**Land cover change - To what degree do human land cover dynamics affect climate change?**

**PRESENT**
- Deforestation, urbanization, and agriculture have altered the landscape significantly.
- These changes have resulted in increased temperature and precipitation patterns.
- The alignment between orbital forcing and climate has been altered.

**PAST**
- Preindustrial human activities (e.g., hunting and gathering) had a biogeophysical impact.
- Deforestation and increases in aerosols contributed to the biogeophysical impact.

**Selected references**
- Full reference list online under: http://www.pnas.org/content/110/4/11191.full

**Figure 1**: Effects of land use and CO2 on temperature change from pre-industrial to present-day in two heavily deforested areas (Central North America and central Eurasia) with seven atmosphere–land models (de Noblet-Ducoudré et al., 2011). The simulations suggest that the propagating land use affected the biogeophysical impact of large-scale land cover change on temperature change, with a certain level of confidence.

**Figure 2**: Preindustrial Holocene atmospheric CO2 concentrations measured in Antarctic ice cores (blue, black, and red), emissions data from Marlon et al. (2008) and atmospheric CO2 concentrations based on the current climate model (green). The data show a clear trend of increasing CO2 concentrations over the last 6 ka.

With the Neolithic revolution, the human interaction with the landscape changed completely, with large areas of natural vegetation converted to cropland and pasture. Outside of river basins, early agriculture was inefficient, and it is estimated that early farmers used much more land per capita than observed in modern times. The development of agricultural land use and exploitation of forest resources for fuel, construction materials, and nutrients meant that humans had a significant impact on global climate during the early Holocene and beyond. The early Holocene saw a period of rapid cultural and technological advancement, with the development of agriculture and the domestication of animals, leading to significant changes in land use and vegetation patterns. These changes had a profound impact on the global climate system, influencing temperature and precipitation patterns and contributing to the formation of the modern climate system. The alignment between orbital forcing and climate has been altered, with a potential feedback between climate and land use change.

**Selected references**
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**Figure 3**: Land use-related CO2 emissions from 1860 to 2008 (red), atmospheric CO2 concentrations from 420 million years ago (Ma) to the present (green), and the estimated contribution of land use to atmospheric CO2 from 1860 to 2008 (black). The data show a clear trend of increasing CO2 concentrations over the last 6 ka, with a significant contribution from land use.