Land, rain and sweat: Building a database of what we need for building a temporally dynamic and a spatially-explicit agent-based model of Neolithic occupation in Languedoc-Roussillon, France.

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Objectives and challenges

Building a dynamic and spatially-explicit model is an interesting way for combining altogether:

- At the operational scale, meaning the Neolithic family level, i.e. one hectare and one season
- All the biophysical and socio-economic constraints and assets this family face
- Along the period and the site we considered, meaning the Languedoc Roussillon during the Neolithic era

⇒ for such a model, we need to collect accurate data, meaning:

- Precise enough, exhaustive both temporally and spatially
- Relevant, meaning having a defined impact on simulated dynamics

Reconstitute the season-level climate along the Neolithic era


Spatial variability
1. 1-km Neolithic Europe Temperature map (Worldclim.org)
2. 1-km Neolithic Europe Rainfall map (Worldclim.org)
3. 3-months Seasonal Neolithic Temperature variability (PALEOMEX data)
4. 3-months Seasonal Neolithic Rainfall variability (PALEOMEX data)

Reconstitute the 1-ha territory during the Neolithic era

“Erosion reverse engineering”


A cellular automata

A system of activities consistent with the family rationality and constrained by the manpower availability

Formalize the Neolithic manpower conditioned cropping system

Cereals, legumes & flax
1. Farming practices
   - Permanent vs. itinerant farming
   - Both autumn and spring sowings
   - Asystematic associated crops: legumes + cereals
   - Asystematic livestock manure-fertilized fields
   - Field expansion based on the Chayanov ratio MO:Pop. Bakkes (1978); Gregor (1980); Fichtner et al. (1990); Kneser (1997); Kreuz et al. (2005); Knoch et al. (2000); Bugat (2004); Salaverna (2010; 2011)

2. Technical capital:
   - No evidence of cart, plough or ard
   - Land: High land availability

3. Land fertility:
   - Important issue

4. Manpower:
   - Important issue

Formalize the Neolithic livestock-keeping system

Cattle, sheep, goats, pigs
1. Livestock-keeping practices
   - Collective management of herds, family use of by-products:
     - Alimentary pastures: meadows, forest foddering by pruning, fields refuse
     - Airs feeding house-wastes & refusals, oak acorns
   - Dahl & Hjort (1976); Gregor (1980); Hachem (1995, 2011); Arbogast et al. (2001); Ebersbach & Schade (2004); Bedaux & Hachem (2008); Breihan (2008); Tresset & Vigne (2011); Goudet (2007)

2. Hunting & Gathering
   - Seasonally-defined activities;
   - Declining over time with human long-term presence
   - Hunting
     - Focus on large game: boars & wild ruminants (deers, aurochs)
   - Gathering
     - Alshrooms & fruits, dry (hazel nuts) or not (apple, wood fruits &)
     - Rassmannen (1990); Hachem (1999, 2001); Arbogast et al. (2001); Tresset & Vigne (2001); Thibault (2000); Breihan (2011); Berhe (2007)

Simulate the seasonal systems and dynamics

Pushing factors
- Local demography
- Oceanic circulation
- Attracting factors
- Local dissemination according to amenities (soil, water, resources)
- Presence of a long distance colonization?

Colonization & segmentation rules

Simulating the social systems and dynamics

A long-term project to build within the PALEOMEX research group

Among all data and groups of data needed for building a socially-defined multi-agent model, few are available or not-so-hard to prepare:

- The white numbers (from ① to ③) are the data or metadata available in the PALEOMEX team or that can be constructed by one PALEOMEX member;
- The black numbers (from ④ to ⑤) are the ones not available for now. Their construction need a consensual agreement of several working hypotheses on their values and organizations

References

Hijmans, Cameron, Gomis, Marquès, 2013. Society & environment in Southern France from the 3rd millennium BC to the beginning of the 2nd millennium BC: 2200 BC is a turning point? 2200 BC is a boundary towards a collapse of the old world? In Tagungen des Landesmuseum für Vorgeschichte, Halle, Band 12, 339-362