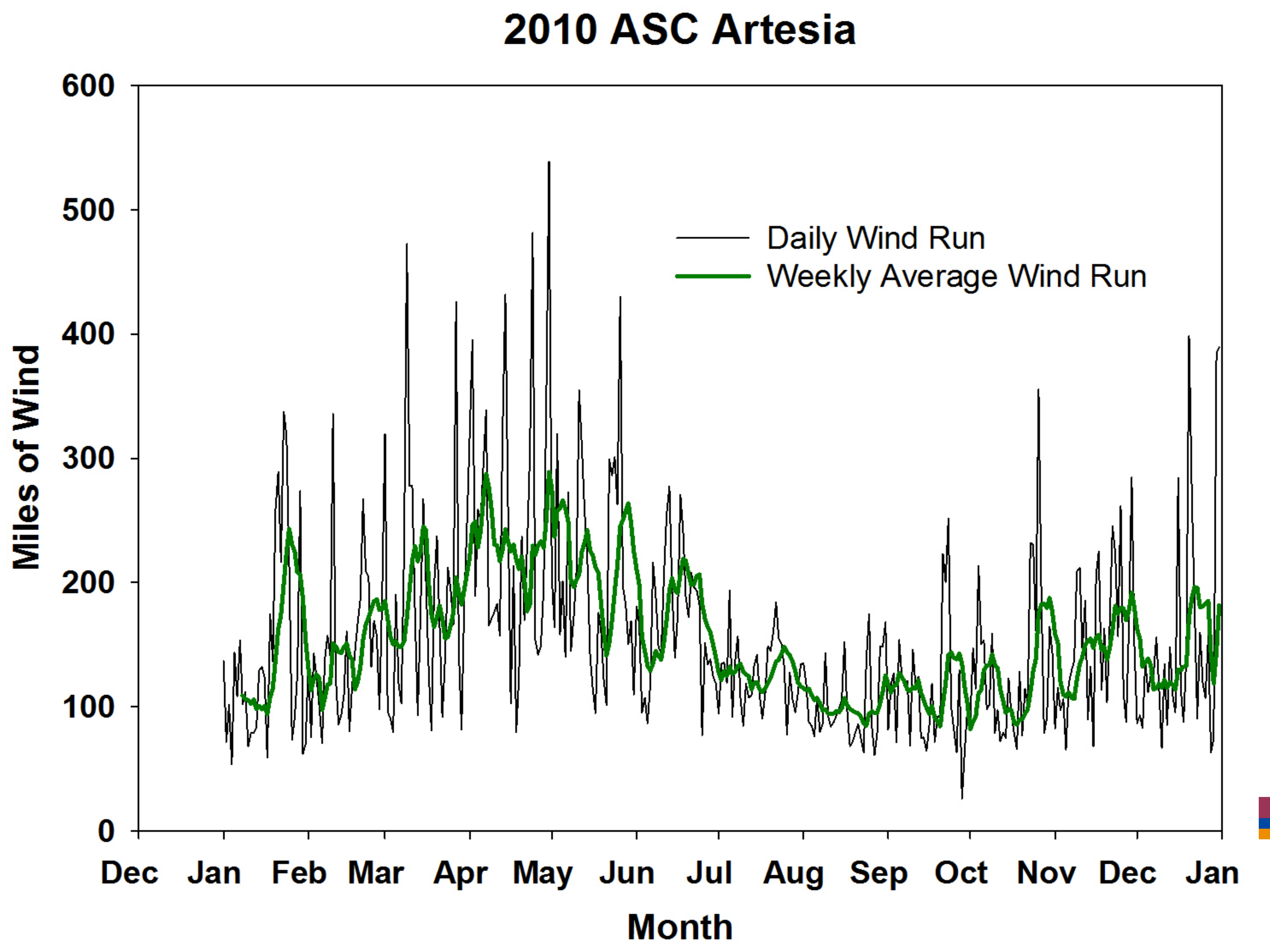
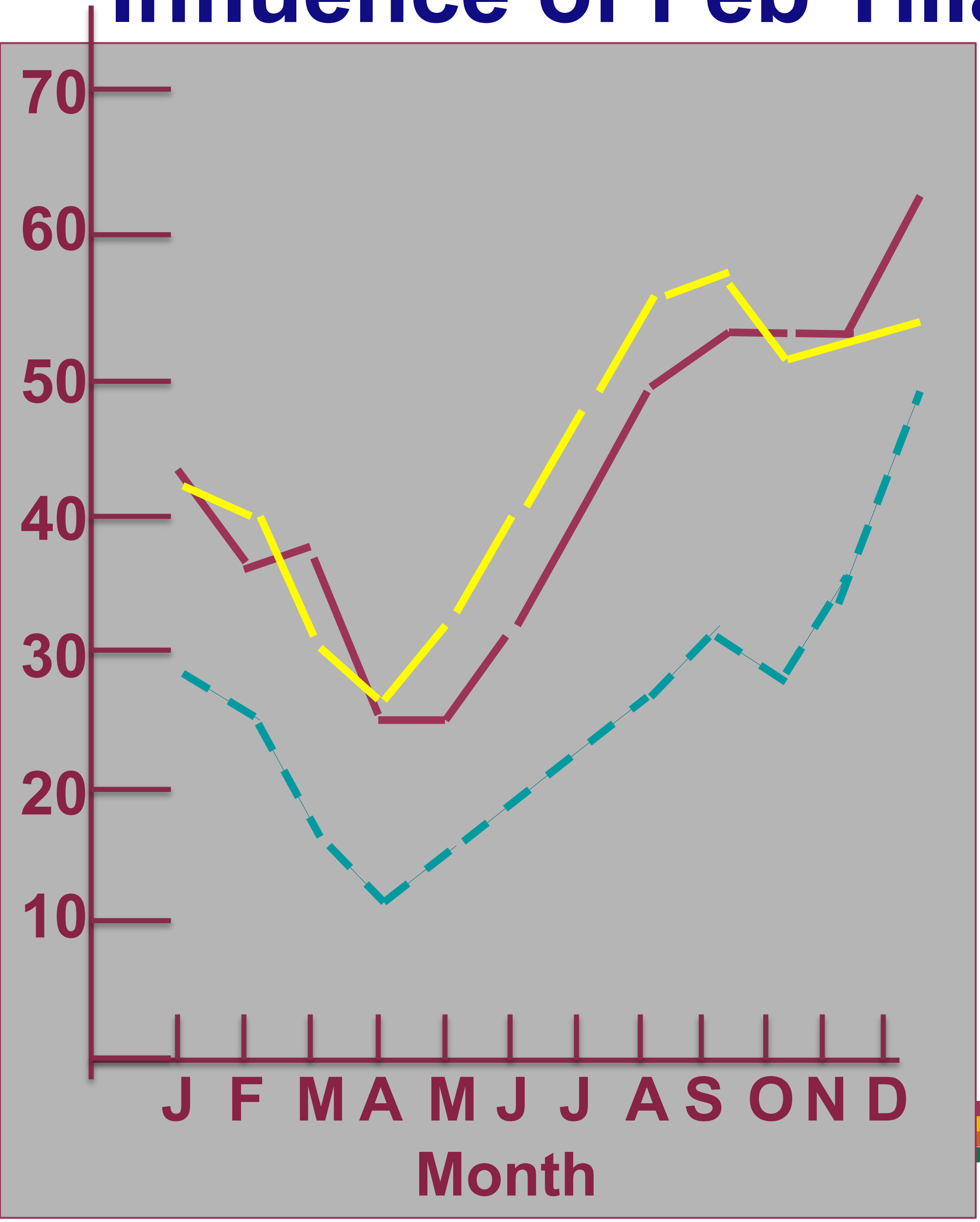


2010 ASC Artesia
Daily Wind Run
Weekly Average Wind Run
Miles of Wind
600
500
400
300
200
100
0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Month

Influence of Feb Tillage on Erodibility



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What about windbreaks?


S Roosevelt Rd W
S Roosevelt Rd W


S Roosevelt Rd W
S Roosevelt Rd W

Prevailing Wind
Cannon AFB

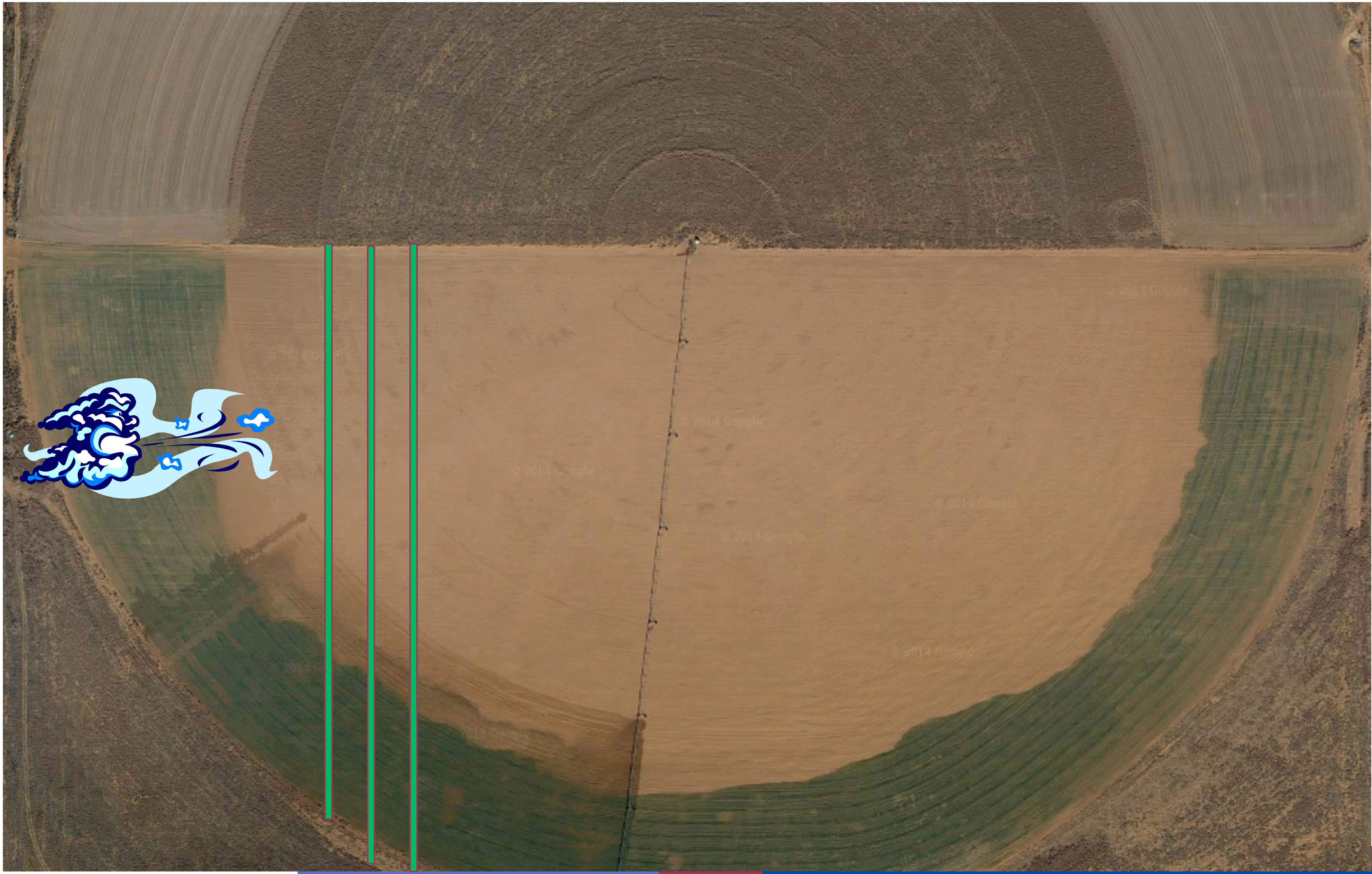
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
W	W	W	W	S	S	S	S	S	W	W	W	W

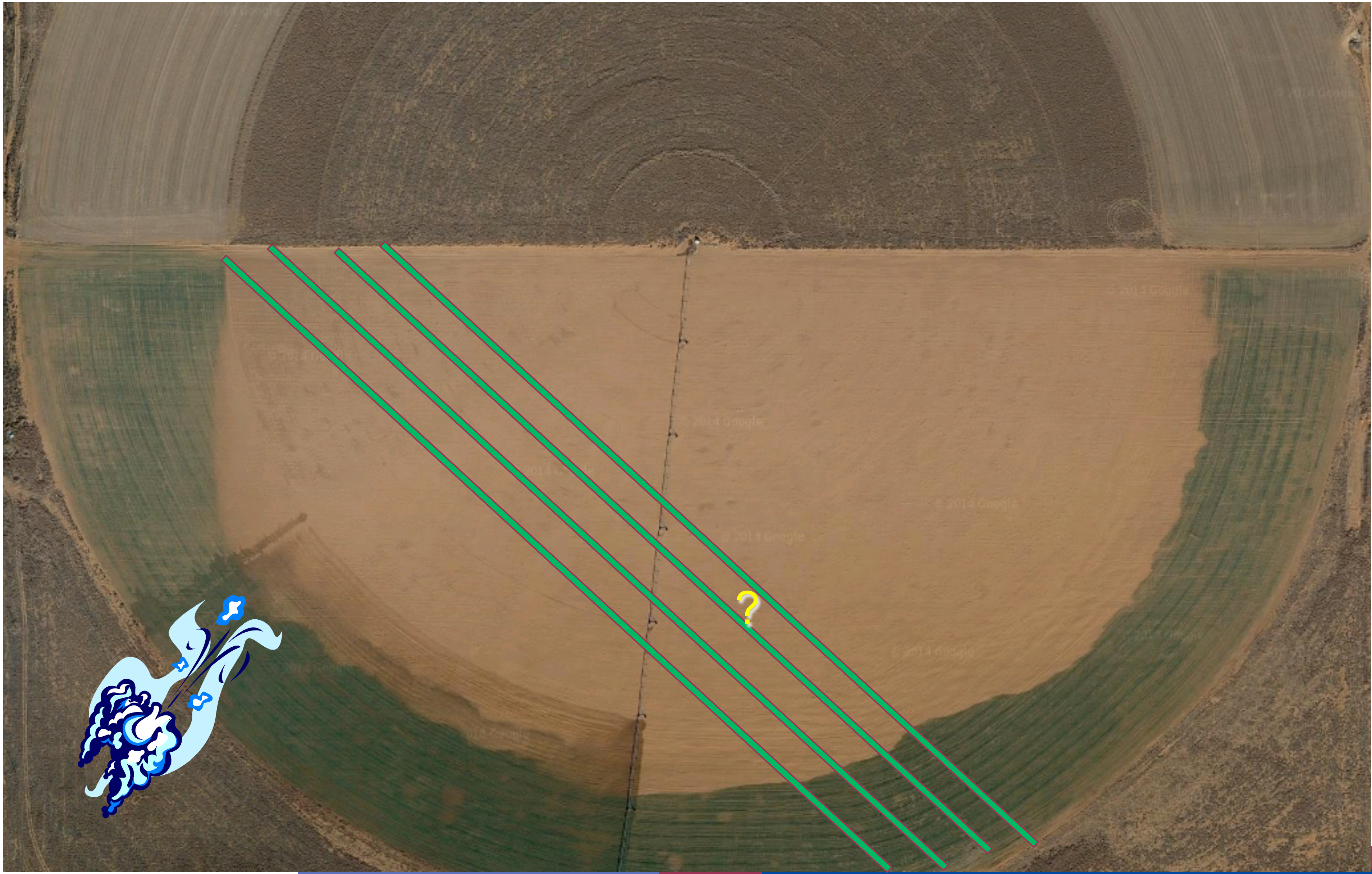
Hobbs

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
W	W	W	W	S	S	S	S	S	W	W	W	W

Roswell

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
N	SSE	SSE	S	S	SSE	SSE	SSE	SSE	SSE	N	N	SSE





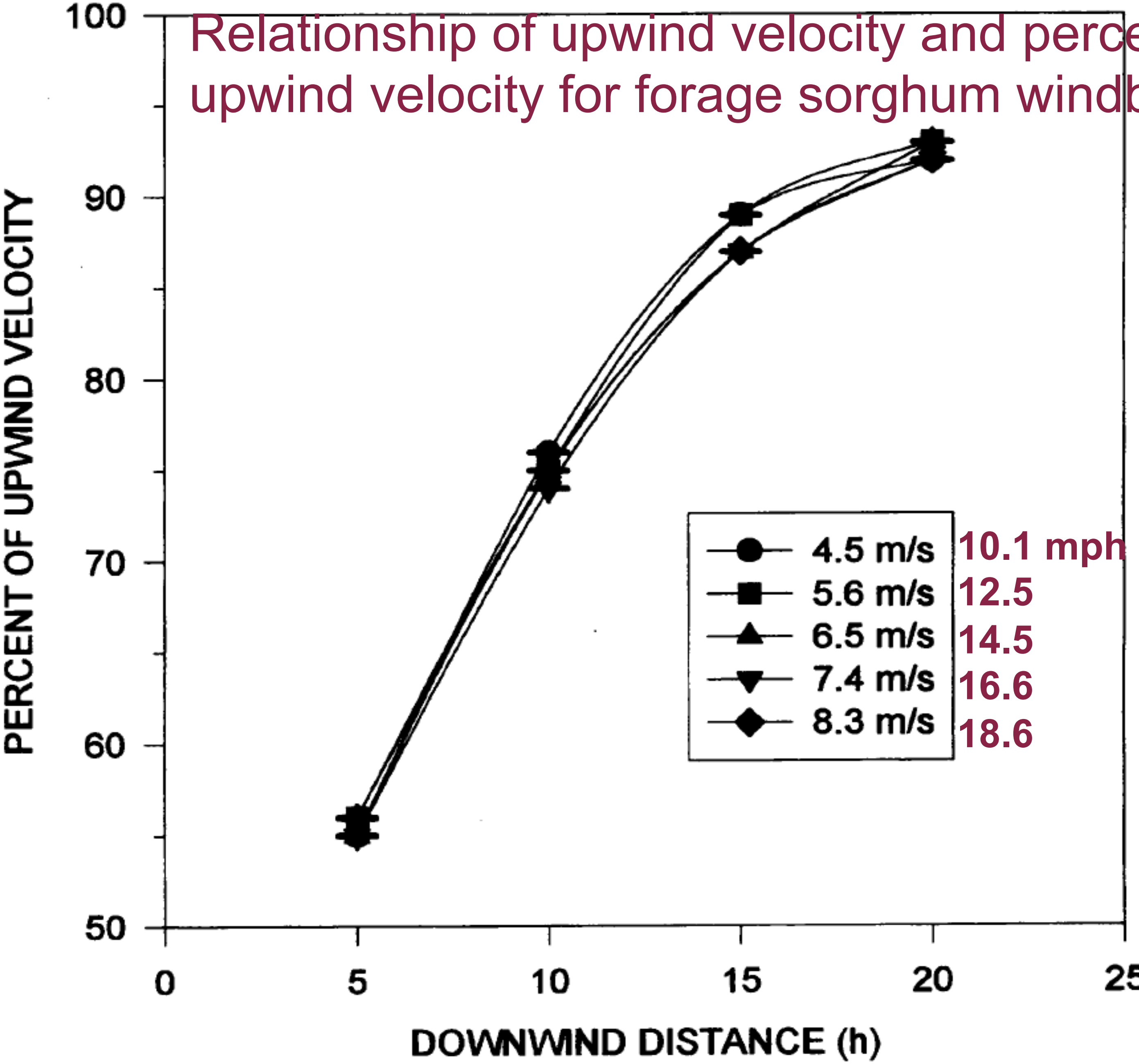
Wind Barrier Study-Comparative

- **forage sorghum**
- **grain sorghum**
- **kenaf**
- **switchgrass**
- **Slabfence**

- J.D. **Bilbro and D.W. Fryrear, J. Soil and Water Conservation 52(6):447-452**

Examples of plants used in upwind velocity study

Relationship of upwind velocity and percentage of upwind velocity for forage sorghum windbarrier



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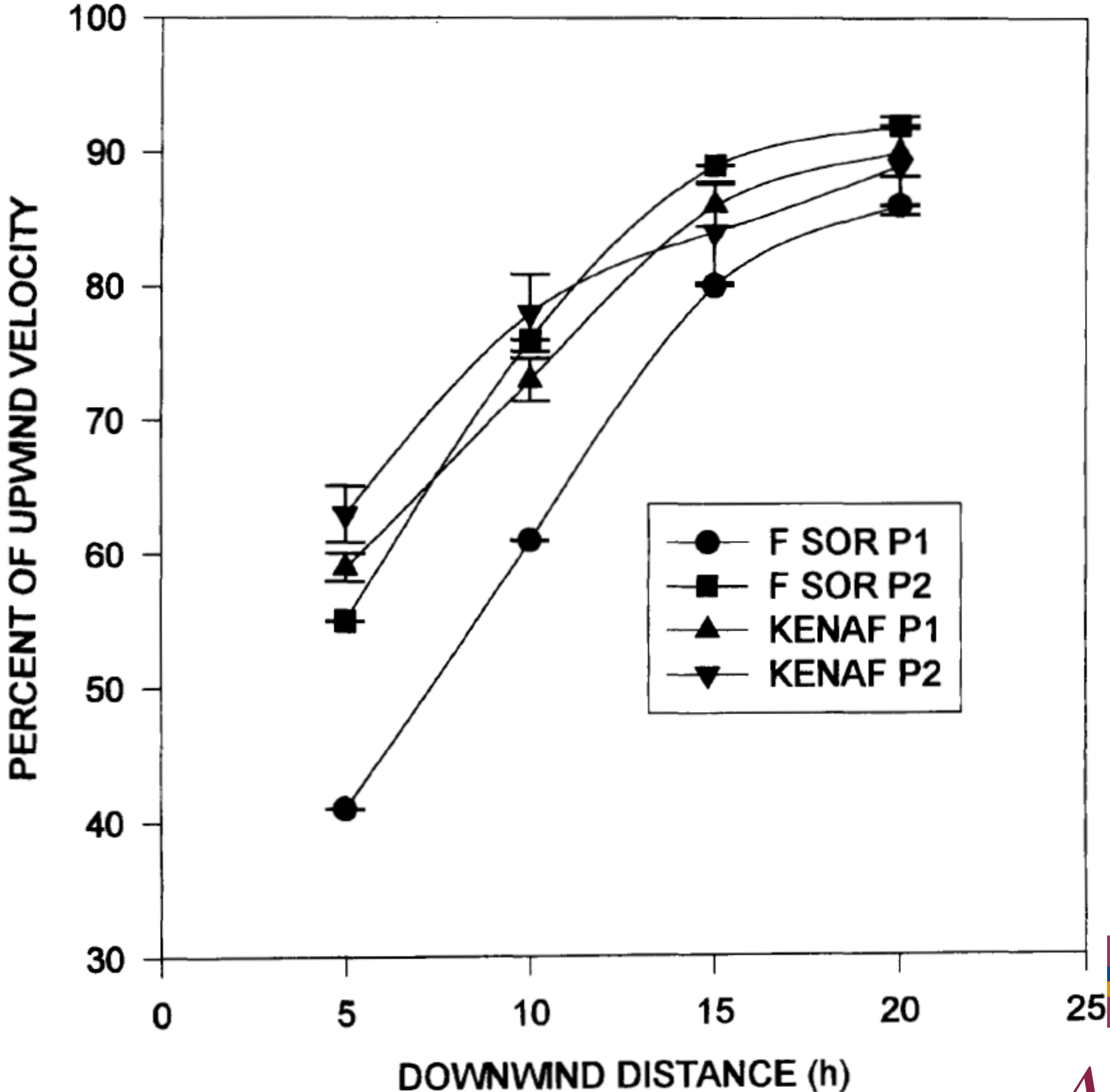
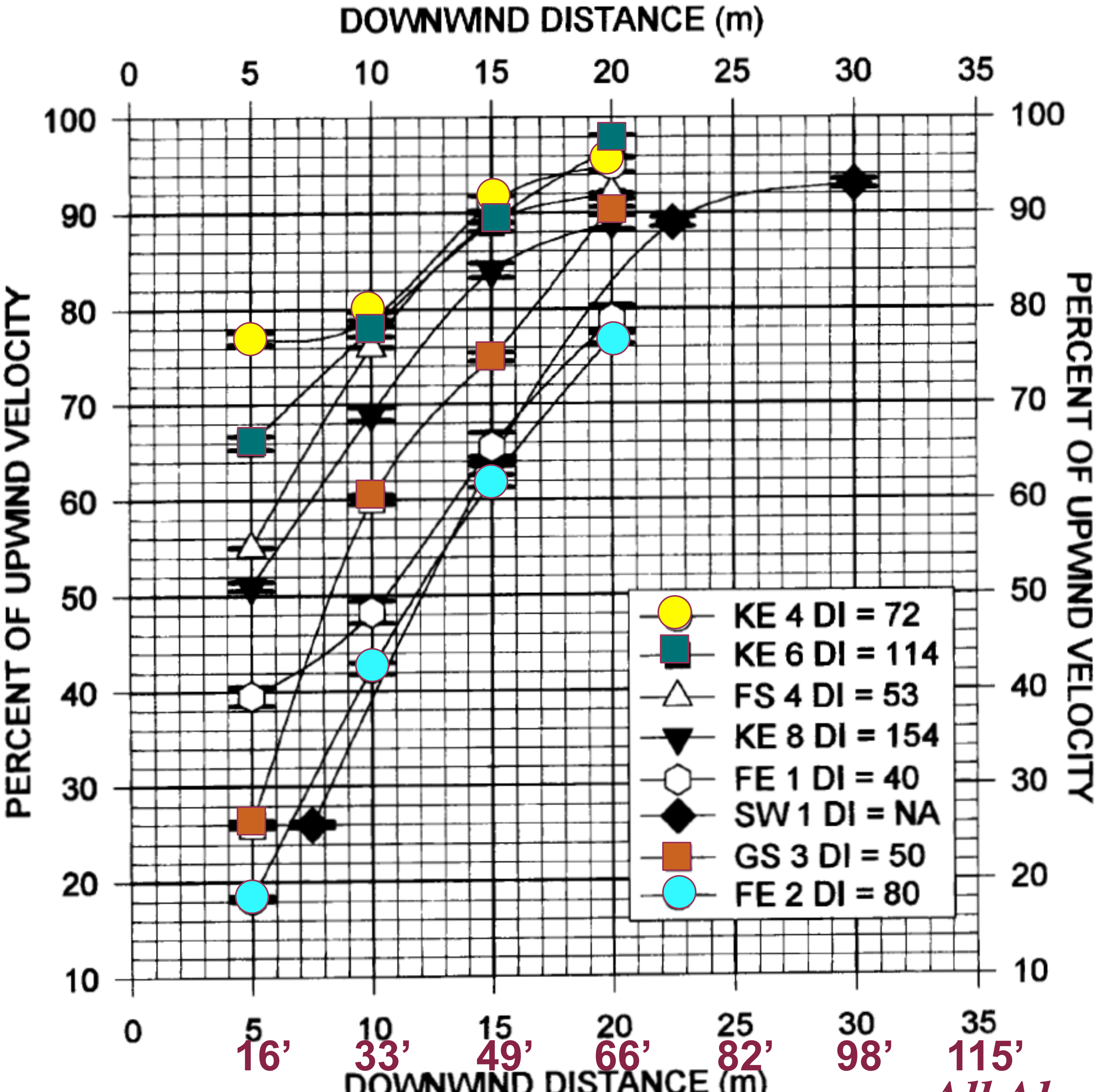
Bilbro JD, & D.W. Fryrear 1997 J. Soil and Water Conservation 52(6):447-452

%age of upwind velocities for two periods for forage sorghum and kenaf



P1 = period 1
P2 = period 2



KE = kenaf
FS = forage sorghum
FE = fence, slat
SW = switchgrass
GS = grain sorghum

1= one row
3 = three rows
4= four rows
6= six rows
8= eight rows

DI=Density Index

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Density Index (DI)

- $DI = ((TSSA + ELA) / PSA) \times 100$
  - ELA = effective leaf area (cm^2)
  - PSA = Possible Silhouette Area for 1-m of row
  - TSSA = Total Stem Silhouette Area (cm^2)
    - $\sum ((TD + BD)/2 \times H) \times PLTm$
      - ∑ summation over rows 1-N
      - *TD = average stem diameter at top*
      - *BD = average stem diameter at cut-off point (cm)*
      - *H = average plant height (cm)*
      - *PLTm = plants per meter of row*

Other Issues

Declining Water Availability

Methods to Reduce Wind Erosion

- Cover a high percentage of the soil surface with grass or crop residues
- Roughen the soil surface with soil ridges or clods (as long as not a single grain structure)
- Reduce the wind velocity below the threshold velocity with wind barriers

Alternative Plants

Genus species	Lime Tolerance	Fertility Rqt	Minimum ppt	Seedling vigor
Andropogon gerardii	High	Low	12	Low
Bouteloua gracilis	Medium	Low	8	Low
Bromus hordeaceus	High	Low	12	High
Elymus glaucus	High	Low	16	High
Elymus lanceolatus	Medium	Medium	8	High
Panicum amarum	Low	Low	18	Medium
Pleuraphis jamesii	High	Low	6	Medium
Sporobolus cryptandrus	Medium	Low	8	Low
Agropyron fragile	Medium	Low	6	High
Leymus cinereus	High	High	8	Medium
Thinopyrum ponticum	High	Medium	10	High
Krascheninnikovia lanata*	High	Low	6	High
Sporobolus wrightii†	High	Low	5	Medium
*shrub †low salinity tolerance. Also not usually mowed but can be cut back.				

On Sandy Soils

- Probability of producing sufficient crop residue to protect the soil
  - 45% for winter wheat
  - 15% for grain sorghum

Start with a Soil & Water Test

http://www.youtube.com/nmsuaces#p/a/u/2/aQMZ-MsYBiQ