East-West Orientation of Historical Empires

Peter Turchin, Jonathan M. Adams, and Thomas D. Hall

November 2004

Does environment affect the ability of states to project power? If state expansion is more easily accomplished by staying within the same ecological zone, then state territories should be oriented in the east-west direction, mirroring the orientation of major ecological zones of the world. Our analysis of 62 largest empires in history supports this conjecture.

In a chapter entitled "Spacious Skies and Tilted Axes" Jared Diamond (1997) argued that food production spreads more easily latitudinally (in the East-West direction) rather than longitudinally. A latitudinal shift is easier because similar climates and soil types tend to be arranged in east-west oriented bands. This geographic pattern 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. Consider the greatest empire ever (in terms of territorial extent), conquered by the Mongols under Chinggis Khan and his immediate successors. The core of the Mongolian Empire was the Great 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 rapidly extend 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, being instead subjected to tribute. As a result, the Mongolian Empire, with its core 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 the great 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. Note that this "ecologic factor" should be detectable only at large geographic scales—a small state, as long as it stays within the same biome, will find it equally easy (or equally hard) to expand in any direction, longitudinal or latitudinal.

Territorial expansion by states is a complex macrosociological process, influenced by many factors other than the environment. Does the ecological factor have a detectable effect on the projection of military/political power, or is its influence 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 Mm^2 (= 1,000,000 km^2), and measured the distances from their eastern to western extremes, as well as from the northern to southern extreme (Endnote 1). 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 (Endnote 2) the "latitudinal index."

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 latitidinal 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 was located on the west coast of South America, where

ecological zones run longitudinally (see Figure 1) due to a major mountain chain, the Andes. 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 the more general rule of "expansion within an ecological zone."

All of the largest empires (with territory over 10 Mm^2) 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 Mm^2 in 1895), originated in the transitional zone between the steppe and the forest (ecologists call such transitional zones *ecotones*). Once the Muscovite state began expanding 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.

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 occuring within the same ecological zone. Expansion into other biomes is possible, but more difficult, slow, and requires greater state resources. The case of China is probably the best illustration of this principle. The native biome of the Chinese is the temperate seasonal forest (Endnote 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, and at their peaks the great Chinese empires intruded into the steppe (Inner Mongolia, Chinese Turkestan), the alpine biome (Tibet), and the tropical rain forest (Vietnam).

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 Mm^2 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. Partly this could be due to the effect of modern technology, but we suspect that it is also an artefact of the propensity of modern states to claim territory even if it is not used by their populations. 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 almost totally devoid of human occupation, 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.

In conclusion, our results indicate that the physical and biological environment has a detectable effect on the shapes of historic and modern states. It appears that projection of

military/political power is easier within the same ecological zone (biome). Our results should not be interpreted as a kind of "ecological determinism"—although ecology is important, its influence on state expansion patterns is transmitted by entirely social mechanisms. On the other hand, certain techniques and ideas from ecological sciences have proved to be fruitful in suggesting novel approaches to the study of social systems (Turchin and Hall 2003). 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). 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 suggest one possible explanation for this macrohistoric pattern.

Endnotes:

Note 1. Our list of large historical states was based on the compilation by Taagepera (1978, 1978, 1979, 1997), which has been systematized and posted on the web by Chase-Dunn and coworkers (http://www.irows.ucr.edu/). We checked the Taagepera list with all major historical atlases in the library of the University of Connecticut and found additional eight empires that fitted our criteria (Axum, Hsi-Hsia, Kara-Khitai, Srivijaya, Maurian, Kushan, Gupta, and Maratha). We excluded the maritime empires of the European Great Powers, because our measure of the latitudinal tendency is not applicable to such noncontiguous, 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 a 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. See Table 1 for the list of empires.

Note 2. Log-transforming the ratio of distances was necessary to make the distribution of the index symmetric. Positive values indicate east-west orientation, and negative values – north-south orientation.

Note 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.

References

Barfield, T. J. 1994. The devil's horsemen. Pages 157-182 *in* S. P. Reyna and R. E. Downs, editors. Studying war: anthropological perspectives. Gordon and Breach, Langhorn, PA.

Chase-Dunn, C., S. Manning, and T. D. Hall. 2000. Rise and fall: east-west synchronicity and Indic exceptionalism reexamined. Social Science History **24**:727-754.

Chase-Dunn, C. K., and T. D. Hall. 1997. Rise and demise: comparing world-systems. Westview Press, Boulder, CO.

Diamond, J. 1997. Guns, Germs, and Steel: The Fates of Human Societies. W. W. Norton, New York.

McNeill, W. H. 1964. Europe's Steppe Frontier. University of Chicago Press, Chicago, IL.

Pagel, M., and R. Mace. 2004. The cultural wealth of nations. Nature **428**:275-278.

Ricklefs, R. E. 2001. The Economy of Nature, 5th edition. W. H. Freeman, New York.

Taagepera, R. 1978. Size and duration of empires: systematics of size. Social Science Research **7**:108-127.
Taagepera, R. 1978. Size and duration of empires; growth-decline curves, 3000 to 600 BC. Social Science Research **7**:180-196.
Taagepera, R. 1979. Size and duration of empires: growth-decline curves, 600 B.C. to 600 A.D. Social Science History **3**:115-138.
Taagepera, R. 1997. Expansion and contraction patterns of large politices: context for Russia. International Studies Quarterly **41**:475-504.
Turchin, P. 2003. Historical dynamics: why states rise and fall. Princeton University Press, Princeton, NJ.
Turchin, P., and T. D. Hall. 2003. Spatial synchrony among and within world-systems: insights from theoretical ecology. Journal of World Systems Research **9**:37-64.
Wells, P. S. 2003. The Battle that Stopped Rome: Emperor Augustus, Arminius, and the Slaughter of Legions in the Teutobutg Forest. W. W. Norton, New York.

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
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

Table 2

Region	*Mean*	*SE*	*n*	*t*	*P*
Africa	0.21	0.28	7	0.72	0.50
Central Asia	0.48	0.08	13	5.80	<0.001
East Asia	0.18	0.10	9	1.71	0.12
Europe	0.35	0.12	9	2.92	0.02
South & SE Asia	0.07	0.13	9	0.51	0.62
Southwest Asia	0.52	0.15	14	3.40	0.005
America	–1.14	–	1	–	–
All regions	**0.31**	**0.06**	**62**	**4.83**	**<0.001**

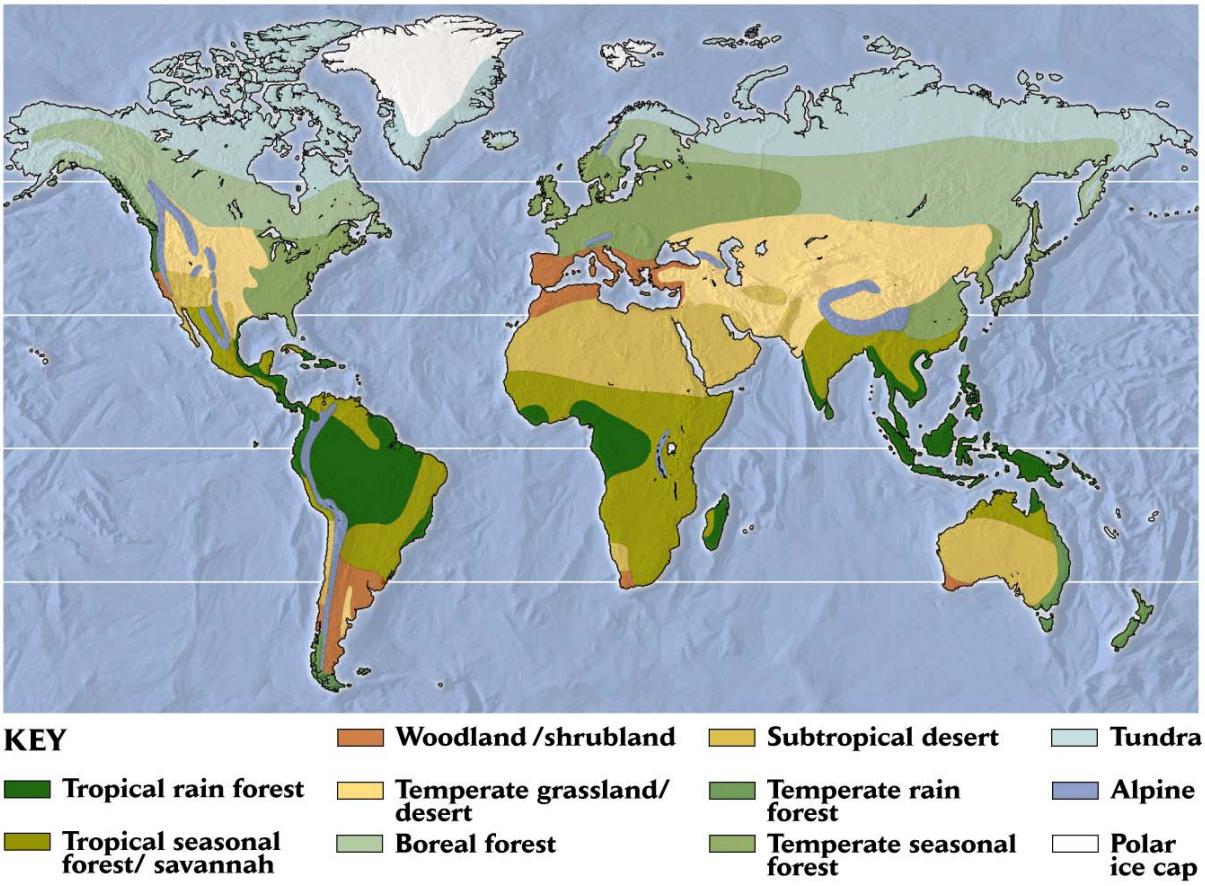

Figure 1. Distribution of world biomes (Ricklefs 2001).

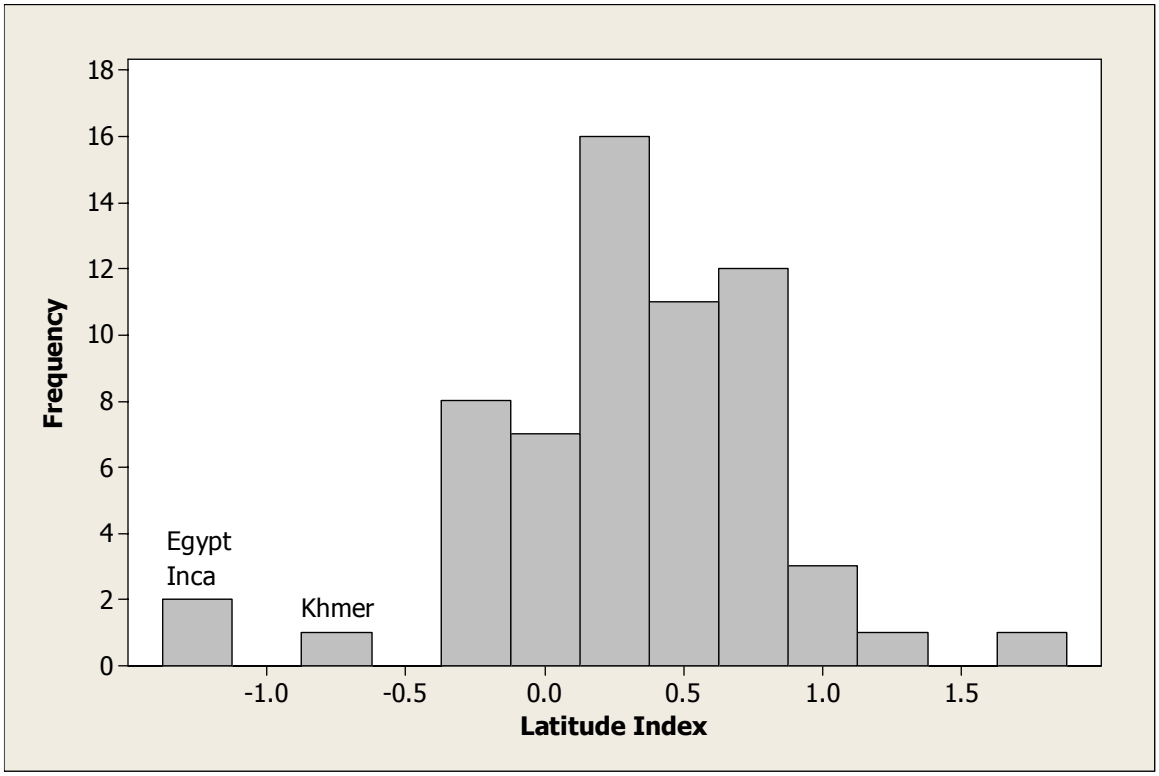

Figure 2. Frequency distribution of the Latitude Index in the sample of large empires.