

Mega-Droughts of The Last Millennium - What are their Causes and Impacts?

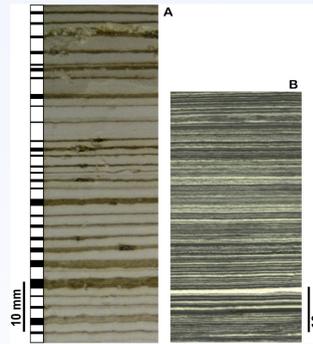


Meaning of a Mega-Drought:

A prolonged period of negative deviation in water balance compared to the climatological norm in a given area.
"A formally accepted climatological definition does not exist" [1].

How do we gain information about Mega-Droughts?

• Lake and Ocean Sediments



[2]

• Tree rings



<http://www.rmtr.org/images/s-FireScar.jpg>

• Documentary Evidence



[3]

Causes for Mega-Droughts are not always clear!

• Natural Forcing:

- Increasing Temperatures and Aridity [1,6]
- Decreasing Temperature Difference between Land and Ocean [1,5,6]
- Ocean/ Atmospheric Circulation [1,4,6]
- Reinforcing Factors [1,5,6]

• Non-Natural Forcing

- Anthropogenic Influences [1,6]

Impacts are seen in:

• Ecologically:

- Low Lake, River and Groundwater Levels [1,3]
- Environmental Deterioration [1]
- Collapse of the Food Base [1,3]

• Socially:

- Famines and Disease [1,3,5]
- Political Instability [1,3,5]
- Social Changes [1,3,5]

Example: Ming Dynasty Mega-Drought (MDMD) [5]

Causes:

- sparked by a natural Drought Event in 1637
- reinforced by a Volcanic Eruption in 1641
- Volcanic Eruption caused a weakened East Asian Summer Monsoon

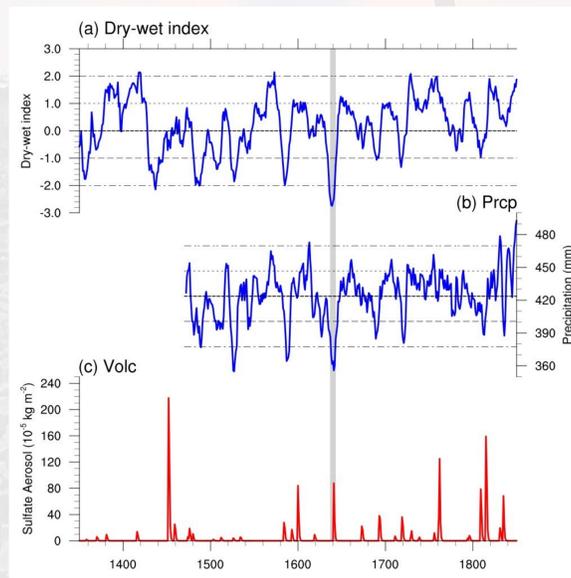


Fig. 1: The MDMD in reconstructions.

(a) the reconstructed Dry-Wet-Index; (b) The reconstructed 5-year running mean summer precipitation; (c) The reconstructed sulphate aerosol. [5]

Impacts:

- Food Crises
- Famines
- Plagues
- Wars
- End of Ming Dynasty and Beginning of Qing Dynasty in 1644

Conclusion/ Future outlook:

- Better Definition of Mega-Drought is needed to improve understanding and ease strategy development
 - Future Mega-Droughts will be different than past ones
 - Our current climate trend supports the possibility of future Mega-Droughts
- Modern scientist still try to uncover the connection of single factors for Mega-Drought occurrence

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- [5] Chen, K. et al. (2020). One Drought and One Volcanic Eruption Influenced the History of China: The Ming Dynasty Mega-drought. *Geophysical Research Letters*. ESSOAr, Earth and Space Science Open Archive.
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- [7] Kaufman, M. (2019). The warming U.S. foretells the return of dreaded megadroughts. <https://mashable.com/article/southwest-megadroughts-future/?> (23.06.2020)