Middle America LandCover6k

Revision of 7.6.16 by Andrew Sluyter.

The GIS used is the latest version of QGIS (Essen 2.14.0, released 26.2.15), with these basic features.

- Project file name: LandCover6k_Middle_America.qgs.
- Coordinate Reference System: WGS 84/Pseudo Mercator (ESPG: 3857), the default projection for web mapping.
- WMS (Web Map Service) tiled raster base maps:
    - Google Satellite.
    - Google Hybrid.
    - OCM (Open Cycle Map) Landscape.
    - MapQuest-OSM (Open Street Map).
- Vector base maps:
    - Middle American Countries (derived from TM_WORLD_BORDERS-3.0, created in 2008 by Schuyler Erle, Sean Gilles, and Bjorn Sandvik, downloaded from Github.org, and modified by deleting irrelevant polygons so that it includes all mainland countries from Mexico through Panama, the Greater Antilles, Lesser Antilles, minor Caribbean islands such as the Caymans, and the islands off the coast of northern South America such as Isla Margarita, Aruba, and so on but excludes the islands now part of Mexico more than 250 km off its Pacific coast and the Bahamas, which are Atlantic islands).
    - Middle America Region (derived from Middle American Countries by joining the individual country polygons into a single feature; revising the coastline at a scale of 1:250,000 so that it better follows the OCM Landscape base map and includes all coastal lagoons and barrier islands; and digitizing polygons for all but the smallest islands; with no adjustments for Holocene sea-level rise).
- Scale bar: m/km.
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To guide the level of generalization of the land-use polygons, an overlay grid was added with X-Y intervals of 8 km/8,000 m. The ALCC (Anthropogenic Land-Cover Change) models have grid cells as small as 5 minutes ($1/12^{th}$ of a degree). A grid with 8 km intervals approximates that resolution because a degree of latitude is about 111 km long and a degree of longitude varies from about 110 km at the southernmost point of Middle America, in Panama (7.21° N; 110,445 m), to about 94 km at the northernmost point, along the US-Mexico border (32.72° N; 93,747 m). If a nominal degree in Middle America is therefore taken to be 100 km, then $1/12^{th}$ is 8,333 m, rounded down to 8 km/8,000 m.

The land-use layers are contained in three groups, each named for one of the target dates agreed to at the first LandCover6k meeting (Paris, February 18-20, 2015): Land-Use 6000 BP; Land-Use 1500 CE; Land-Use 1850 CE. Each of the groups has vector-polygon layers named for the land-use categories agreed on at the first LandUse6k meeting: Putting History to Work on Climate Change (Paris, October 22-23, 2015) and confirmed at the subsequent Skype meeting of the Coordinators for North and South America (December 21, 2015). For example, the Land-Use 1500 CE group contains nine vector-polygon layers named Pastoralism 1500 CE; Urban, Extractive 1500 CE; Hunting, Fishing, Gathering 1500 CE; No land

Use 1500 CE; Agriculture—Wetland Cultivation 1500 CE; Agriculture—Floodwater and Irrigated Cultivation 1500 CE; Agriculture—Arboriculture and Horticulture 1500 CE; Agriculture—Rainfed Cultivation 1500 CE; and Agriculture—Terrace Cultivation 1500 CE. Each layer has an attribute table with the following fields: the default Id (an integer up to 10 digits long, which will allow up to 1,000,000,000/1 billion features); Type (text string up to 50 characters for Agriculture, Pastoralism, and so on); Subtype (text string up to 50 characters for Agroforestry, Wetland Cultivation, and so on); Comments (text string set to 100 characters for brief notes about local names such as *chinampas* and other supplemental information); Source (text string up to 100 characters, editable for the name of the georeferenced map used to digitize the feature); Citation (text string up to 100 characters set to editable for citation of the source of the georeferenced map and other information used to digitize the feature).

Each of the land-use polygons represents an area throughout which a particular type of land use occurred at the time of the target date. The land use does not necessarily occur at all locations within that polygon at the same time, or even ever. For example, the land use throughout much of Middle America at 6000 BP was hunting, fishing, gathering; yet people were not engaged in that land use at all times in all places within Middle America at 6000 BP and, in fact, might not ever have engaged in that land use is some particular locations within the polygons. Similarly, in 1500 CE, large parts of the tropical area of Middle America was used for shifting cultivation, but that land use by its nature requires large areas of the polygon throughout which it occurs to be fallow for decades, meaning that people were not actively planning and harvesting at all locations throughout the shifting cultivation polygons at the same time.

In addition, a group named Base Maps contains all the WMS and vector layers that serve as base maps: WMS Google Satellite, Google Hybrid, OCM Landscape, and MapQuest-OSM; Lakes; MiddleAmericanCountries; and MiddleAmericaRegion.

The 1850 CE and 1500 CE groups contain all layers related all five major land-use categories: Agriculture; Pastoralism; Urban, Extractive; Hunting, Fishing, Gathering; and No Land Use. It breaks the Agriculture category down into five subtypes because of the complexity of types of agriculture at that time, resulting in a total of nine layers.

The 6000 BP group, in contrast, does not contain an Urban, Extractive layer because no urbanized or extractive areas that reached the 500 ha threshold in 6000 BP existed anywhere in Middle America at that time. Only urbanized and extractive areas with total areas equal to or greater than 500 ha (5 km^2) were mapped. An area of 500 ha is approximately 8% the size of the grid cells of 8,000 m by 8,000 m (64 km^2/6,400 ha) used to judge the level of generalization appropriate for the project. So even an area of 500 ha, which, if a square, would have sides about 2.25 km (2,250 m) long, is not particularly significant and serves as an absolute lower threshold. The first urban civilization in Middle America was the Olmec, and its cities of San Lorenzo and La Venta, in the topical lowlands along the Gulf of Mexico did cover areas greater than 500 ha but date to from 1200 BCE through 400 BCE, several millennia after 6000 BP (Diehl 2004). The Olmecs also quarried and mined for precious stones and other materials but, again, not as early as 6000 BP (Weigand and Gwynne 1982).

The 6000 BP group also does not contain a Pastoralism layer because livestock arrived in Middle America only in 1493 CE, with the second voyage of Christopher Columbus (Sluyter 2012, 12).

The 6000 BP group also does not contain an Agriculture layer because it falls near the midpoint of the Archaic period (7000-2000 BCE) that marked the transition from land use dominated by mobile groups hunting for large, Pleistocene mammals to the proliferation of agricultural land use and sedentary groups living in villages beginning approximately 4000 BP. Hunters, fishers, and gatherers had domesticated two Middle American staples well before 6000 BP: maize (*Zea mays*) by 8700 BP; and squash (*Cucurbita pepo*) by 10,000 BP (Piperno and Smith 2012, table 11.1). Those domesticates, however, formed a relatively minor component of land use in highland areas in 6000 BP, where the focus remained on wild plants and animals, with maize and squash grown in small gardens adjacent to seasonal habitations (Kennett 2012, 142-44; Piperno and Smith 2012, 156). More evidence of an increasing reliance on maize cultivation by 6000 BP, including evidence for shifting cultivation, occurs throughout seasonally dry tropical lowlands (Kennett 2012, 145-48; Piperno and Smith 2012, 156). The areas of cultivation in 6000 BP were nonetheless small and widely dispersed, predating the emergence of villages, denser populations, and extensive use of shifting cultivation by some 2,000 years.

References

Diehl, Richard. 2004. *The Olmecs: America's First Civilization*. London: Thames and Hudson.

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Sluyter, Andrew. 2012. *Black Ranching Frontiers: African Cattle Herders of the Atlantic World, 1500-1900*. New Haven: Yale University Press.

Weigand, Phil C. and Gretchen Gwynne, eds. 1982. *Mining and Mining Techniques in Ancient Mesoamerica*, special issue of *Anthropology* 6 (1, 2): 1-226.