**Supplemental Text 1: Crop Plant Data Collection and Model Inputs**

*Crop Plant Selection*

For this research, key economic crops, such as maize and manioc, were chosen given their likely status as dietary staples. Some crops chosen for this research (such as maize) were also commodity crops (both storable and transportable) with potential economic significance (Fedick 2017). The designation of “commodity crop” is not limited to dietary staples; commodity crops can be non-staple food crops as well as non-food crops. Likely non-staple food and non-food commodities were valued for their use in ritual, prestige, and pleasure, rather than for their nutritional value. Cacao (*Theobroma cacao*) for example, is a non-staple food crop that was used in several elite and ritualized beverages (Fedick 2017). Cotton *(Gossypium hirsutum),* in contrast, is a non-food crop that was used as a commodity and woven into mantles that were given in tax and tribute. The spatial patterns of production, consumption, exchange, and trade of these different commodities, like the construction of terraces and channeled fields influenced and was influenced by physical and cultural landscape of the Lowlands (see Guderjan et al. 2017). Of course, the crops chosen for this research do not provide a comprehensive list of commodity crops grown and utilized by ancient Maya people. Postulated commodities that do not grow in the study region, due to their restrictive ecological ranges, were not selected. Vanilla (*Vanilla spp.*), though a likely commodity for which there is historical evidence of production in the region (Caso Barrera and Aliphat Fernández 2006), was not chosen due to its restrictive ecological range and its low visibility in the archaeological record (Fedick 2017; Morell-Hart 2020). Other key crops, such as tobacco (*Nicotiana* spp.) grow easily in a number of homegarden ecologies and have largely been identified through archaeobotanical studies only to the family level (e.g., Cagnato 2018), and thus may not have acquired the same value as other economic plants that are more difficult to grow.

*Crop Plant Preference Data*

Botanical, ethnobotanical, and ethnohistoric data from the Maya region and, at times, the Caribbean, were collected for the selected 18 crops (see References below; Supplemental Table 1). These data were used to determine the suitability of the conditions within each layer for each crop prior to using the Weighted Overlay tool. The soil moisture and the various soil texture columns (Supplemental Tables 1 and 2) were specifically consulted for this purpose. The other data columns, though not used in this study, can later be expanded to include more species, varietals, and variables for use in future studies in the Maya area and beyond. Further, the data columns presented in the table in Supplemental Table 1 are not an exhaustive list of environmental considerations important in determining crop suitability. Many other crop preferences, such as soil depth, may influence the suitability of the land for certain crops. These other crop preferences are not incorporated in this model, given the limitations of the available soils data sets that we can use in modeling ancient land use.

*Soil Texture*

The importance of soil for agricultural decision making is recognized by all contemporary Maya farmers. Itza Maya farmers of Guatemala’s Petén region, for example, clearly classify and local soils and associate certain crops and cultivation methods with different soil types (Atran et al. 1993). Further, the prevention of soil erosion and retention of soil nutrients are soil-based motivations for the investment in landesque capital, such as terraces (Wilken 1971). Soil texture was given the highest weight, 50%, as it is one of the dominant factors in determining natural agricultural potential (Dorshow 2012).

Here soil texture is considered in terms of percent clay, where sand dominant soils are 0-15% clay, loam and silt dominant soils are 15-35% clay, and clay dominant soils are 35% + clay. The raster used for this layer of the model was created by Hengl (2018), and maps percent clay content (kg/kg) at a depth of 60 cm at 250 m resolution. The Hengl dataset is based on machine learning predictions from a compilation of global soil profiles and samples and was retrieved from OpenLandMap.

Soil maps for the region are digitally available from the Instituto Nacional de Estadística y Geografía (INEGI). The most recent of these, in GIS compatible formats, are from 2007 and are available at a scale of 1: 250 000 and use the 1999 World Reference Base for Soil Resources classification system. While these maps are small-scale, they have been criticized for a low number of field observations (Krasilnikov et al. 2013). Additional GIS-compatible soil maps, including modeled clay content maps, are available from the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO); however, these maps are not as refined as those used in the model (1 km resolution).

*Soil Moisture*

The second most important layer for determining crop suitability in this model, given a weight of 40%, is soil moisture. Soil moisture was given less importance than soil texture, as the region is largely moist (mean plant available water capacity = ~61 mm), though its importance is still relatively high. In this model we approximate soil moisture using plant available water capacity (PAWC), also known as available water capacity, which is a standard measure of the water holding capacity of soil for plants (Gillreath-Brown, Nagaoka, and Wolverton 2019). The layer used was retrieved from OpenLandMap and maps PAWC in mm at a depth of 60-100 cm at a resolution of 250 m. It is also based on machine learning predictions from a compilation of global soil profiles and samples (Hengl and Gupta 2019).

A very high PAWC value in the top meter of soil is 300 mm (Kristensen et al. 2019), thus the maximum values of 78-111 mm in the study area are considered wet, 77-45 are considered moist, and below 44 mm is considered dry (see Supplemental Table 2 for further description of the range of all input layers). This parameter considers aspects of soil texture and depth; thus, it is important to note that soil characteristics are being considered twice.

*Slope*

The slope raster used in the model was derived from a 0.5 m resolution digital elevation model (DEM) that was produced by NCALM from LiDAR data collected in June 2019 using the Titan MW LiDAR unit in collaboration with the PABC. Further details on this data collection are outlined in Golden et al. (2021). The original NCALM-produced DEM was converted to the common cell size of 250 m. At this resolution, fine-grained distinction of the terrace slopes is likely obscured, though we note the location of identified terraces in our output maps. After pre-processing the Slope tool in ArcGIS Pro (output measurement in percent rise) was used to produce the input slope raster.

All crops in this study are considered to prefer flat land to reflect the propensity for agricultural fields to be located on flat lands. However, slope was given the least weight in the model (10%) considering the evidence of terracing on slopes < 14°.

*Crop Plant* Groupings

As described in the Methods section, five crop groupings naturally emerged, given general habitat preferences of the 18 plants selected (see Supplemental Table 1). Each of these natural groupings formed the basis of one output suitability map.

*Group A.* Group A consists of *Xanthosoma sagittifolium* (malanga) and *Phaseolus vulgaris* (common bean). These crops prefer moist soils, loam and clay soils.

*Group B.* Group B consists of *Attalea cohune* (cohune palm), *Acrocomia aculeata* (coyol palm), and many of the root crops investigated in this study: *Ipomoea batatas* (sweet potato), *Manihot esculenta* (manioc), and *Maranta arundinacea* (arrowroot). This group grows best in moist soils as well, though prefer sandy-textured soils.

*Group C.* Group C includes only *Protium copal*, which grows best in moist, clayey soils.

*Group D.* Group D crops include *Bixa orellana* (annatto), *Curcurbita pepo* (squash), *Gossypium hirsutum* (cotton), *Theobroma cacao* (cacao), *Pimienta dioica* (allspice), the three *Zea mays* varietals, and *Capsicum annuum* (chile pepper). These grow best on moist soils of many different soil textures.

*Group E.* Group E includes only *Pouteria sapota* (mamey sapote), which grows in moist, clayey or sandy soils.

**References Cited**

Atran, Scott, Arlen F. Chase, Scott L. Fedick, Gregory Knapp, Heather McKillop, Joyce Marcus, Norman B. Schwartz, and Malcolm C. Webb. 1993. “Itza Maya Tropical Agro-Forestry [and Comments and Replies].” *Current Anthropology* 34 (5): 633–700.

Cagnato, Clarissa. 2018. “Shedding Light on the Nightshades (Solanaceae) Used by the Ancient Maya: A Review of Existing Data, and New Archeobotanical (Macro- and Microbotanical) Evidence from Archeological Sites in Guatemala.” *Economic Botany* 72 (2): 180–95. https://doi.org/10.1007/s12231-018-9412-8.

Caso Barrera, Laura, and Mario Aliphat Fernández. 2006. “Cacao, Vanilla and Annatto: Three Production and Exchange Systems in the Southern Maya Lowlands, XVI-XVII Centuries.” *Journal of Latin American Geography* 5 (2): 29–52.

Dorshow, Wetherbee B. 2012. “Modeling Agricultural Potential in Chaco Canyon during the Bonito Phase: A Predictive Geospatial Approach.” *Journal of Archaeological Science* 39 (7): 2098–2115. https://doi.org/10.1016/j.jas.2012.02.004.

Fedick, Scott L. 2017. “Plant-Food Commodities of the Maya Lowlands.” In *The Value of Things : Prehistoric to Contemporary Commodities in the Maya Region*, edited by Jennifer P. Mathews and Thomas H. Guderjan, 163–72. University of Arizona Press, Tucson.

Gillreath-Brown, Andrew, Lisa Nagaoka, and Steve Wolverton. 2019. “A Geospatial Method for Estimating Soil Moisture Variability in Prehistoric Agricultural Landscapes.” *PLOS ONE* 14 (8): e0220457. https://doi.org/10.1371/journal.pone.0220457.

Guderjan, Thomas H., Sheryl Luzzadder-Beach, Timothy Beach, Steven Bozarth, and Samantha Krause. 2017. “Production of Ancient Wetland Agricultural Commodities in the Maya Lowlands.” In *The Value of Things: Prehistoric to Contemporary Commodities in the Maya Region*, edited by Jennifer P. Mathews and Thomas H. Guderjan, 20–48. University of Arizona Press. Tucson.

Hengl, Tomislav. 2018. “Tomislav Hengl. (2018). Clay Content in % (Kg / Kg) at 6 Standard Depths (0, 10, 30, 60, 100 and 200 Cm) at 250 m Resolution (v0.2).” Zenodo. https://doi.org/10.5281/zenodo.1476855, accessed March 22, 2022.

Hengl, Tomislav, and Surya Gupta. 2019. “Soil Available Water Capacity in Mm Derived for 5 Standard Layers (0-10, 10-30, 30-60, 60-100 and 100-200 Cm) at 250 m Resolution.” Zenodo. https://doi.org/10.5281/zenodo.2784001, accessed October 18, 2021.

Krasilnikov, Pavel, Ma del Carmen Gutiérrez-Castorena, Robert J. Ahrens, Carlos Omar Cruz-Gaistardo, Sergey Sedov, and Elizabeth Solleiro-Rebolledo. 2013. Soil Research and Soil Mapping History. In *The Soils of Mexico*, 5–23. World Soils Book Series. Springer, Dordrecht, Netherlands.

Kristensen, Jeppe Aagaard, Thomas Balstrøm, Robert J. A. Jones, Arwyn Jones, Luca Montanarella, Panos Panagos, and Henrik Breuning-Madsen. 2019. “Development of a Harmonised Soil Profile Analytical Database for Europe: A Resource for Supporting Regional Soil Management.” *SOIL* 5 (2): 289–301. https://doi.org/10.5194/soil-5-289-2019.

Morell-Hart, Shanti. 2020. “Plant Foodstuffs of the Ancient Maya: Agents and Matter, Medium and Message.” In *Her Cup for Sweet Cacao: Food in Ancient Maya Society*, edited by Traci Ardren, 124–60. Austin, TX: University of Texas Press.

Wilken, Gene C. 1971. “Food-Producing Systems Available to the Ancient Maya.” *American Antiquity* 36 (4): 432–48. https://doi.org/10.2307/278462.