This is the print version of the Skeptical Science article 'Ljungqvist broke the hockey stick', which can be found at http://sks.to/ljungqvist.

How does Ljungqvist's reconstruction compare to others?

What The Science Says:
Ljungqvist's millennial temperature reconstruction was very similar to Moberg et al. (2005) and Mann et al. (2008). It also concludes that current northern hemisphere surface air temperatures are significantly higher than during the peak of the Medieval Warm Period (MWP). Further, arguing for a hot MWP is also arguing that climate sensitivity is not low - which undermines a critical argument for "skeptics".

Climate Myth: Ljungqvist broke the hockey stick

"[Ljungqvist 2010 shows that] there is nothing *unusual*, nothing *unnatural* or nothing *unprecedented* about the planet's current level of warmth, seeing it was just as warm as, or even warmer than, it has been recently during both the Roman and Medieval Warm Periods, when the atmosphere's CO_2 concentration was more than 100 ppm *less* than it is today. And this latter observation, together with the realization that earth's climate *naturally* transits back and forth between cooler and warmer conditions on a millennial timescale, demonstrates that there is absolutely no *need* to associate the planet's current level of warmth with its current higher atmospheric CO_2 concentration, in clear contradiction of the worn-out IPCC and climate-alarmist claim that *the only way* to explain earth's current warmth is to associate it with the greenhouse effect of CO_2" (NIPCC)

Fredrik Ljungqvist created a 2000-year temperature history of the extra-tropical portion of the Northern Hemisphere (30-90°N) based on 30 proxy records. Certain "skeptics" have argued that his reconstruction shows greater natural variability than previous reconstructions, and that it shows the peak of the Medieval Warm Period (MWP) hotter than today's surface air temperatures.

Ljungqvist Compared to other Reconstructions

However, Ljungqvist's reconstruction is not substantially different from the many other millennial northern hemisphere temperature reconstructions, as the author himself states in his paper:

> “Our temperature reconstruction agrees well with the reconstructions by Moberg et al. (2005) and Mann et al. (2008) with regard to the amplitude of the variability as well as the timing of warm and cold periods, except for the period c. AD 300–800, despite significant differences in both data coverage and methodology.”

Indeed by plotting Ljungqvist's data along with Moberg et al. (2005), Mann et al. (2008), and the surface temperature record, we can confirm that the three reconstructions are very similar (Figure 1).

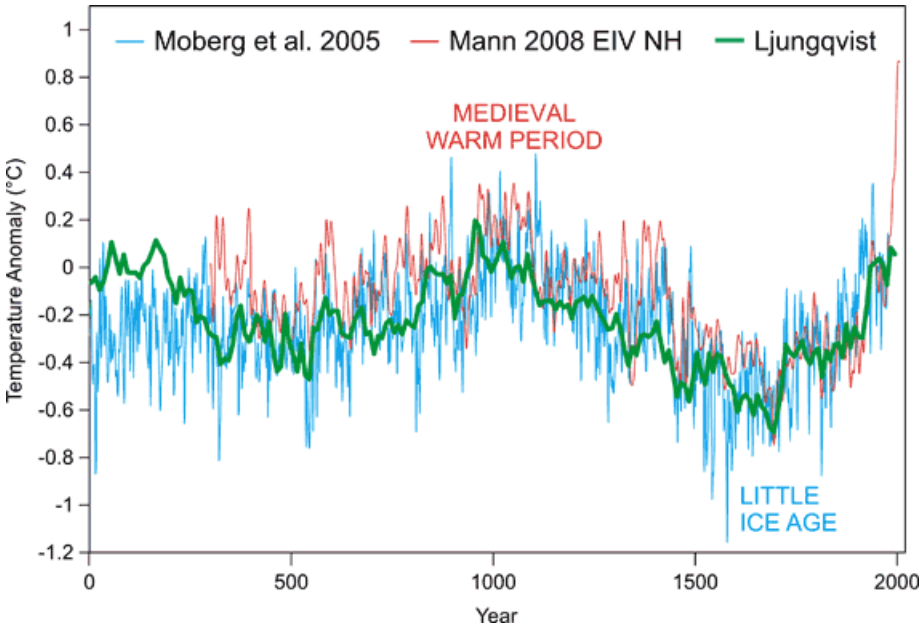

Figure 1: Moberg et al. 2005 NH (blue), Mann et al. 2008 EIV NH (red), and Ljungqvist 2010 NH (green). Courtesy of Robert Way and John Cook.

MWP Peak vs. Current Temperature

Contrary to "skeptic" claims that his reconstruction shows the peak of the MWP as hotter than today's temperatures, Ljungqvist says the following when combining his proxy reconstruction with recent instrumental temperature data:

> "Since AD 1990, though, average temperatures in the extra-tropical Northern Hemisphere exceed those of any other warm decades the last two millennia, even the peak of the Medieval Warm Period"

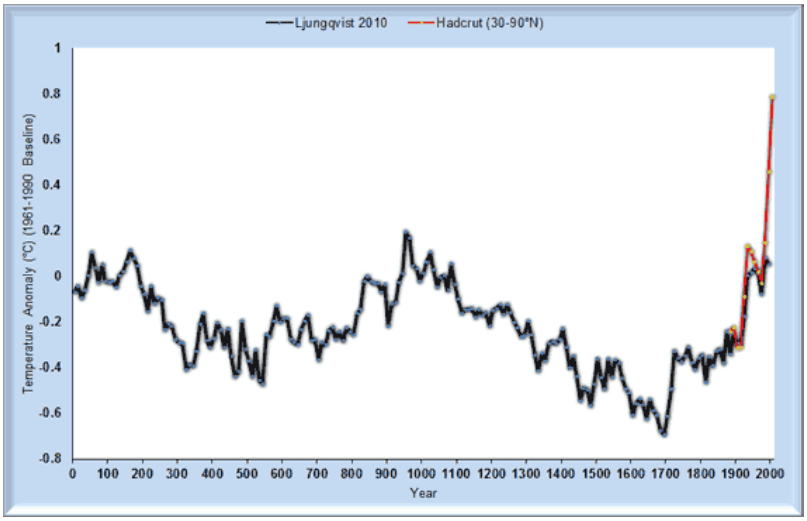

Figure 2: Ljungqvist (2010) 30-90°N decadal averages (black) vs. HadCRUT land-ocean 30-90°N decadal averages (red). Courtesy of Robert Way.

What Reconstructions Tell Us

The NIPCC also claims that if the MWP was as hot as today (which it wasn't), that means that current global warming and climate change could be natural. It's true, hypothetically, the current warming could be natural, *if there were a natural mechanism causing it*. However, there is no such known mechanism. There is a measured energy imbalance caused by the increase in atmospheric greenhouse gases. We know that this energy must cause the planet

to warm, and how much it warms depends on the climate sensitivity to the energy imbalance.

In fact, the hotter the MWP, the more sensitive the climate is to these energy imbalances. So arguing for a hot MWP is actually arguing that greenhouse gases must be causing significant global warming - the NIPCC has it exactly backwards.

Summary

Despite the different methodologies and data coverage used in Ljungqvist (2010), his reconstruction is consistent with previous peer-reviewed northern hemisphere temperature reconstructions, and like all previous peer-reviewed reconstructions, concludes that current temperatures are higher than the peak of the MWP. Claiming that the MWP was hotter than today is also counter-productive for "skeptics", because a hotter MWP means climate sensitivity is high.

Intermediate rebuttal written by dana1981

Update July 2015:

Here is a related lecture-video from Denial101x - Making Sense of Climate Science Denial

[*see video at* ***this link***.]

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