

Perspectives on Human-Driven Changes in Drought

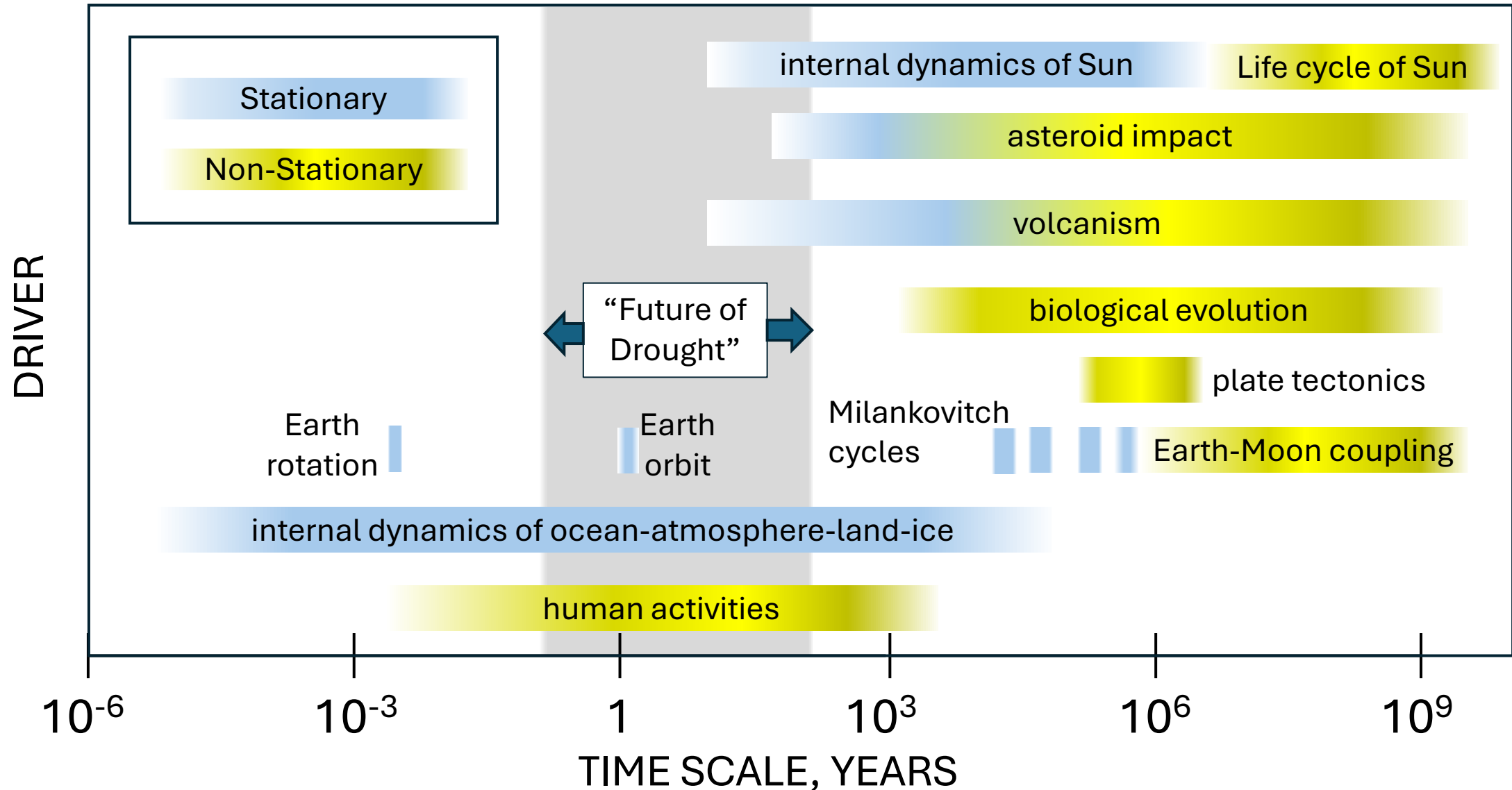
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Views expressed are my own and not necessarily those of the USGS or the Department of
the Interior.

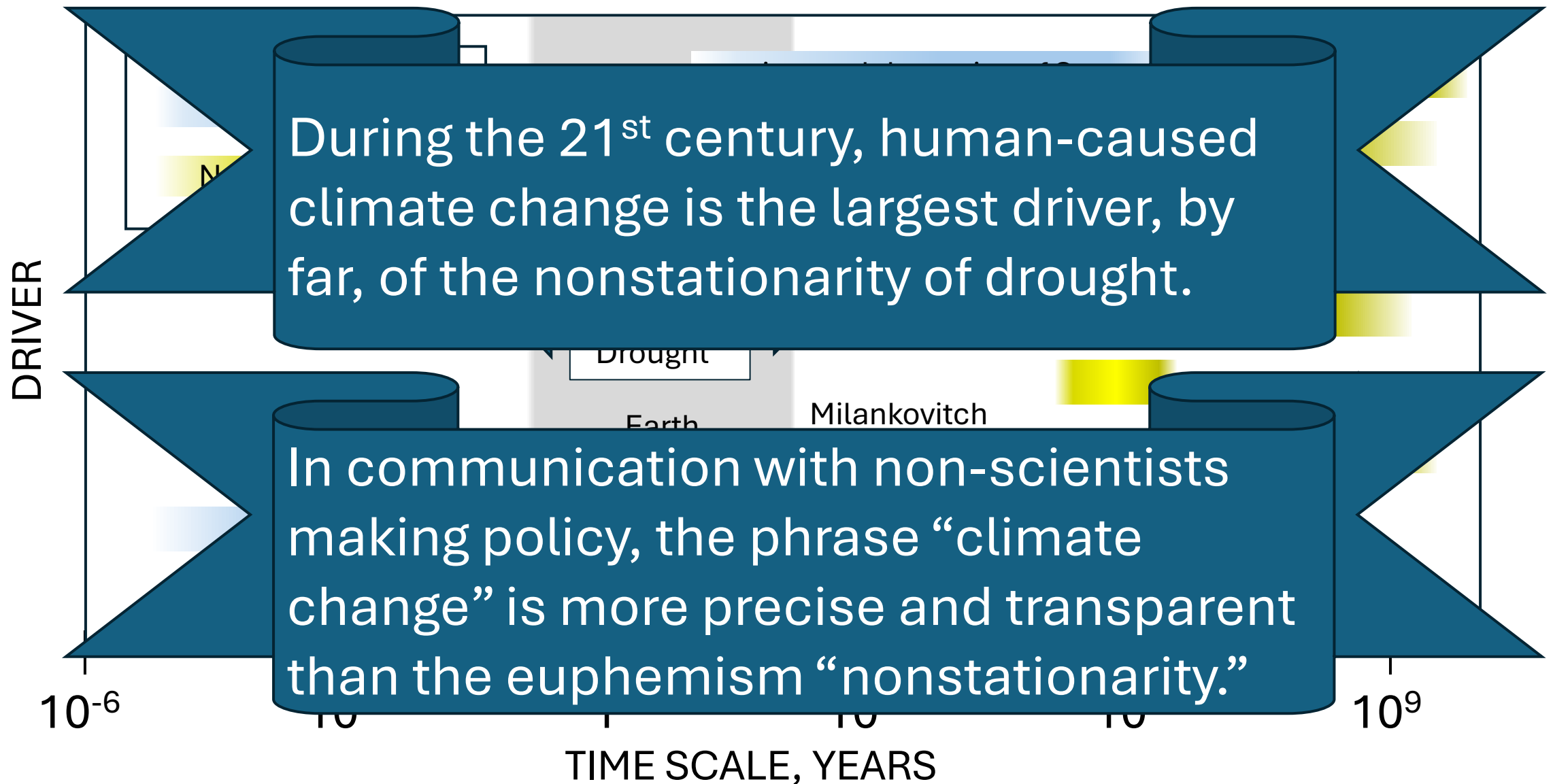
“Drought” and “Aridification”

- **Drought:** a **significant, natural** dry departure of environmental water availability from its **expected value** within a given climate.
- **Aridification:** ambiguous; either...
 - a **significant** decrease in the **expected value** of environmental water availability (or, alternatively, atmospheric humidity) caused by **changing climate (natural or human-driven)**; or
 - a “**slow**” **natural variation in a constant climate**; a “**long**” drought.
- **Climate change** can drive **increases of drought frequency/intensity/duration without aridification**.

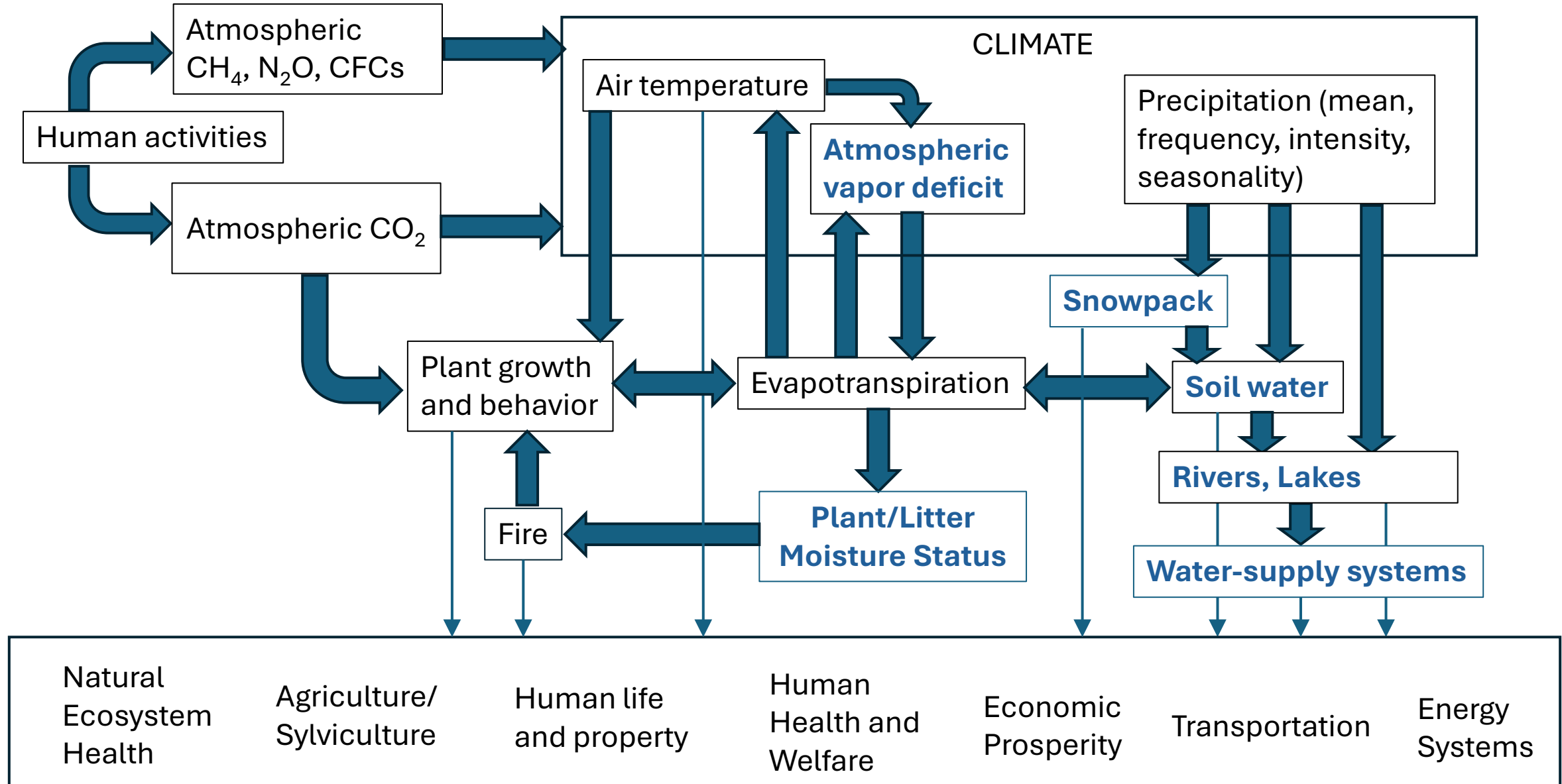
Stationary and Nonstationary Drivers of Drought



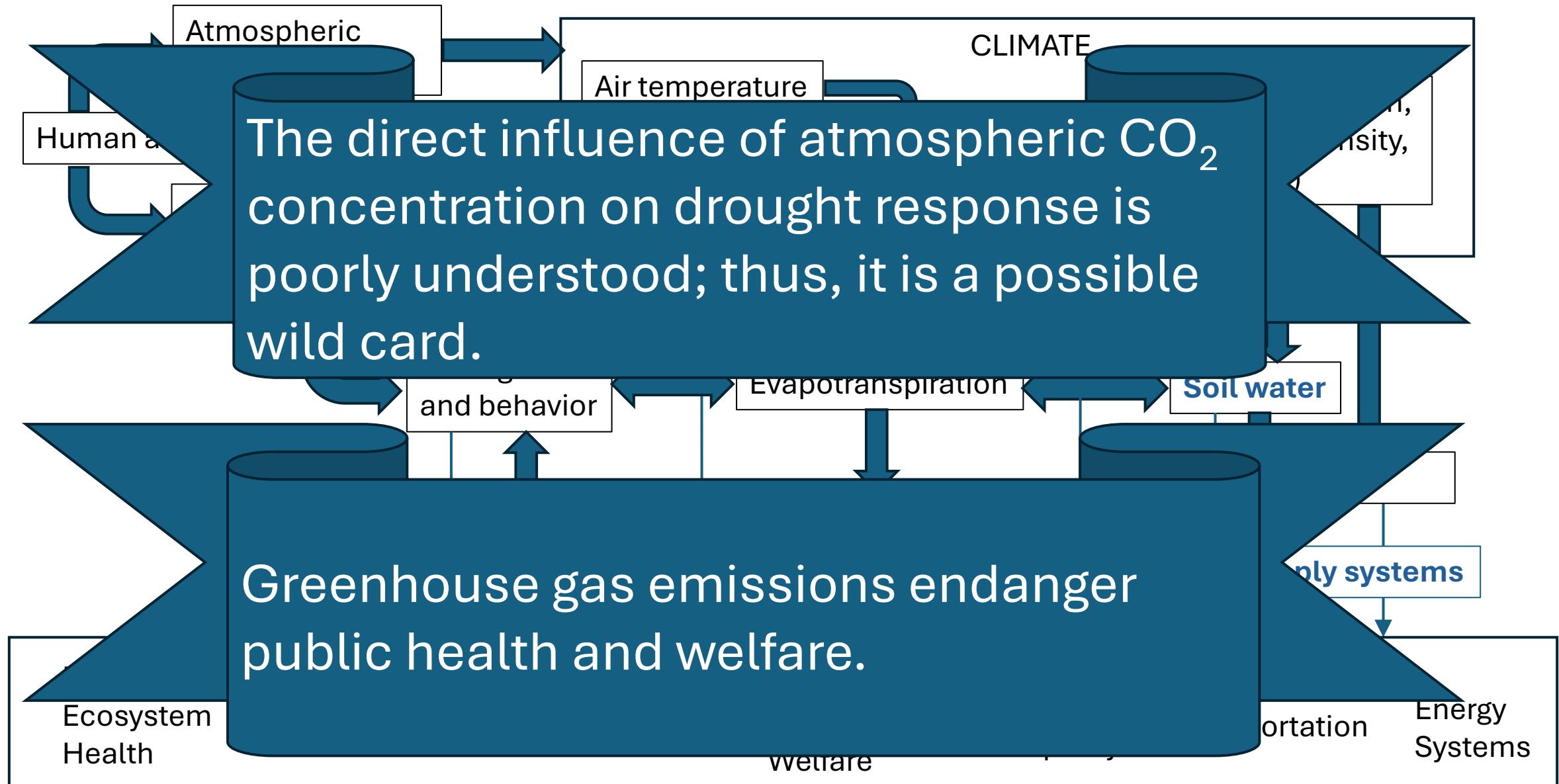
Stationary and Nonstationary Drivers of Drought



Climate-Change and Drought Processes



Climate-Change and Drought Processes



Assessment

- It's not just climate that's nonstationary; it's the validity of assessment methods, too:
 - PDSI and other temperature-based methods for assessing evaporative demand
 - ASCE Standardized Reference Evapotranspiration
- To be relevant to multiple affected sectors/interests/stakeholders, assessment must be multi-dimensional—just like drought itself.
- Process complexity and the diversity of impacts demand development of a comprehensive Earth-system (land-atmosphere-ocean) data assimilation system (EDAS) to assess drought in the changing climate.
- Vigorous scientific research is needed to support understanding of drought processes and impacts in the changing climate.
- Comprehensive observations are needed both for research and for EDAS ingestion.

Drought assessment would benefit from a comprehensive EDAS.

Effective adaptation to the future of drought will require long-term Federal commitment to Earth observations and scientific research.

Summary

- During the 21st century, human-caused climate change is the largest driver, by far, of the nonstationarity of drought.
- In communication with non-scientists making policy, the phrase “climate change” is more precise and transparent than the euphemism “nonstationarity.”
- The direct influence of atmospheric CO₂ concentration on drought response is poorly understood; thus, it is a possible wild card.
- Greenhouse gas emissions endanger public health and welfare.
- Drought assessment would benefit from a comprehensive EDAS.
- Effective adaptation to the future of drought will require long-term Federal commitment to Earth observations and scientific research.