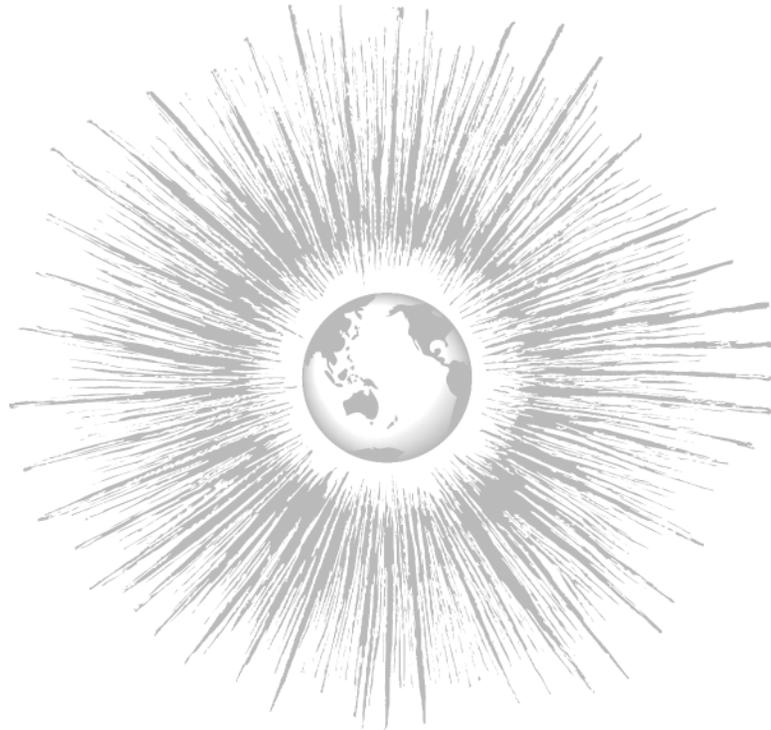


EAST-WEST ORIENTATION OF HISTORICAL EMPIRES AND MODERN STATES

Peter Turchin
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ABSTRACT:

Jared Diamond (1997) hypothesized that if environment is important in limiting the spread of cultures, cultural units would also tend to extend more broadly along lines of latitude than along lines of longitude. We test this hypothesis by studying the range shapes of (a) historical empires and (b) modern states.

Our analysis of the 62 largest empires in history supports this conjecture: there is a statistically significant tendency to expand more east-west than north-south. Modern states also show this trend, although the results are not statistically significant.

INTRODUCTION

In a chapter entitled “Spacious Skies and Tilted Axes” Jared Diamond (1997) argues that crops and domestic animals are spread more easily along lines of latitude (along an East-West axis) rather than along lines of longitude (along a North-South axis). Diamond suggests that East-West spread is easier because similar climates and soil types tend to be arranged in east-west oriented bands. This geographic pattern is fundamental to natural vegetation types and wild animal distributions, and is best illustrated by a map of the global distribution of biomes (Figure 1). A *biome* is a major type of ecological community such as the grassland, desert, or temperate seasonal forest (Ricklefs 2001).

Although Diamond focused primarily on the spread of crop cultivars and domesticated animals, the same principle should influence the military/political, demographic, and cultural dynamics of societies. An obvious example which seems to fit this pattern is the Mongol empire under Chinggis Khan and his

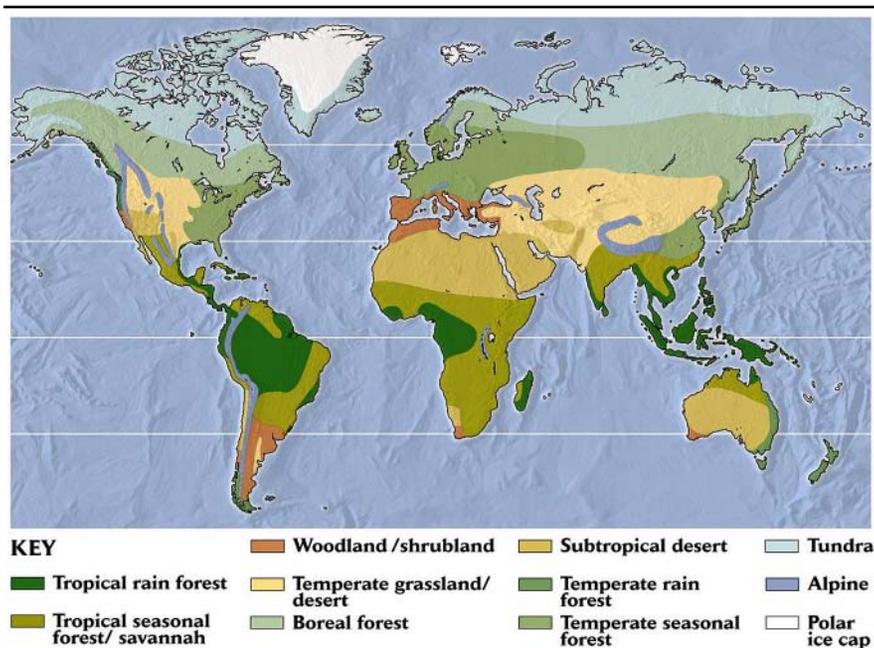
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Figure 1 – Distribution of World Biomes (Ricklefs 2001)



immediate successors; the largest historical empire in terms of contiguous territory. The core of the Mongolian Empire was the Eurasian Steppe that stretches for many thousands of kilometers from the Khingan Mountains in the east to the Carpathians in the west (McNeill 1964). The Mongols were steppe warriors, and they were able to extend rapidly their influence over this whole region (Barfield 1994). The regions inhabited by settled agriculturalists adjacent to the steppe were incorporated more slowly and to a lesser degree than the steppe. For example, the Russian principalities of the forest zone were not occupied by the steppe-dwellers, and were instead subjected to tribute. As a result, the Mongol Empire, based on the steppe, was much wider in the latitudinal rather than longitudinal direction.

The ease of conquest was not the only factor promoting the latitudinal spread of large empires. Societies inhabiting similar ecological zones tend to be more similar to each other than societies located in very different zones. Techniques developed for integrating and controlling a certain type of society should, therefore, be easier to extend latitudinally. There is also a scale aspect to this “ecological factor.” It will be detectable primarily at large geographic scales. Small states or empires, as long as they stay within the same biome, should find

it equally easy (or equally hard) to expand in any direction because the climatic differences in any direction will be minor. A major exception here might be those states which encompass highly varied terrain.

Finally, we note that the latitudinal effect should be much stronger for land-based, contiguous empires than for sea-borne empires. Thus, we would expect stronger latitudinal effect for historical empires than for modern empires. Also as we note below we omit modern colonial empires from the analysis. However we revisit this issue in the conclusion.

ANALYSIS OF THE SHAPES OF HISTORICAL EMPIRES

Territorial expansion by states is, of course, a complex process, influenced by many factors other than the environment. The question of interest here is whether this ecological factor has a detectable effect on the projection of military/political power, or if its influence is lost in the “noise” of complex interactions. To answer this question we compiled a list of all large historical empires with peak territories exceeding 1 Mm² (= 1,000,000 km²), and measured the distances from their eastern to western extremes, as well as from the northern to southern extremes.¹

Many of the historical empires in our analysis rose and fell starting from the same territory, for instance the different Chinese dynasties. However, this does not invalidate the analysis because each dynastic empire had the opportunity to expand either north-south or east-west (omitting repeat empires from the analysis produced substantially the same result).

¹ Our list of large historical states was based on the compilation by Taagepera (1978a, 1978b, 1979, 1997), which has been systematized and posted on the web by Chase-Dunn and coworkers <http://irows.ucr.edu/>. We checked the Taagepera list with all major historical atlases in the library of the University of Connecticut and found eight additional empires that fit our criteria (Axum, Hsi-Hsia, Kara-Khitai, Srivijaya, Maurian, Kushan, Gupta, and Maratha). For historical empires, we used states that peaked before 1900. We excluded the maritime empires of the European Great Powers, because these empires were not contiguous (widely distributed collections of territories). One difficulty in constructing the list was presented by the repeated rise of empires in the same location, such as in China. We adopted the middle road of counting each major dynasty (Han, Tang, Ming, etc.) as a separate empire, but did not distinguish between cycles within any one dynasty (e.g., Early versus Late Han). Analysis of a reduced dataset, which included only the largest empire for each geographic location, yielded qualitatively the same result. This lends support to our argument that successive dynasties had significantly independent opportunities to expand in any direction. See Table 1 for the list of empires.

Table 1 – The Large Historical States Used in the Analysis

Date (peak)	Empire Name	World Region	Area (Mm ²)	Latitude Index
-1300	Egypt (New Kingdom)	Africa	1.00	-1.292
350	Axum	Africa	1.25	0.241
969	Fatimid	Africa	4.10	0.782
1120	Almoravid	Africa	1.00	0.561
1200	Almohad	Africa	2.00	0.864
1380	Mali	Africa	1.10	0.512
1400	Mameluk	Africa	2.10	-0.225
1527	Inca	America	2.00	-1.139
-176	Hsiung-Nu (Hunnu)	Central Asia	9.00	0.818
405	Juan-Juan	Central Asia	2.80	0.740
557	Turks	Central Asia	6.00	1.026
800	Uigur	Central Asia	3.10	0.213
800	Tufan (Tibet)	Central Asia	4.60	0.605
850	Khazar	Central Asia	3.00	0.139
1100	Hsi-Hsia	Central Asia	1.00	0.655
1210	Khorezm	Central Asia	2.30	0.054
1210	Kara-Khitai	Central Asia	1.50	0.362
1270	Mongol	Central Asia	24.00	0.737
1310	Golden Horde	Central Asia	6.00	0.153
1350	Chagatai	Central Asia	3.50	0.383
1405	Timur's	Central Asia	4.40	0.426
-1122	Shang	East Asia	1.25	0.050
-50	China-Early Han	East Asia	6.00	0.661
579	Liang	East Asia	1.30	0.137
715	China-Tang	East Asia	5.40	0.375
947	Liao (Kitan)	East Asia	2.60	0.606
980	China-Sung	East Asia	3.10	-0.164
1126	Jurchen (Chin)	East Asia	2.30	-0.147
1450	China-Ming	East Asia	6.50	-0.138
1790	China-Manchu	East Asia	14.70	0.246
117	Rome	Europe	5.00	0.204
441	Huns (Atilla's)	Europe	4.00	1.003
555	East Roman	Europe	2.70	0.516
814	Frankish	Europe	1.20	0.092
1000	Kiev	Europe	2.10	-0.132
1025	Byzantine	Europe	1.35	0.806

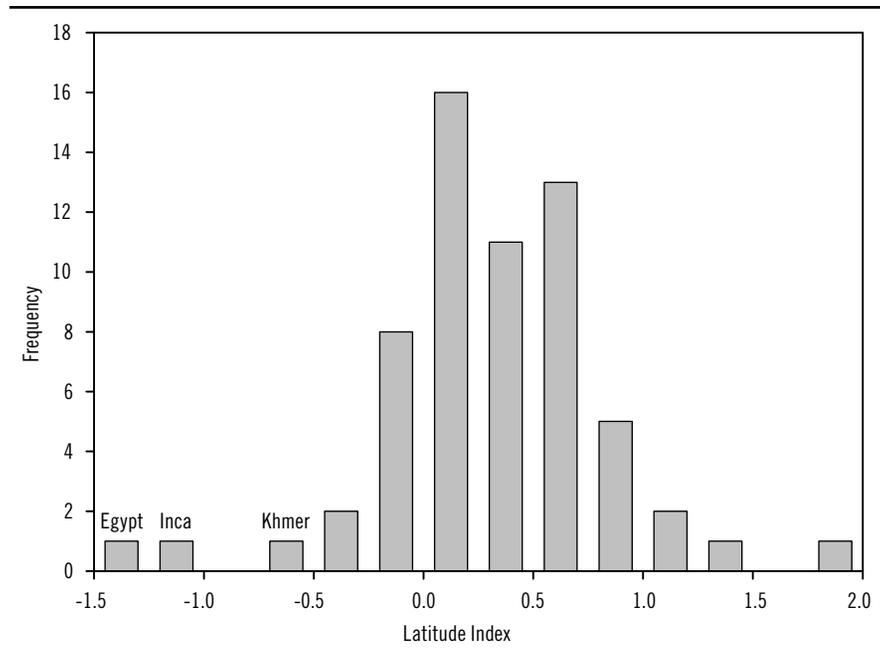
Table 1 (Continued)

Date (peak)	Empire Name	World Region	Area (Mm ²)	Latitude Index
1480	Lithuania-Poland	Europe	1.10	0.079
1683	Ottoman	Europe	5.20	0.320
1895	Russia	Europe	22.80	0.303
1200	Srivijaya	Southeast Asia	1.20	0.272
1290	Khmer	Southeast Asia	1.00	-0.665
-250	Mauryan	South Asia	5.00	0.191
200	Kushan	South Asia	2.00	0.095
400	Gupta	South Asia	3.50	-0.031
648	Harsha (Kanyakubia)	South Asia	1.00	0.668
1312	Delhi	South Asia	3.20	-0.082
1690	Mughal	South Asia	4.00	0.435
1760	Maratha	South Asia	2.50	-0.280
-670	Assyria	Southwest Asia	1.40	1.845
-585	Media	Southwest Asia	2.80	0.141
-500	Achaemenid Persia	Southwest Asia	5.50	0.200
-323	Alexander's	Southwest Asia	5.20	0.478
-301	Seleucid	Southwest Asia	3.90	0.882
0	Parthia	Southwest Asia	2.80	1.374
550	Sassanian Persia	Southwest Asia	3.50	0.292
750	Caliphate	Southwest Asia	11.10	0.730
928	Samanid	Southwest Asia	2.85	-0.194
980	Buyid (Buwahid)	Southwest Asia	1.60	0.142
1029	Ghaznavid	Southwest Asia	3.40	0.689
1080	Seljuk	Southwest Asia	3.90	0.409
1190	Ayyubids	Southwest Asia	2.00	-0.300
1310	Il-Khan	Southwest Asia	3.75	0.664

Our measure of the tendency to expand in the latitudinal direction is the log-transformed ratio of the east-west distance to north-south distance.²

² Log-transformation of the ratio of distances was necessary to make the distribution of the index normal, because the ratio cannot be less than zero. Logically, the metric chosen to quantify the East-West versus North-South spread should give the same magnitude to ratios of 1:10 and 10:1 (but with the opposite sign), and log-transformation accomplishes this. Positive values of the log-transformed ratio, thus, indicate east-west orientation, and negative values north-south orientation.

Figure 2 – Frequency Distribution of the Latitude Index in the Sample of Large Empires



The frequency distribution of the latitudinal index in our sample of 62 historic empires is strongly skewed to the right (Figure 2), and the mean index is significantly greater than zero ($t = 4.83$, $P < 0.001$). The great majority of empires, nearly 80%, have a positive latitudinal index—that is, they are wider in the east-west compared to the north-south direction. There are only three empires that have a strong north-south orientation, and these are the proverbial exceptions that prove the rule. The New Kingdom of Egypt had at its core the valley of a major river running south-north, the Nile. The Inca empire is located on the west coast of South America where ecological zones are longitudinal (see Figure 1) along the Andean mountain chain. We do note, however, that Andean empires, especially the Inca, did transcend ecological zones from the altiplano to the coast, but these are over very short distances. Indeed, many empires, if examined more locally, would also exhibit short range biome diversity. Finally, the Khmer empire was located entirely within the wet tropical forest biome. Thus, even though these three cases do not conform to the rule of latitudinal spread, they obey a more general rule of expansion within an ecological zone.

All of the largest empires (with territory over 10 Mm²) were oriented in the east-west direction. We have already discussed the case of the Mongol

empire. The Islamic Caliphate is a variation on the same pattern, except that the “native biome” of the Arabs was the subtropical desert, rather than the temperate grassland/desert of the Mongols. The next largest state in history after the Mongols, the Russian empire (peak area of 22.8 Mm² in 1895), originated in the transitional zone between the steppe and the forest (ecologists call such transitional zones *ecotones*). When the Muscovite state began to expand in the sixteenth century, it spread fastest precisely within the same ecotone—eastward along the boundary between the Eurasian steppe and northern taiga. Eastward expansion was extremely rapid, so that the Pacific was reached by the mid-seventeenth century. In contrast, the southern advance into the steppes and deserts of Central Asia took a much longer time, and they were conquered only by the late nineteenth century. In addition to ecological considerations the presence of strong pastoral confederacies abetted this slowing (Khodarkovsky 2002). But this is also indirectly ecological since these confederacies, many remnants of the Mongol Empire, depended on a steppe environment to make their living.

Another example of the same dynamic is the early expansion of Rome. The territory of the Roman Empire in the first century B.C.E. coincides almost precisely with the woodland/shrubland biome (also known as the Mediterranean zone). Subsequent expansion took the Romans into the forests of northern Europe. However, severe reverses, such as the battle of Teutoburg Forest in 9 C.E., in which 20,000 legionnaires were obliterated by the tribal Germans (Wells 2003), persuaded the Romans to abandon plans of further conquest. The general rule, thus, seems to be that expansion is easiest and most lasting when occurring within the same ecological zone.

Expansion into other biomes is possible, but more difficult, slow, and requires greater state resources. China is probably the best illustration of this principle. The native biome for China is the temperate seasonal forest,³ and this was precisely the area that was first unified by each of a long succession of Chinese empires. The strength of the Chinese state, however, allowed it to expand into alien biomes. At their peaks the Chinese empires intruded into the steppe (Inner Mongolia, Chinese Turkestan), the alpine biome (Tibet), and the tropical rain forest (Vietnam).

³ It may seem strange to call the Chinese home biome a “forest,” because in present-day China, of course, very few forests are left. Remember, however, that the biome names reflect the types of ecological communities that would be present before substantial human impact. The names are simply a short-hand reference to particular combinations of the climate and soil types. The same principle applies to the “subtropical desert.” Some examples of this biome (e.g. Sahara) extend well beyond the subtropics in the strictly geographic sense of the word.

ANALYSIS OF THE SHAPES OF MODERN POLITICAL STATES

Is the influence of ecology detectable in the shapes of modern states? At first glance, no. The average latitude index for the 29 modern states whose territory exceeds 1 Mm² is positive, but not significantly different from 0. However, if we exclude South American countries, where biomes extend in the longitudinal direction, the statistical test indicates that the pattern is detectable even today ($t = 2.66$, $P = 0.014$). The tendency to east-west orientation in modern countries, nevertheless, is much weaker than for historical empires. There are multiple reasons for this. First, most modern colonial states were sea-borne and not land based. Second, modern transportation technology made and continues to make long-distance travel much cheaper (Ciccantell and Bunker 1998; Bunker and Ciccantell 2005a, 2005b). Third there has been a propensity among colonial states to claim territory that is either not inhabited by the home populations, or little used, or being held in reserve for future use. A striking example of this tendency is Canada, whose population is squeezed into a narrow band running east-west along its southern border with the US, but which nevertheless claims extensive territories in the Arctic. Because of the addition of these lands, which are very sparsely populated, the latitudinal index of Canada is slightly negative. Algeria and Lybia provide other examples of the same tendency—their populations are largely confined to the east-west band along the Mediterranean littoral, but their latitudinal indices are essentially zero, because they claim huge territories to the south, in the Saharan desert.

Fourth, and probably the most important in world-system terms, with advent of industrial technology and the rise of modern capitalism, states intentionally sought new resources (Bunker and Ciccantell 2005a, 2005b). Where those resources were ecologically based, increased biological and ecological diversity became a desiderata if not an explicit goal. This marked a significant change in world-system logic as argued by Chase-Dunn and Hall (1997).

CONCLUSIONS

Our results indicate that the physical and biological environment has a detectable effect on the shapes of historic states and to a lesser extent on modern states. It appears that projection of military/political power is easier within the same ecological zone (biome). This, however, does not support “ecological determinism.” Although ecology is important, its influence on state expansion patterns is transmitted by social mechanisms which can either abate, or sometimes overturn these ecological effects. Despite the complexities of the human world, certain techniques and ideas from ecological sciences have proven to be fruitful in suggesting novel approaches to the study of social systems (Turchin

and Hall 2003; Hall and Turchin 2007). Diamond’s original insight, which motivated our study, is one example. Another is the recent demonstration that cultural variability exhibits a latitudinal gradient (Pagel and Mace 2004). Our results also have interesting implications for the study of historical dynamics (Turchin 2003).

Researchers working within the world-system paradigm have noted that the rise and fall of populations, cities, and empires is characterized by a broad-scale synchronicity (Chase-Dunn and Hall 1997, Chase-Dunn et al. 2000; Chase-Dunn, Hall, and Turchin 2007). For example, there is a substantial correlation between the dynamics of Western Europe and China. On the other hand, South Asian dynamics are completely uncorrelated with the rest of Eurasia. Our finding that the propagation of “signals” within military-political networks is facilitated in the latitudinal, but not longitudinal, directions suggests another possible explanation for this pattern.

Finally, these results support the arguments originally advanced by Wallerstein (1974, 2004) and elaborated by Chase-Dunn and Hall (1997). Contra Frank and Gills (1993), there was significant break in world-system logic with rise of modern capitalism. It is here evidenced in an attenuation of the latitudinal, or ecological, effects on shapes of states and empires with the rise of industrial capitalism. The logic of capitalist accumulation of capital⁴ emphasizes ecological diversity over contiguity, shored up by radical decreases in transportation costs and regimes. It remains fascinating, yet problematic, that even in modern states there is still some residual ecological effect. This is a topic that warrants further, and more nuanced, research than the broad-brush analysis presented here.

⁴ The phrase “capitalist accumulation of capital,” which comes from Chase-Dunn and Hall (1997), serves to distinguish capitalist modes of accumulation from tributary or kin modes of accumulation. Our point is that the logic of capitalist accumulation emphasizes ecological diversity much more than any other mode of accumulation, thus overcoming much of the latitude effect.

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