Towards global land-cover and land-use reconstructions over the Holocene

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The LandCover6K working group (Gaillard et al. 2015) met for its third yearly general workshop. The focus was on how the quantitative land-use and land-cover reconstructions achieved so far should be synthesized and formatted to be useful for (i) climate and dynamic vegetation modeling studies, and (ii) evaluation and improvement of scenarios of past anthropogenic land-cover change (ALCC). Introductory presentations by S. Harrison on CMIP6-PMIP4 (climate/paleoclimate modelling intercomparison programs); A. Dallmeyer on a new ensemble of transient model simulations of vegetation change performed in MPI-ESM1.2 using different forcings (e.g. land use); B. Stocker on recent modeling results of CO_2 emissions from ALCC estimated using global dynamic vegetation models forced by scenarios of the extent of past anthropogenic land use (Stocker et al. 2017); K. Klein Goldewijk on the latest version of HYDE 3.2 (Klein Goldewijk et al. 2016); E. Ellis on the concepts of anthrome, sociocultural niche construction and anthroecological change, and the GLOBE project; and M. J. Gaillard (global land cover), M. Madella (global land use), U. Lombardo and W. Gosling (Latin America), A. Kay and C. Courthey-Mustaphi (Africa), M. Chaput (Canada), S. Teng (China), and J. Bunting (pollen productivity estimates) on

the major progress made in studies of pollen productivity estimates and land-cover/land-use reconstructions in the world provided the necessary background to formulate and plan LandCover6k products.

Pollen-based REVEALS reconstructions of plant cover exist for Europe (Trondman et al. 2015), temperate China (Li 2016; Fig. 1), and Siberia (X. Cao and U. Herzschuh, unpublished). Reconstructions for North America, Canada and Alaska are in progress, as well as studies on pollen productivities and REVEALS reconstructions in SE India and West Africa. Land-use maps are ready for Northern and Central America and the implications for the HYDE scenarios and effects on climate have been evaluated. The land-use maps for West Africa (A. Kay et al.) and a major synthesis of pollen data, archaeological and historical data for East Africa (R. Marchant et al.) were finalized. The process of gathering archaeologists and historians in Europe, Latin America, India and China has been successful. The LandUse6k community is now ready to achieve land-use mapping at the global scale in the coming few years.

Four LandCover6k products are currently in progress:

1. Gridded (1°x 1°) pollen-based REVEALS estimates of plant cover in the northern hemisphere (>40°N) for five time windows of the Holocene based on the available REVEALS estimates in northern America, Canada, Alaska, Europe, Siberia and China.

2. A comparison at a 1°x 1° grid spatial resolution and 500 years' time resolution over the last 8 ka between (i) the plant cover obtained from the transient runs presented by A. Dallmeyer and (ii) the plant cover obtained from pollen data using the REVEALS model (Marquer et al. 2017).

3. A comparison at 1°x 1° resolution for Europe of the fraction of deforested land as estimated by the ALCC scenarios of HYDE 3.2 and the pollen-based REVEALS estimates of the cover of openland for five time windows of the Holocene (see 1. above).

4. A new set of multi-model land C cycle simulations covering the Holocene using LandCover6k-improved ALCC scenarios (Stocker, see above).

The "products" 1-2 above and a roadmap for the model-intercomparison study (product 4) will be presented at the 1st PMIP4 conference in Stockholm in September 2017 (www.pmip2017.se).

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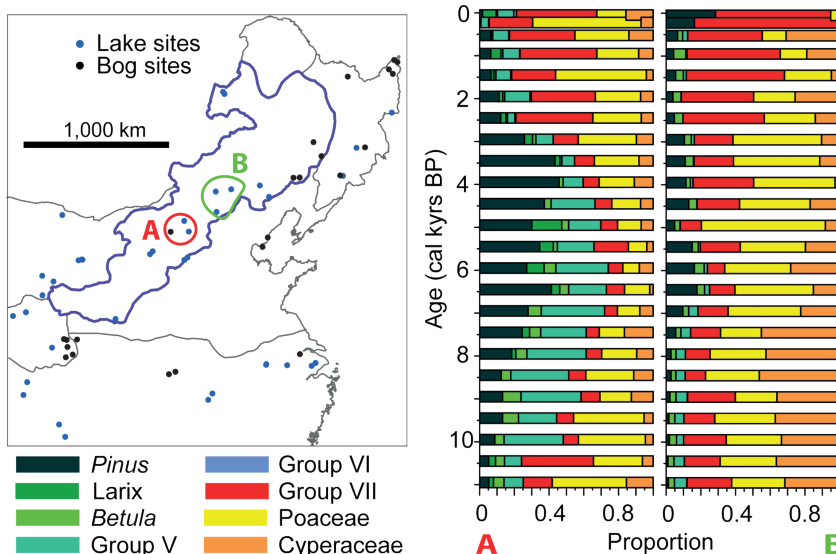Trondman A-K et al. (2015) Glob Change Biol 21: 676-697

Figure 1: Examples of REVEALS estimates of plant cover (in proportion for an area >100x100 km) over the Holocene for five plant taxa and three taxa groups in the temperate steppes zone of China (purple on map). Each diagram represents the results from REVEALS runs using pollen records from several sites: **(A)** 1 bog (black) and 2 lakes (blue); **(B)** 3 lakes. V: Cool mixed forest, temperate broad-leaved forest, i.e. *Fraxinus*, *Quercus*, *Tilia*, *Ulmus*, and Rosaceae. VI: Warm temperate forest and tropical forest, i.e. in those reconstructions only Rubiaceae. VII: Cultivated land, temperate grassland, tundra, and desert taxa, i.e. *Artemisia*, Asteraceae, Brassicaceae, Caryophyllaceae, *Castanea*, Chenopodiaceae, Convolvulaceae, Fabaceae, *Cannabis/Humulus*, *Juglans*, Lamiaceae, Liliaceae, Polygonaceae, and Ranunculaceae. Data by Furong Li (pers. comm.; see also Li 2016).