G20 MACS International Virtual Experts Meeting on Promoting Sustainable Agriculture Development in Drylands
Farmers, ranchers and agricultural sector partners must have access to a wide-range of tools and resources in order to overcome complex challenges in drylands.
Texas panhandle dust storm, 1930's
Collaboration

One example:
Recent research & outreach highlights

→ Providing farmers, ranchers, and agricultural sector partners access to a wide-range of tools and resources to enable sustainable agriculture and science-based and data-driven decision-making.
THANK YOU

&

STAY CONNECTED!

@USDAScience
APPENDIX

Recent examples of collaborative work with USDA, arranged by the seven topic areas

1. Plant breeding and better crop selection for improved dryland stress resistant varieties development to enhance productivity

*Advanced breeding methods in drylands*

- Genome-wide transcriptome and physiological analyses provide new insights into peanut drought response mechanisms
  - Bhogireddy, S., Xavier, A., Garg, V., Leyland, N., Arias De Ares, R.S., Payton, P.R. 2020. Scientific Reports. 10:4071. [https://doi.org/10.1038/s41598-020-60187-z](https://doi.org/10.1038/s41598-020-60187-z)

- Plant Releases: Forage and Range Research Laboratory, Logan, Utah

(Appendix continued on next slide)
APPENDIX continued

2. Optimizing water and/or soil management in drylands

Resource inventories

Resource inventories are critical to ascertain the state of the resources from a statistical sampling point of view. In the United States, the Rangeland Hydrology and Erosion Model (RHEM) is used in rangeland National Resource Inventories, where data on plant species cover and production are collected to evaluate hydrology and erosion risk with varying land management scenarios. RHEM has been extended for use in Central Asia.

- Hydrology and Erosion Risk Parameters for grasslands in Central Asia

- Rangeland Hydrology and Erosion Model (RHEM) web tool [https://dss.tucson.ars.ag.gov/rhem/](https://dss.tucson.ars.ag.gov/rhem/)

- Interpreting Indicators of Rangeland Health
2. Optimizing water and/or soil management in drylands (continued)

Soil ecology

- Soil organic matter and microbial community responses to semiarid croplands and grasslands management

- Current knowledge and future research directions to link soil health and water conservation in the Ogallala Aquifer region

- Simulating Soil Organic Carbon Responses to Cropping Intensity, Tillage, and Climate Change in Pacific Northwest Dryland

Data trends and statistics on farm practices and management

- Understanding irrigated agriculture

- Agricultural Resources and Environmental Indicators – esp Ch 1.2 and 3.24
APPENDIX continued

3. Pests and diseases challenging animal and plant health in drylands

*Early Warning Strategies for vector-borne diseases*

- Big data–model integration and AI for vector-borne disease prediction

*Reducing risk of Vesicular Stomatitis Virus (VSV)*

- Reducing the Risk of Equines Contracting Vesicular Stomatitis Virus (VSV) in the Western United States

*Cotton viruses*

- Molecular insight into cotton leaf curl geminivirus disease resistance in cultivated cotton (*Gossypium hirsutum*)
4. Scenarios for climate smart livestock systems in drylands

The USDA Climate Hubs support climate smart livestock systems in drylands via research and science synthesis (e.g. precision ranching and supply-chain options), tool development and provision (e.g. forage estimates, localized drought alerts, crop loss economic assessment, dust monitoring and mitigation) and convening stakeholders (e.g. drought monitor workshops for service agencies and producers).

- Heritage Cattle and Precision Ranching Research highlighted in the Sustainable Southwest Beef Project: [https://southwestbeef.org/](https://southwestbeef.org/)

- Cattle, conservation, and carbon in the western Great Plains

- Vulnerability of grazing and confined livestock in the Northern Great Plains to projected mid- and late-twenty-first century climate
  - Justin Derner, David Briske, Matt Reeves, Tami Brown-Brandl, Miranda Meehan, Dana Blumenthal, William Travis, David Augustine, Hailey Wilmer, Derek Scasta, John Hendrickson, Jerry Volesky, Laura Edwards, Dannele Peck (2017. Climatic Change [https://doi.org/10.1007/s10584-017-2029-6](https://doi.org/10.1007/s10584-017-2029-6)

- Informing grazing practices on rangelands

Appendix continued

5. Innovative technology adoption to enhance resource use efficiency through systems approach for better climate adaptability in drylands

Grass-Cast – Grassland Productivity Forecast

Grassland Productivity Forecast is a tool that translates seasonal precipitation outlooks into a grassland outlooks for ranchers, helping them anticipate how much grass might grow out on native grasslands/rangelands to improve management decisions.

- [https://grasscast.unl.edu](https://grasscast.unl.edu)
- Flexible stocking with Grass-Cast: A new grassland productivity forecast to translate climate outlooks for ranchers
  - Peck, Dannele; Derner, Justin; Parton, William; Hartman, Melannie; Fuchs, Brian (2019) Western Agricultural Economics Association 17

Land PKS – Land Potential Knowledge System

The Land Potential Knowledge System is a free mobile phone app to assess land info (e.g., soil and ecological site info), land cover, and land management. It is a global tool that has been focused on drylands.

- [https://landpotential.org/](https://landpotential.org/)
- ARS video: [https://www.youtube.com/watch?v=ODymv3nWbH0](https://www.youtube.com/watch?v=ODymv3nWbH0)
APPENDIX continued

5. Innovative technology adoption to enhance resource use efficiency through systems approach for better climate adaptability in drylands (continued)

North American Drought Monitor

The NADM is a cooperative effort between drought experts in Canada, Mexico and the United States to monitor drought across the continent on an ongoing basis. Funded in part by the USDA, the drought monitor reports changes in drought conditions and USDA relies on the drought monitor for farmer assistance programs.

• https://droughtmonitor.unl.edu/nadm/Home.aspx

Farmer experimentation and extension support

• Cover crops on dryland wheat? Challenge Accepted!
  • https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/stories/?cid=nrcseprd1291630

Adaptation strategies to changing climatic conditions

• Vulnerability of crops and croplands in the US Northern Plains to predicted climate change
APPENDIX continued

6. High and low-tech innovative farming solutions to enhance resilience of small-scale farmers (both pastoral and crop based)

- Climate Hub Adaptation Workbook -- includes semiarid production in Colorado and Texas
  - https://www.climatehubs.usda.gov/hubs/topic/adaptation-resources-agriculture-case-studies-using-adaptation-workbook

- Dust Mitigation Handbook