

Drought Effects on Non Point Source Pollution

Dyck Arboretum

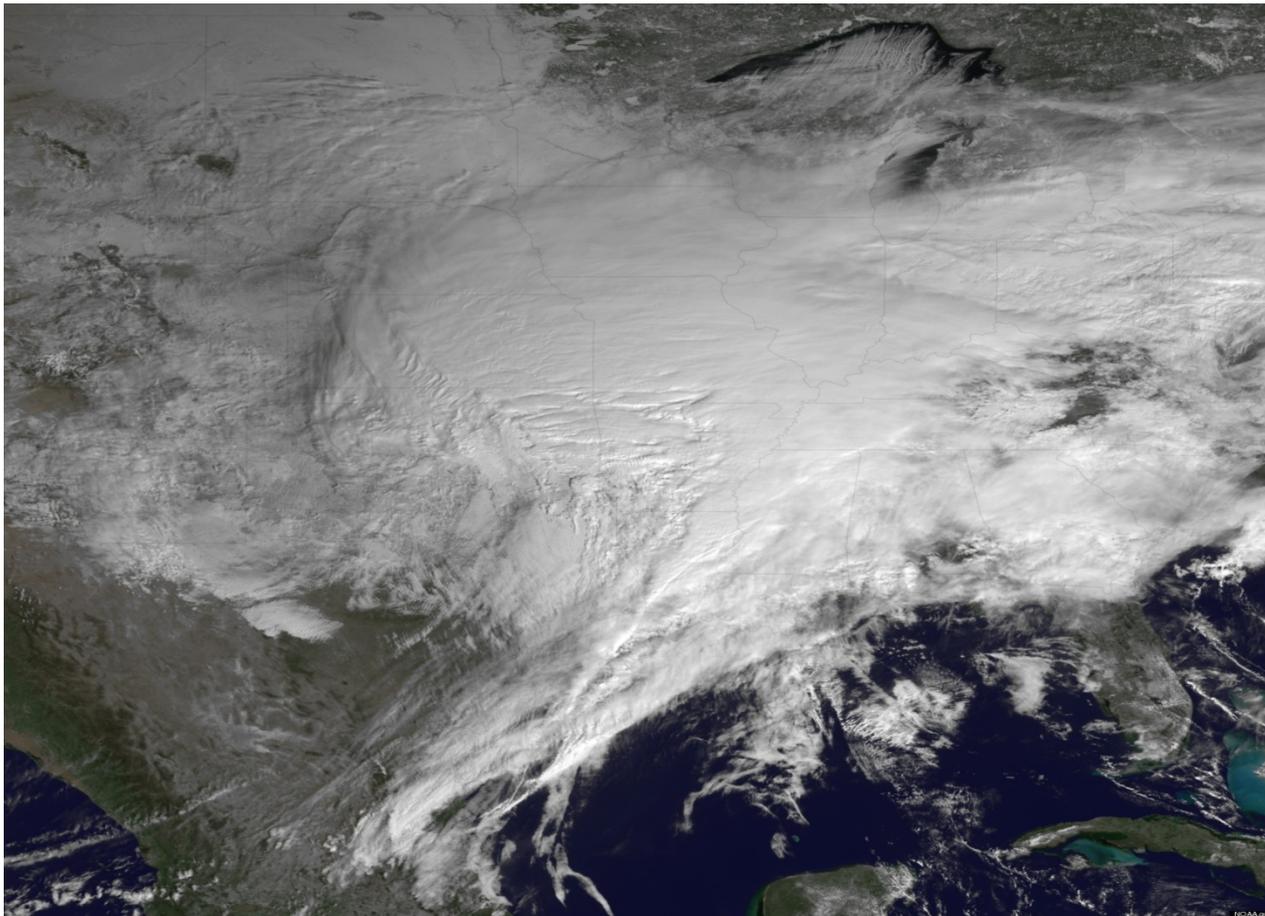
March 7th, 2015

**Richard Basore
Watershed Field Coordinator
KDHE Wichita, Ks**



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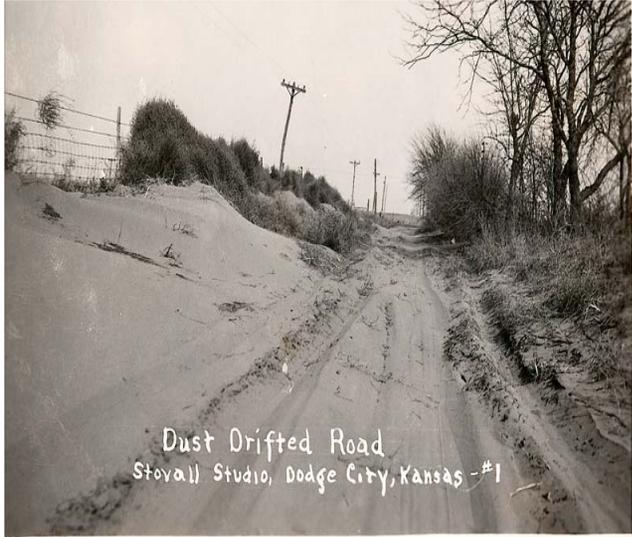
Non Point Source Pollution occurs when it rains or other precipitation creates runoff that carries pollutants from the land surface to a water body or creates percolation thru the soil into groundwater (rb)



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Sometimes We Don't Get Enough





DATES, THE MOST
 SEPTEMBER Wonderful
 22nd to Inventor
 26th of the
 Century.

Inclusive Frank McQuinn, the Rain Wizard.

Melbourne the "Ohio Rain Wizard"
 Will be at GOODLAND

Fair Week.

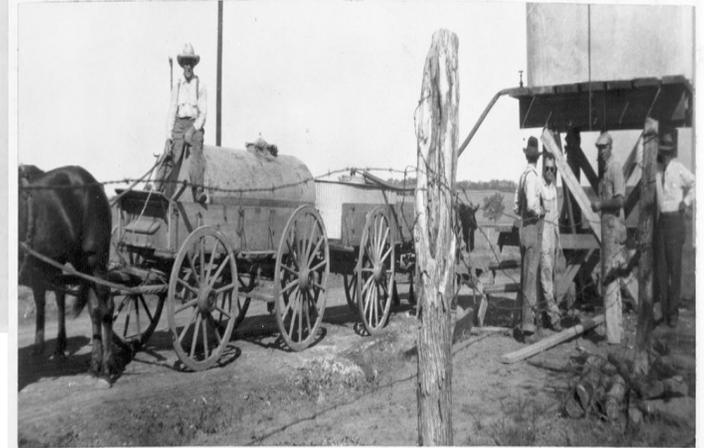
And has contracted to produce a Heavy Rain the last day of the Fair, Sept 26th.

Governor Humphrey
 Will be present one day.

The management of the Fair Association will spare no pains or expense to make this fair the most entertaining of any ever held in western Kansas.

One and One Third Rate
 has been secured over the Rock Island.

Alex Martin, Pres., Wm. Walker Jr. Sec'y.
 SHERMAN COUNTY FARMER Print, Goodland, Kansas.



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Sometimes We get Too Much.....



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Drought

Webster's defines 'Drought' as;
*“A period of dryness especially when prolonged;
specifically;
One that causes extensive damage to crops or
prevents their growth”*

Meade Co. Ks. Cornfield 1936



You can have hot temperatures and wind and still grow things (water the desert and it blooms, irrigate western Ks and grow corn, water is the defining issue)

Historically

Through out history drought has been synonymous with "Famine" and the combined effects have changed civilizations – over and over and.....

Early cultures changed or vanished – remember Ur of the Chaldees? The Anasazi in Mesa Verde? Why did Joseph predict 7 lean years for the Pharaoh in Aegypt?



HISTORY (or what you slept thru in high school)

- The Sahara was once green, and evidence suggests that desertification drove humans from that area to the Nile delta leading to the development of the Aegyptian civilization.... (I love archaic spellings !!)
- The Huns and Vandals that overran the Roman Empire were likely motivated by drought/famine in the steppes of Russia....
- Genghis Khan & the later Mongols may have had the same motivations in overrunning most of Asia, China & E. Europe a few hundred years later...
- The collapse of the Mayan culture in central America is thought to be caused by drought...(and the end date of their calendar was wrong too..!)



DROUGHT IMPACTS



- Crops
- Fail to germinate, partially or totally;
- Poor initial stands;
- Emerged plants may wither and die;
- Increased susceptibility to disease & pests;
- Fail to pollinate &/or produce grain;
- Stressed diseased plants may not be suitable even for salvage as feed,
- Reduced OM in soil;
- Reduced stubble cover and soil root mass;
- Results
- **More exposed soil = more susceptible to wind and water erosion**

Results; (con't.)

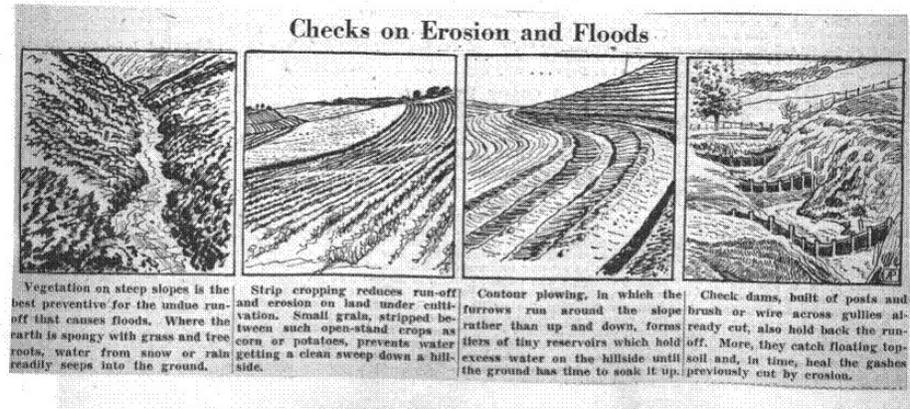
- Reduced crops/food/feed supplies = higher prices/cost & higher cost to transport food/feed into drought stricken area,
- Result is reduced income to producer
= higher relative cost to live & operate
= less \$\$\$ to spend on BMPs to protect water quality...



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Results; (con't.)

- No motivation, *“No rain, no runoff, so no pollution, right?”* or
- *“I can’t afford to do things that won’t make me money..”*
- Extended drought lowers Ag land property values,
(was reduced by 50% in Western Ks in the 1930’s Dust Bowl..)
- Ag Use Value Appraisal = Reduced prop. taxes to county
(concurrently with reduced income taxes to state)
 - = Reduced funding to Conservation Districts and Division of Conservation for cost share for water quality related BMP practices,
 - = Even less motivation for producers to install or practice BMPs,
 - = Reduced impact of WRAPS efforts at Protection & Restoration
 - = Continuing or higher potential NPS pollution loads in future.....

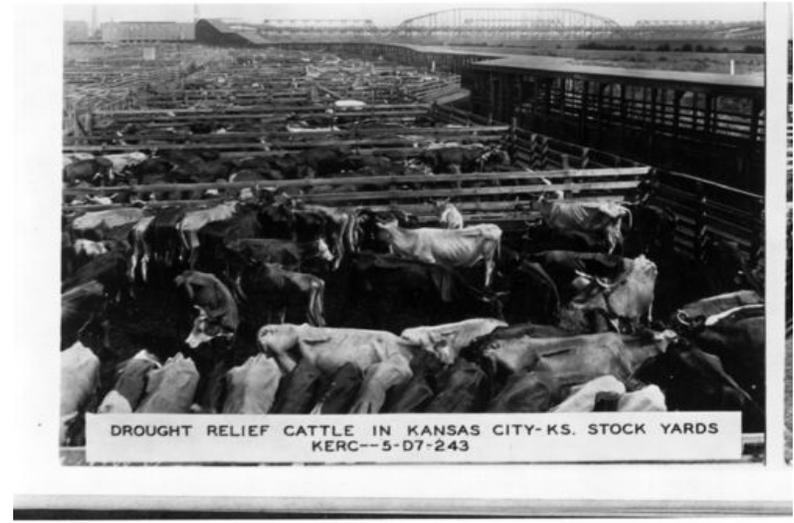


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DROUGHT IMPACTS

- Grass & Pasture Lands;

- Reduced vegetative growth; stand die off
- Reduced root mass to hold soil;
- Reduced O.M. and water infiltration;
- Reduced feed values in stressed plants;
- Increased compaction increases runoff
- Stressed grass more susceptible to disease & pests;
- Increase in animal nutritional disorders, consumption of marginal or even dangerous plants, invasive species increase, reduced carrying capacity
- More dirt exposed for erosion, reduced nutrient uptake & removal
- Reduced C sequestration



GRASS DROUGHT IMPACTS con't.

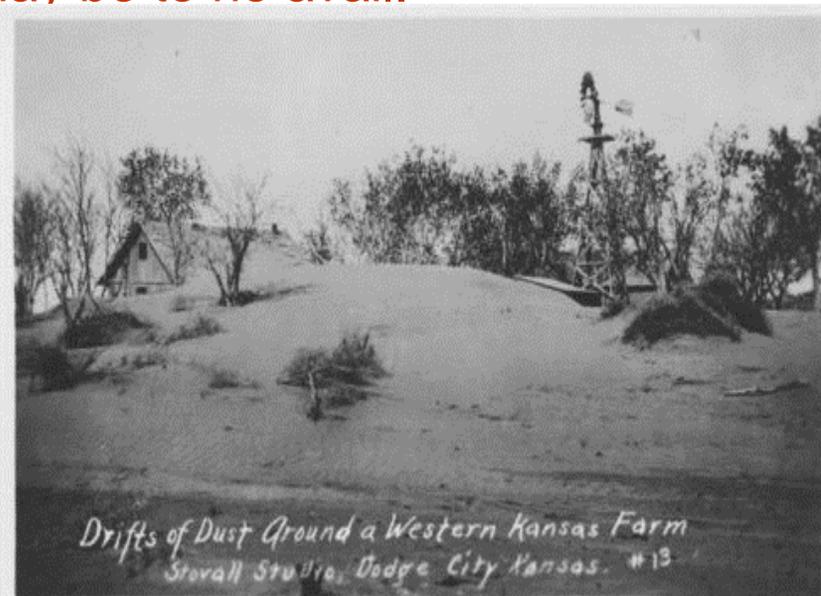
- Operator impacts;
- Increased supplemental or even full time feeding, = more cost + pollutant loading @ new feeding areas: (NPS cost share need?)
- Increased costs for feed,
- Increased veterinary expense,
- Weight loss; Death loss,
- Cost to rent pasture out of affected area. (and shipping)
- Cost to haul water or develop alternative water source(s), (ponds/streams dry) (NPS cost share need?)
- Pollutant loading at new water source areas



\$BMP Funding Impact\$

- Extended drought lowers Ag land property values & Ag income,
= reduced property and income taxes,
= reduced cost share funds + reduced landowner income,
- Together = reduced ability to fund NPS/WRAPS BMP implementation
= continued or increased future pollution potential.....
- And droughty soil will make successful construction of BMPs difficult, planted buffers or other vegetation may fail to emerge or stress & fail in the next season or two, ground cannot be compacted for structures, BMP money spent may be to no avail.

Oklahoma
Historical
Society®



*Drifts of Dust Around a Western Kansas Farm
Stovall Studio, Dodge City Kansas. #13*

Drought Load Reduction?

(or no rain = no runoff loading, right?)

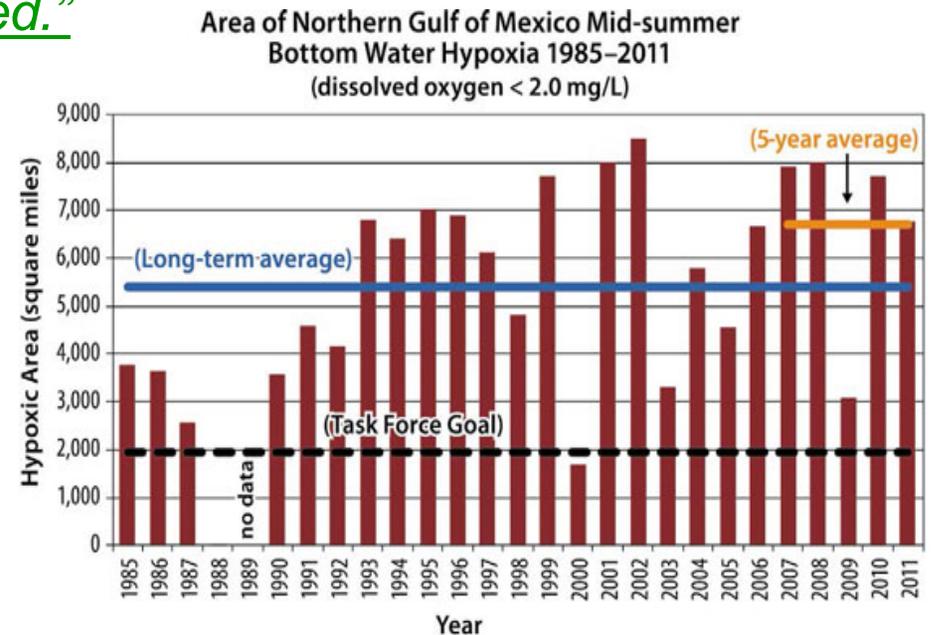
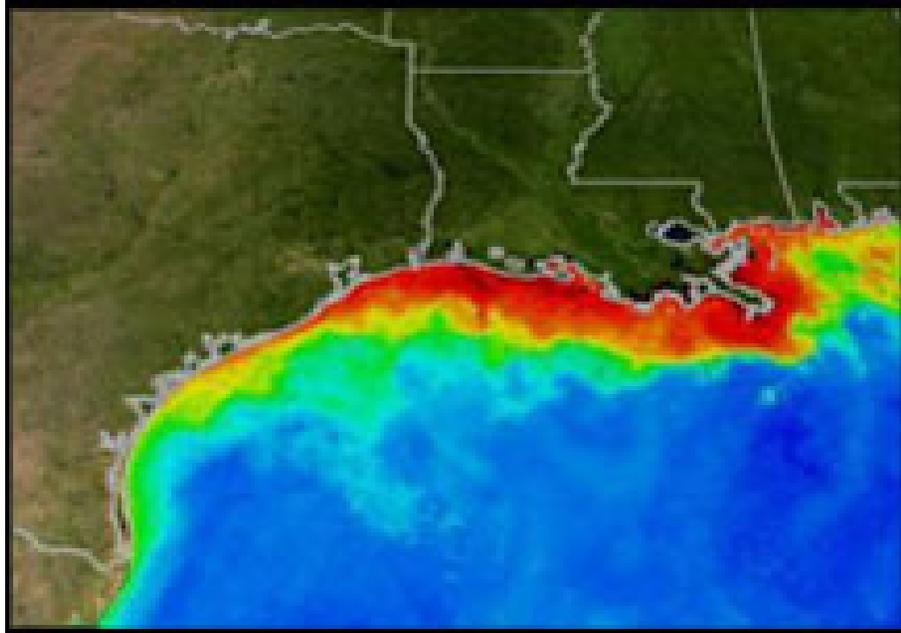
- First flush from strong runoff events will carry larger than normal accumulated loads of pollutants off site because;
- Poor crops leave unutilized fertilizer and herbicide residues in & on soil which is susceptible to future runoff events;
- Sparse pasture vegetation & crop residue offer poor buffering & filtration of nutrients, livestock wastes, & sediment;
- Dry ponds/streams, lack of grass = use of new supplemental feeding & watering areas which builds concentrated livestock waste accumulations;
- Drought damage to vegetation in buffers, filter strips and grass waterways reduces water quality treatment/load reduction of these BMPs
- Damage to riparian area trees & vegetation reduces stream bank stability & increases erosion potential
- Dry stream beds attract ATVs = increased damage to stream banks & riparian areas



Drought Downstream Load Reduction

(Or would the Dead Zone by any other name would remain the same?)

The oxygen-starved dead zone in the Gulf of Mexico had grown to only 2,889 square miles in 2012. The 2013 dead zone was the fourth smallest recorded since mapping began in 1985 according to scientists supported by the National Oceanic and Atmospheric Administration. *“The small size of the dead zone was likely driven by drought-induced record low amounts of nutrient runoff to the Mississippi River watershed.”*



Our NPS WRAPS Goal; Reduce the Loads

(and my money says we still apply fertilizers, etc, even in dry years so is part of that load is out there... somewhere... just lurking.....?)

This is where it ends up



Gulf BP Platform Oil Spill



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Other Unintended Drought Water Quality Consequences

- Low or stagnant flows in streams, lakes and reservoirs concentrate nutrients & create conditions favorable to Harmful Blue Green Algae blooms (HBGA) which impact amount, quality & treatment costs of PWS source water & have a strong negative economic impact to many water related small business's and communities in Ks
- POWWTS outflows mean increased relative concentrations due to reduced stream flows



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Other Unintended Drought Consequences (con't)

- Current climate change predictions include longer dry periods interspersed with larger & intense rain events.
- If true, larger first flush events will not only carry larger pollution loads that have been accumulated, including in MS4 cities and towns, but will also directly assault weakened conservation BMPs, riparian buffers and dry susceptible stream banks resulting in increased streambank erosion and sediment transport.



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Point Source (Municipal) Drought Impact on NPS

- ***Reduced water use in cities/towns instituting water conservation measures (low flow toilets, showerheads, appliances, etc.) means that sewage volumes will be reduced, reducing instream flows downstream and affecting minimum daily streamflows and habitat for fish and wildlife.***
- ***Drought reduced natural streamflows means that the effluent from public sewage treatment plants will make up a higher percent of the combined flow downstream – resulting in reduced water quality in the stream impacting habitat for fish and wildlife.***
- ***Drought reduced precipitation will allow accumulation of urban pollutants in towns similar to that occurring in rural areas, resulting in a similar increase “first flush” runoff pollutant impact from sporadic intense precipitation events. (again affecting downstream water quality)***
- ***Similar effects might be seen from Industrial NPDES discharge permit holders.***



Wind Erosion NPS Impact

- Windblown soil & dust impact exposed dirt & creates more dust from farm fields, construction sites, sparse rangeland, etc. (dust begets more dust....)
- Strong wind and dust with resultant static electricity 'fry' plants, or may 'sand blast' or cut them off further reducing cover
- Windblown dust & dirt accumulates in road ditches and field swales, and becomes a surface water runoff NPS pollutant in the next strong rain



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Wind Erosion Health Impacts

- “Dust Pneumonia” was a common diagnosis in the Dust Bowl, many people were affected and numerous infants, children and elderly died from it’s impact
- Autopsied cattle were found to have dirt choked nostrils and lungs & their stomachs full of dirt from trying to graze stunted grass to close to the ground, *the volume of dead animal proper disposal to protect health & the NPS environment also became an issue.*



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GLOBAL WARMING? vs. CLIMATE CHANGE?

There is much discussion in the science community on this – is the current apparent warming ‘trend’ and ‘unsettled’ weather strictly an anthropomorphic result?

Or is it a manifestation of long period recurring climatological cycles?

Note: The International Geophysical Year (IGY) of 1957-'58 for worldwide data gathering was partially driven by the worry that we were overdue to experience another Ice Age...!

Historic Droughts in Ks; 1860, 1874 (w/grasshopper invasion), 1894, 1930's, 1950's, 1980, 1988, 2011-12.....+ ?

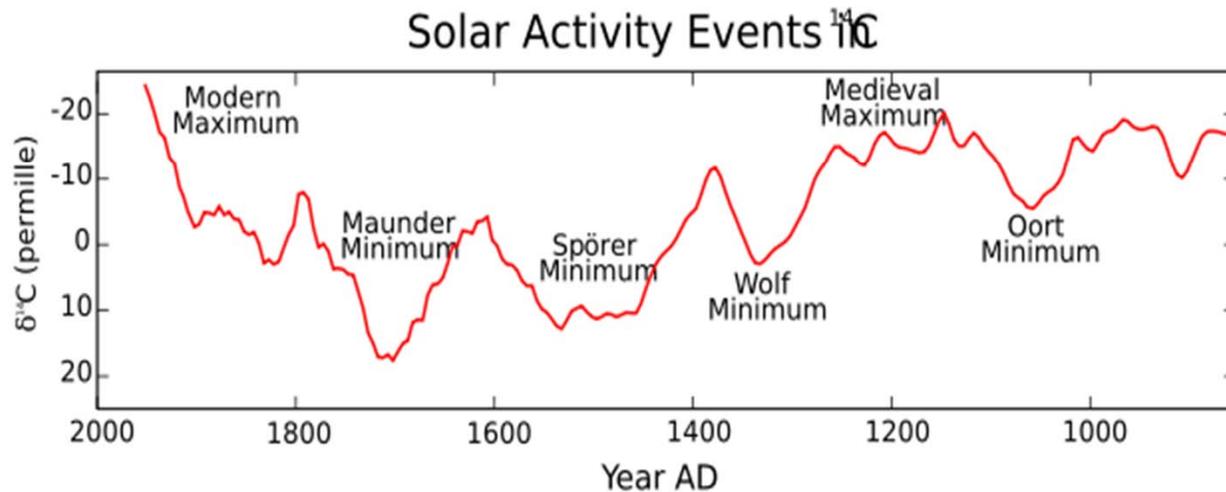
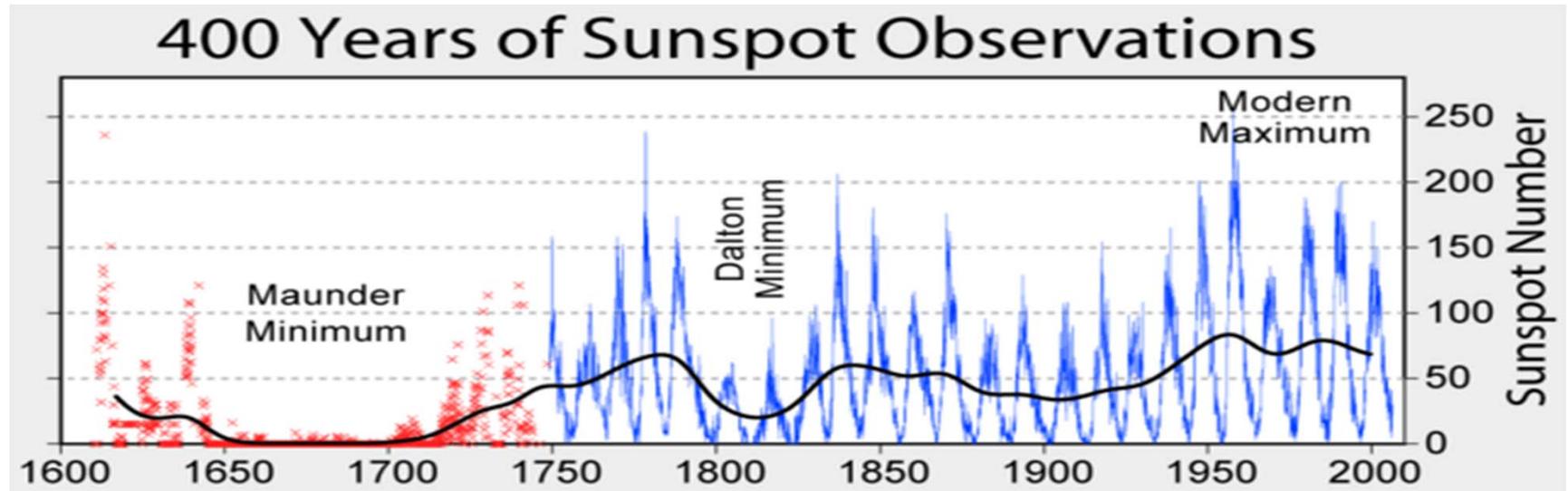
Historic Floods in Ks; 1844, 1901-04, 1938 & '43, 1951, 1965, 1974, 1991, 1993, 2007....



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CLIMATOLOGY

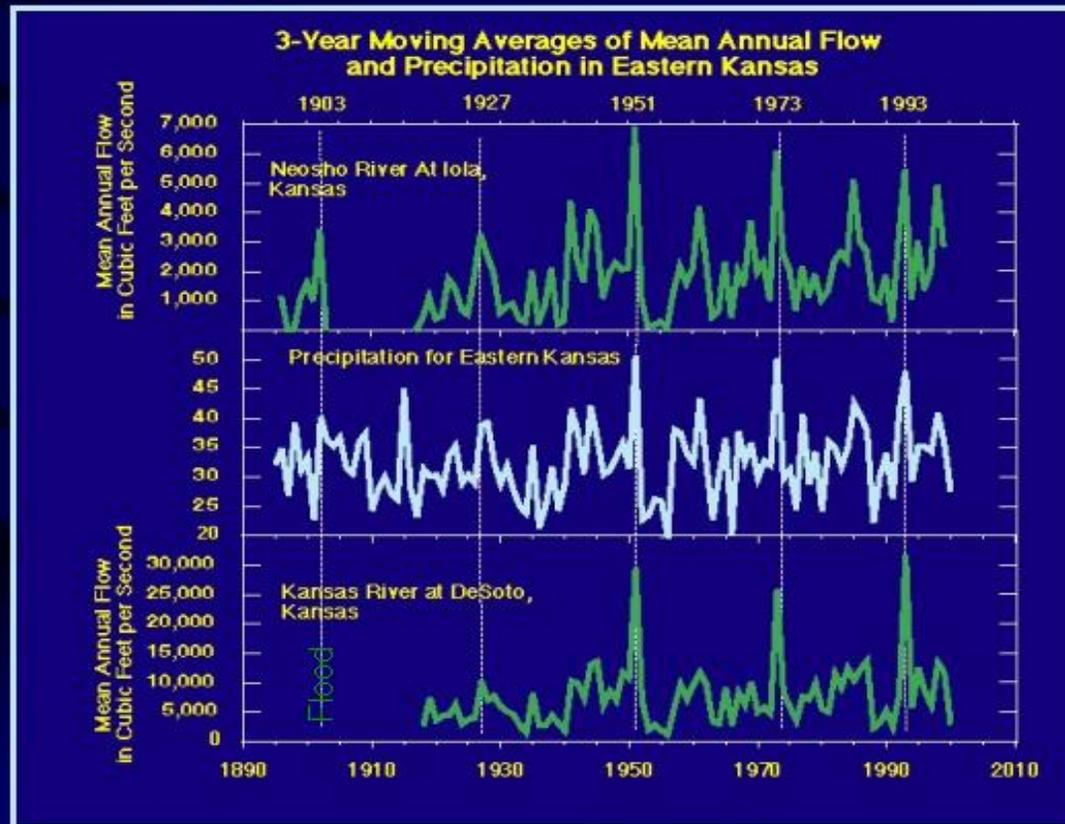
Sunspots activity occurs in repeating 22yr cycles, and 11yr lesser nodes...



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Coincidence?.....

Large floods occur on the average every 22 years, while smaller floods generally occur midway between



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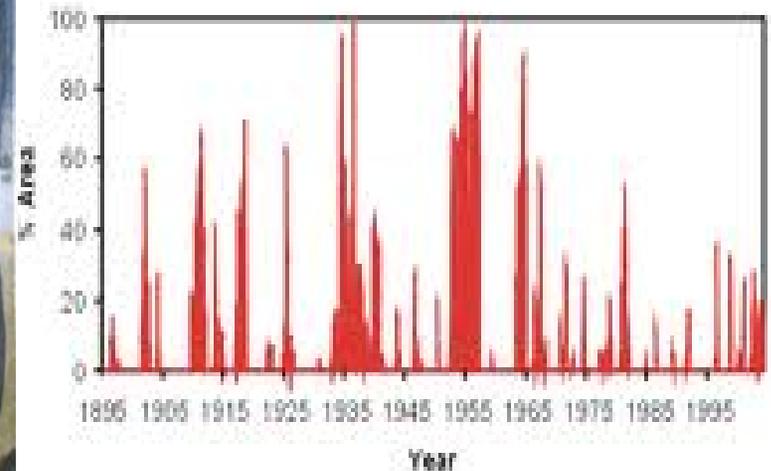


“Drouthy Kansas”...

1870’s Kansas PR Effort to counter “Drought” image



Percent Area of the Arkansas–White–Red Basin
Experiencing Severe to Extreme Drought
January 1895–March 2004



Based on data provided by the National Climatic Data Center, NOAA

Copyright 2004 National Drought Mitigation Center

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Longer Dry Periods..

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Interspersed With Intense Precip Events..

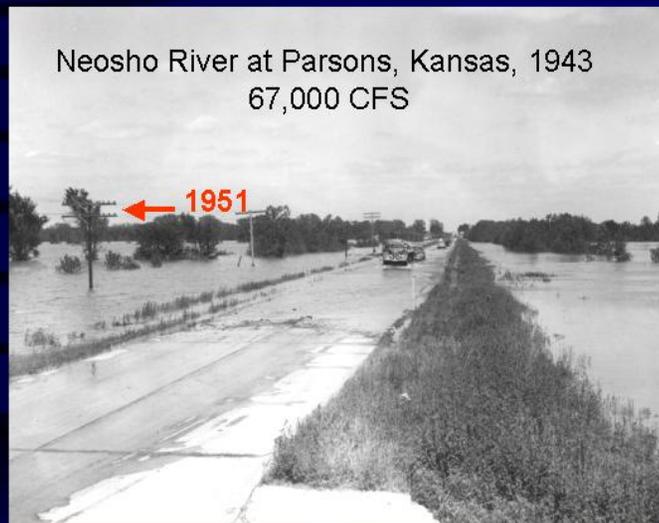
Manhattan, 1951



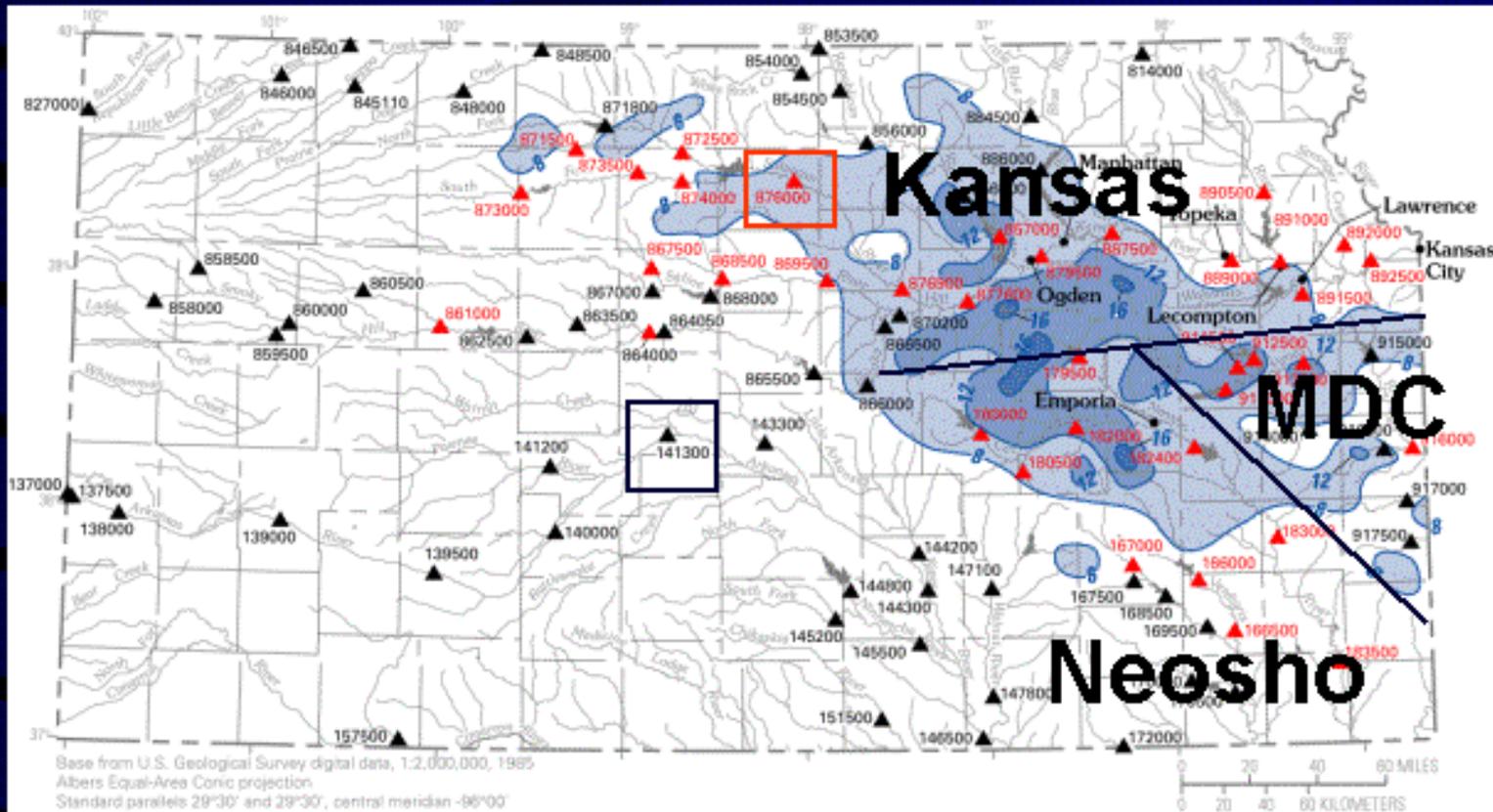
North Lawrence, Kansas, July 13, 1951



Neosho River at Parsons, Kansas, 1943
67,000 CFS



In 1951 the water was 11 feet deeper -- 410,000 CFS



EXPLANATION

- 12— Lines of equal total rainfall, July 9–13, 1951—
Interval 4 inches
- 147100 ▲ Streamflow-gaging station and number
- 166000 ▲ Streamflow-gaging station and number—
Peak of record in 1951





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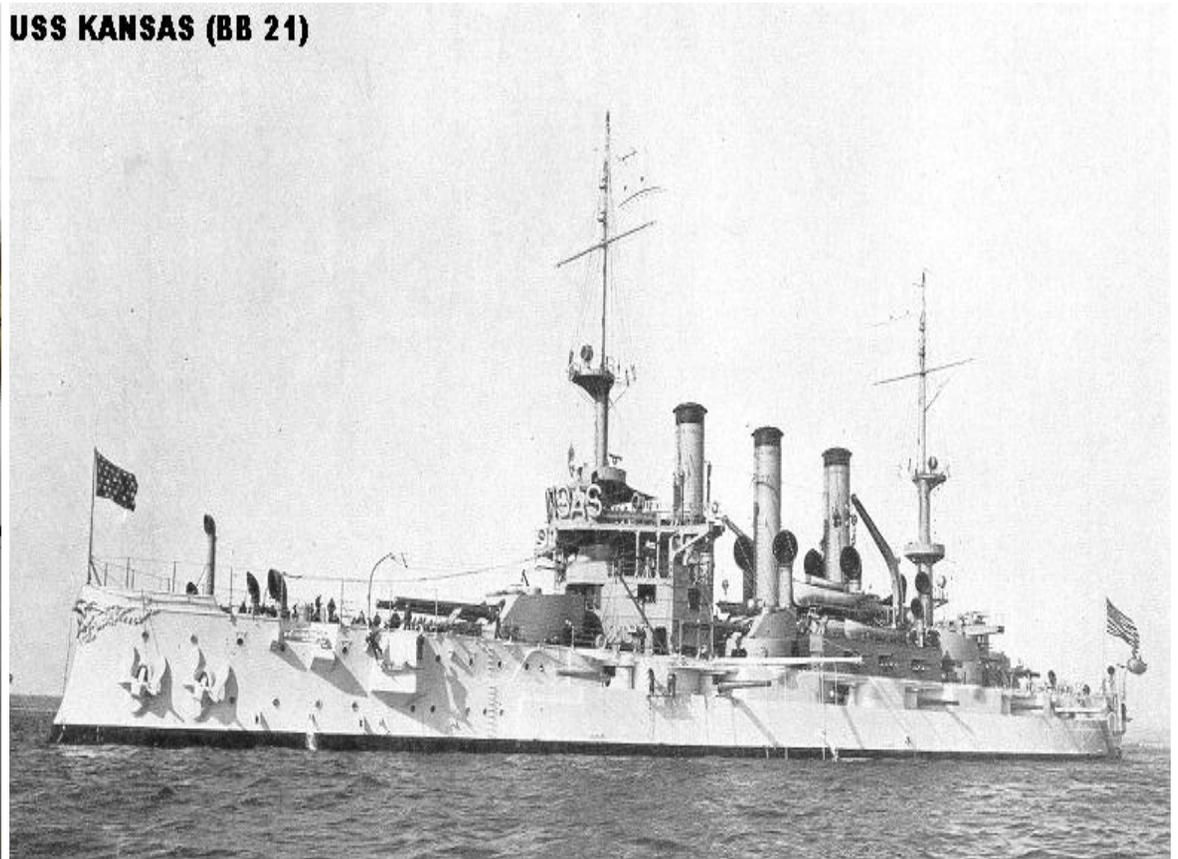


So how much rain will it take to break the drought?

- Enough to catch fish again in your favorite pond ?
- Enough to float a Battleship ?



USS KANSAS (BB 21)



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Does our future hold this?

Arkansas River at Garden City



Arkansas River Bridge at Lakin

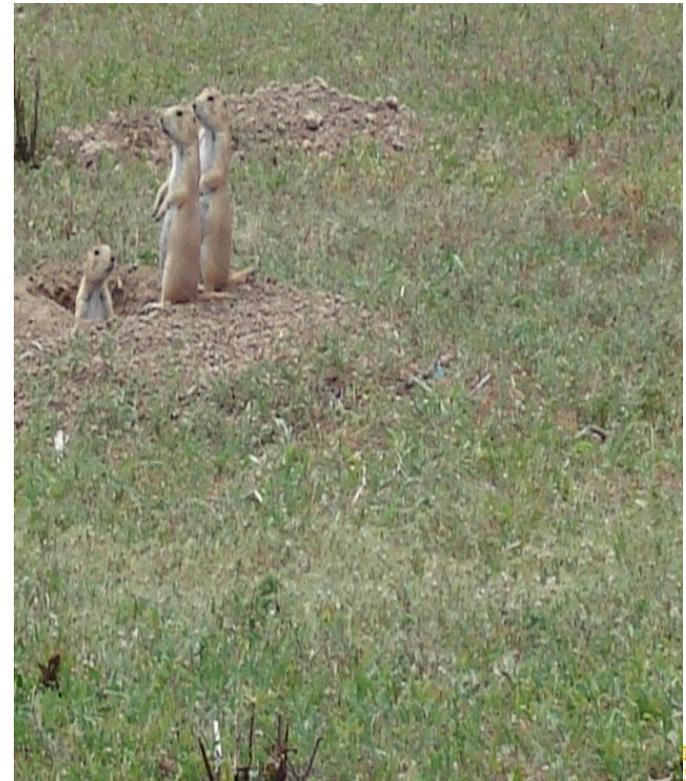


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Or This ?

GRASSHOPPER HARVESTER

WATERSHED COMMITTEE MEETING



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ITHACA, N.Y. – *The consequences of climate change paint a bleak picture for the Southwest and much of America’s breadbasket, the Great Plains. A “megadrought” likely will occur late in this century, and it could last for three decades, according to a new report by Cornell University and NASA researchers in the journal Science Advances,* published today. “The results were striking. As a society, we’ve weighted the dice toward megadrought. Data clearly point to a high risk in the Southwest and Great Plains, as we continue to add carbon dioxide into our atmosphere,” said Toby Ault, Cornell associate professor of earth and atmospheric sciences. “However, if we manage to get serious about lowering greenhouse gases within the next 10 years, we could face a lower risk.”

With a drier future and higher regional temperatures amplifying possible late-century droughts, the situation presents a major adaptation challenge for managing the region’s water needs, explains Ault, who along with lead author Benjamin Cook and Jason Smerdon, both of NASA, published their new study, “Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains Drought Risk in Western North America.”

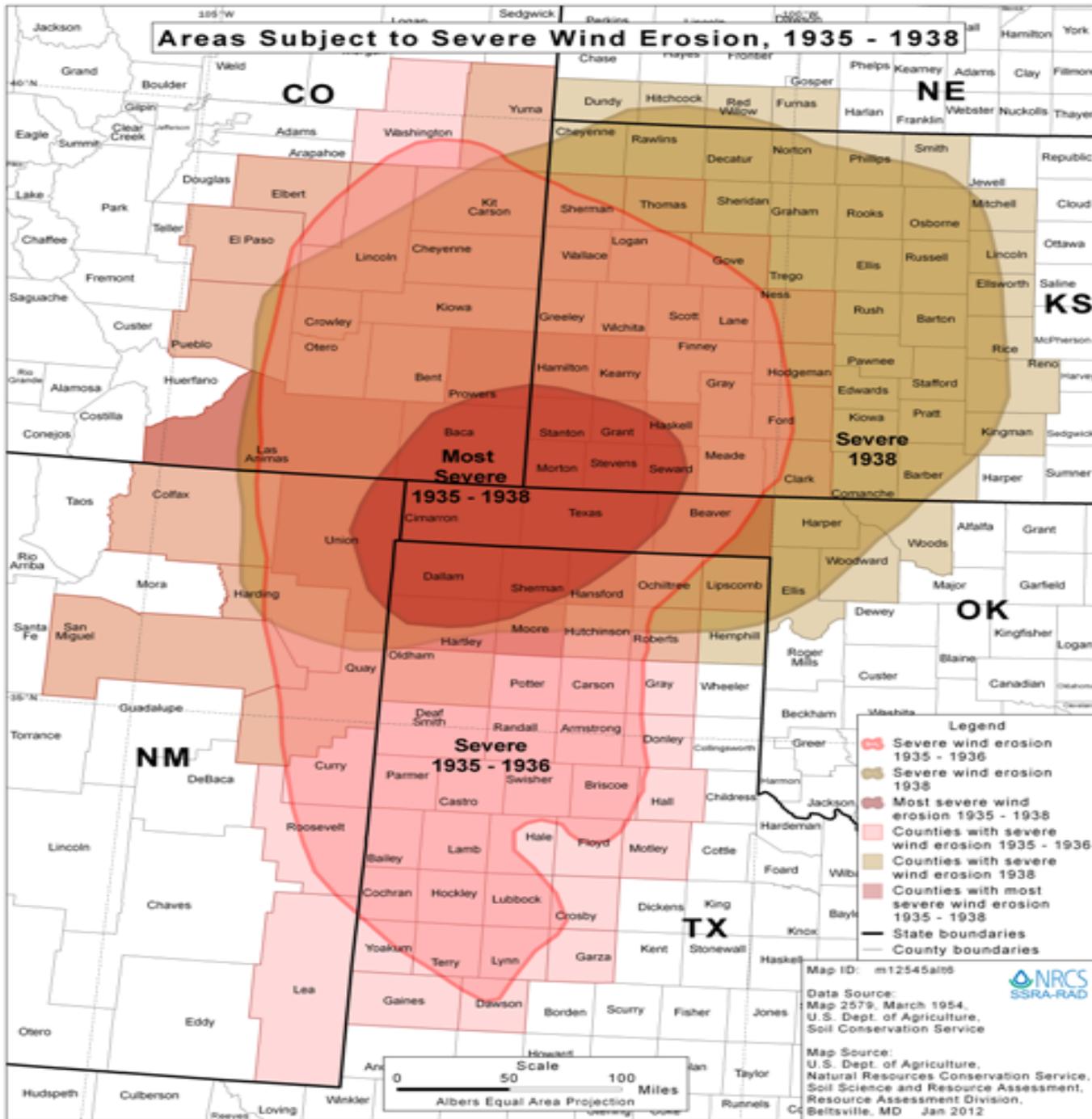
By examining tree rings and other physical clues, previous research had identified a period of time called Medieval Climate Anomaly – from the year 1100 to the year 1300 – when megadroughts were more common. By analyzing data from 17 state-of-the-art global climate models, the researchers learned that western North America’s future drought risk exceeded even the driest centuries of the Medieval Climate Anomaly.

“Hurricanes and tornadoes are natural hazards and they strike fast. A megadrought is a natural hazard, but it unfolds slowly – over a period of decades,” said Ault. “It’s just another natural hazard and one we can manage.”

Ault wants to lower carbon dioxide emissions quickly. “The time to act is now. The time to start planning for adaptation is now,” he said. “We need to assess what the rest of this century will look like for our children and grandchildren.”

—Cornell University

February 14, 2015



THE FUTURE...

- ***Whether drought or flood, NPS Pollution sources will continue to be an area of concern that will need to continue to be addressed, as we pursue the Clean Water Act goal of making all waters in the US (including Kansas) “Swimmable, Fishable, and Drinkable”***

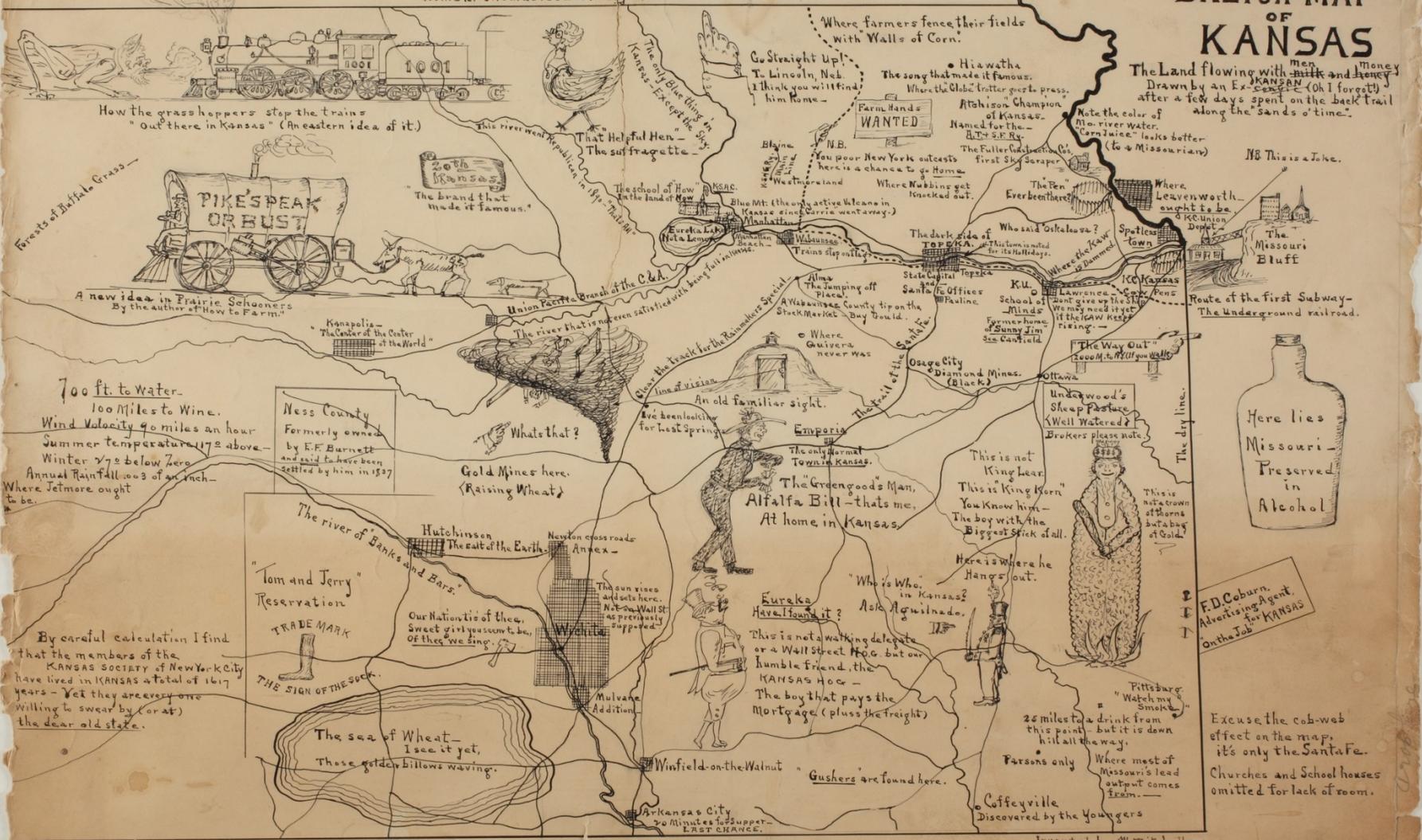
rb 4/5/2013

NEBRASKA

Home for Incurables - namely W.J.B.

SKETCH-MAP OF KANSAS

The Land flowing with ^{men} milk and ^{money} honey
Drawn by an Ex-^{cent} (Oh I forgot!) after a few days spent on the back trail along the 'sands o' time.'



How the grasshoppers stop the trains "out there in Kansas" (An eastern idea of it.)



A new idea in Prairie Schooners By the author of 'How to Farm.'

Kanopolis - "The Center of the Center of the World"

700 ft. to Water - 100 Miles to Wine. Wind Velocity 40 miles an hour Summer temperature 112° above - Winter 1/2° below Zero Annual Rainfall 30.3 of an inch - Where Jetmore ought to be.

Ness County Formerly owned by F.F. Barnett and said to have been settled by him in 1827

Gold Mines here. (Raising Wheat)

"Tom and Jerry" Reservation TRADE MARK



By careful calculation I find that the members of the KANSAS SOCIETY of New York City have lived in KANSAS a total of 1617 years - Yet they are every one willing to swear by (or at) the dear old state.

The sea of Wheat - I see it yet, Those golden billows waving.

OKLAHOMA

«Fresh and Green»



F.D. Coburn, Advertising Agent for KANSAS On the Job

Excuse the cob-web effect on the map, it's only the Santa Fe. Churches and School houses omitted for lack of room.

Invented by - W. Mitchell