

d18 Grasses, Palms < Miocene prairies, silica accumulator plants >

Grass ... Growth at the leaf base permits grazing. — David Laing *The Earth System*.¹

Grasses

The importance of the grasses is evident to us for the grains that we eat and for fodder for the animals that we eat. Our vision of a pastoral world is one that humans have largely created by extending the grasslands. Woods are cut and burned. We acquired the skills of agriculture and animal husbandry after our species had learned to venture with tools onto the grasslands. Our distant ancestors had begun the trend when they were tempted from the forest verge possibly to scavenge the kills of carnivores who hunted grassland herbivores. And by our penchant for land clearing, we continue what nature started by a cooling climate that opened grasslands where forests were. In North America, the prairies are perpetuated by high elevation and rain shadow that resulted from Pliocene uplift. The appearance of extensive grasslands earlier was due to global cooling.²

Grass seed preserved in an intact state or carbonized, are common fossils; most identifiable to the species level. Also, grasses contain opal phytoliths (silica bodies with distinctive, often angular, shapes) that, being relatively inert, survive as fossils after organic tissues have decomposed.³

Well-preserved fruitlets of *Panicum*, *Stipa*, and the extinct genus *Berriochloa*, (all grasses) have been found in the Pliocene Ogallala fm, Kansas, in association with fossils of grazing mammals.⁴ Nature had open the grassland in earnest during the Miocene when worldwide the land was mostly low lying. Hypsodont (high-crowned teeth) grazers became the majority by 5 million years ago amongst many unrelated widely dispersed brachyodont (low-crowned cheek teeth) browsing-animal lineages. Their rise beginning 20 million years ago evidences persistent extensive grasslands since then.⁵ Browsers that were rare and local, did not, according to a fossil count made by Jukka Jernvall and Mikael Fortelius in 2002, evolve the high-crowned teeth that the more widely dispersed did to graze on grasses abrasive for their silica phytoliths and attached grit in dusty environments.⁶

The spread of grasslands at the expense of woodlands can be linked to the general cooling and drying climatic changes beginning 40 million years ago. Late Miocene Kilgore flora and palynoflora (pollens), described from Nebraska by H. D. MacGinitie in 1962, is of valley forests and open pine-oak wooded grassy uplands. Associated fossil faunas indicate frost-free winter temperatures and moderate summer rains. Before the Miocene, no exclusively grazing animals existed.

The climate during the Paleogene in North America was generally warm and wet and had favored trees. Grasses then were among forbs in the understory⁷ and were with a long history having migrated from where, during the Late Cretaceous in the Gondwanaland realm of Pangea, they were munched on by titanosaur sauropods (as is evidenced by phytoliths in their coprolites). Possibly gondwanatherian mammals with hypsodont cheek teeth were grazers.⁸

Palms

The Cenozoic is noted for its record of a cooling trend in world climate (**Footnote d18.1**) from the warm time as is recorded in North America by late Eocene upper Jackson Group palynoflora.⁹ Then palms extended into Alaska¹⁰ where also nutmegs and *Ertgelhardtia*, a tropical member of the Juglandaceae, were abundant. This time of maximum warmth followed the torrid though cooler climate of the mid-Eocene recorded by the Claiborne palynoflora.¹¹ Palynoflora of the late Paleocene upper Wilcox Group is well known from its extensive fossil preservation along the coastal plain of the Gulf of Mexico from Alabama to Texas. Chester A. Arnold in 1947 wrote: “It contains 543 described species belonging to about 180 genera and 82 families. The flora is typically a warm temperate one indicative of abundant rainfall. Conditions apparently were more tropical than those of the preceding late Cretaceous when palms made their first appearance.”⁴ □