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Short Communication: Geographic Insight in Brief

On the Ecological Niche of the West

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Abstract: The Western Civilization, comprising Western Europe, the US, Canada, Australia, and New Zealand, challenges the definition of civilization as a group of populations sharing a common geographic locus. However, its locus may be biogeographic rather than geographic. This study examined whether Western European and transoceanic Western nations share a common ecological niche. Results across 145 countries indicate that high steady rainfall and low ultraviolet radiation characterize and differentiate an encompassing West from Europe to Oceania. Moreover, these meteorological variables help explain the West's expansion from its inception to the Carolingian Empire and the present. Owing to their weaker steady rainfall, Italy, Spain, and Portugal form a peripheral West, suggesting the need to study their cultural differentiation from the core West. However, their northern provinces may be part of the core ecological West. Provincial-level research is needed to better delineate the West's frontiers.

Keywords: ecology; Western civilization; steady rainfall; ultraviolet radiation; core West; peripheral West

Highlights:

- The West is characterized by high steady rainfall & low ultraviolet radiation.
- Exceptions are Italy, Spain & Portugal, which have insufficient steady rainfall.
- Cultural differences between core & peripheral Western ecologies should be studied between & within Western countries.

1. Introduction

Virtually all the social scientists interested in civilizations share the general view that these are large complexes of societies in extended space and time which present a rise, flowering and decline and are characterized by a common history, language, culture, tradition, technology, and/or religion (Huntington, 1993; Targowski, 2019; Toynbee, 1947). A complementary definition describes civilization as a group of populations sharing a large and common geographic locus (Wei, 2011). However, the West includes Western Europe; the US and Canada – separated from Europe by an ocean – and Australia and New Zealand – separated from Europe by two oceans. This apparent contradiction can be resolved by considering the West's locus as biogeographic. The spread of culture across extensive regions exposed to a common climate, rather than across differing climates (Diamond, 1998), suggests that meteorological data could identify a Western ecological niche that differentiates the West from the rest of the world. The present study focused on three ecological variables that have been associated with the development of civilizations. The first variable is steady rainfall, which is defined as neither excessive nor insufficient (Van de Vliert et al., 2018); this level of rainfall is considered favorable for pastoralism and agriculture, which are fundamental activities in all civilizations, as noted by Toynbee (1947). The second variable is temperature, which played a crucial role in human history; the rise in temperature at the end of the Ice Age made agriculture possible, while excessive heat is thought to inhibit economic development, as argued by Wesselbaum (2021). The third variable is ultraviolet radiation (UVR), which has been linked to a wide range of cultural and social patterns in various studies (Ezcurra, 2024; Fredriksson and Mohanty, 2021; León, 2018, 2023a, 2023b, 2024a, 2024b).

Civilizations are born, develop, and die, but, in retrospect, change is particularly visible at the start of a civilization, when "a creative minority in a nation-state develops new ways of doing things – ways that enable them to get ahead of their neighbours" (Toynbee, 1947, p. 214). This advantage can drive the expansion of civilizations beyond single nation-states. Historians mainly concur with Toynbee's (1947) view that the West originated from a mix of Germanic cultural elements, Latin writing, and Catholicism. From at least the third century CE, "barbarian" Frankish groups repeatedly invaded Roman territory west of the northern Rhine. Eventually, they were employed by the Roman Army and adopted Roman practices and customs. At the end of the Roman Empire, the Franks expanded southward. At Charlemagne's death in 814 CE, his empire stretched from the present Netherlands and Belgium to northern Italy and Slovenia. By that time, England was becoming Catholic, whereas Saxony would do it in the next century and Sweden in the 11th century. During the Renaissance, the Americas were "discovered" and then the West expanded to what is now the USA and Canada. Later, it expanded to Australia and New Zealand. Why did this expansion stop there?

Other regions' ecology could explain this phenomenon. This idea is supported by the West's limited migratory and cultural expansion in Sub-Saharan Africa and Southeast Asia, despite its successful establishment of colonies there, which may have been due to difficulties in adapting to tropical climates. In contrast, sustainable Western European settlement occurred in South Africa, which lies outside the tropics. The West also failed to expand into multi-climatic India, and the admixture of Westerners with Amerindians in the tropics derived in the emergence of the Latin

American Civilization. The development of the West appears to be consistent with the explanation of civilizations as human responses to particular geographies (Fernández-Armesto, 2001). In worldwide comparisons between countries, low temperature appears to enhance national wealth (Andersen et al., 2016) and high steady rain appears to promote emancipative values (Welzel et al., 2025). In turn, lower UVR is associated with higher IQ (León, 2018), individualism (Fredriksson & Mohanty, 2021), and governance (Ezcurra, 2024) as well as with lower gender inequality (León, 2023a), aggression (León, 2023b), and outgroup discrimination (León, 2024b). These relationships may have contributed to the development of the West, presently characterized by wealth, individualism, equalitarianism, cognitive capital, governance, and gender equality. As a first research step in this context, I tested the following:

- ***Hypothesis 1:*** *Western European and transoceanic Western countries are part of a unitary ecological zone determined by steady rainfall, temperature, and UVR, which differentiates the West from non-Western countries.*
- ***Hypothesis 2:*** *The expansion of the West was limited by ecological constraints.*

2. Materials and Methods

This study diverges from more common geographic-historical studies (e.g., Vargha & Eichert, 2025) by specifying very few variables. Western civilization was treated as a binary variable (Yes = 1, No = 0), indicating membership of the West as defined by Huntington (1993), who updated Toynbee (1947) taking into account the dismemberment of Czechoslovaquia and Serbia in the late 20th century. Three meteorological variables were obtained for 145 countries. Van de Vliert et al. (2018) calculated an indicator of steady rainfall by dividing minimum monthly precipitation by maximum monthly precipitation. Nordhaus (2006) developed the G-Econ database, which measures temperatures in 1° latitude × 1° longitude geographic cells for all large countries. Andersen et al. (2016) calculated UVR scores using NASA's radiation information for 1o latitude × 1o longitude geographic cells. In all these cases, population was controlled. Finally, there was a historical variable: before-after Charlemagne's death (814 CE).

Discriminant analysis is utilized to evaluate the capacity of several independent variables to predict a classification of objects (Norusis, 1990). Steady rain, temperature, and UVR were used as predictors and the Western vis-à-vis non-Western Huntington dichotomy of countries as classificatory system. Wilk's lambda indicated the adjustment of the multivariate model and canonical correlation the extent to which prediction of country membership in the West was ecologically justified. The analysis required specifying the number of observations and requesting predicted group membership for each country. This yielded four possible classification outcomes: (1) correct prediction of Western membership for a country that is actually Western; (2) correct prediction of non-Western membership for a country that is actually non-Western; (3) incorrect prediction of Western membership for a non-Western country; and (4) incorrect prediction of non-Western membership for a Western country.

3. Results

Discriminant analysis yielded a Wilks' lambda of 0.41, $\chi2 = 125.55$, $p < .001$, and a canonical correlation of .77. The standardized coefficients of the canonical discriminant function were .61 (steady rainfall), .30 (temperature), and −.83 (UVR). The model predicted that Italy, Portugal, and Spain were unlikely to belong to the West; their low steady rainfall was a distinguishing feature. On Figure 1, the results of discriminant analysis were utilized to select the colour of the dots and define ecological regions depending on the classification of countries as Western or non-Western. For example, 12 non-Western countries were classified as part of the West. The three bivariate charts in the figure depict the results. The upper panel shows that temperature versus UVR did not effectively distinguish between Western and non-Western countries; Western countries were dispersed among non-Western countries along the regression line. The steady rainfall vs temperature chart (middle panel) improved the separation of Western and non-Western countries, but no clear boundary enclosing Western countries and differentiating them from non-Western countries could be traced. This was not the case for the steady rainfall vs UVR chart (lower panel), indicating that temperature was not relevant to testing Hypothesis 1. Hence, discriminant analysis was performed again using only steady rainfall and UVR as predictors. Wilks' lambda reached 0.42 ($\chi2 = 123.42$, $p < .001$), and the canonical correlation was .76. The standardized coefficients of the canonical discriminant function were .61 for steady rainfall and −.60 for UVR. Figure 2 depicts the findings; note that Georgia was classified as a Western country, whereas Brunei was excluded, in contrast to the previous analysis.

4. Discussion

A common Western ecology, characterized by high steady rainfall and low UVR, emerged across oceans. More specifically, data associated with the two meteorological variables encompassed Western European and transoceanic Western countries in a space not shared with non-Western countries. Furthermore, the meteorological data reflected the history of Western civilization from its beginnings in the present Netherlands and Belgium and its early expansion to northern Italy and Slovenia, followed by a second expansive phase in two directions: towards north-eastern Europe and towards the transoceanic Western countries (Figure 2). Eastward expansion was probably constrained by the Eastern Roman Empire and, later, the Orthodox civilization (present Belarus, Russia, Macedonia, Ukraine, Moldova, Bulgaria). Throughout these expansions, ecological commonality and uniqueness were maintained. The change from the Medieval Warm Period to the Little Ice Age caused an agricultural crisis (Skoglund, 2023), but meteorological changes of the past two millennia do not appear to account for the systematic growth of the Western Civilization.

On the other hand, Italy, Spain, and Portugal did not fully share the Western ecology; owing to their rainfall levels, they were excluded from the Western ecological space in the discriminant analysis. This suggests the need to redefine the West by distinguishing between a core Western ecology, characterized by high steady rainfall and low UVR, and a peripheral Western ecology with low steady rainfall and low UVR. Notably, northern areas of both Spain and Italy have rainfall patterns more similar to north-western Europe than to their southern provinces. The northern Spanish regions of Galicia, Asturias, Cantabria, Basque Country, Navarra, northern Aragon, and northern Catalonia are collectively known as "green Spain" owing to their continuous rainfall (Del Río et al., 2011). In northern Italy, humid provinces include Valle d'Aosta, Piemonte, Lombardia, Trentino-Alto Adige, Veneto, and Friuli-Venezia Giulia (Brunetti et al., 2004). In contrast, Portugal lacks steady rainfall in all its regions (Santos et al., 2005). Further research should refine the delineation of the Western ecological frontier that divides Italy and Spain into northern and southern parts. Whether the peripheral West deviates culturally from the core West should be investigated between- and within-countries; there is evidence of significant north-south social and psychological differences in Italy and Spain (e.g., Lynn, 2010, 2012).

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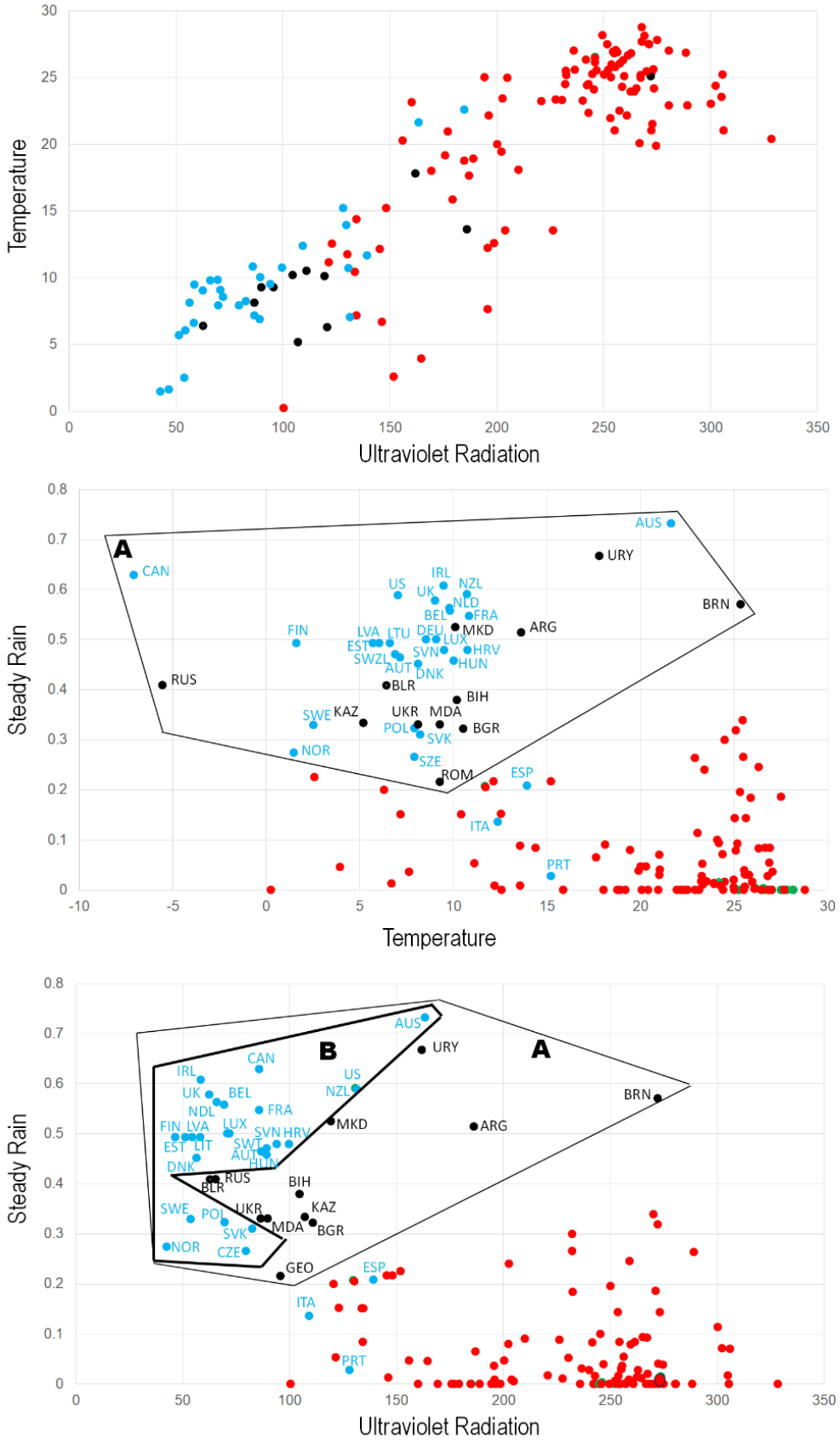

Figure 1. Scatter plots of 145 countries based on steady rainfall, temperature, and ultraviolet radiation. Blue dots: countries classified as Western according to Huntington (1993); red dots: countries not classified as Western; black dots: countries not classified as Western but predicted by discriminant analysis to be Western. Region A: Western and non-Western countries predicted to be Western; Region B: Western countries correctly predicted to be Western.

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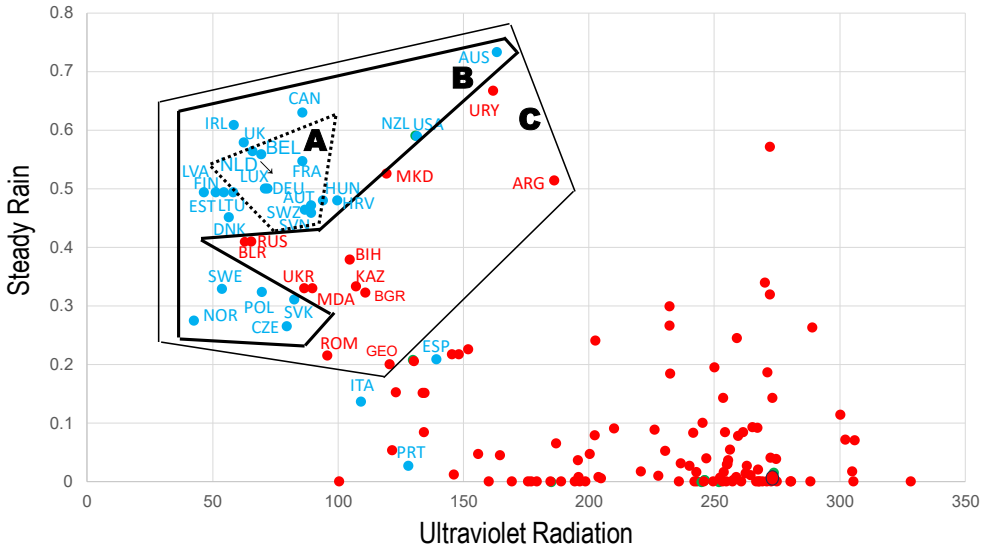

Figure 2. Scatter plot of 145 countries based on steady rainfall and ultraviolet radiation. Blue (red) dots represent countries classified as Western (not Western) according to Huntington (1993). Region A: Countries within the Carolingian Empire at Charlemagne's death (814 CE). The arrow indicates the direction of expansion from the present Netherlands and Belgium. Region B: Western countries predicted to be Western. Region C: Western and non-Western countries predicted to be Western

In summary, the present findings indicate that ecology contributes to the explanation of the frontiers of the West across history. This is a gross conclusion that requires follow-up studies focusing mediators (e.g., agriculture, infections, individualism) through which steady rain and UVRexert(ed) specific influences in the West. A limitation of the study was its sample size; dozens of smaller countries lacked data on the study variables. Another limitation was the concentration in a single methodology. Alternative statistical techniques and exploration of possible curvi-linear relationships involving temperature should be tried in the future as well as alternative conceptual models. More ambitious studies can add other meaningful environmental, cultural, and social variables to obtain comprehensive and detailed explanations and the topic can be broadened by asking why cultural and genetic Western/non-Western admixture succeeded in tropical Latin America but not in tropical Africa and Southeast Asia. The present study was only the opening of a research topic for geographers and social scientists.

5. Conclusion

Western European and transoceanic Western countries are part of a unitary ecological zone, characterized by high steady rainfall and low UVR, which differentiates the West from non-Western countries. Italy, Spain, and Portugal are excluded from this ecology, although the northern provinces of Italy and Spain may share the Western ecology. There is a need to distinguish the core and peripheral parts of the Western ecology and study how this ecological division relates to cultural differences within the West. The north-south divisions of Italy and Spain need special research attention.

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