Historical Perspectives on Food, Health, and Prosperity

Nathan Nunn
Professor of Economics
Harvard University

May 31, 2012

Importance of Food and Nutrition

- Contemporary importance is clear, particularly for developing countries.
- However, historically food has played a very important role in shaping the evolution of societies.
- And, these historical impacts continue to matter today.

The Historical Impacts of Food

1. **Columbian Exchange**: involved the transfer of food crops between the New and Old Worlds.
   - **Potatoes** brought to the Old World.
     - Increased health and prosperity.
   - **Sugar** plantations established in the New World.
     - Led to underdevelopment in the Americas, but increased welfare in Europe.
2. **Traditional Agricultural Technology**: shaped by the crops a society was endowed with.
   - Some crops were particularly well suited for intensive **plough agriculture**, rather than shifting hoe agriculture.
   - Plough agriculture significantly decreased female participation in work outside the home.
   - And this in turn, affected the evolution of beliefs about the **unequal roles of men and women** in societies.


Columbian Exchange
AMERICAS TO EUROPE, AFRICA, AND ASIA
EUROPE, AFRICA, AND ASIA TO AMERICAS
ATLANTIC OCEAN
Tomato
Corn
Beans
Vanilla
Potato
Peanut
Cassava
Peppers
Avocado
Sweet Potato
Cacao Bean
Quinine
Pineapple
Squash
Tobacco
Turkey
Pumpkin
Turnip
Grape
Onion
Sugar Cane
Banana
Olive
Peach, Pear
Coffee Bean
Citrus Fruits
Honeybee
Grains
• Wheat
• Rice
• Barley
• Oats
Livestock
• Cattle
• Sheep
• Pig
• Horse
Diseases
• Smallpox
• Influenza
• Typhus
• Measles
• Malaria
• Diptheria
• Whooping Cough

The World's Most Popular Foods in 2000

Average Daily Consumption (calories)		*Annual Production (millions of tonnes)*		*Land Harvested (millions of hectares)*	
Rice	567	*Sugar cane*	*1,252.5*	Wheat	215.5
Wheat	527	Rice	598.8	Rice	154.1
Sugar	*196*	**Maize**	**592.5**	**Maize**	**137.0**
Maize	**147**	Wheat	585.9	*Soybeans*	*74.4*
Potatoes	**60**	**Potatoes**	**328.7**	*Barley*	*54.5*
Cassava	**42**	Sugar beet	247.1	*Sorghum*	*41.0*
Sorghum	*32*	**Cassava**	**176.5**	*Millet*	*37.1*
Sweet Potatoes	**29**	*Soybeans*	*161.3*	Rapeseed	25.8
Millet	*29*	**Sweet potatoes**	**138.7**	**Sunflower seed**	**21.1**
Soybeans	*17*	*Barley*	*133.1*	**Potatoes**	**20.1**
Bananas	*14*	Oil palm fruit	120.4	*Sugar cane*	*19.5*
Coconuts	12	**Tomatoes**	**108.9**	**Cassava**	**17.0**
Apples	9	Watermelons	76.5	Oats	12.7
Tomatoes	**8**	*Bananas*	*64.9*	*Coffee, green*	*10.8*
Oranges	*8*	Grapes	64.8	Coconuts	10.6
Rye	7	*Oranges*	*63.8*	Chick peas	10.1
Yams	7	Apples	59.1	Oil palm fruit	10.0
Onions	7	*Sorghum*	*55.8*	Rye	9.8
Plantains	*7*	Coconuts	52.9	**Sweet potatoes**	**9.7**
Barley	*7*	Onions, dry	49.8	Olives	8.3
Other Notable New World Foods:					
Cacao Beans	**3**	**Eggplants**	**27.2**	**Cacao beans**	**7.6**
Pineapples	**2**	**Sunflower seed**	**26.5**	**Natural rubber**	**7.6**
		Chillies/peppers, green	**20.9**	**Tobacco**	**4.2**
		Pineapples	**15.1**	**Tomatoes**	**4.0**

Top Consuming Countries for Various New World Foods

(average calories per capita per day)

Maize		*Cassava*		*Sweet Potatoes*	
Country	*Consumption*	*Country*	*Consumption*	*Country*	*Consumption*
Lesotho	**1,508**	**Congo, Dem. Rep.**	**925**	**Solomon Islands**	**457**
Malawi	**1,151**	**Congo**	**688**	**Rwanda**	**330**
Mexico	1,093	**Angola**	**668**	**Burundi**	**293**
Zambia	**1,058**	**Mozambique**	**650**	**Uganda**	**228**
South Africa	**924**	**Ghana**	**639**	**China**	**106**
Zimbabwe	**903**	**Benin**	**470**	**Timor-Leste**	**64**
Guatemala	835	**Liberia**	**451**	**Madagascar**	**59**
Timor-Leste	**808**	**Togo**	**393**	Cuba	57
El Salvador	772	**Madagascar**	**382**	**Tanzania**	**57**
Kenya	**766**	**Central African Rep.**	**374**	Haiti	45

Potatoes		*Tomatoes*		*Pineapples*	
Country	*Consumption*	*Country*	*Consumption*	*Country*	*Consumption*
Belarus	**320**	**Greece**	**68**	Costa Rica	84
Latvia	**258**	**Libya**	**47**	**Thailand**	**26**
Estonia	**255**	**United Arab Emirates**	**45**	**Kenya**	**20**
Lithuania	**248**	**Egypt**	**44**	**Philippines**	**14**
Ukraine	**248**	**Turkey**	**42**	**Samoa**	**11**
Poland	**242**	**Italy**	**38**	**Venezuela**	**10**
Portugal	**221**	**Lebanon**	**33**	Antigua and Barbuda	8
United Kingdom	**221**	**Tunisia**	**32**	**Australia**	**8**
Russian Federation	**217**	**Israel**	**29**	**Malaysia**	**8**
Ireland	**209**	Cuba	26	**Swaziland**	**8**

Largest Producers of New and Old World Foods

(millions of tonnes unless otherwise indicated)

Panel A: Ten Largest Producers of New World Foods

Potatoes		*Chili Peppers, Dry*		*Chili Peppers, Green*	
Country	*Production*	*Country*	*Production*	*Country*	*Production*
China	**66.32**	**India**	**0.98**	**China**	**9.44**
Russia	**33.98**	**China**	**0.21**	Mexico	1.73
India	**24.71**	**Pakistan**	**0.17**	**Turkey**	**1.48**
Poland	**24.23**	**Bangladesh**	**0.14**	**Spain**	**0.95**
United States	23.30	**Ethiopia**	**0.12**	United States	0.91
Ukraine	**19.84**	**Viet Nam**	**0.08**	**Indonesia**	**0.73**
Germany	**13.69**	Peru	0.06	**Nigeria**	**0.72**
Belarus	**8.72**	Mexico	0.06	**Egypt**	**0.43**
Netherlands	**8.23**	**Myanmar**	**0.05**	**South Korea**	**0.39**
UK	**6.64**	**Nigeria**	**0.05**	**Italy**	**0.36**

Tomatoes		*Cacao Beans*		*Tobacco*	
Country	*Production*	*Country*	*Production*	*Country*	*Production*
China	**22.32**	**Côte d'Ivoire**	**1.40**	**China**	**2.56**
United States	11.56	**Ghana**	**0.44**	**Brazil**	**0.58**
Turkey	**8.89**	**Indonesia**	**0.42**	**India**	**0.52**
Italy	**7.54**	**Nigeria**	**0.34**	United States	0.48
India	**7.43**	Brazil	0.20	**Zimbabwe**	**0.23**
Egypt	**6.79**	**Cameroon**	**0.12**	**Turkey**	**0.20**
Spain	**3.77**	Ecuador	0.10	**Indonesia**	**0.15**
Iran	**3.19**	**Malaysia**	**0.07**	**Greece**	**0.14**
Brazil	2.98	**Papua New Guinea**	**0.05**	**Italy**	**0.13**
Mexico	2.67	Colombia	0.04	Argentina	0.11

Panel B: Ten Largest Producers of Old World Foods

Sugar Cane		*Coffee (Green)*		*Soybeans*	
Country	*Production*	*Country*	*Production*	*Country*	*Production*
Brazil	**327.70**	**Brazil**	**1.90**	**United States**	**75.06**
India	299.23	Viet Nam	0.80	**Brazil**	**32.73**
China	69.30	**Colombia**	**0.64**	**Argentina**	**20.14**
Thailand	54.05	Indonesia	0.55	China	15.41
Pakistan	46.33	Côte d'Ivoire	0.38	India	5.28
Mexico	**44.10**	**Mexico**	**0.34**	**Paraguay**	**2.98**
Australia	38.16	**Guatemala**	**0.31**	**Canada**	**2.70**
Cuba	**36.40**	India	0.29	**Bolivia**	**1.20**
Colombia	**33.40**	Ethiopia	0.23	Indonesia	1.02
United States	**32.76**	**Honduras**	**0.19**	Italy	0.90

Oranges		*Bananas*	
Country	*Production*	*Country*	*Production*
Brazil	**21.33**	India	14.14
United States	**11.79**	**Ecuador**	**6.48**
Mexico	**3.81**	**Brazil**	**5.66**
India	2.67	China	5.14
Spain	2.62	Philippines	4.93
Italy	1.88	Indonesia	3.75
Iran	1.84	**Costa Rica**	**2.18**
Egypt	1.61	**Mexico**	**1.86**
Pakistan	1.33	Thailand	1.75
China	1.18	**Colombia**	**1.61**

Native Andean Potato Breeds

Is there Something Special about the Potato?

- In the *Wealth of Nations*, Adam Smith wrote:
  - "the food produced by a field of potatoes is. . . much superior to what is produced by a field of wheat. . . No food can afford a more decisive proof of its nourishing quality, or of its being peculiarly suitable to the health of the human constitution."
- And historians have even asserted that:
  - "Potatoes, by feeding rapidly growing populations, permitted a handful of European nations to assert domination over most of the world between 1750 and 1950. . . It is certain that without potatoes, Germany could not have become the leading industrial and military power of Europe after 1848, and no less certain that Russia could not have loomed so threateningly on Germany's eastern border after 1891." (McNeill, 1999)

TABLE I

AVERAGE CROP YIELDS OF ENGLISH FARMS IN THE EIGHTEENTH CENTURY

	Average yield per acre		Energy value of crop	Acres of land needed to provide 42 megajoules per day for one year
	Bushels	Kilograms	Megajoules	
Wheat	23	650	8,900	1.70
Barley	32	820	11,400	1.40
Oats	38	690	9,300	1.60
Potatoes	427	10,900	31,900	0.50

Notes. Data are from eighteenth-century England, recorded in Young's (1771, p. 20) *The Farmer's Tour through the East of England*, Volume 4; reproduced in Davidson et al. (1975).

Quantifying the Impacts of the Potato on Health and Prosperity

- But did the diffusion of the potato really have large impacts in the Old World?
- In Nunn and Qian (QJE, 2011) we attempt to empirically quantify the impact of the potato on Old World population, city growth, and adult heights.

The FAO Data

- Data on the suitability for potato cultivation are taken from the *Global Agro-Ecological Zones* (GAEZ) 2002 database.
  - Provides information on suitability for growing different crops across 50km $\times$ 50km grid cells.
  - Constructed by combining information on crop-specific growing constraints with detailed grid-cell level GIS data on the temperature, rainfall, sunlight, and soil.
- We define land that can obtain at least 40% of the maximum yield as being suitable for potato cultivation.

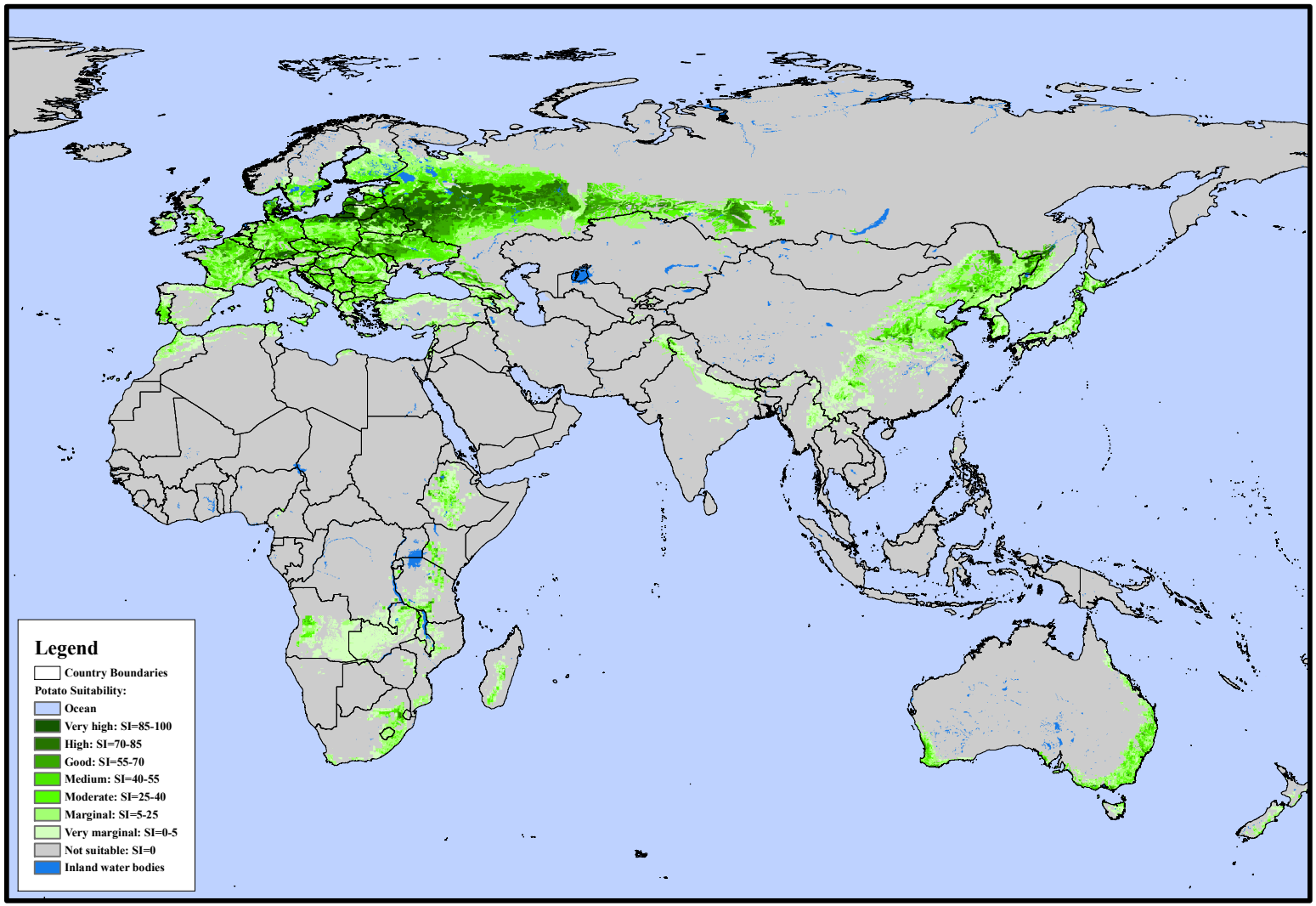
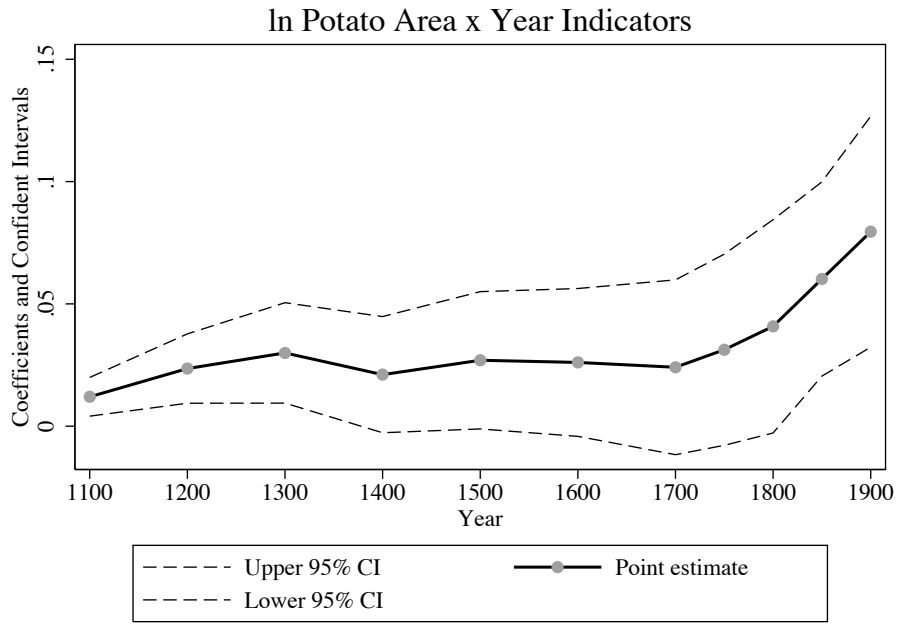


Figure II: Average potato suitability in the Old World.

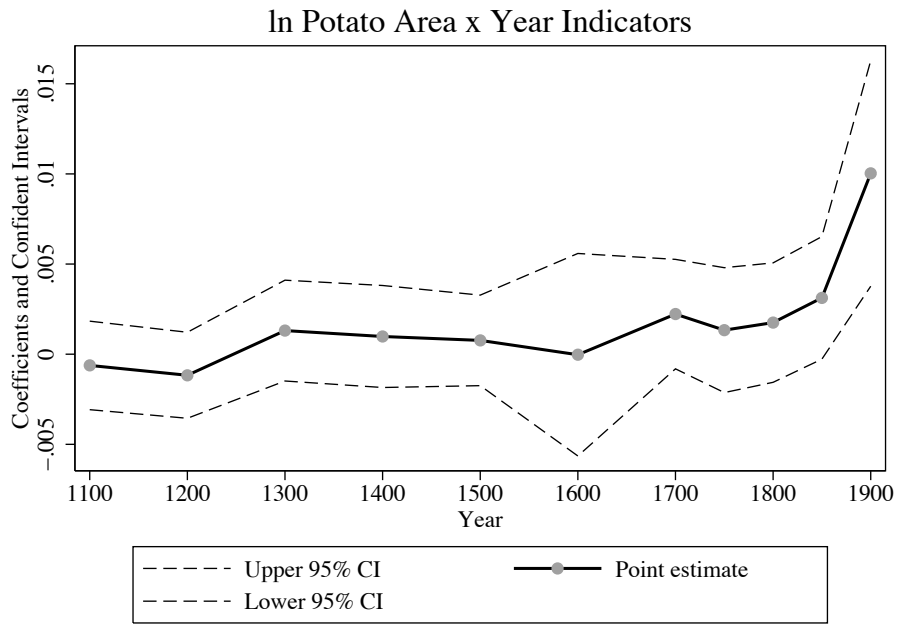
Flexible Estimating Equation

$$y_{it} = \sum_{j=1100}^{1900} \beta_j \ln Potato\ \ Area_i \cdot I_t^j + \sum_{j=1100}^{1900} \mathbf{X'}_i \mathbf{I}_t^j \Phi_j + \sum_c \gamma_c I_i^c + \sum_{j=1100}^{1900} \rho_j I_t^j + \varepsilon_{it}$$

- $\ln Potato\ Area_i$ is the log of land area suitable for the cultivation of the potatoes.
- $\sum \mathbf{X'}_i \mathbf{I}_t^j$ is a vector of controls interacted with time-period FEs.
- I_i^c are country fixed effects
- I_t^j are time period fixed effects: 1000, 1100, 1200, 1300, 1400 1500, 1600, 1700 1750, 1800, 1850, 1900



(a) ln Total Population



(b) City Population Share

Difference-in-Difference Estimating Equation

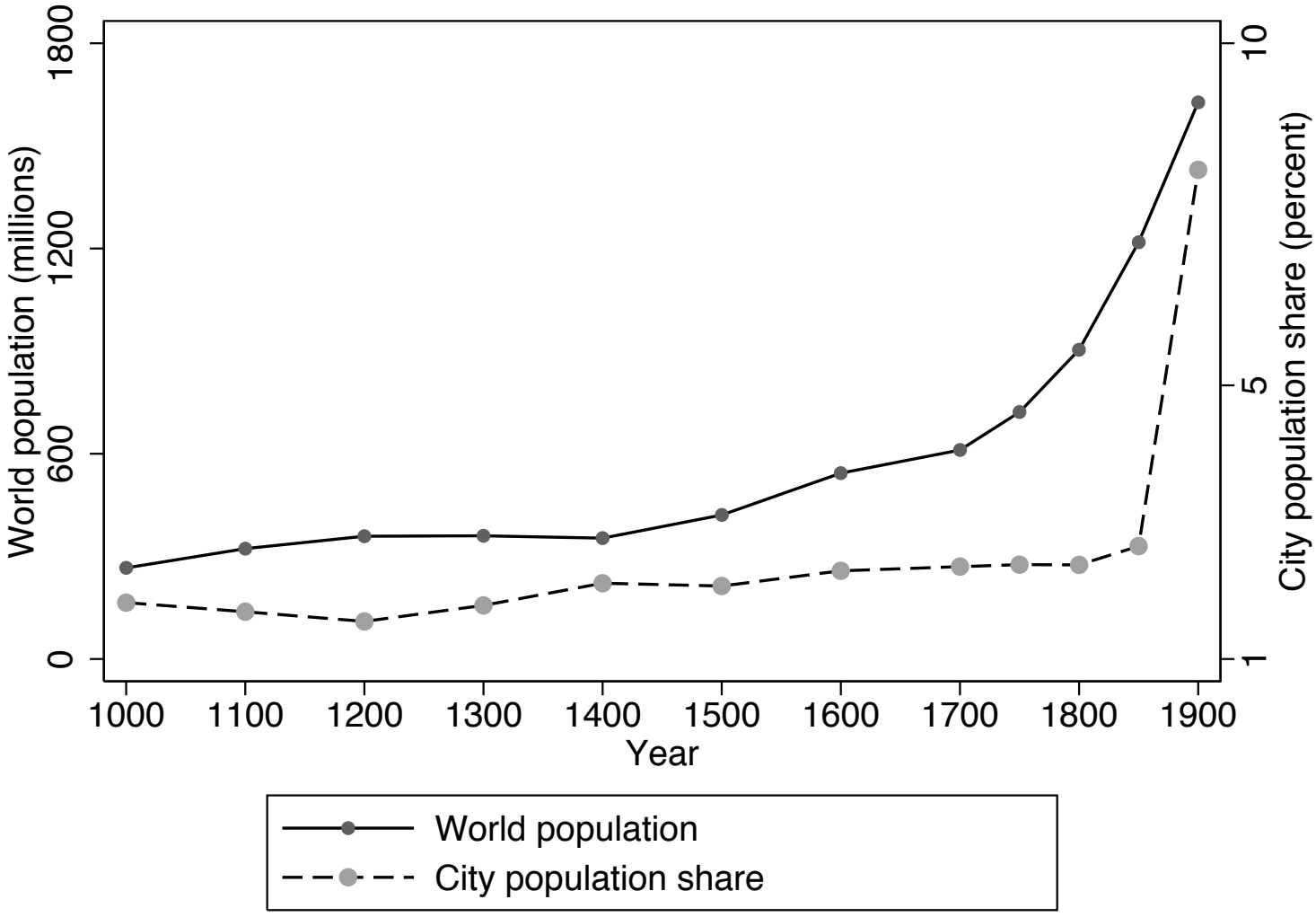
$$y_{it} = \beta \ln Potato\,Area_i \cdot I_t^{Post} + \sum_{j=1100}^{1900} \mathbf{X'}_i \mathbf{I}_t^j \Phi_j + \sum_c \gamma_c I_i^c + \sum_{j=1100}^{1900} \rho_j I_t^j + \varepsilon_{it}$$

- $lnPotato\,Area_i$: the natural log of land suitable for potato cultivation.
- I_t^{Post}: an indicator variable for the post-1700 time periods.
- $\sum \mathbf{X'}_i \mathbf{I}_t^j$: a vector of controls interacted with time-period FEs.
- I_i^c: country fixed effects
- I_t^j: time period fixed effects

TABLE IV
THE IMPACT OF THE POTATO: BASELINE ESTIMATES

	Dependent Variable									
	ln total population					City population share				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ln *Potato Area* × Post	0.059	0.044	0.032	0.034	0.043	0.0044	0.0046	0.0036	0.0039	0.0039
	(0.009)	(0.011)	(0.012)	(0.011)	(0.014)	(0.0009)	(0.0009)	(0.0012)	(0.0011)	(0.0011)
Baseline Controls (× Year fixed effects):										
ln *Old World Crops Area*	N	Y	Y	N	Y	N	Y	Y	N	Y
ln *Elevation*	N	N	Y	Y	Y	N	N	Y	Y	Y
ln *Ruggedness*	N	N	Y	Y	Y	N	N	Y	Y	Y
ln *Tropical Area*	N	N	Y	Y	Y	N	N	Y	Y	Y
Other Controls (× Year fixed effects):										
ln *All Crops Area*	N	N	N	Y	N	N	N	N	Y	N
ln *Maize Area*	N	N	N	N	Y	N	N	N	N	Y
ln *Silage Maize Area*	N	N	N	N	Y	N	N	N	N	Y
ln *Sweet Potatoes Area*	N	N	N	N	Y	N	N	N	N	Y
ln *Cassava Area*	N	N	N	N	Y	N	N	N	N	Y
Observations	1552	1552	1552	1552	1552	1552	1552	1552	1552	1552
R-squared	0.99	0.99	0.99	0.99	0.99	0.38	0.39	0.44	0.44	0.48

Notes. Observations are at the country-year level. All regressions use a baseline sample of 130 Old World countries. Countries in North and South America are excluded. The periods are 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1850, and 1900. The dependent variable is either the natural log of the total population of the country measured in persons (ln total population), or the share of the population living in cities with forty thousand inhabitants or more (City population share). ln *Potato Area* is the natural log of land that is defined as suitable for the cultivation of potatoes. The Post indicator variable equals zero for the periods 1000–1700 and one for the periods 1750–1900. All regressions include year fixed effects and country fixed effects. Each control variable listed is interacted with a full set of time-period fixed effects. Full details of each control variable are provided in the text and Data Appendix. The inclusion of a control variable interacted with the full set of time-period fixed effects is indicated by a Y; N indicates that the control is not included in the specification. Coefficients are reported with standard errors, clustered at the country level, in parentheses.

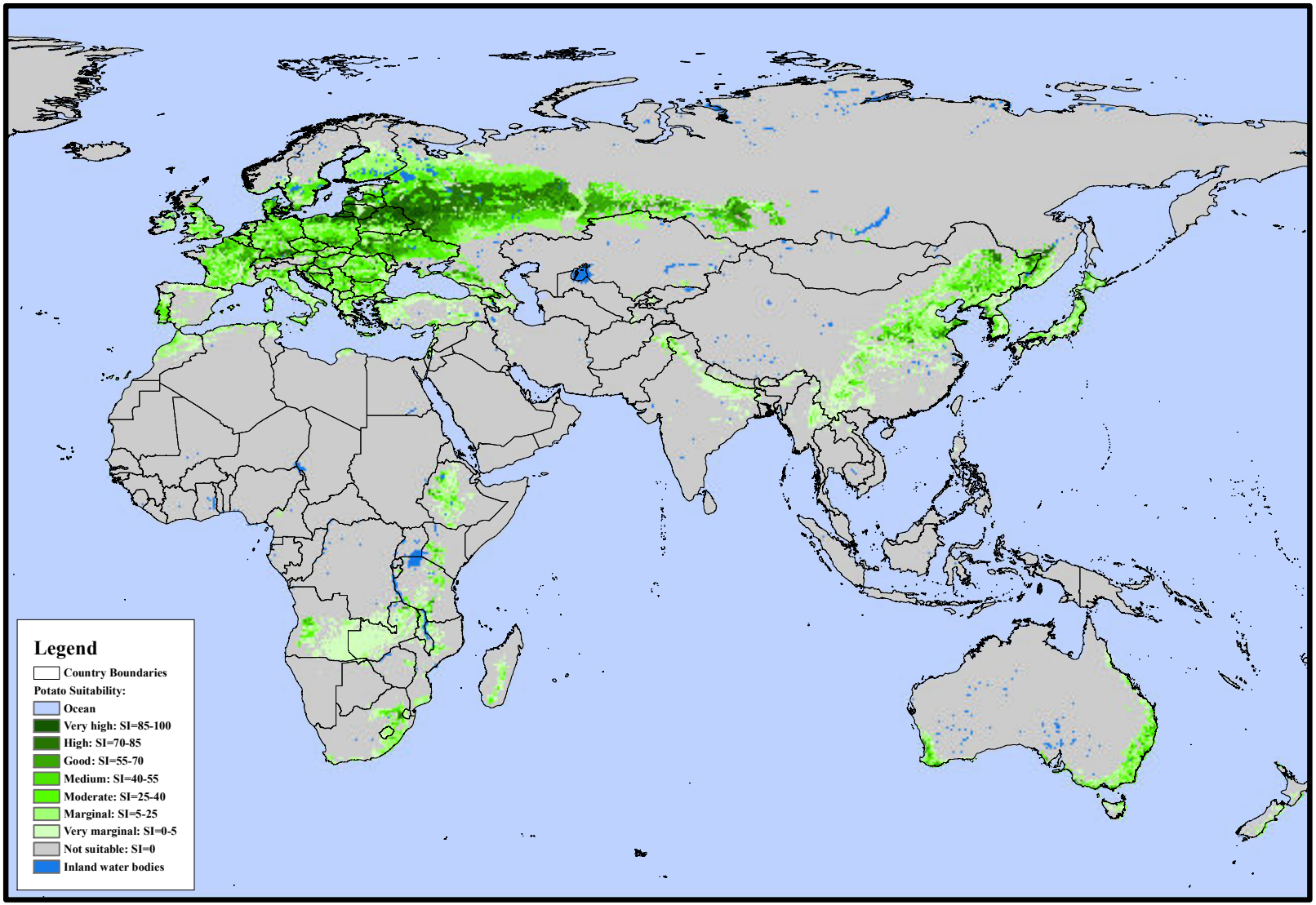


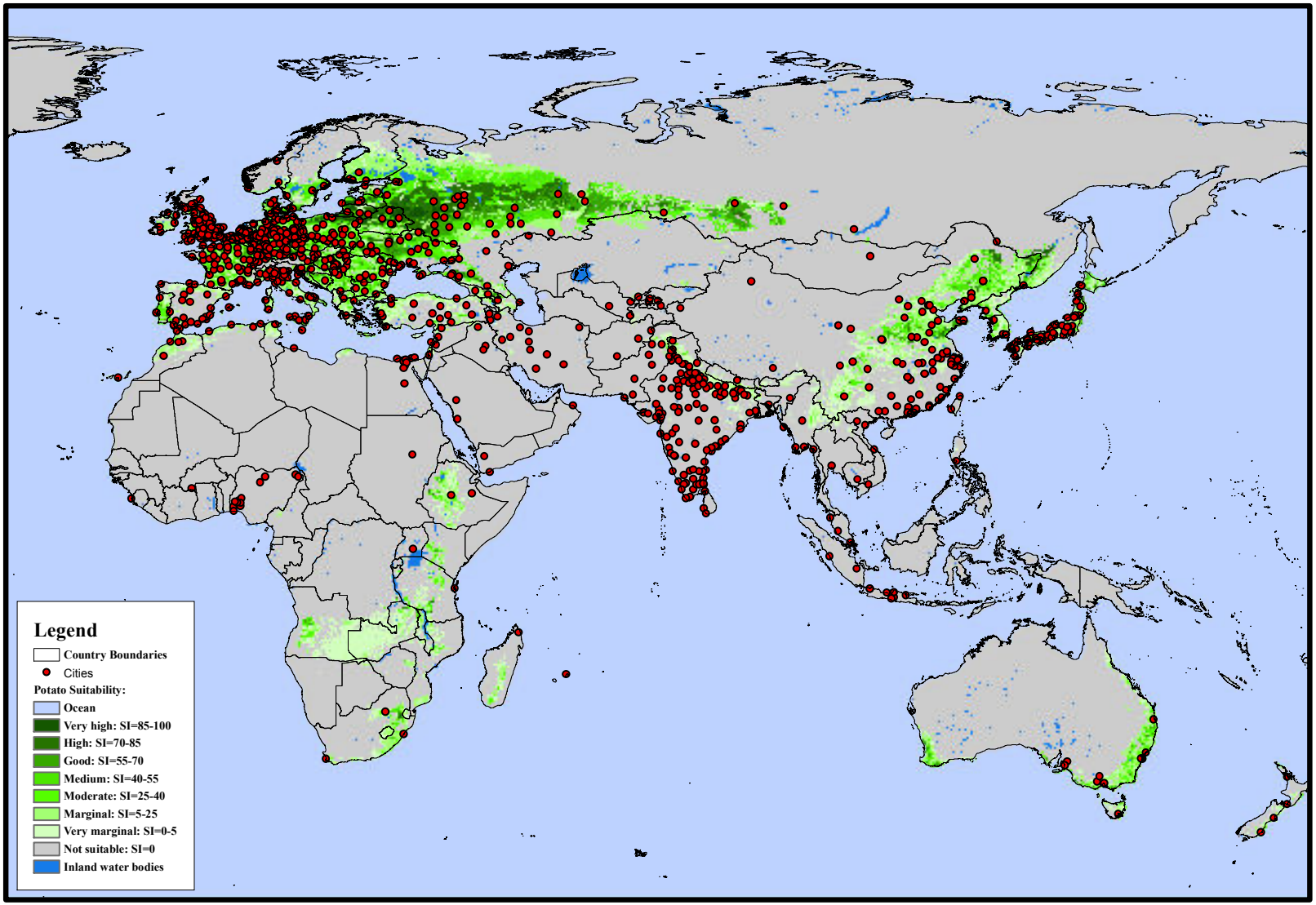
Sources: See Data Appendix.

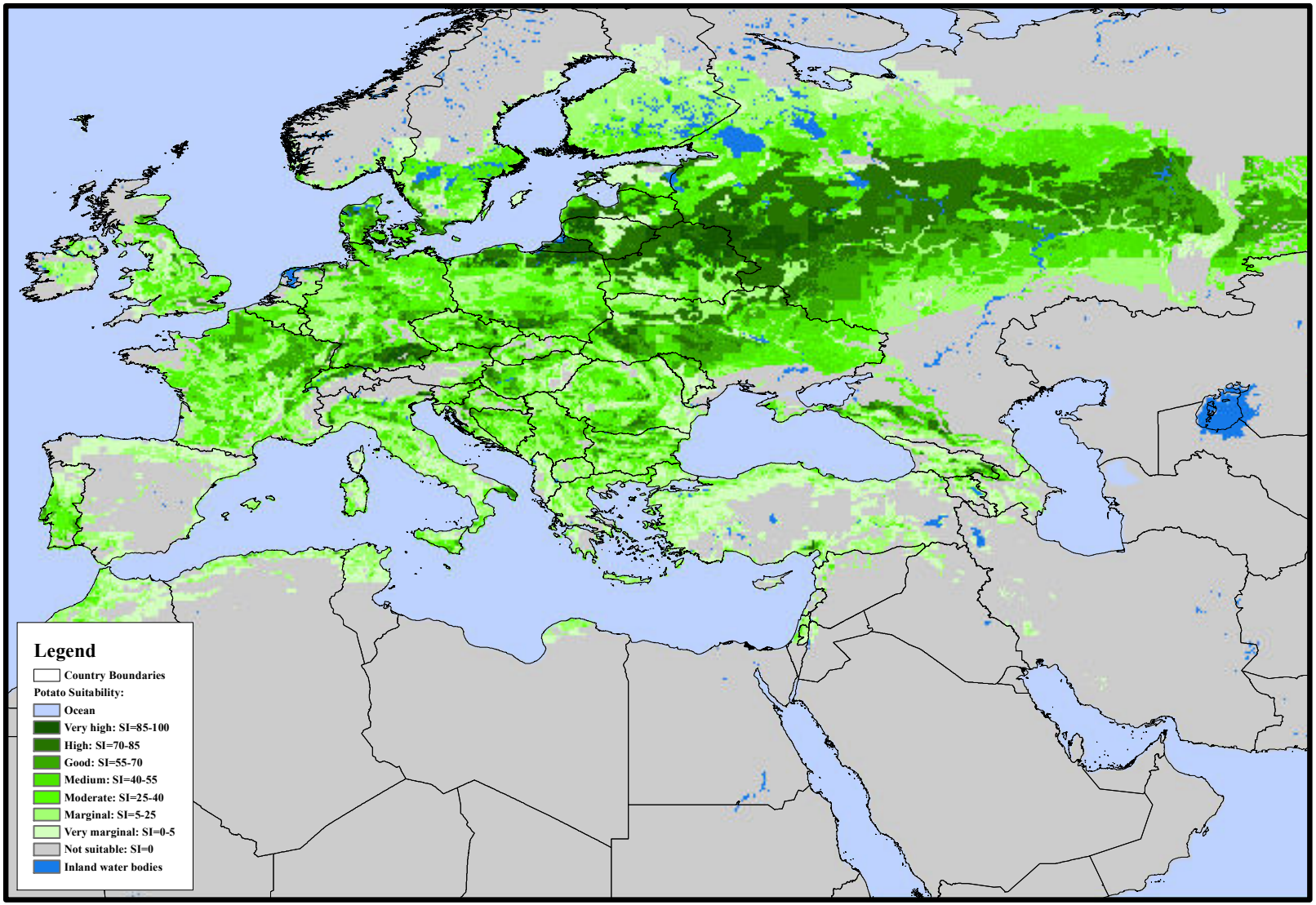
Figure I: Growth in world population and urbanization, 1000–1900.

Magnitudes

- How much of the increase in population/urbanization from 1700 to 1900 can be attributed to potatoes?
- Estimates suggest that this figure is approximately 25% for both population and urbanization.


Legend
Country Boundaries
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies


Legend
Country Boundaries
Cities
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies


Legend
Country Boundaries
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies

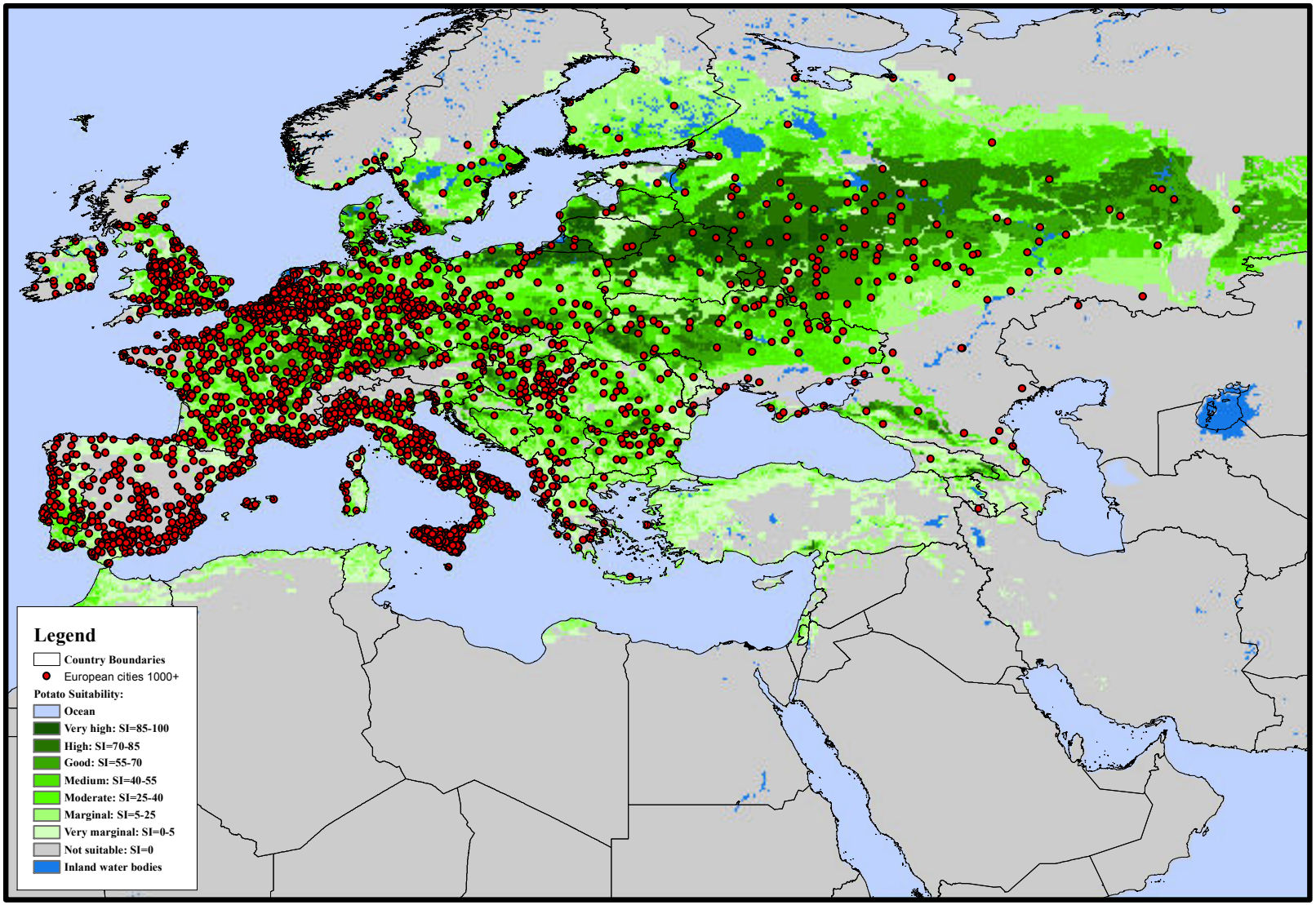

Legend
Country Boundaries
European cities 1000+
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies

TABLE VIII
THE EFFECTS OF THE POTATO ON CITY POPULATIONS

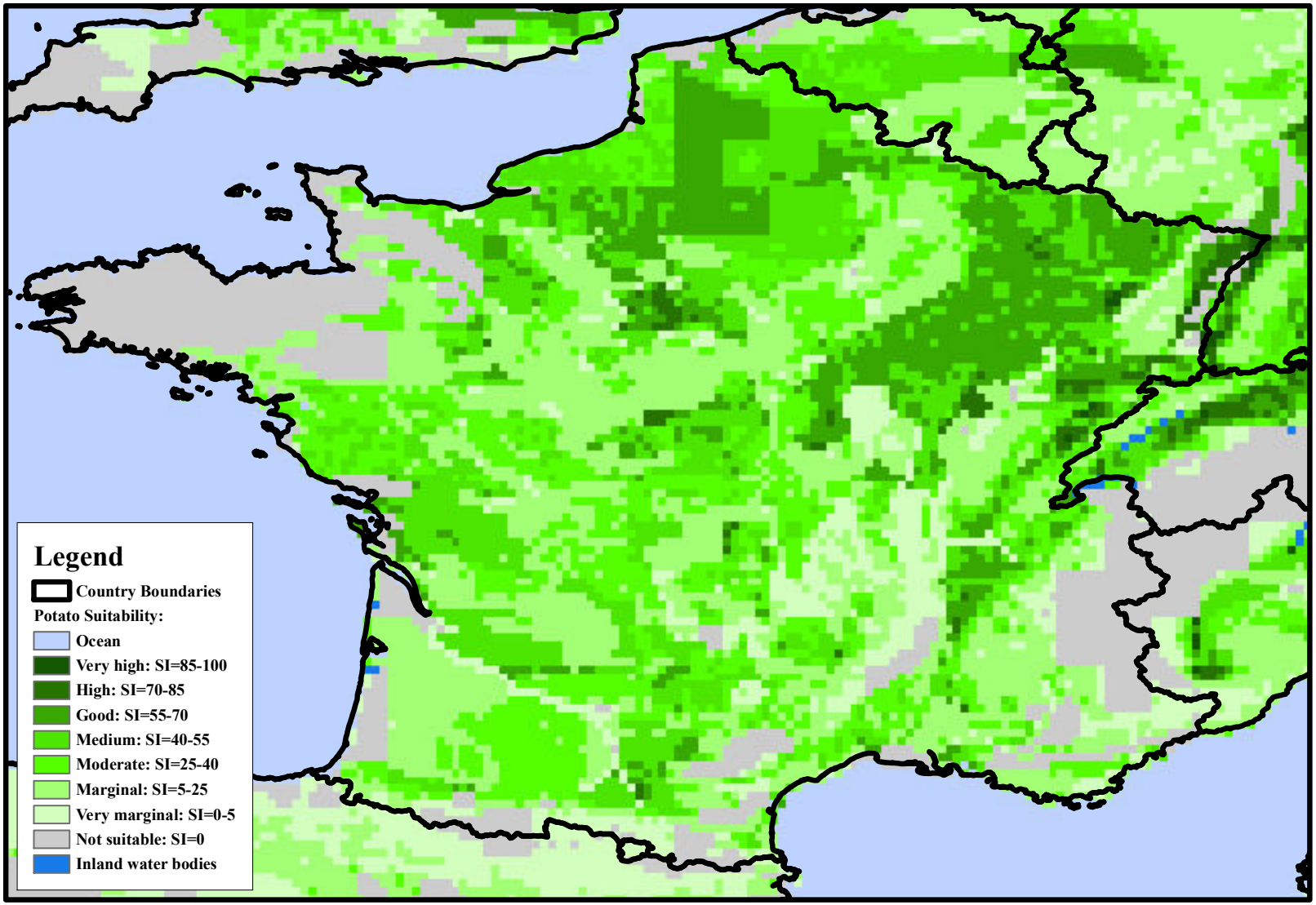
	Dependent Variable: ln city population						
	Cities with 40,000+ Population (Baseline Sample)					Cities with 1000+ Population	
	All Old World Cities		Omitting Europe		Europe Only	Europe Only	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln Potato Area × Post	0.050	0.047	0.035	0.039	0.034	0.042	0.029
Clustered s.e.	(0.023)	(0.021)	(0.022)	(0.019)	(0.075)	(0.025)	(0.015)
Conley s.e.	[0.020]	[0.020]	[0.024]	[0.021]	[0.045]	[0.023]	[0.019]
Controls (× time-period fixed effects):							
Baseline controls	Y	Y	Y	Y	Y	Y	Y
Continent fixed effects	N	Y	N	Y	Y	N	N
Country fixed effects	N	N	N	N	N	N	Y
Observations	1607	1607	933	933	674	9319	9319
R-squared	0.77	0.79	0.75	0.75	0.87	0.74	0.79

Notes. Observations are at the city-year level. Columns (1)–(5) use a sample of cities with forty thousand or more inhabitants and the following time periods: 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1850, and 1900. Columns (6) and (7) use a sample of European cities with one thousand or more inhabitants and the following time periods: 1000, 1200, 1300, 1400, 1500, 1600, 1700, 1750, 1800, and 1850. For all specifications, the Post indicator variable equals zero for the periods 1000–1700 and one for periods 1750 and later. All regressions include year fixed effects, city fixed effects, and the following baseline controls, each interacted with the full set of time-period fixed effects: ln *Old World Crop Suitable Area*, ln *Elevation*, ln *Ruggedness*, ln *Tropical Area*. The inclusion of a control variable interacted with the full set of time-period fixed effects is indicated by a Y; N indicates that the control is not included in the specification. In all specifications, coefficients are reported with clustered standard errors, clustered at the country level, in parentheses. Conley standard errors are reported in square brackets. Spatial autocorrelation is assumed to exist among observations that are within ten degrees of each other.

Impacts on Heights: Estimating Equation

$$\begin{aligned} Height_{ivt} &= \eta \ln Potato\,Area_v \cdot I_t^{Post} + \mathbf{X'}_i\Gamma \\ &\quad + \sum_d \mathbf{X'}_v \mathbf{I}_t^d \Phi_d + \sum_v \gamma_v I_i^v + \sum_{j=1658}^{1770} \rho_j I_t^j + \varepsilon_{ivt} \end{aligned}$$

- i indexes individuals, v villages of birth, and t years of birth, where t=1658–1770.
- $Height_{ivt}$: adult height, measured in inches.
- I_t^{Post}: indicator for post-adoption period (after 1700).
- $\sum_d \mathbf{X'}_v \mathbf{I}_t^d \Phi_d$: vector of village-level control variables interacted with decade FEs.
- $\sum_v \gamma_v I_i^v$: town-of-birth fixed effects.
- $\sum_j \rho_j I_t^j$: year-of-birth fixed effects.


Legend
Country Boundaries
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies

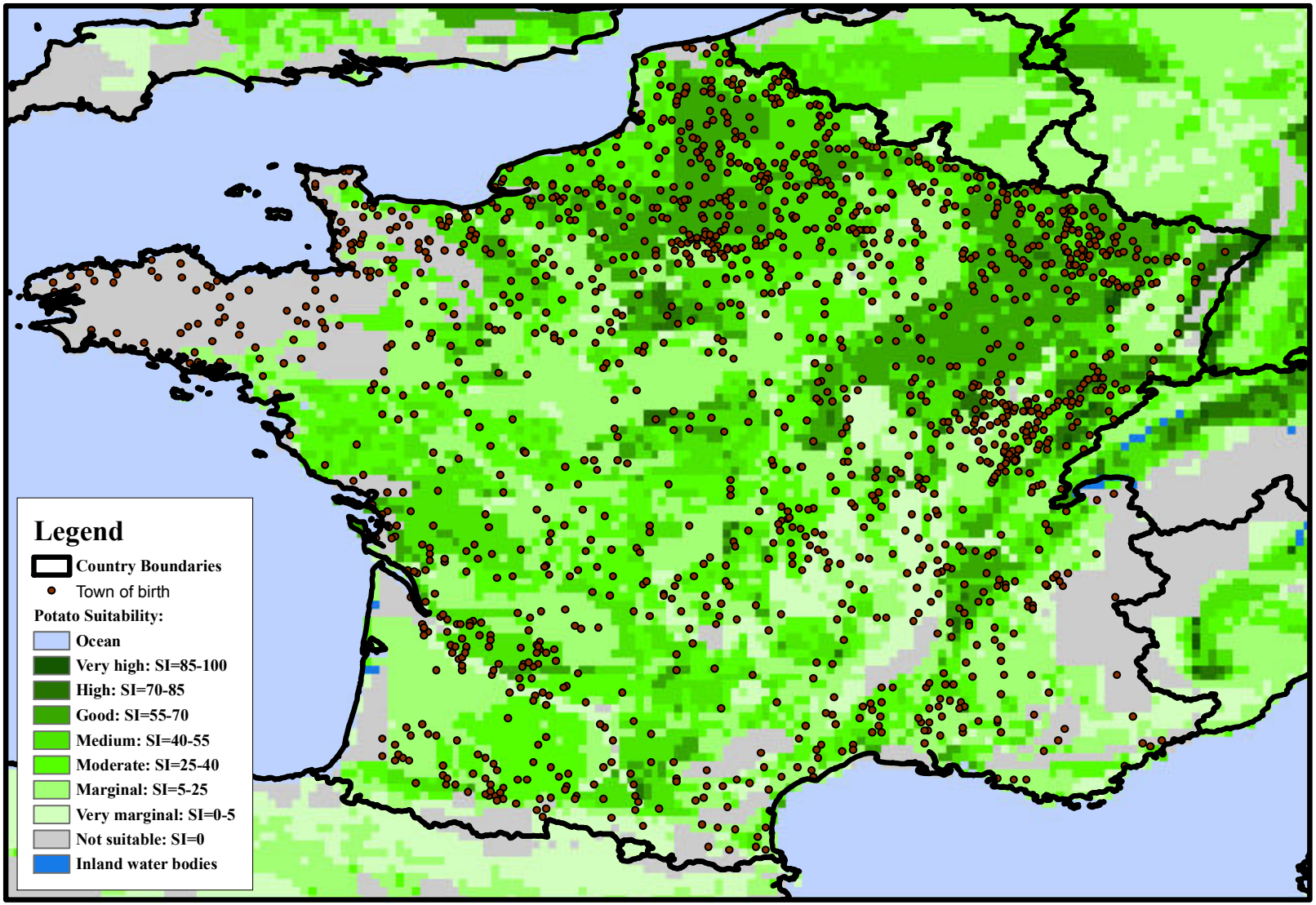

Legend
Country Boundaries
Town of birth
Potato Suitability:
Ocean
Very high: SI=85-100
High: SI=70-85
Good: SI=55-70
Medium: SI=40-55
Moderate: SI=25-40
Marginal: SI=5-25
Very marginal: SI=0-5
Not suitable: SI=0
Inland water bodies

TABLE IX

THE EFFECTS OF THE POTATO ON SOLDIER HEIGHTS WITHIN FRANCE

	Dependent Variable: Adult height (inches)			
	(1)	(2)	(3)	(4)
ln *Potato Area* × Post	0.102	0.062	0.103	0.054
Clustered s.e.	(0.025)	(0.018)	(0.025)	(0.018)
Conley s.e.	[0.014]	[0.013]	[0.017]	[0.015]
Controls (× decade fixed effects):				
Baseline controls	Y	Y	Y	Y
French region fixed effects	N	Y	N	Y
Additional controls	N	N	Y	Y
Observations	13646	13646	13646	13646
R-squared	0.23	0.23	0.23	0.24

Ongoing research . . .

- Potatoes increased living standards, health and prosperity.
- Contemporary evidence suggests that increased prosperity is associated with decreased conflict.
- Initial findings suggest that within Europe the introduction of the potato also led to a decline in conflict (inter-state and intra-state).

Subsequent Research on the Columbian Exchange

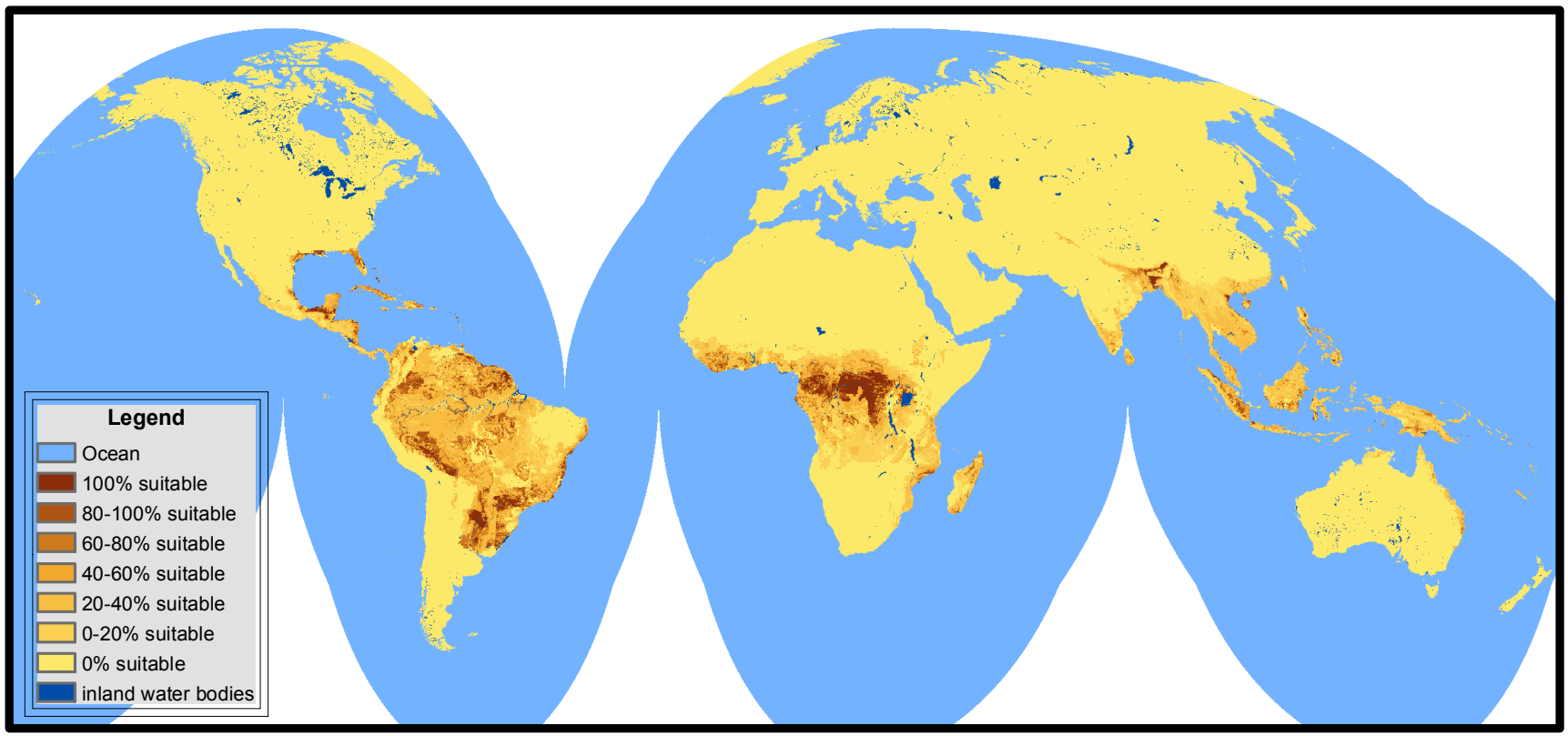
Shuo Chen and James Kung (2011): "The Malthusian Quagmire: Maize and Population Growth in China, 1500–1900"

- Show that the adoption of maize in China increased population but not urbanization rates.

Ruixue Jia (2011): "Weather Shocks, Sweet Potatoes and Peasant Revolts in Historical China"

- Documents a positive relationship between droughts and peasant revolts (floods have no effect) between 1470 and 1900.
- The adoption of the sweet potato, because of its drought resistance, severed the link between drought and conflict.

Sugar and the Columbian Exchange



Sugar, Plantation Slavery and Economic Underdevelopment

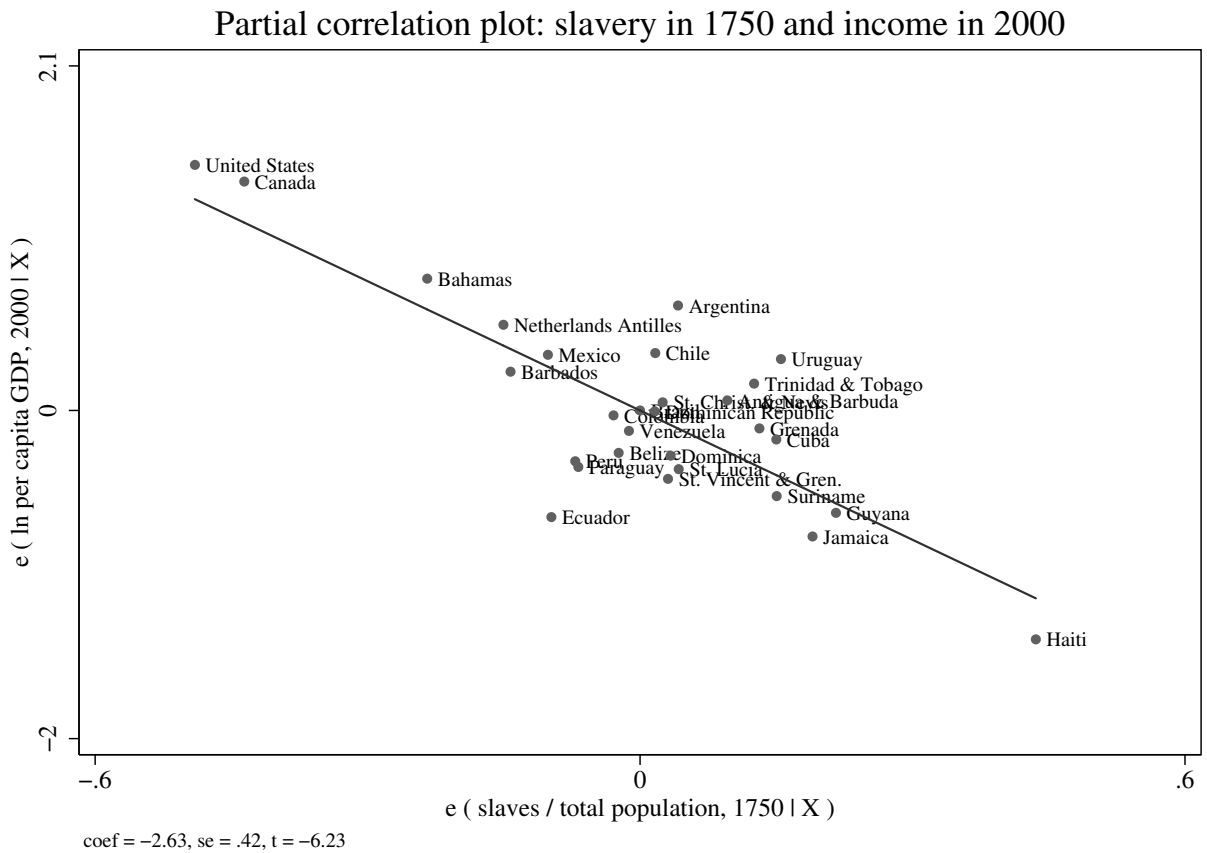


Figure 2: Partial correlation plot showing the relationships between the proportion of slaves in the population in 1750 S_i/L_i and the natural log of per capita GDP in 2000 $\ln y_i$.

Sugar, Plantation Slavery and Economic Underdevelopment

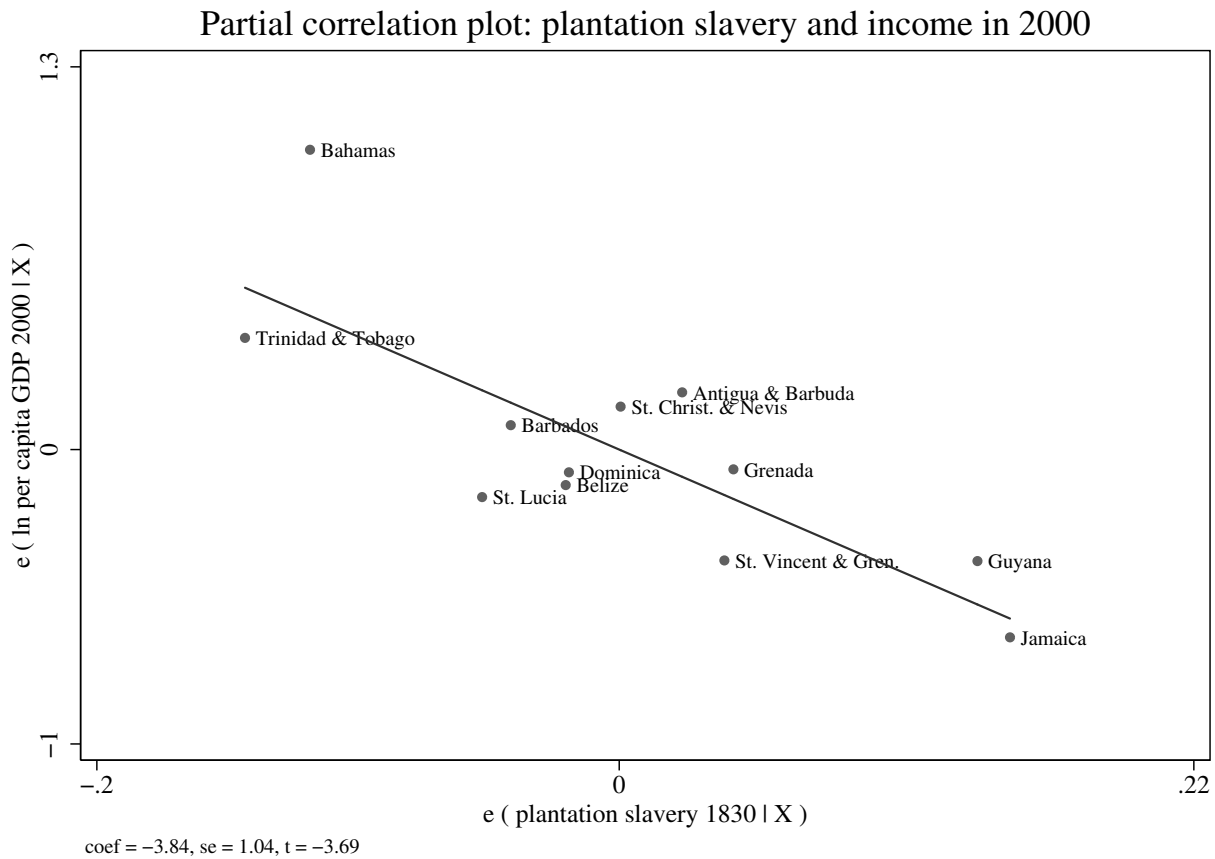


Figure 4: Partial correlation plots showing the relationships between plantation slavery S_i^P/L_i and the natural log of per capita GDP in 2000 $\ln y_i$.

The Benefits of the Sugar Boom in Europe

- Sugar provided a cheap source of calories consumed by all classes.
- Hersch and Voth (2011) consider the welfare impacts of greater access to sugar due to its mass cultivation in the Americas.
- They estimate that between 1600 and 1850, sugar consumption increased welfare by 7.5-8.0%.

Crops and Traditional Agriculture

- Our examination of the Columbian Exchange illustrates the historical impacts of food on health and prosperity.
- Alesina, Giuliano and Nunn (2011) consider an alternative (perhaps less obvious) persistent impact of traditional food crops.
- **Hypothesis**: Crops $\Rightarrow$ Agricultural technology $\Rightarrow$ Female participation in agriculture $\Rightarrow$ Persistent norms regarding female work outside the home.

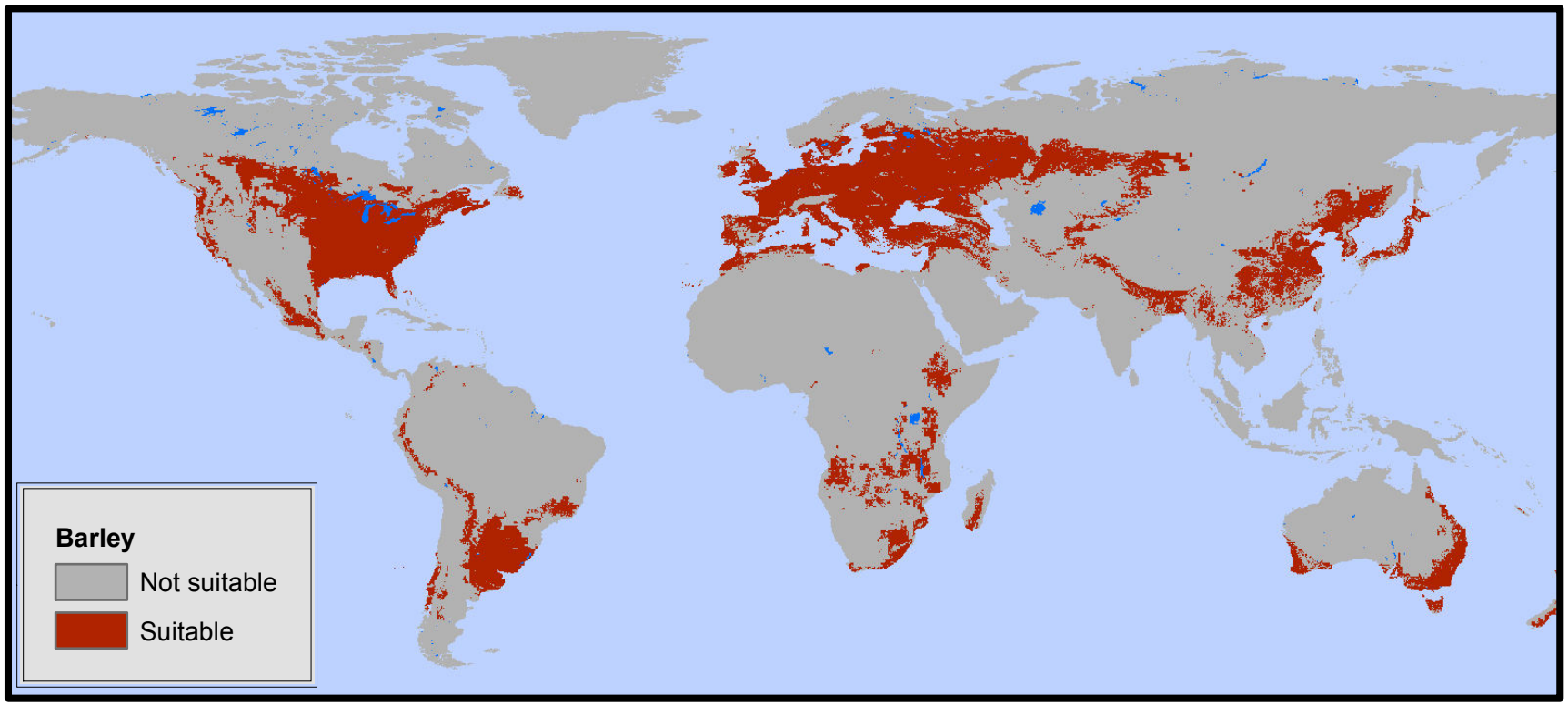
Plough Agriculture

Hoe Agriculture

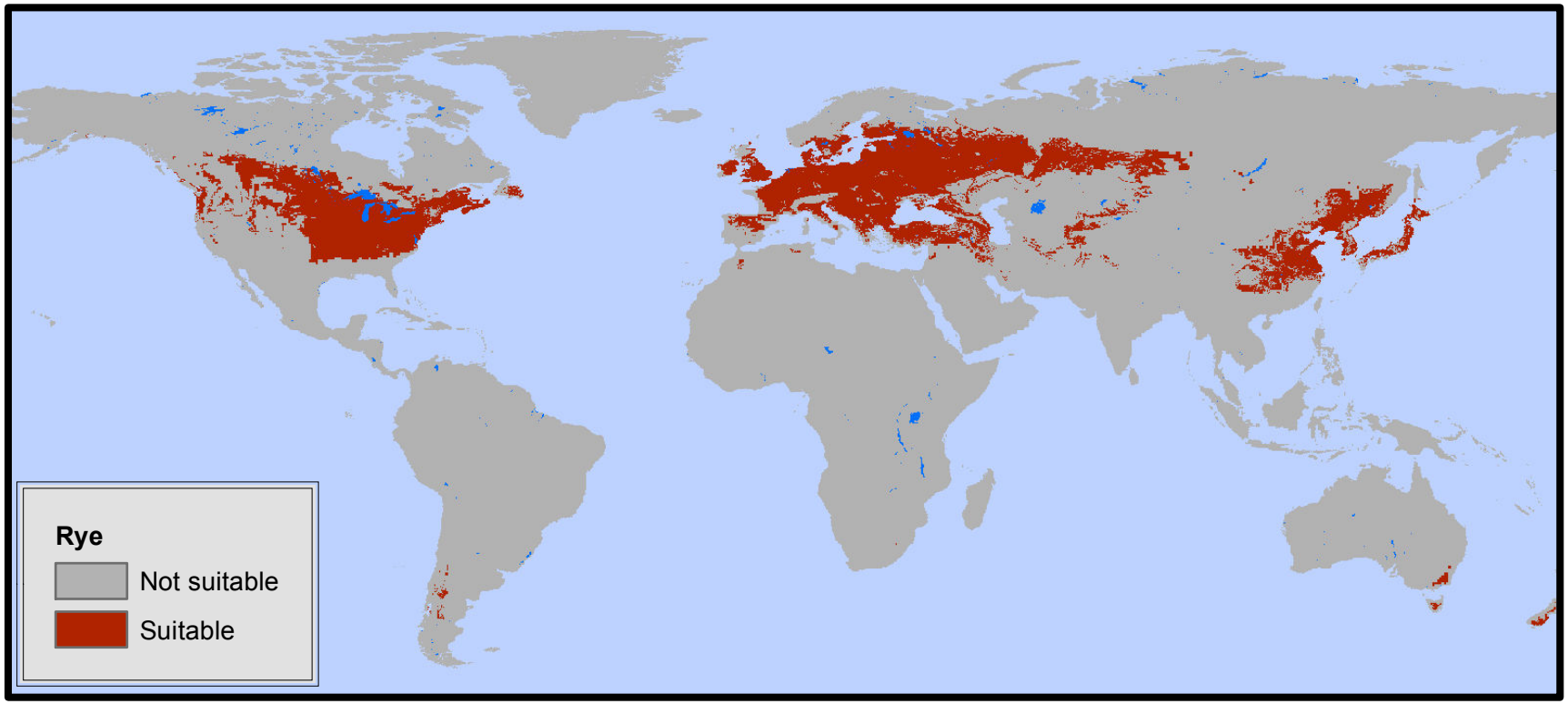
Crops and plough use

- There are differences in the extent to which crops benefit from the introduction of the plough.
- Factors identified in the anthropological literature include:
  - Length of planting season.
  - Frequency of planting.
  - Amount of land to be prepared.
  - Qualities/characteristics of the soil that crops can be grown in (sloped, rocky, swampy, clayey vs. loamy, depth, etc).
- Pryor (1985) groups crops into two categories:
  1. **Plough-positive crops**: teff, wheat, barley, rye, buckwheat, wet rice, and industrial crops.
  2. **Plough-negative crops**: millet, sorghum, root crops, maize, dry rice and tree crops.

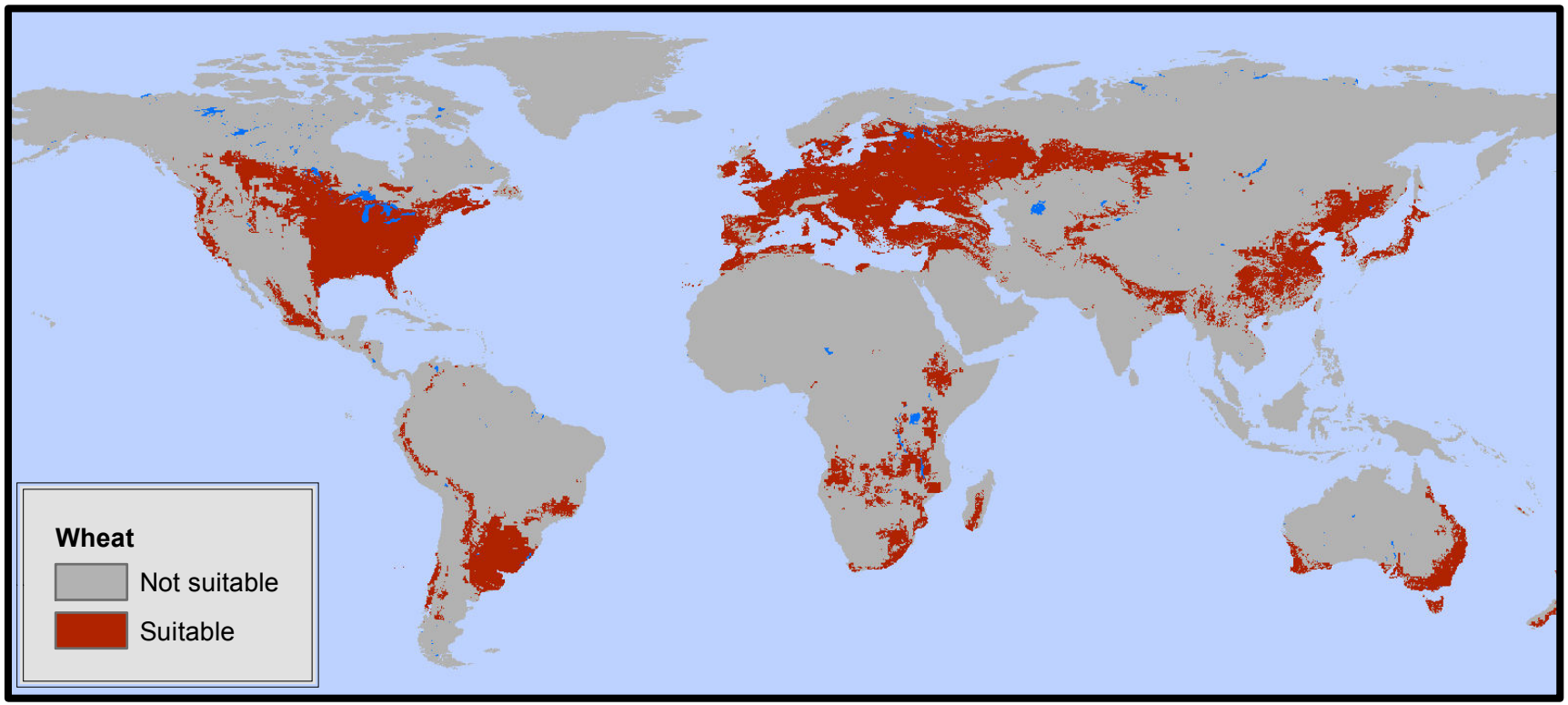
Barley



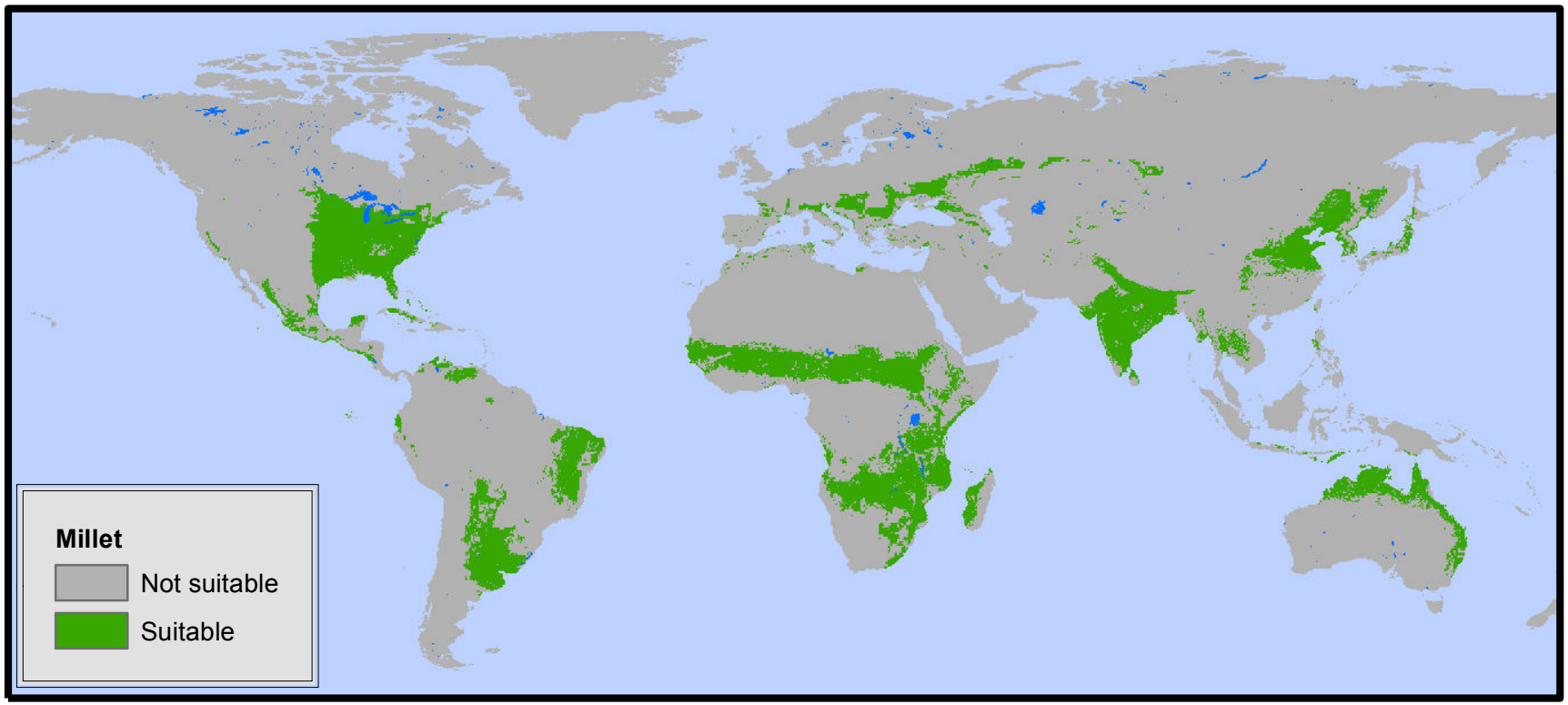
Rye



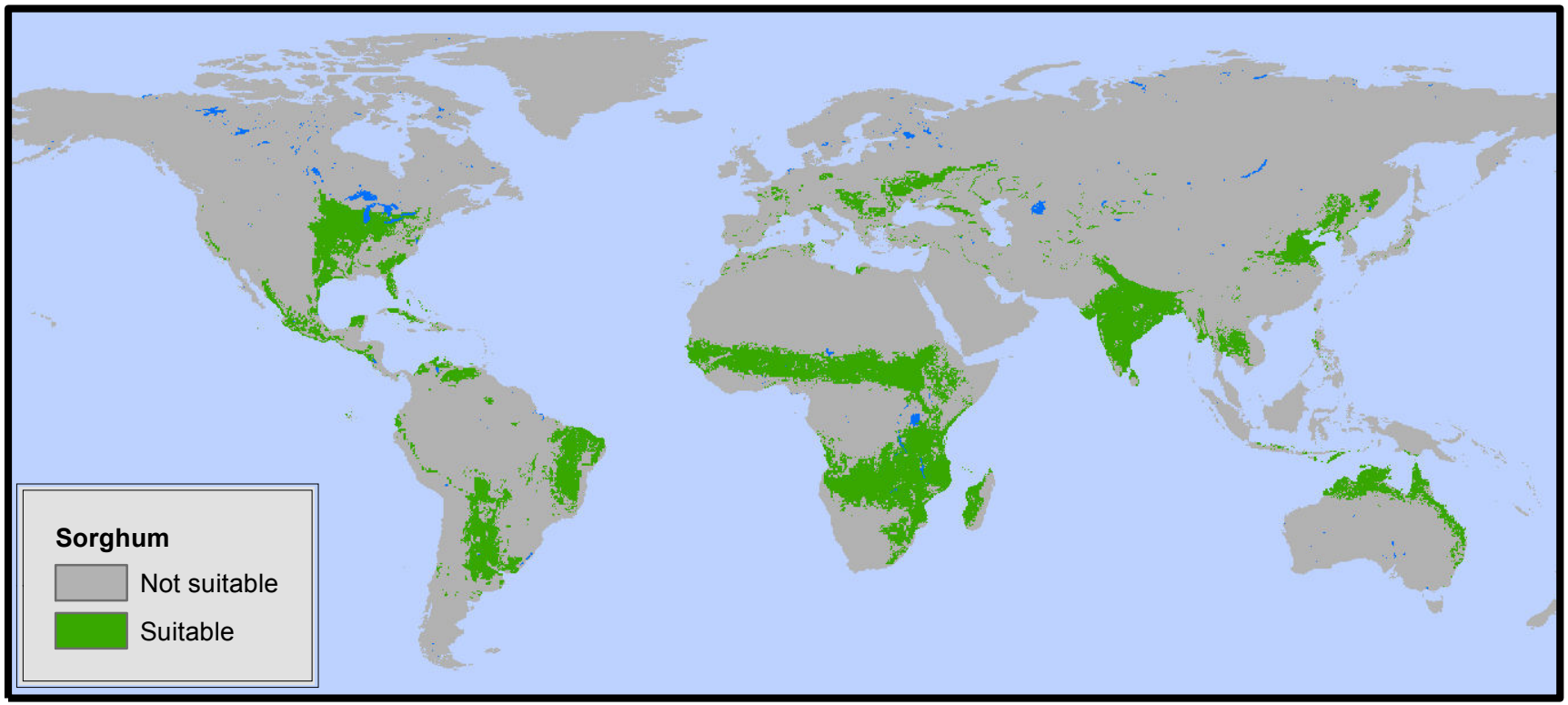
Wheat



Millet



Sorghum



Plough Agriculture

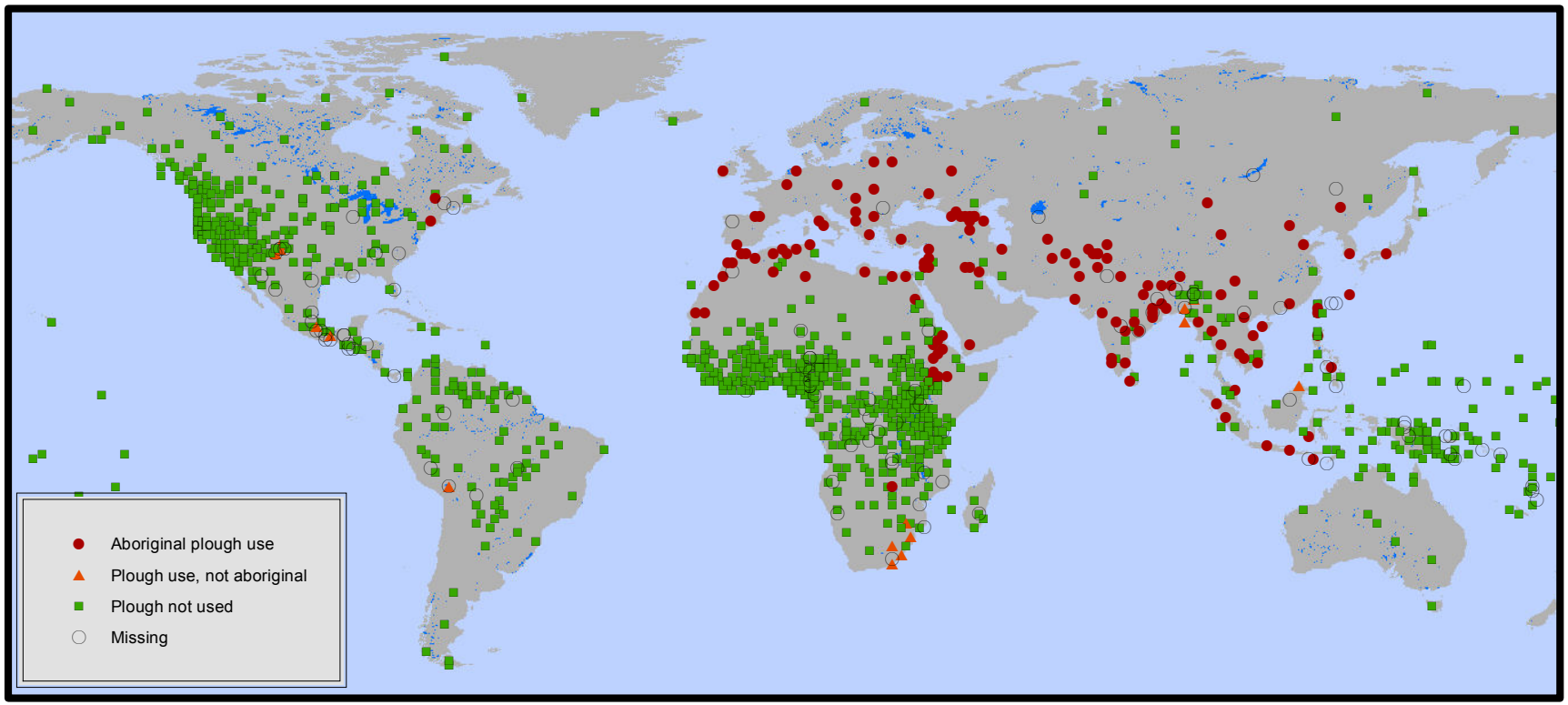
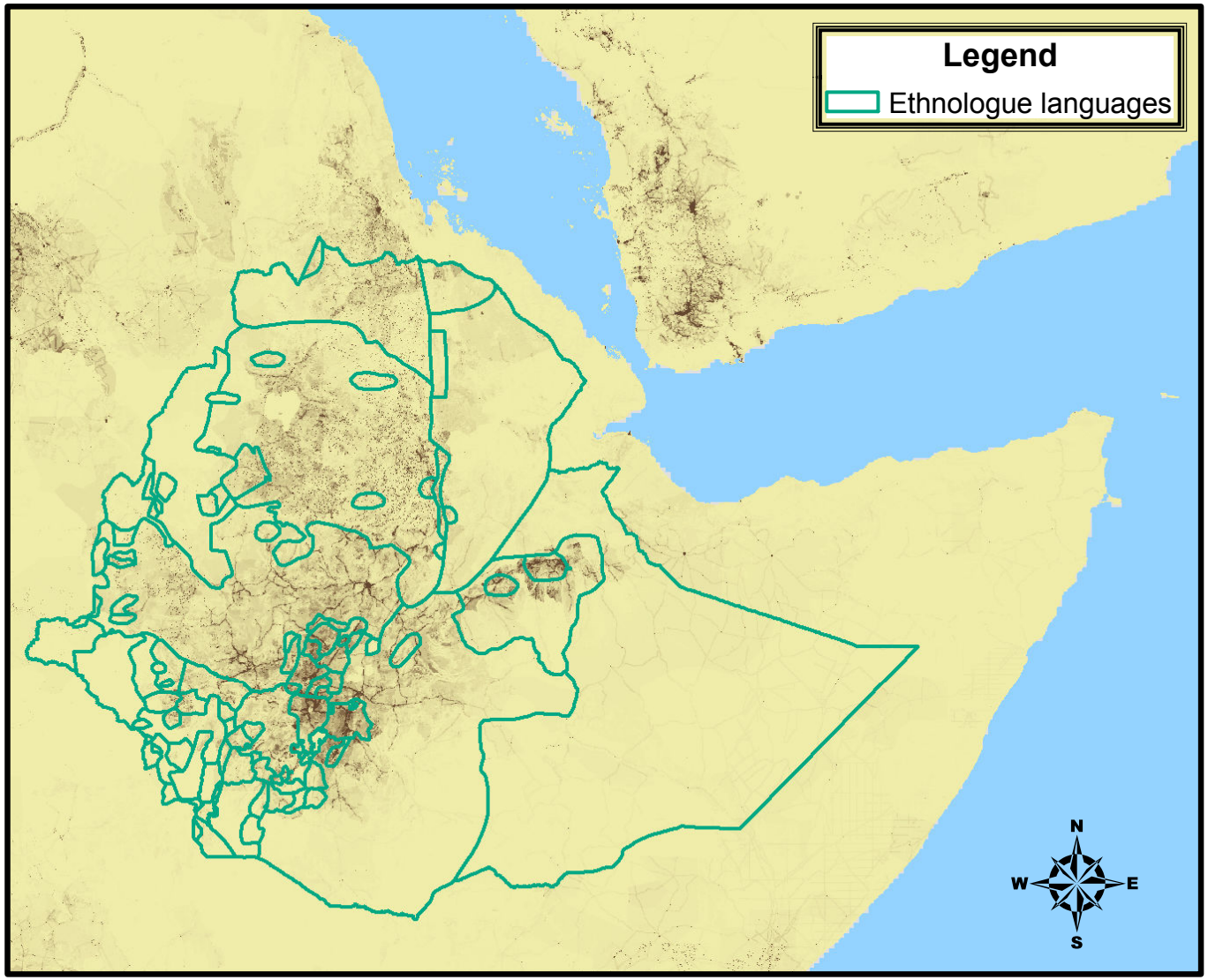
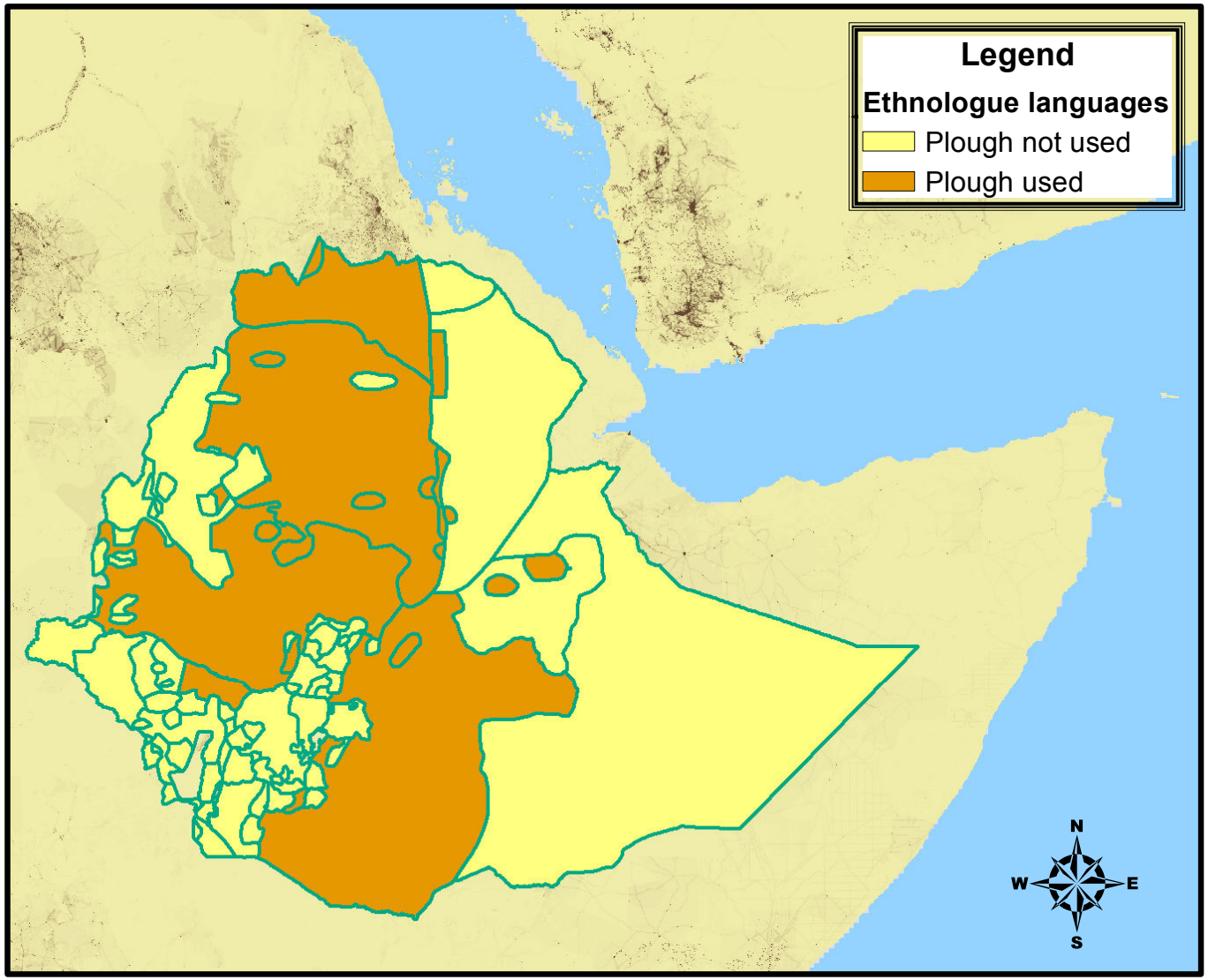


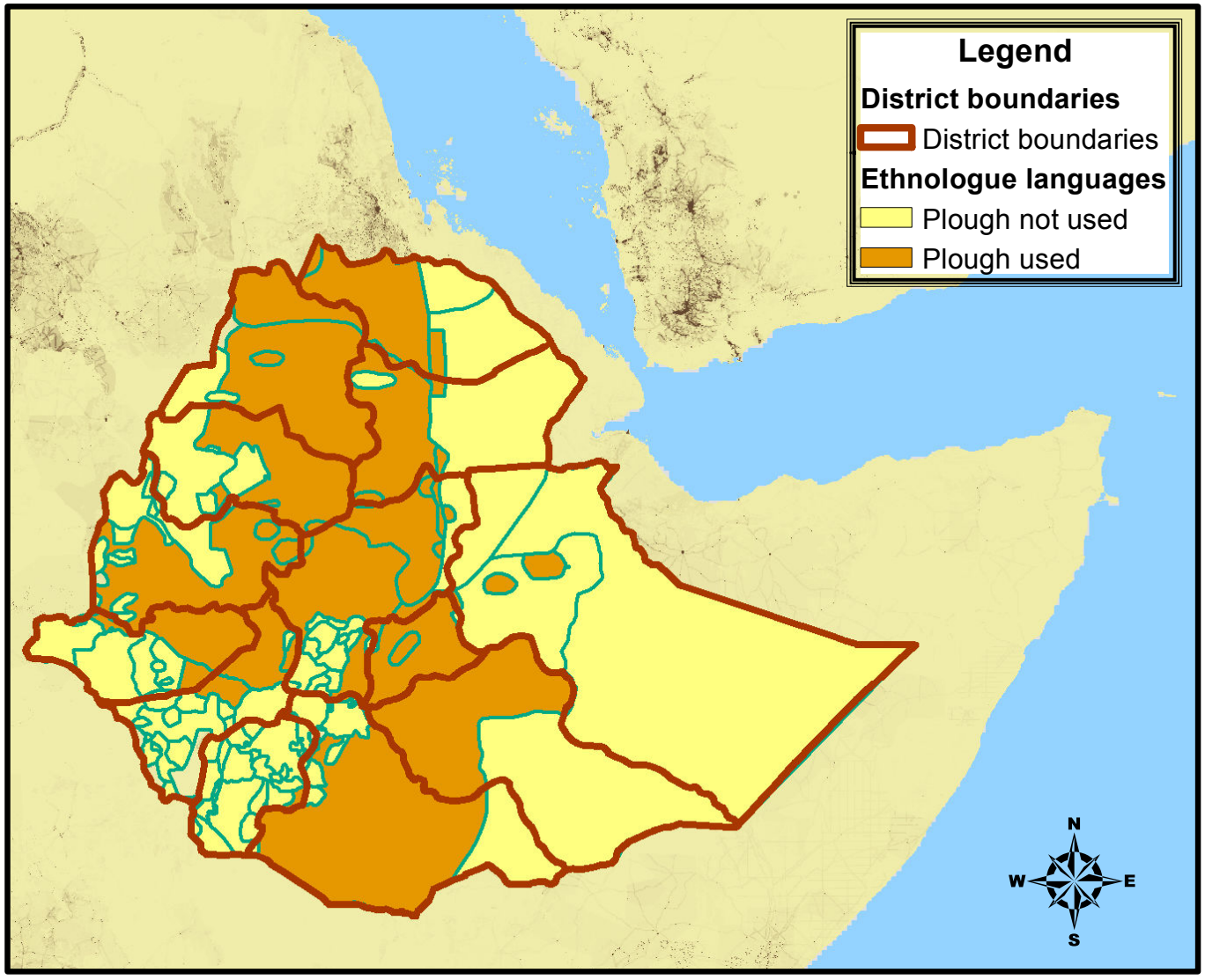
Table: Was plough agriculture associated with a gender division of labor?

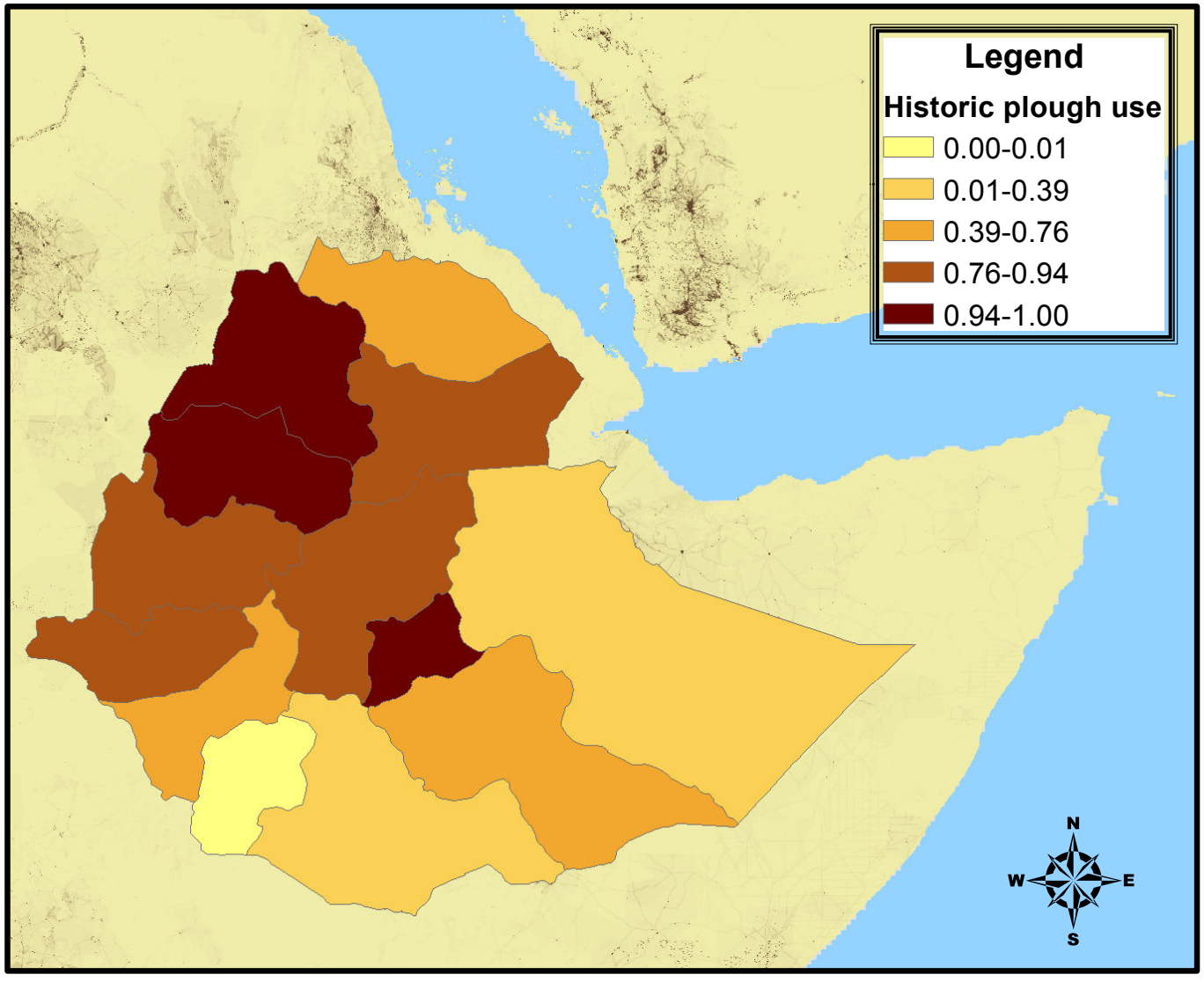
	Dependent variable: Participation of females relative to males in the following tasks:						
	Overall agriculture		Land clearance	Soil preparation	Planting	Crop tending	Harvesting
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Traditional plough agriculture	-0.861***	-1.133***	-0.414**	-1.164***	-1.244***	-1.033***	-0.770**
	(0.217)	(0.272)	(0.200)	(0.355)	(0.341)	(0.367)	(0.308)
Ethnographic controls	yes	yes	yes	yes	yes	yes	yes
Observations	660	124	129	124	131	122	131
R-squared	0.14	0.22	0.15	0.13	0.13	0.19	0.19

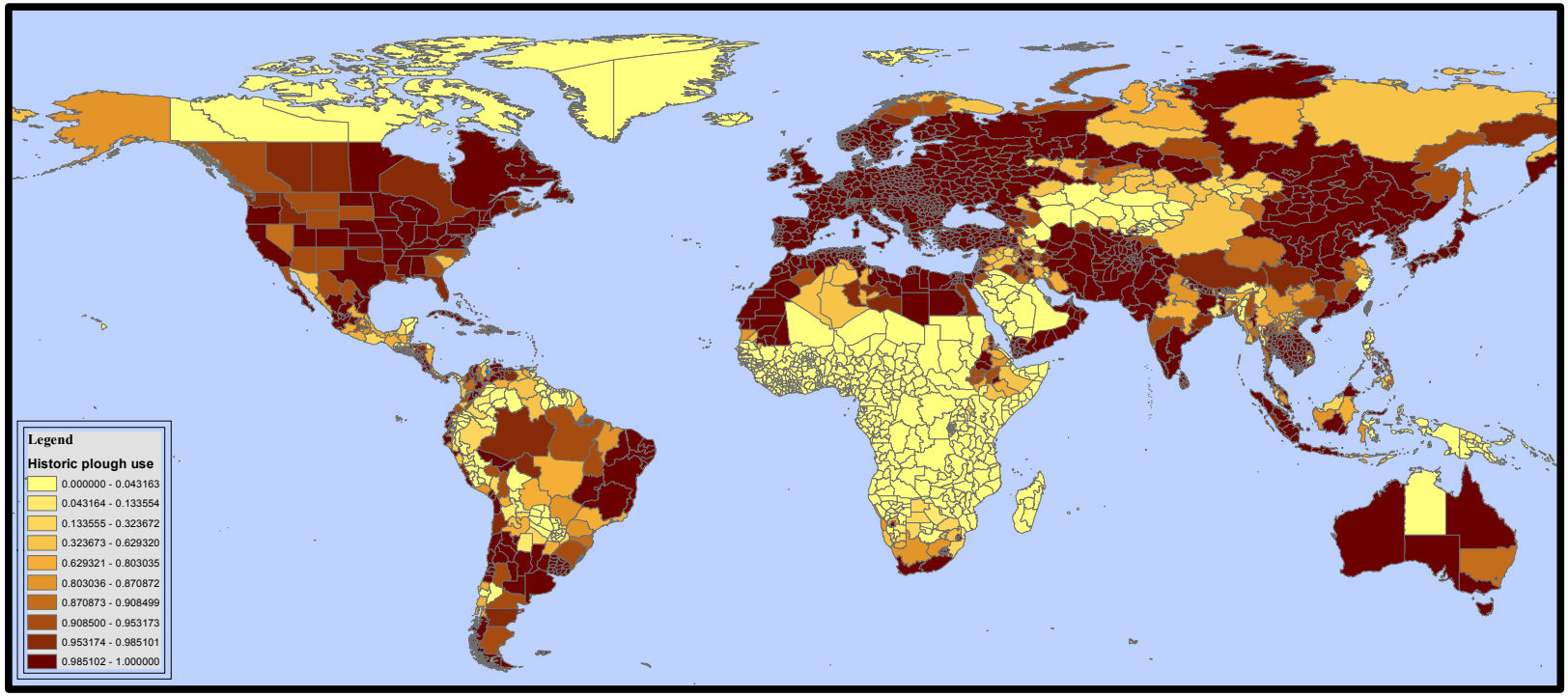
Notes: The unit of observation is an ethnic group. In column 1 ethnic groups are from the *Ethnographic Atlas* and in columns 2-7 they are from the *Standard Cross Cultural Sample*. Each dependent variable measures female participation in a particular activity (e.g., agriculture). The variables take on integer values between 1 and 5 and are increasing in female participation. Coefficients are reported with robust standard errors in brackets. In column 1, we report Conley standard errors adjusted for spatial correlation (assuming a window that is sixty degrees latitude and sixty degrees longitude). ***, ** and * indicate significance at the 1, 5 and 10% levels.


Legend
Ethnologue languages
N
W
E
S


Legend
Ethnologue languages
Plough not used
Plough used
N
W
E
S


Legend
District boundaries
District boundaries
Ethnologue languages
Plough not used
Plough used
N
W
E
S


Legend
Historic plough use
0.00-0.01
0.01-0.39
0.39-0.76
0.76-0.94
0.94-1.00
N
W
E
S


Legend
Historic plough use
0.000000 - 0.043163
0.043164 - 0.133554
0.133555 - 0.323672
0.323673 - 0.629320
0.629321 - 0.803035
0.803036 - 0.870872
0.870873 - 0.908499
0.908500 - 0.953173
0.953174 - 0.985101
0.985102 - 1.000000

Outcomes of interest

Female labor force participation:

1. Proportion of women in the labor force (employed or seeking employment).
2. Beliefs: "When jobs are scarce, men should have more right to a job than women"
   - (i) agree, (ii) neither (iii) disagree
   - Variable equals 1 if agree, and 0 if disagree.

Female representation in positions of power:

1. Proportion of firm owners/managers that are female.
2. Proportion of seats in national parliament held by women.
3. Beliefs: "On the whole, men make better political leaders than women"
   - (i) strongly disagree, (ii) disagree, (iii) agree, (iv) strongly agree
   - Variable takes on values 1, 2, 3, 4.

FLFP

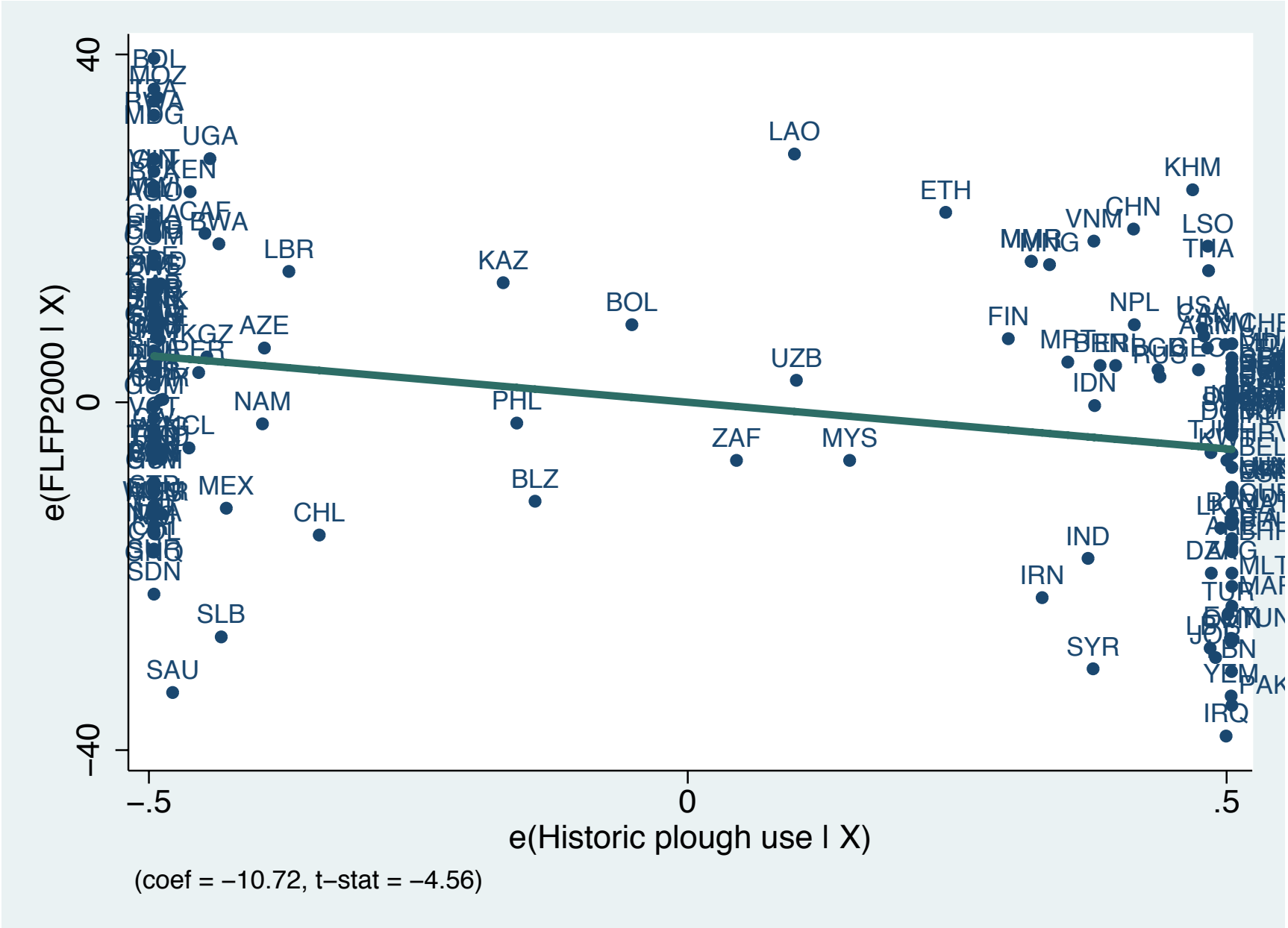

e(FLFP2000 | X)
40
0
−40
−.5
0
.5
e(Historic plough use | X)
UGA
LAO
KHM
ETH
CHN
VNM
LSO
THA
LBR
KAZ
BOL
NPL
FIN
AZE
UZB
IDN
NAM
PHL
ZAF
MYS
MEX
BLZ
CHL
IND
IRN
SDN
SLB
SYR
SAU
IRQ
(coef = −10.72, t−stat = −4.56)

Table: Country-level OLS estimates.

	Dependent variable:							
	Female labor force participation		Share of firms with some female ownership		Females in politics		Average effect size (AES)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Historical plough use	-14.596***	-13.542***	-8.349*	-11.569**	-8.936***	-8.930***	-0.896***	-0.934***
	(3.12)	(3.058)	(4.358)	(5.529)	(2.053)	(2.137)	(0.137)	(0.135)
Historical controls:								
Agricultural suitability	yes	yes	yes	yes	yes	yes	yes	yes
Domesticated animals	yes	yes	yes	yes	yes	yes	yes	yes
Tropics	yes	yes	yes	yes	yes	yes	yes	yes
Political hierarchies	yes	yes	yes	yes	yes	yes	yes	yes
Economic complexity	yes	yes	yes	yes	yes	yes	yes	yes
Contemporary controls:								
ln income, ln income^2	yes	yes	yes	yes	yes	yes	yes	yes
Continent fixed effects	no	yes	no	yes	no	yes	no	yes
Observations	163	163	106	106	144	144	138[a]	138[a]
R-squared	0.413	0.426	0.132	0.208	0.358	0.392		

Notes: OLS estimates are reported with robust standard errors in brackets. The unit of observation is a country. ***, ** and * indicate significance at the 1, 5 and 10% levels.

[a]This is the average number of observations in the regressions for the three outcomes.

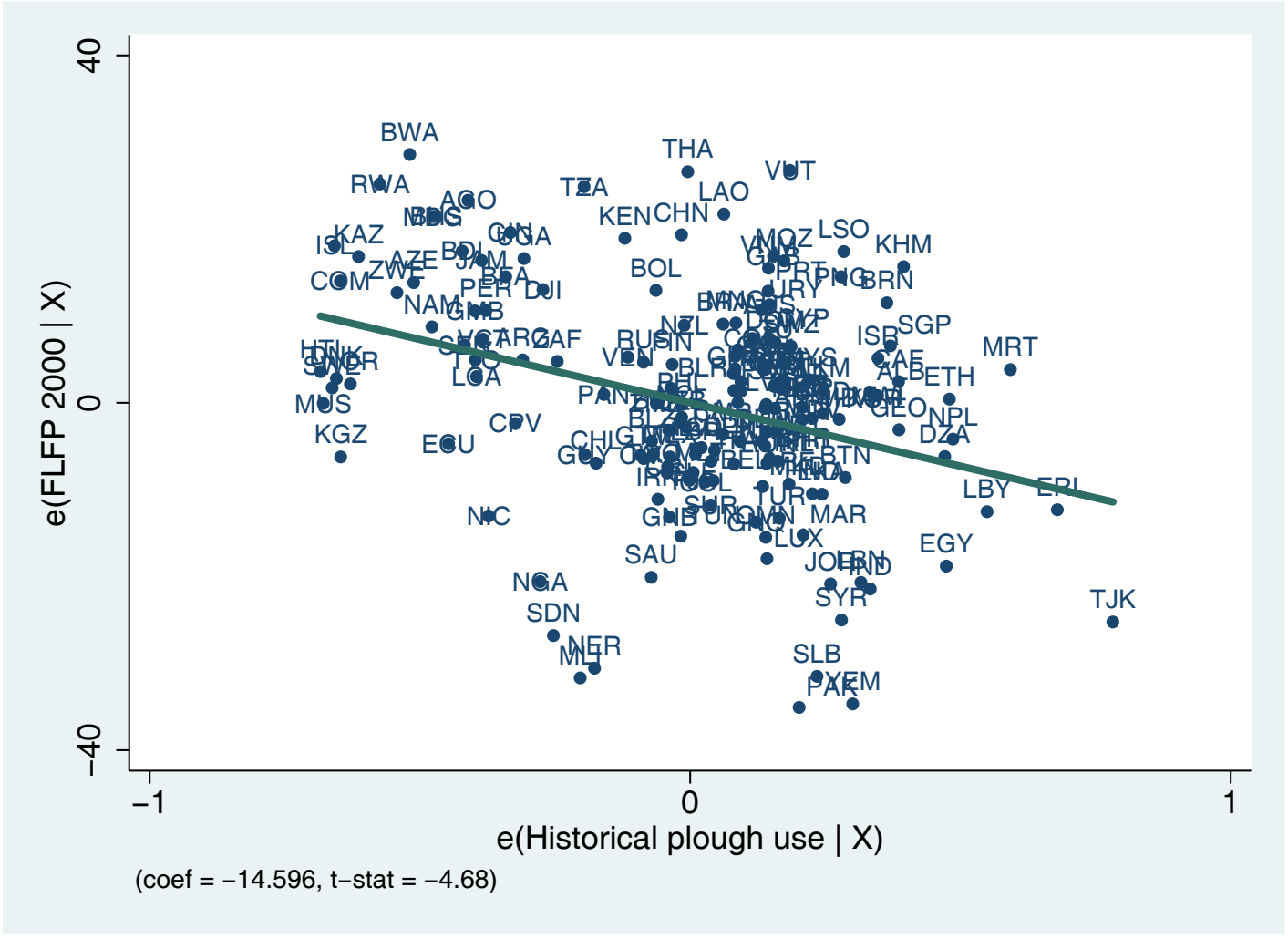


Figure: Partial correlation plot: Dep var is FLFP

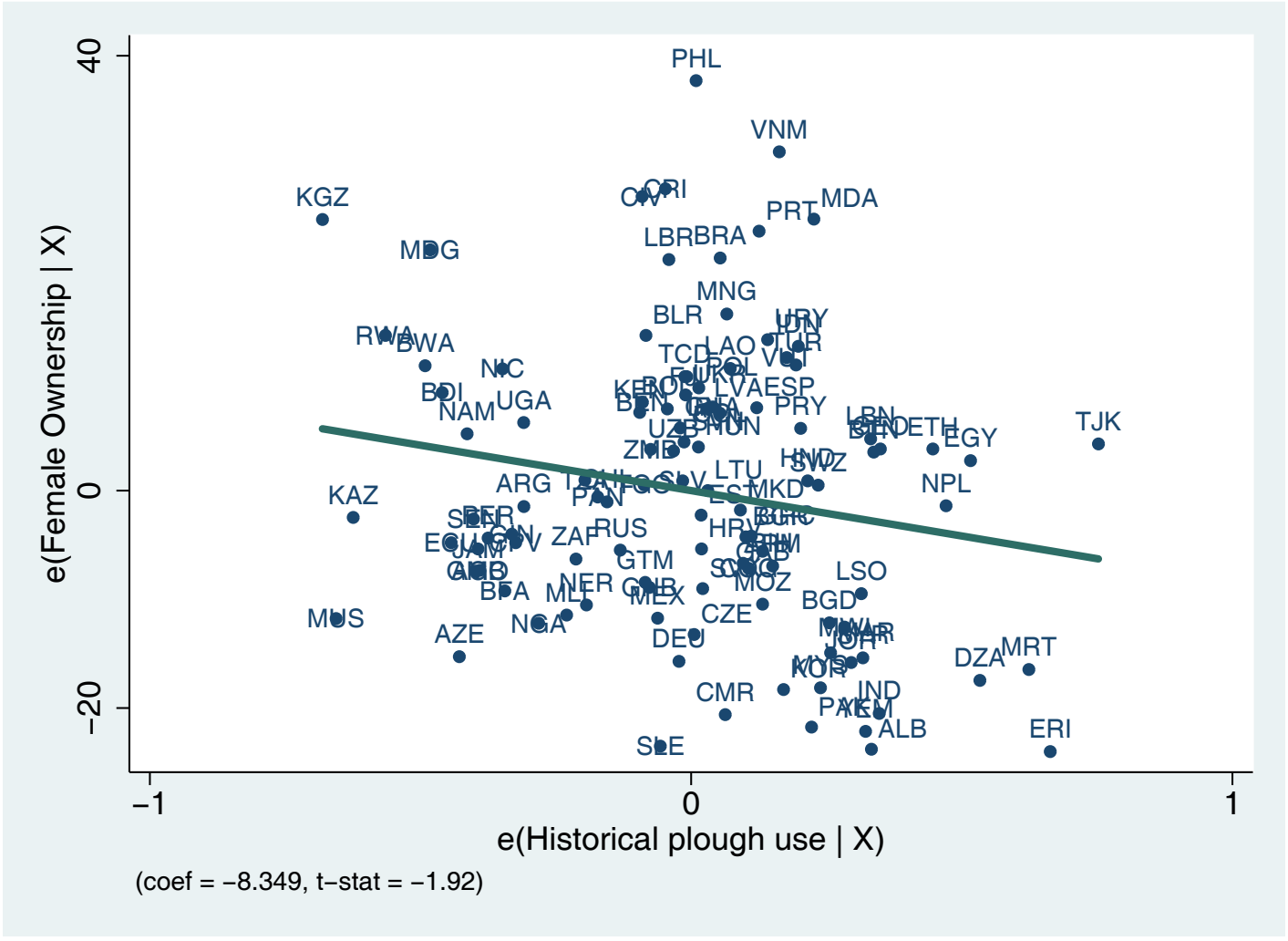


Figure: Partial correlation plot: Dep var is share of firms with female ownership

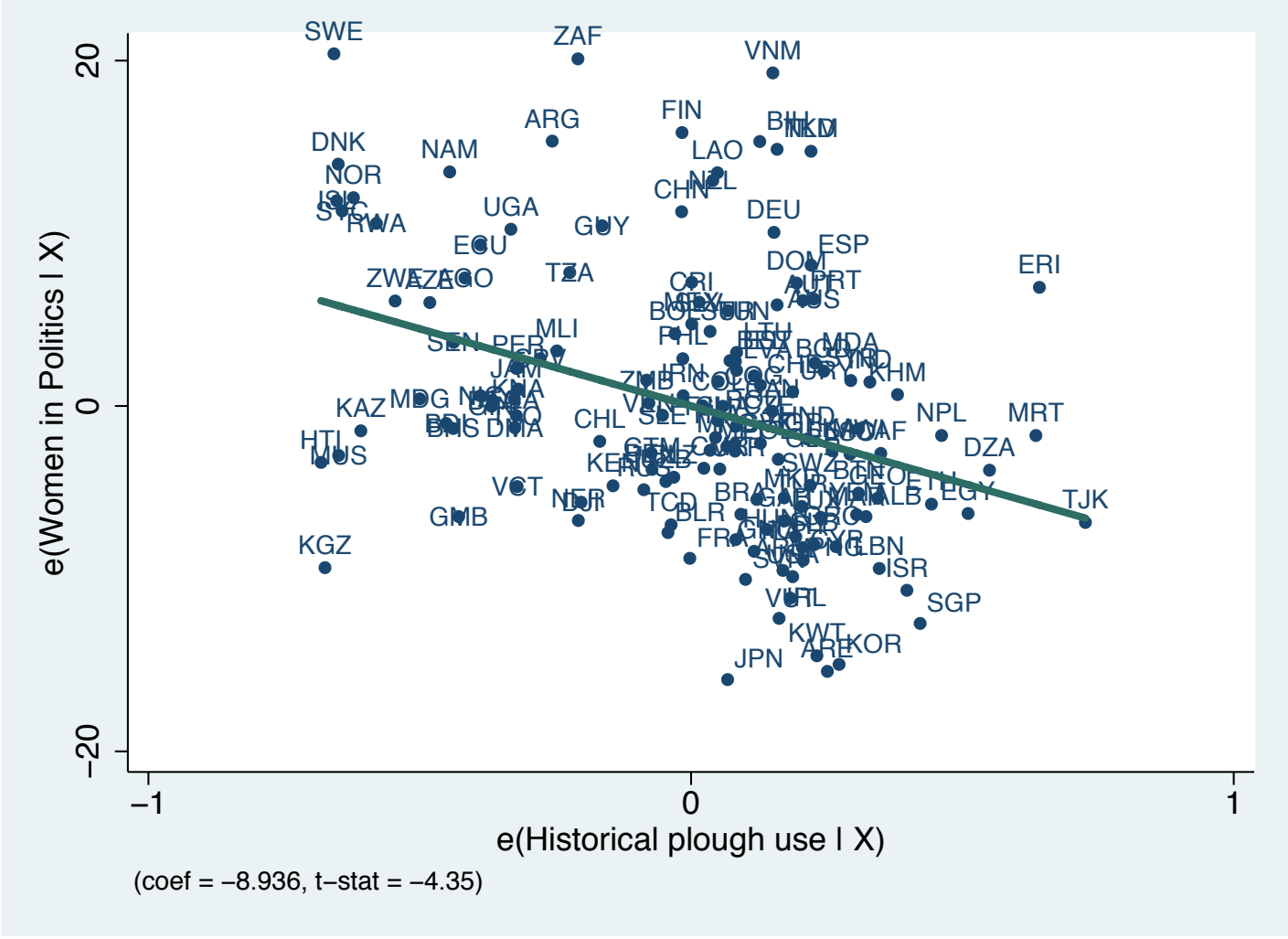


Figure: Partial correlation plot. Dep var is share of national seats held by women

Summary: The Historical Impacts of Food

1. **Columbian Exchange**: involved the transfer of food crops between the New and Old Worlds.
   - **Potatoes** brought to the Old World.
     - Increased health and prosperity.
   - **Sugar** plantations established in the New World.
     - Led to underdevelopment in the Americas, but increased welfare in Europe.
2. **Traditional Agricultural Technology**: shaped by the crops a society was endowed with.
   - Some crops were particularly well suited for intensive **plough agriculture**, rather than shifting hoe agriculture.
   - Plough agriculture significantly decreased female participation in work outside the home.
   - And this in turn, affected the evolution of beliefs about the **unequal roles of men and women** in societies.

References

1. Nunn, Nathan. 2008. "Slavery, Inequality, and Economic Development in the Americas: An Examination of the Engerman-Sokoloff Hypothesis," in E. Helpman (ed.), *Institutions and Economic Performance*, Harvard University Press, pp. 148-180.
2. Nunn, Nathan and Nancy Qian. 2010. "The Columbian Exchange: A History of Disease, Food, and Ideas," *Journal of Economic Perspectives*, 24(2): 163–188.
3. Nunn, Nathan and Nancy Qian. 2011. "The Potato's Contribution to Population and Urbanization: Evidence from a Historical Experiment," *Quarterly Journal of Economics*, 126(2): 593–650.
4. Alesina, Alberto, Paola Giuliano and Nathan Nunn. 2011. "On the Origins of Gender Roles: Women and the Plough," Working Paper, Harvard University.