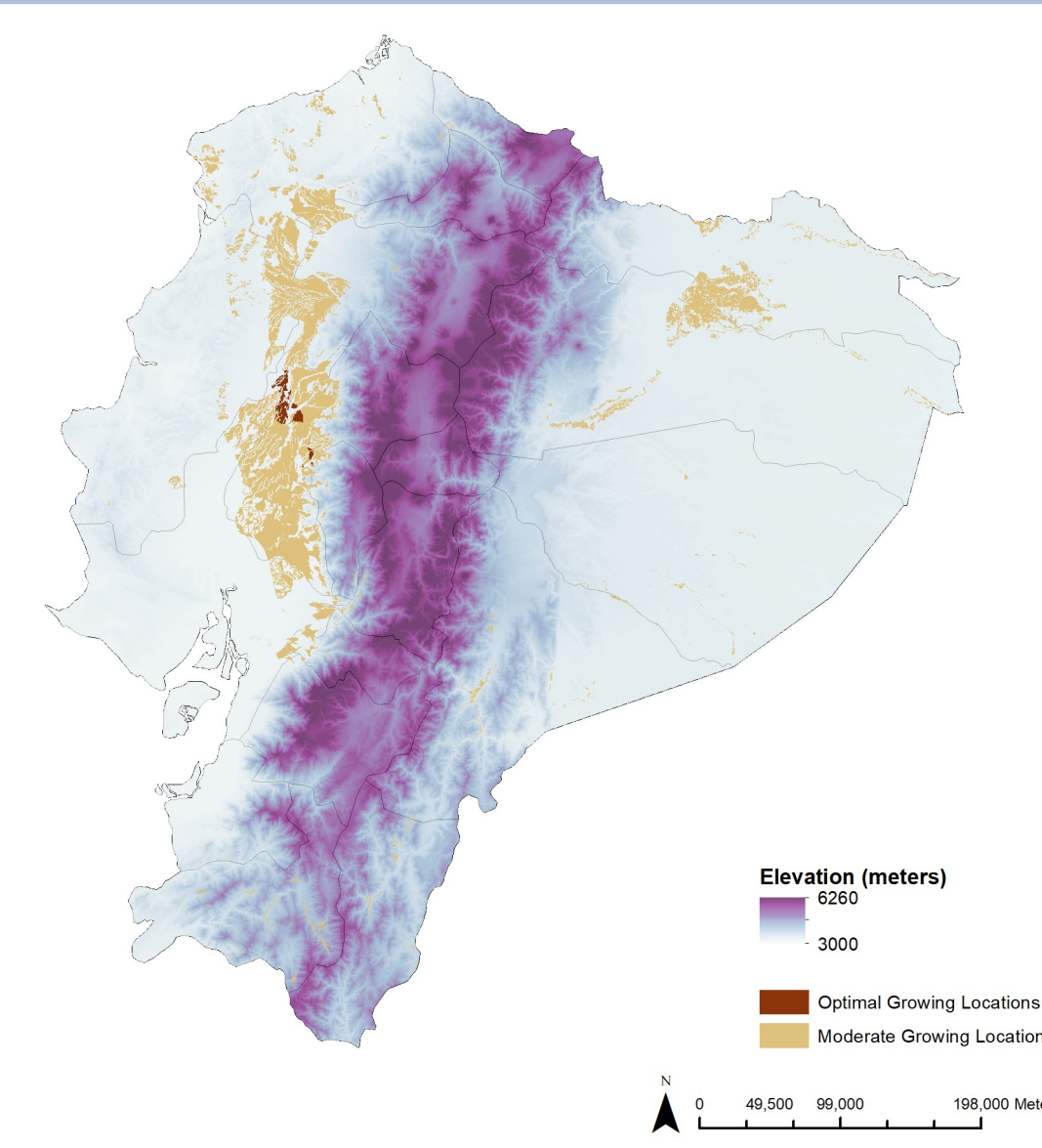


Bananas for coffee:

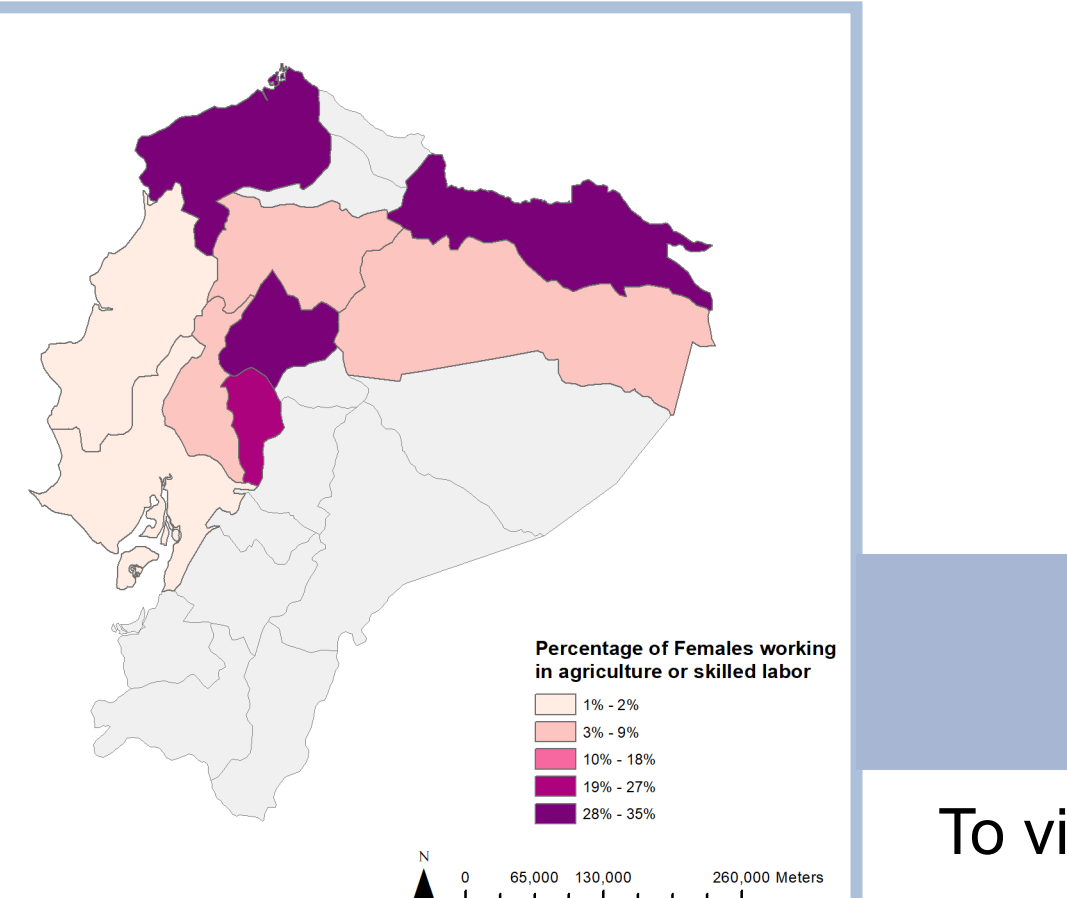
Site suitability for women-empowering coffee development projects in Ecuador

Optimal and moderate conditions for coffee growing, Ecuador 2014

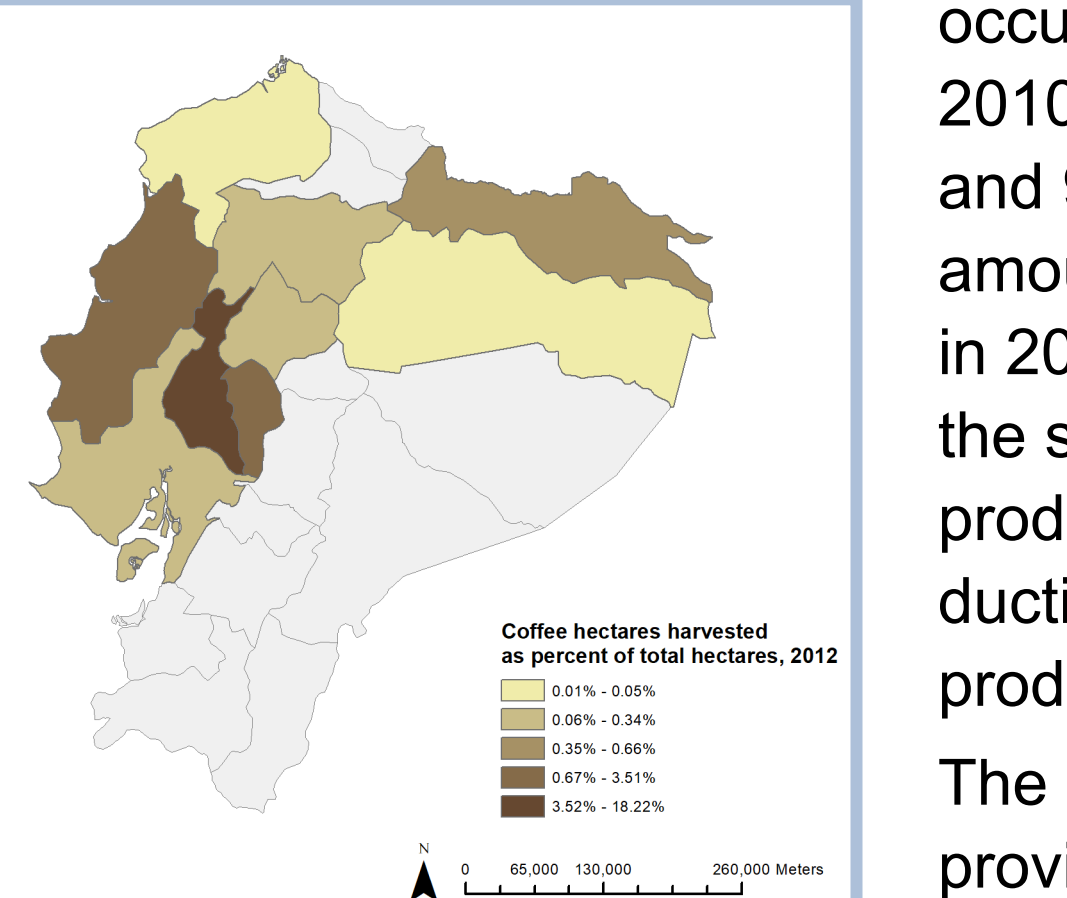


Grade	Description	Total Hectares	Percent of total
Optimal	Areas where soil, elevation and climatic factors are optimal for growing coffee.	26,838	0.3
Moderate	Areas where soil, elevation and climatic factors for growing coffee are limited, but can be managed with appropriate practices	1,181,922	11.8

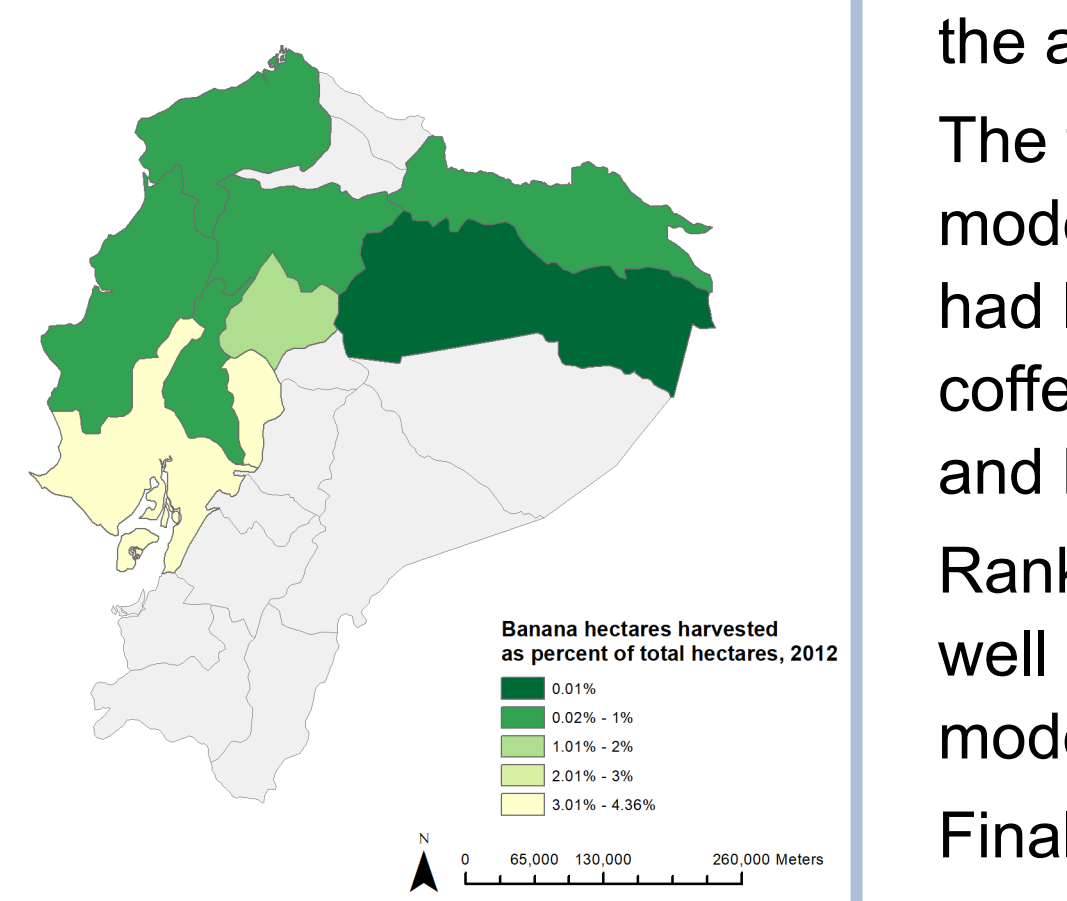
Percent of total occupations, 2012 Census



Percent of total hectares, by province

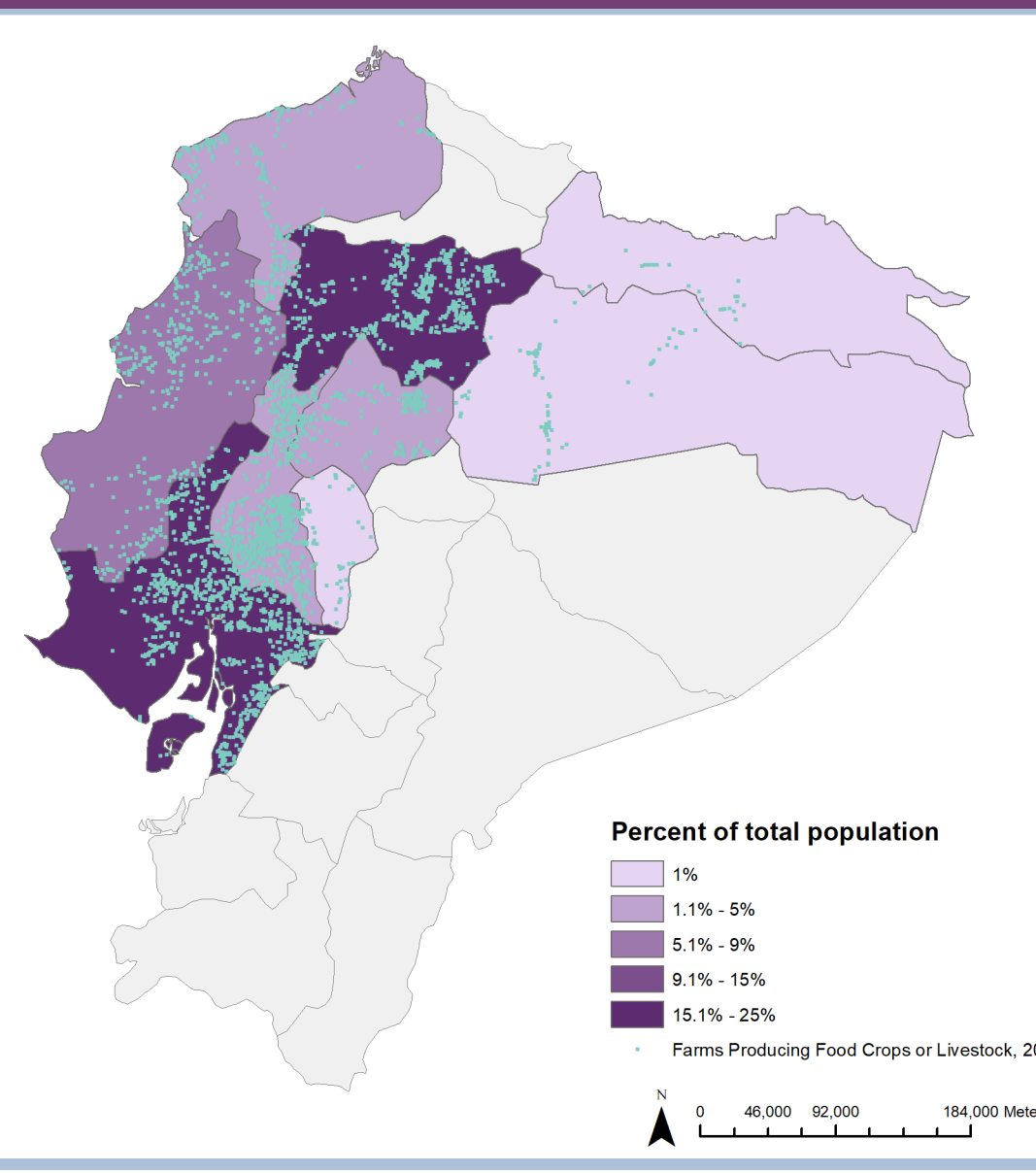


Percent of total hectares, by province



	2012		2013		2014		2015		2016	
	Export Value (USD\$)	% of total Exports	Export Value (USD\$)	% of total Exports	Export Value (USD\$)	% of total Exports	Export Value (USD\$)	% of total Exports	Export Value (USD\$)	% of total Exports
Bananas	2.77 B	11	3.05 B	11	3.22 B	12	3.27 B	17	3.12 B	17
Coffee and tea exports	216 m	0.85	210 m	0.79	179 m	0.64	154 m	0.79	163 m	0.91%

Province population as percent of total, 2012 Census estimates



Introduction

The effects of climate change threaten coffee production worldwide. Increasing temperatures and precipitation variability cause reduced growth, flowering and fruiting in addition to enhancing disease and pest pressures, and suitable land for coffee growth is decreasing across the planet.

Coffee was a top export for Ecuador from the time it was introduced in the early nineteenth century till the 1970s. It has been slowly rebuilding its status yet both domestic consumption and exports of coffee are expected to increase at a higher rate in the coming years.

The Ecuadorian government mapped the most optimal and moderately-suitable growing locations in the country in 2014, using parameters demonstrated in Table 1. The associated map illustrates the concentration of optimal and moderate-condition growing areas in nine provinces; these provinces provide the environment of this analysis.

Intercropping bananas and coffee is one strategy to combat some of the effects of climate change. Banana production provides shade in increasingly warm conditions and helps to financially diversify rural livelihoods by producing another crop for sale. Bananas remain a top export for Ecuador, as illustrated by Table 2, having greatly surpassed coffee production in export value, as well as percent of total of exports. These elements provide an opportunity for coffee development aimed at empowering women in Ecuador; highlighting provinces that have the most hectares of optimal and moderate conditions for coffee growth, lower current coffee production, high banana production and low percentage of working females in agriculture and skilled labor sector.

Methods

To visualize the most suitable provinces for women-empowered coffee development projects, several layers of data were incorporated and ranked.

Estimates of the percentage of females working in agriculture or skilled work occupations by province were generated, drawing from estimates made in the 2010 Ecuador census. The provinces were ranked 1-9, with 1 as the lowest and 9 as the highest. This indicates preference for provinces with lowest amount of females in agriculture. Hectares harvested of coffee and bananas in 2012 were calculated as percentage of total hectares by province; following the same ranking system of 1-9; the province with the lowest amount of coffee produced was ranked as 1—indicating site preference for lowest coffee production and thus biggest gap potential—while the highest amount of bananas produced was ranked as 1, preferred to encourage intercropping.

The square meters of optimal and moderate-conditions were calculated for province and ranked 1-9 where 1 was the province with the most square meters. Provinces that had no optimal locations were ranked as “10” to weight scores. Ranks were calculated by adding all rank per province and dividing by the amount of categories.

The total rank illustrates ranks for provinces across all categories, combining moderate and optimal locations. Ranks closer to 1 indicated provinces that had low percentages of females working in agriculture, low amount of 2012 coffee production, high potential for optimal and moderate condition growth and high amount of 2012 banana production.

Ranks were also calculated illustrating only moderate or optimal conditions, as well as only incorporating percentage of females in agriculture and land in moderate and optimal coffee growing conditions.

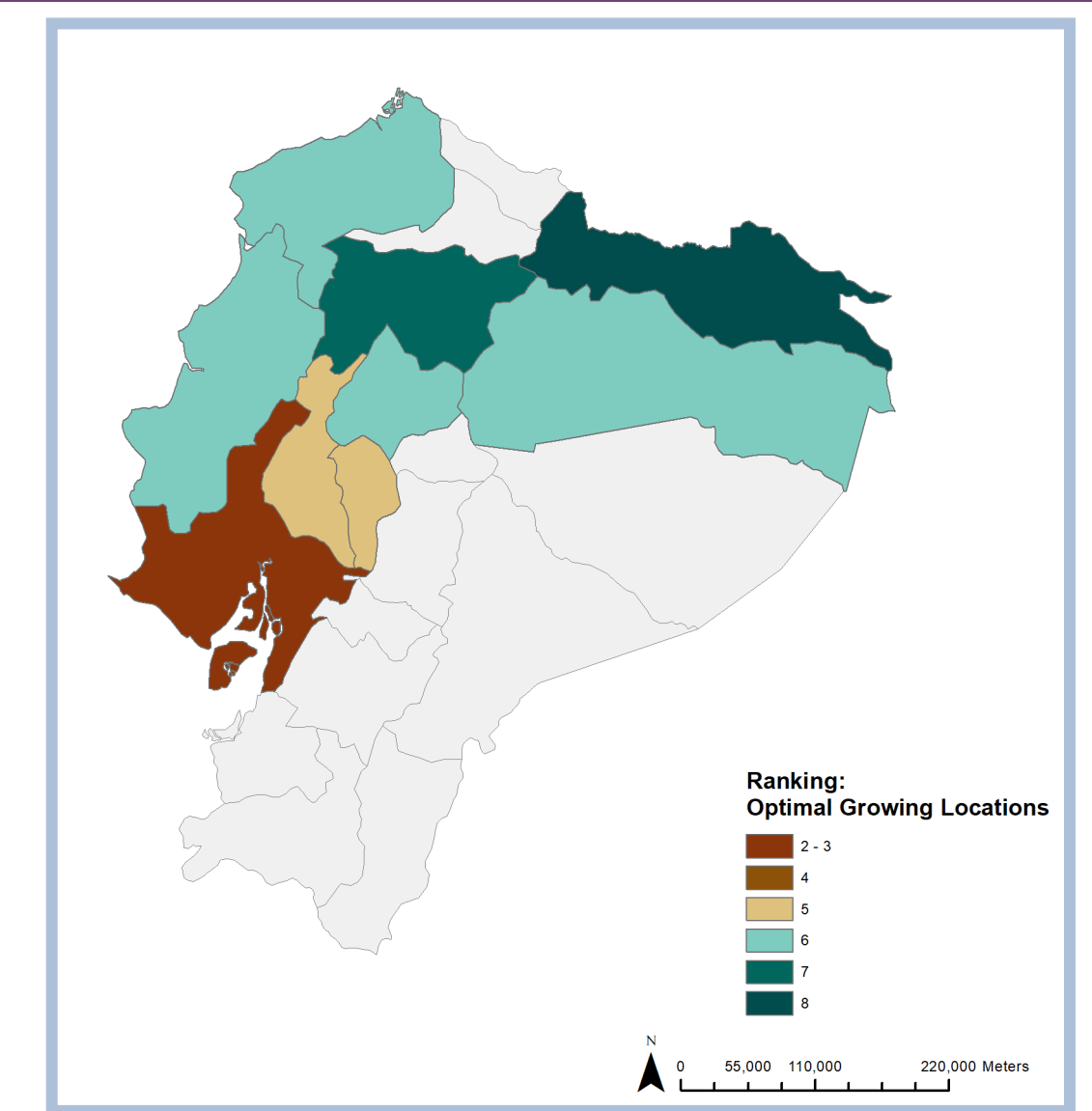
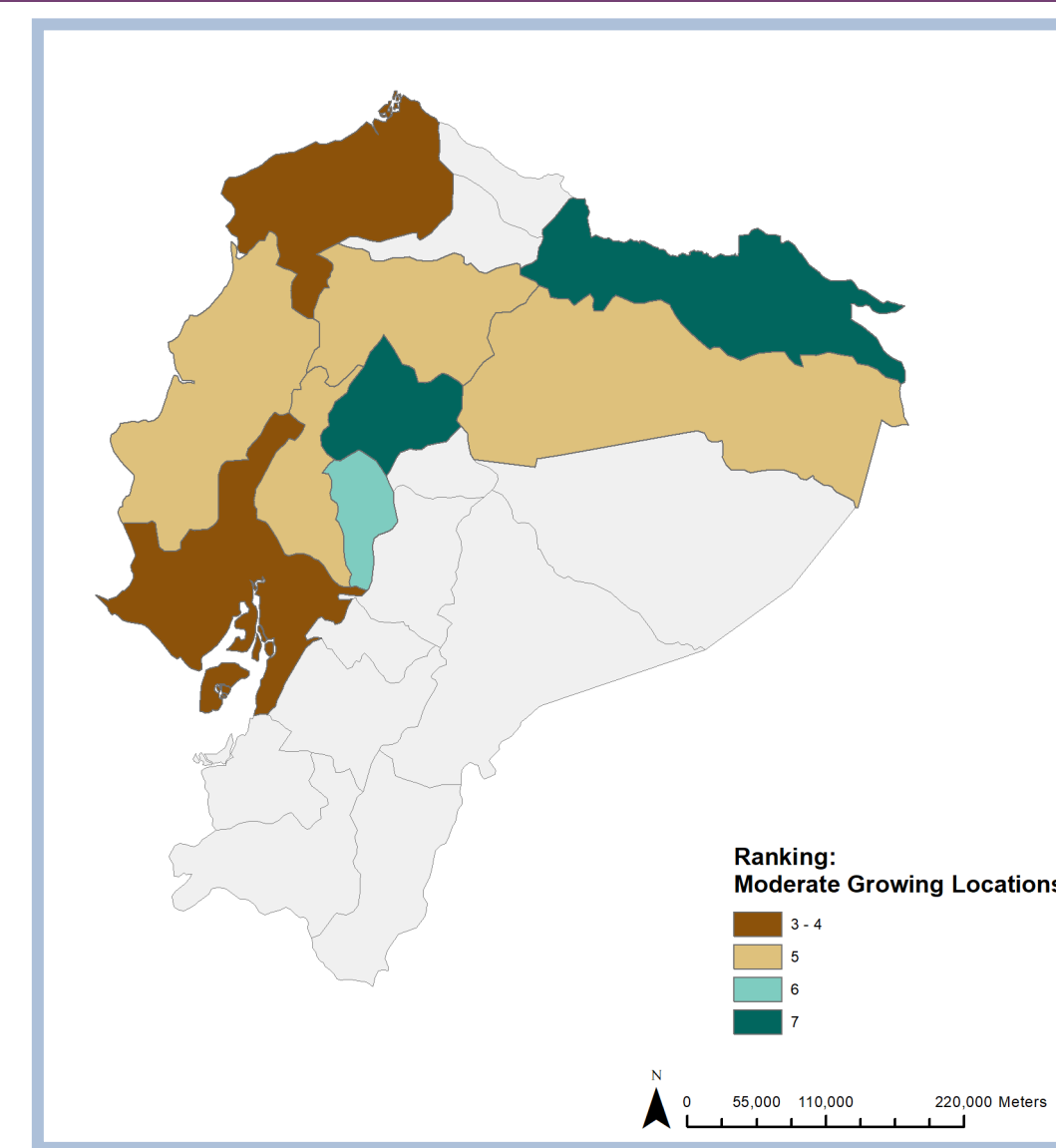
Final ranks calculated as 1 = most suitable and 9 = least suitable.

Findings and Limitations

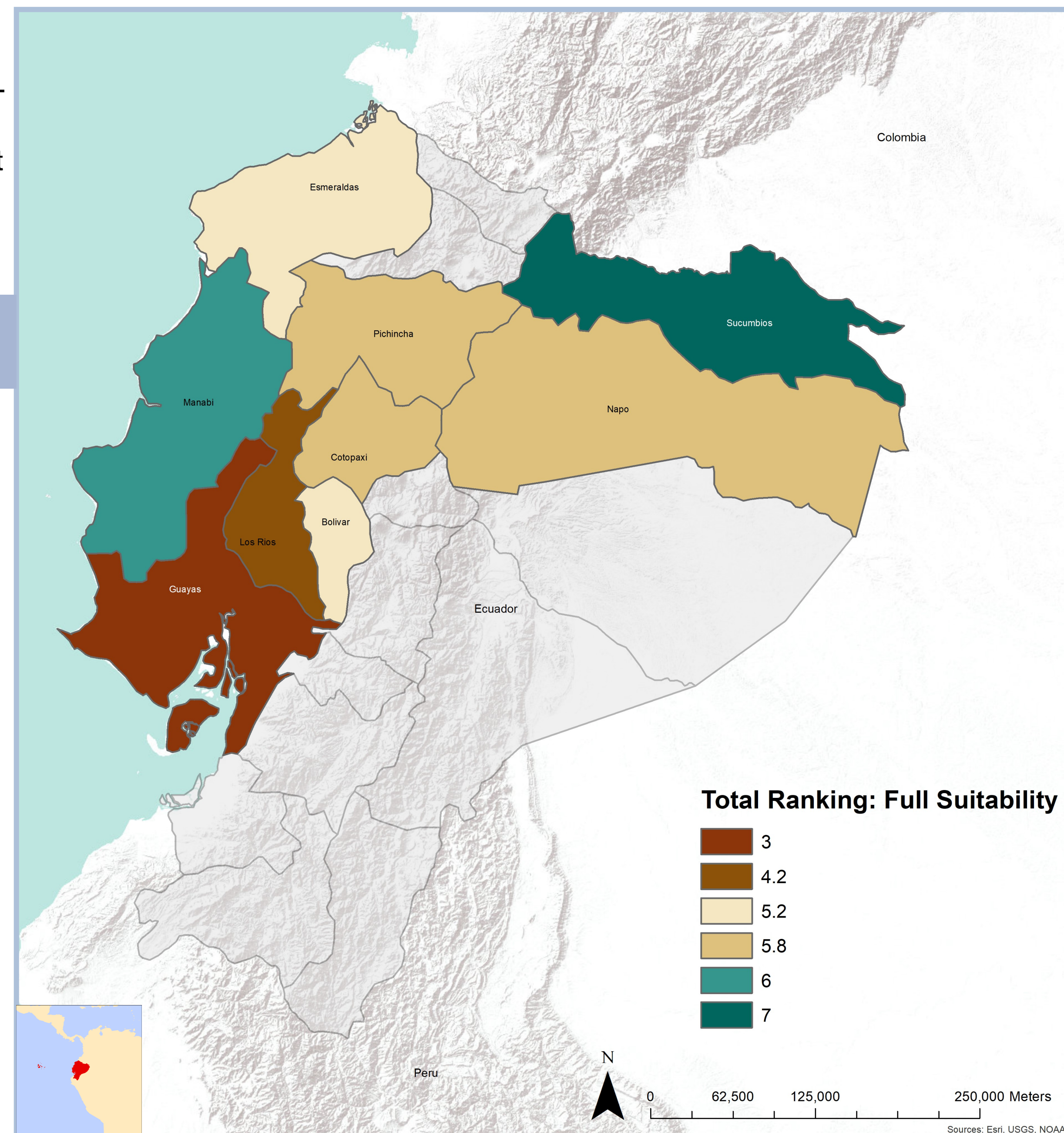
The full ranking range spanned 1-9 but no province ranked number 1, indicating some limitation to any site for “perfect” suitability. Considering all variables, Guayas is shown to be the most suitable for women-empowering coffee development projects, a location that interestingly has very minimal optimal growing locations; it does, however, have a very low percentage low women in agriculture and high banana production. This holds true when distinguishing by optimal and moderate growing locations. Considering only percentage of females in agriculture and no 2012 crop production, Los Rios is ranked at the top for both moderate and optimal.

Much of this data had to be estimated, due to limited data availability. The combination of “agriculture and skilled workers” by the Ecuadorian census means that it is unclear as to whether all of the females indicated actually work in agriculture. Also limited by data availability, the range of data spans the years 2011-2014, with 2012 population data all having been estimated from the 2010 Census.

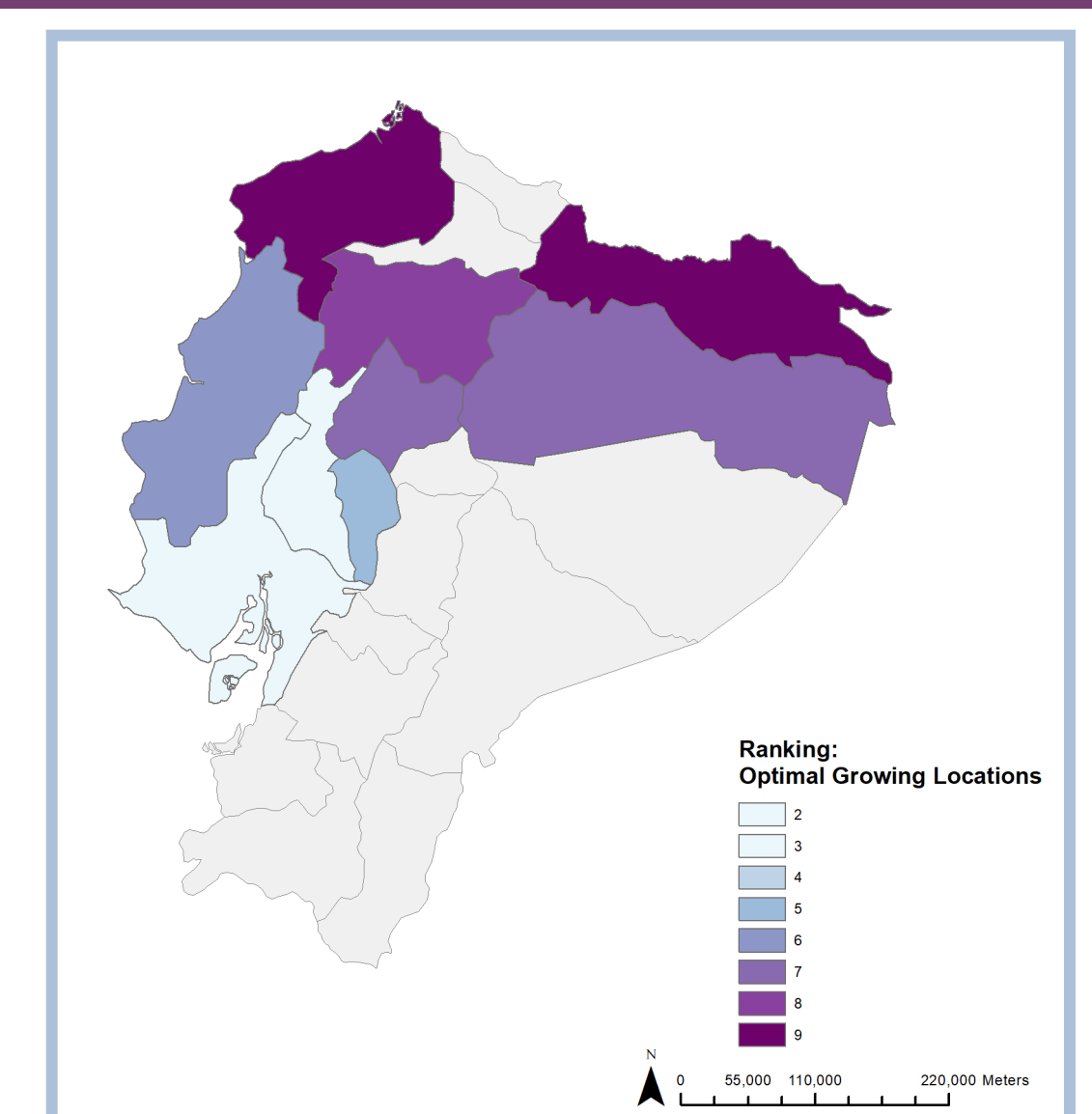
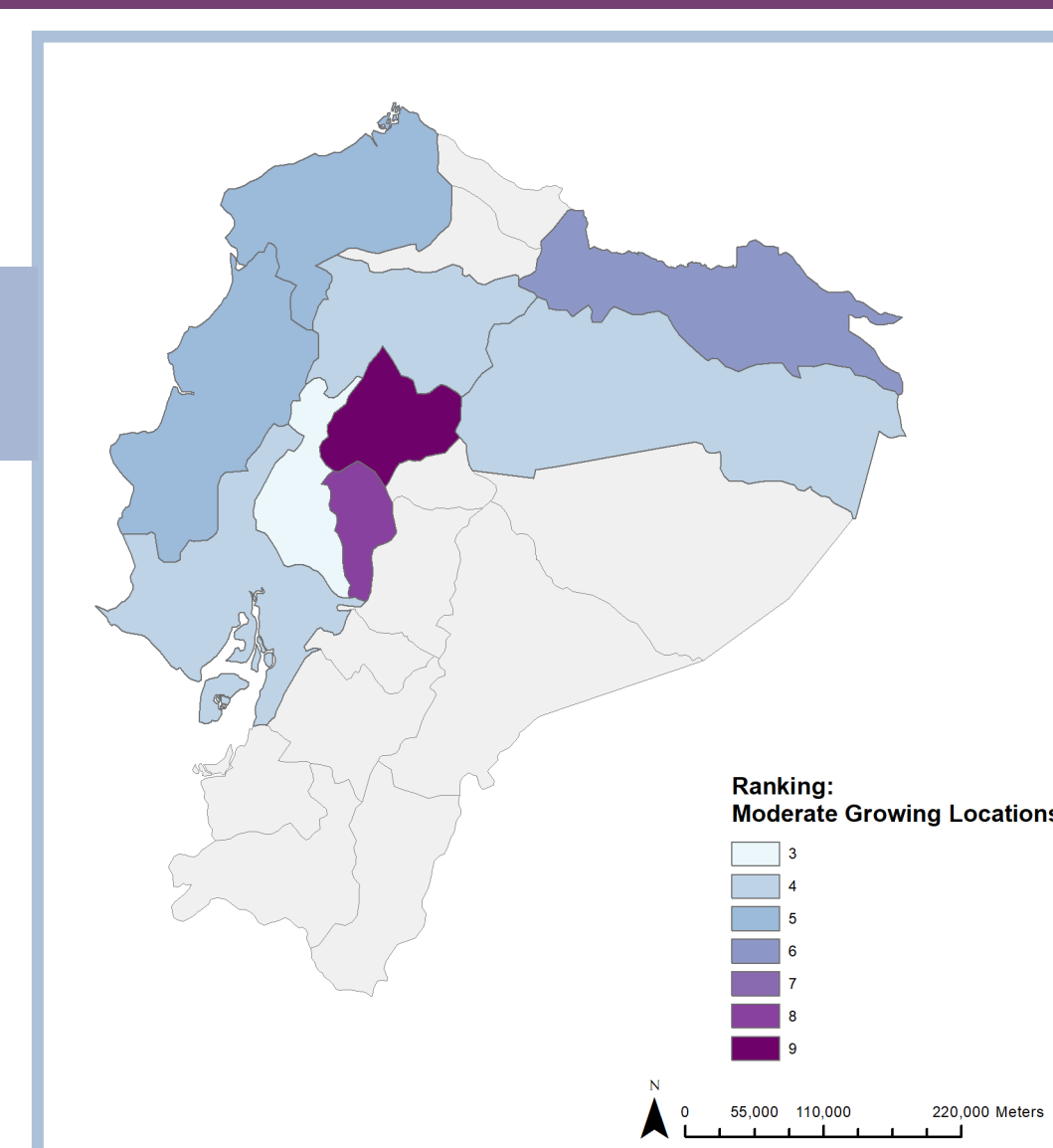
Rank by highest amount of moderate and optimal conditions for coffee growing: including 2012 coffee and banana hectare production, percentage of females in agriculture or skilled occupations



Total Rank of site suitability for women-empowering coffee development projects



Rank by highest amount of moderate and optimal conditions for coffee growing: including percentage of females in agriculture or skilled occupations



Data Sources: Ecuador's Instituto Nacional de Estadística y Censos (2010). Dirección de Investigación y Generación de Datos Multisectoriales (2014). Sistema Nacional de Información (2012). Instituto Geográfico Militar (2011). Observatory of Economic Complexity and Tufts M: Drive

References: History of Coffee in Ecuador. Equal Exchange Available at: <https://equalexchange.coop/history-of-coffee-in-ecuador>. (Accessed: 20th November 2018); FAS Quito Staff. Ecuadorian Coffee Sector Continues to Bounce Back. (2018).; Ovalle-Rivera, O., Läderach, P., Bunn, C., Obersteiner, M. & Schroth, G. Projected shifts in Coffee arabica suitability among major global producing regions due to climate change. PLoS One 10, 1–13 (2015).; Bunn, C., Läderach, P., Ovalle Rivera, O. & Kirschke, D. A bitter cup: climate change profile of global production of Arabica and Robusta coffee. Clim. Change 129, 89–101 (2015).; Ecuador Crops - Flags, Maps, Economy, History, Climate, Natural Resources, Current Issues, International Agreements, Population, Social Statistics, Political System.; Cerda, R. et al. Effects of shade, altitude and management on multiple ecosystem services in coffee agroecosystems. Eur. J. Agron. 82, 308–319 (2017).; López-Bravo, D. F., Virginio-Filho, E. de M. & Avelino, J. Shade is conducive to coffee rust as compared to full sun exposure under standardized fruit load conditions. Crop Prot. 38, 21–29 (2012).; van Asten, Piet; Ochola, Dennis; Wairegi, Lydia; Nibasumba, Anacleto; Jassogne, L. & Mukasa, D. Coffee-Banana Intercropping: Implementation guidance for policymakers and investors. Practice Brief | Climate-Smart Agriculture doi:10.1080/21513732.2015.1050607

Cartographer: Rebecca Lucas
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Projection:
WGS 1984 UTM Zone 17S

