PROPOSALS TO RECOVER AGRICULTURAL ACTIVITY IN MEXICO CITY

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Introduction

Agriculture's importance in urban and peri-urban areas is recognized for providing food by shortening supply chains and as an ecosystem service provider, being a key factor for sustainability. (Almeida et al., 2024). In Mexico City (CDMX), there's peri-urban agriculture in a legally protected territory named conservation soil, representing 59% of the territory (Castelán, et al., 2016). Population in agricultural activities is 16000 people in 11000 production units. (INEGI, 2020). CDMX's agrosystems are mostly managed by small producers who sometimes, seeking for better income, abandon their fields, contributing to land use change (GCDMX, 2020). Agriculture in this territory has been practiced since 1500 BC. During the late Aztec period (1325-1521) irrigation networks enabled the development of "chinampas," a sustainable agriculture pillar, alongside the "milpa" system, which combines maize, beans, squash, and other crops to maximize efficiency and conserve genetic resources (UNAM-DGCS, 2023). The *objective* of this research was to characterize agricultural production in CDMX, estimating potential provision of food and nutrients, and to propose public policy guidelines in pursuit of developing a systemic and integrative vision of the territory.

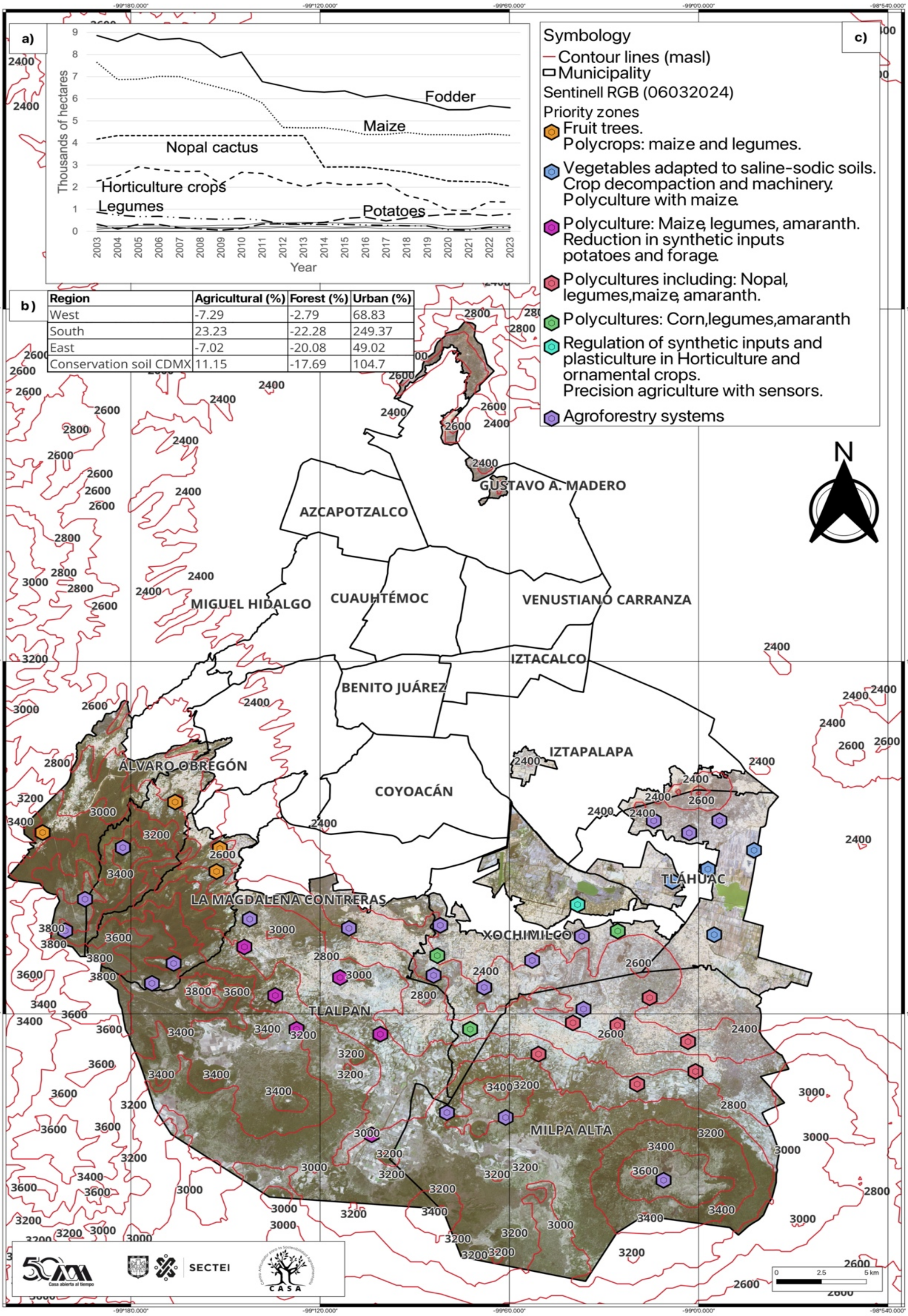
Methods

Dynamics for 72 agricultural products were analyzed using data from Mexico's official agricultural information system (SIAP, 2023), considering surface (ha) and volume (ton), grouped in 10 classes: horticulture crops, fruit trees, fodder, ornamentals, legumes, maize, potatoes, nopal cactus, amaranth, and fungi. Land use (2018-2024) was determined considering five classes: agriculture, forestry, urban, grassland and water, using 10-meter resolution pixel images from Sentinel-2 satellite. A supervised classification was made using QGis Dzetsaka model (QGIS, 2025). To determine nutritional apport, production from 2023 (agriculture and livestock) was considered (SIAP, 2023) for 14 essential nutrients (López-Ridaura et al., 2021), and population was defined with National census data (INEGI, 2020). Three productive regions were determined, according to agricultural production type, edaphoclimatic characteristics, management and vulnerability.

Results

From 2003 (24655.9 ha) to 2023 (14876.7 ha), sown surface in agricultural land use decreased by 39.66%. Municipalities with largest agricultural surfaces (Milpa Alta, Tlalpan, and Tláhuac) reduced their planted surface by 39.78%, 30.89%, and 62.62% respectively, whereas Xochimilco, where most ornamentals are produced, maintained stability. Ornamental plants (229%) and potatoes (199%) have surface increment; fodder (63%), maize (57%), nopal cactus (47%), horticulture (58%) and legumes (80%) have decreased (Fig. 1a). Of the conservation soil, 45% is agricultural (7 of 16 municipalities). Satellite images allowed to determine an increase in urban land from 4121.85 ha to 8437.81 ha (104.7%), and in agricultural land from 35296.20 ha to 39232.71 ha (11.89%). Forest land decreased from 46633.65 ha to 38381.19 ha (-17.69%) (Fig 1b).

Fig 1. (a) Planted area (CDMX 2003-2023). (b) Land use changes by productive region in CDMX (percentage, positive means increase, and negative means decrease). (c) Differentiated public policy proposals



Region	Agricultural (%)	Forest (%)	Urban (%)
West	-7.29	-2.79	68.83
South	23.23	-22.28	249.37
East	-7.02	-20.08	49.02
Conservation soil CDMX	11.15	-17.69	104.7

In 2023, five products provided at least 5% of the population's needs for two or more nutrients: nopal cactus (13), milk (10), potato (8), maize (7) and pork (4). Total production apported more than 10% in vitamin C (44.3%). calcium (16.03%), iron (14.75%) and vitamin A (12.13%). CDMX features diverse agrosystems. Mountainous areas (2600-3900 masl) have seasonal agricultural practices. West (Álvaro Obregón, Cuajimalpa and La Magdalena Contreras), grow mostly fruit trees and maize, often as monocultures. South (Milpa Alta and Tlalpan) is dominated by forage, nopal cactus and maize cultivation. East (Xochimilco and Tláhuac) is the lake zone (2200-2250 masl), characterized by "chinampas", which are intensive agricultural systems primarily growing horticulture, ornamentals, and maize, either alone or mixed with other crops.

Discussion and perspectives

According to the image analysis, a linear trend of change in land use from forestry to agricultural, and from agricultural to urban is observed, which, linked to migration of farmers to the city, is reflected in a reduction in production that impacts not only in nutrition supply and ecosystem services but also in the loss of agrosystems function as a buffer against ongoing urbanization pressures. Based on the three proposed productive regions, differentiated public policy is proposed (Fig. 1c): (1) West. Improvement of existing agroforestry areas, diversifying fruit tree species, and incorporating forest species. Legumes and horticulture crops should be incorporated into current maize crops to promote polyculture and to strengthen nutritional value. (2) South. Impulse of agroforestry systems and nopal cactus, interspersing planting with horticultural crops, legumes, amaranth and maize to reduce soil erosion and strengthen the amount of nutrients. (3) East. Impulse of horticulture's production and diversity, along with legumes and amaranth to improve nutritional value; ornamental production should avoid use of toxic chemicals. "Chinampa" must remain as the leading productive system, because of its ecological and cultural relevance, and the vulnerability of this region. Change detection in temporal dynamics constitutes a valuable tool for urban planning. Methodological lines contributing to the modeling of urban growth and changes in land use, can build alternatives for sustainable spatial configurations (Humacata, 2022).

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