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When All The World's a City: Defining the Future City

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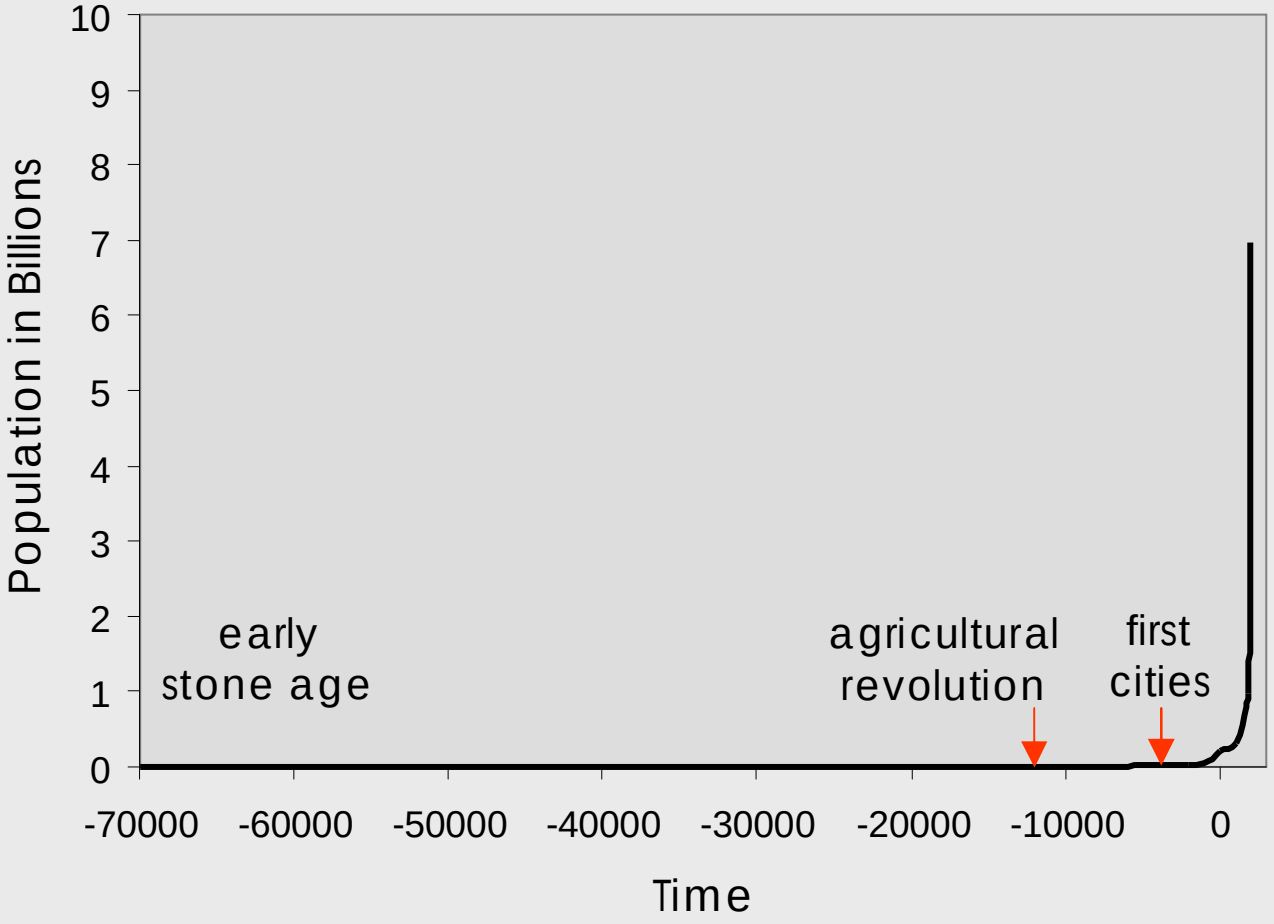
Let us begin with population growth, from a long way back ...


Population in Billions
10
9
8
7
6
5
4
3
2
1
0
-70000
-60000
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Time
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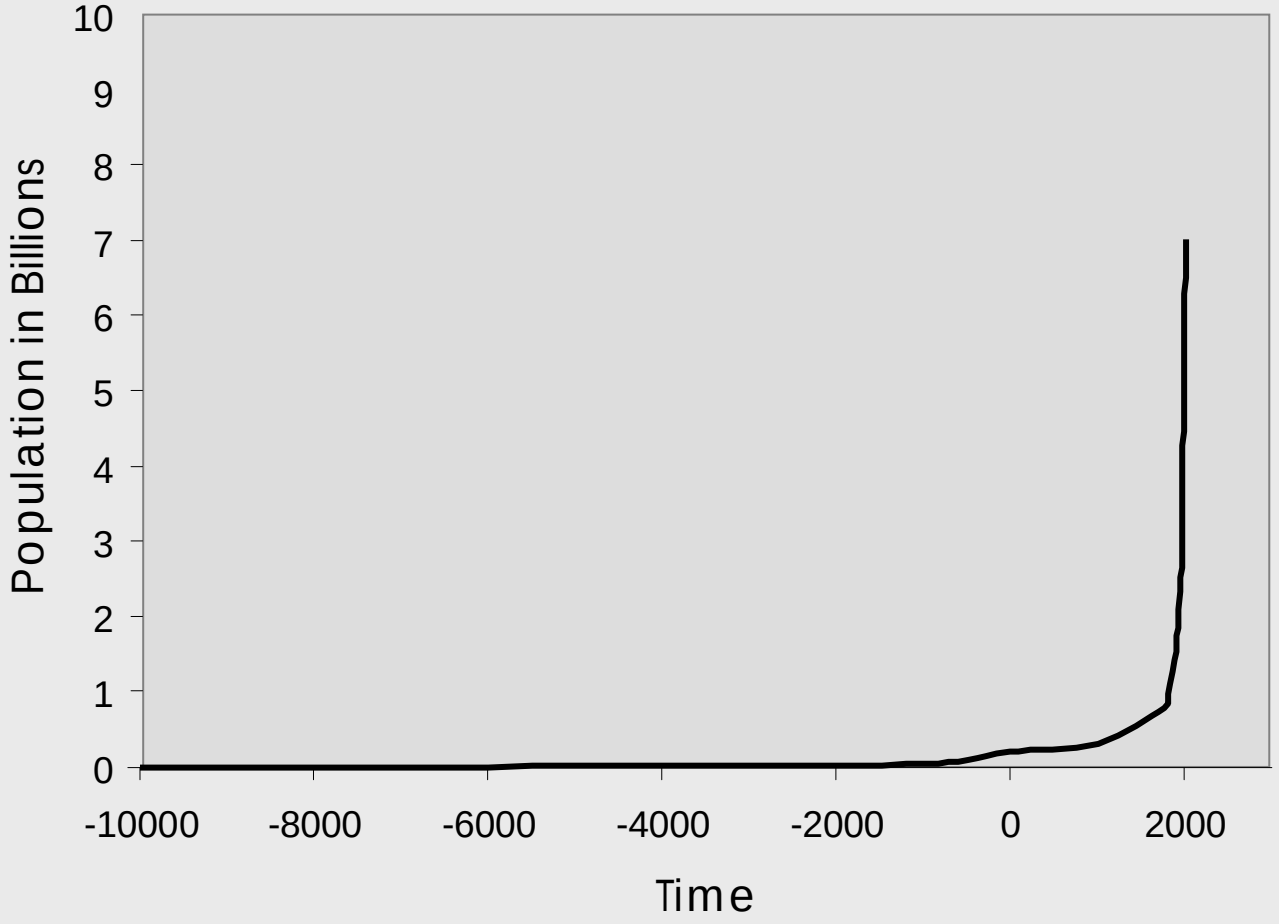
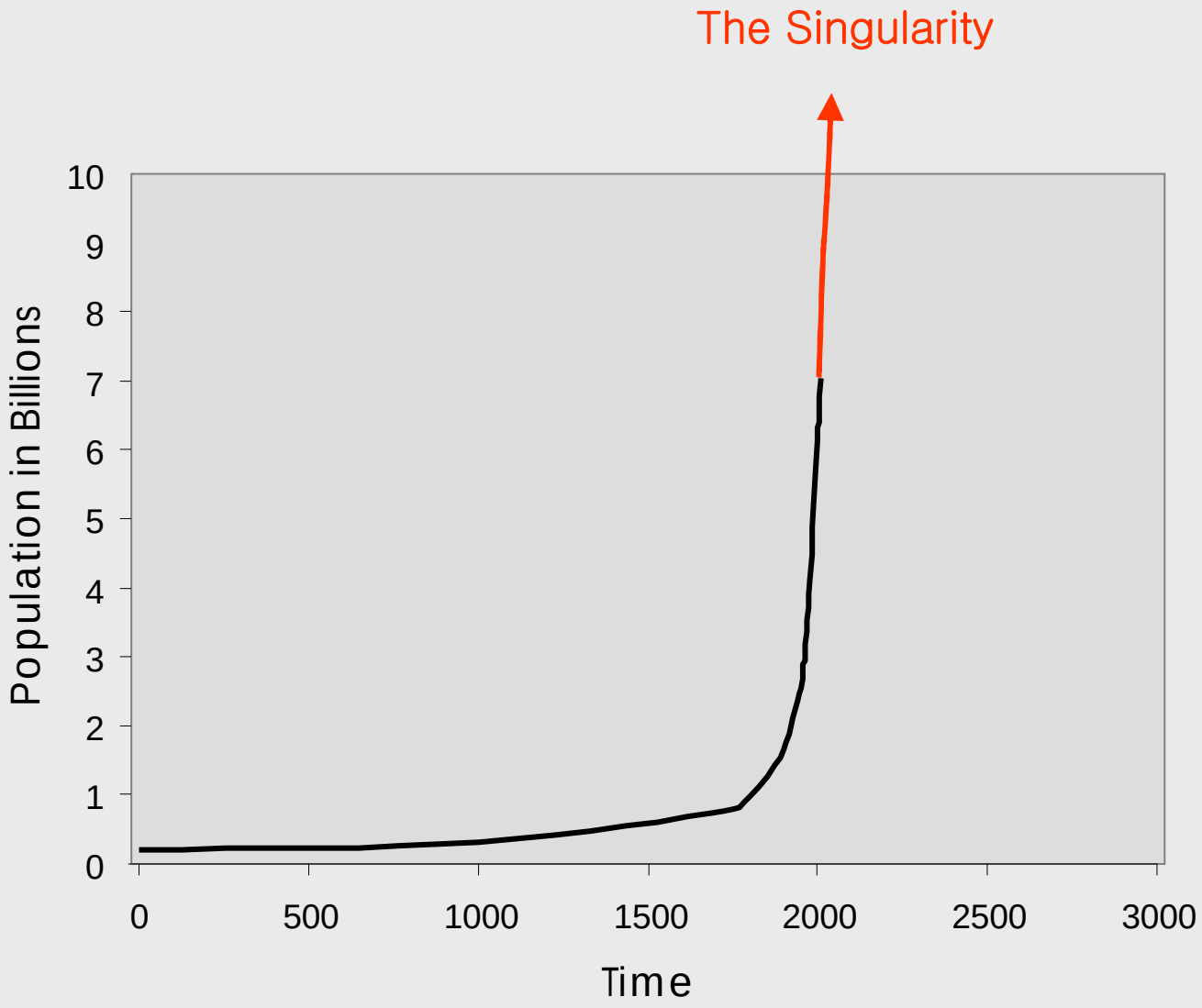
revolution
first
cities



All the World's A City: Defining the Future City


The Singularity
Population in Billions
10
9
8
7
6
5
4
3
2
1
0
0
500
1000
1500
2000
2500
3000
Time

The Singularity - infinite population, immortality, or zero population growth

Doomsday: Friday, 13 November, A.D. 2026

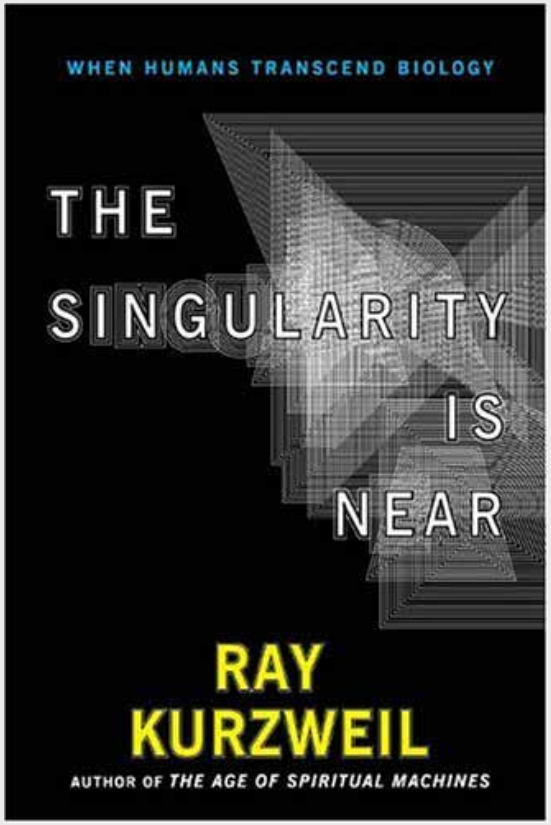
At this date human population will approach infinity if it grows as it has grown in the last two millenia.

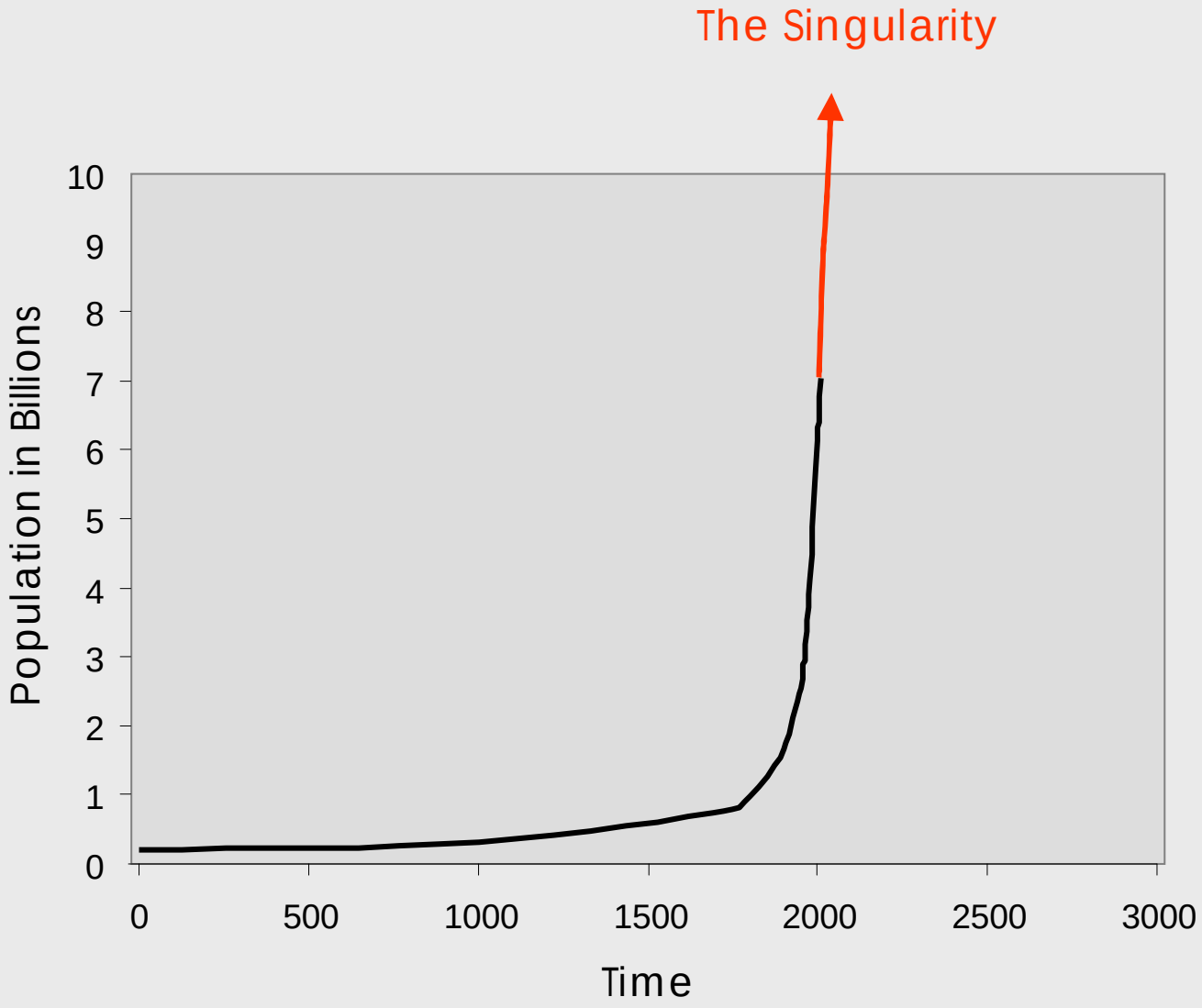
Heinz von Foerster, Patricia M. Mora, Lawrence W. Amiot

Among the many different aspects which may be of interest in the study of biological populations (*1*) is the one in which attempts are made to estimate the past and the future of such a population in terms of the number of its elements, if the behavior of this population is observable over a reasonable period of time.

All such attempts make use of two fundamental facts concerning an individual element of a closed biological population—namely, (i) that each element comes into existence by a sexual or asexual process performed by another element of this population ("birth"), and (ii) that after a finite time each element will cease to be a distinguishable member of this population and has to be excluded from the population count ("death").

Under conditions which come close to being paradise—that is, no environmental hazards, unlimited food supply, and no detrimental interaction between elements—the fate of a biological population as a whole is completely determined at all times by reference to the two fundamental properties of an individual element: its fertility and its mortality. Assume, for simplicity, a fictitious population in which all elements behave identically (equivivant population, *2*) displaying a fertility of γ_0 offspring per element per unit time and having a mortality $\theta_0 = 1/t_m$, derived from the life span for an individual element of t_m units of time. Clearly, the




The Singularity
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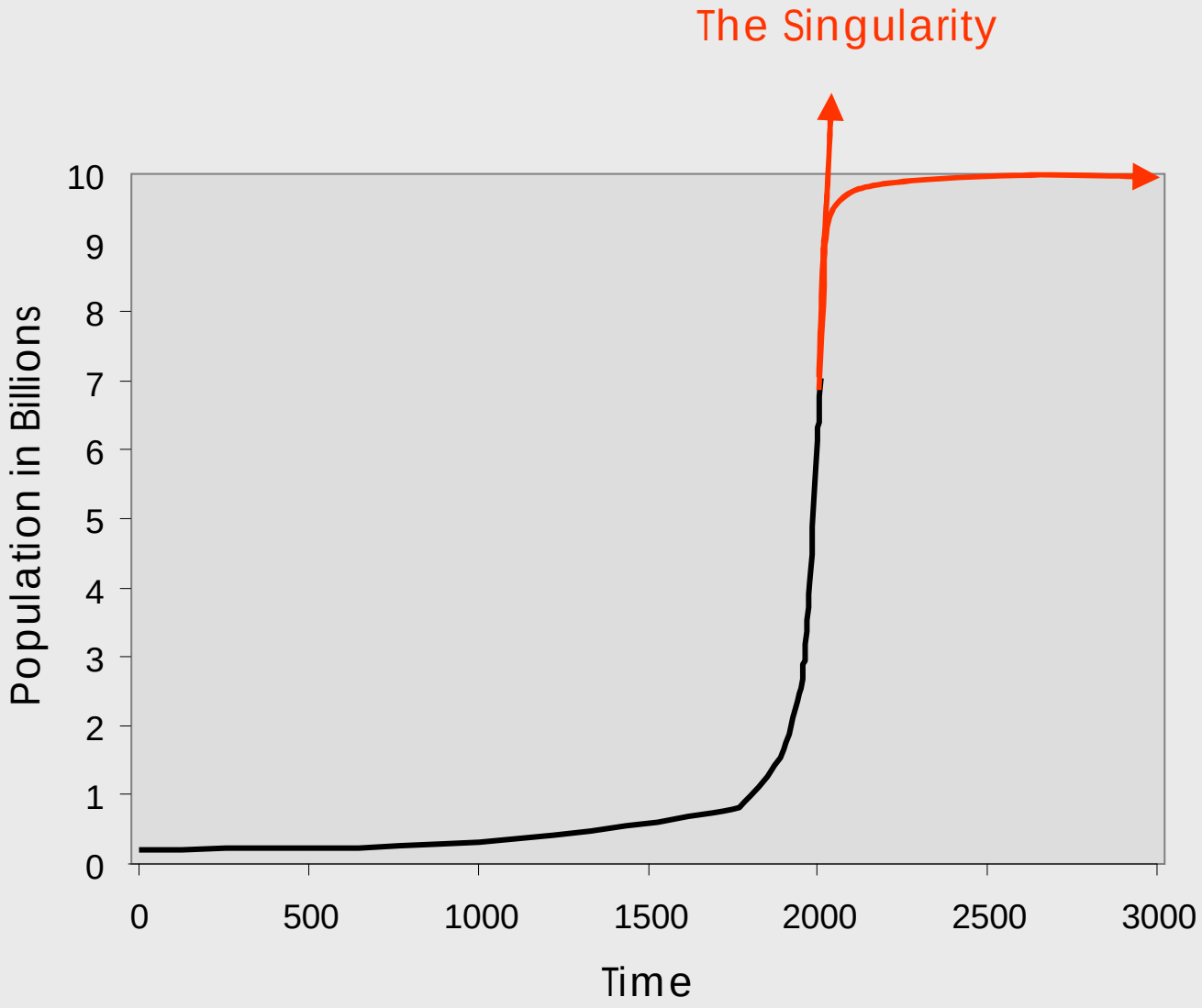
Time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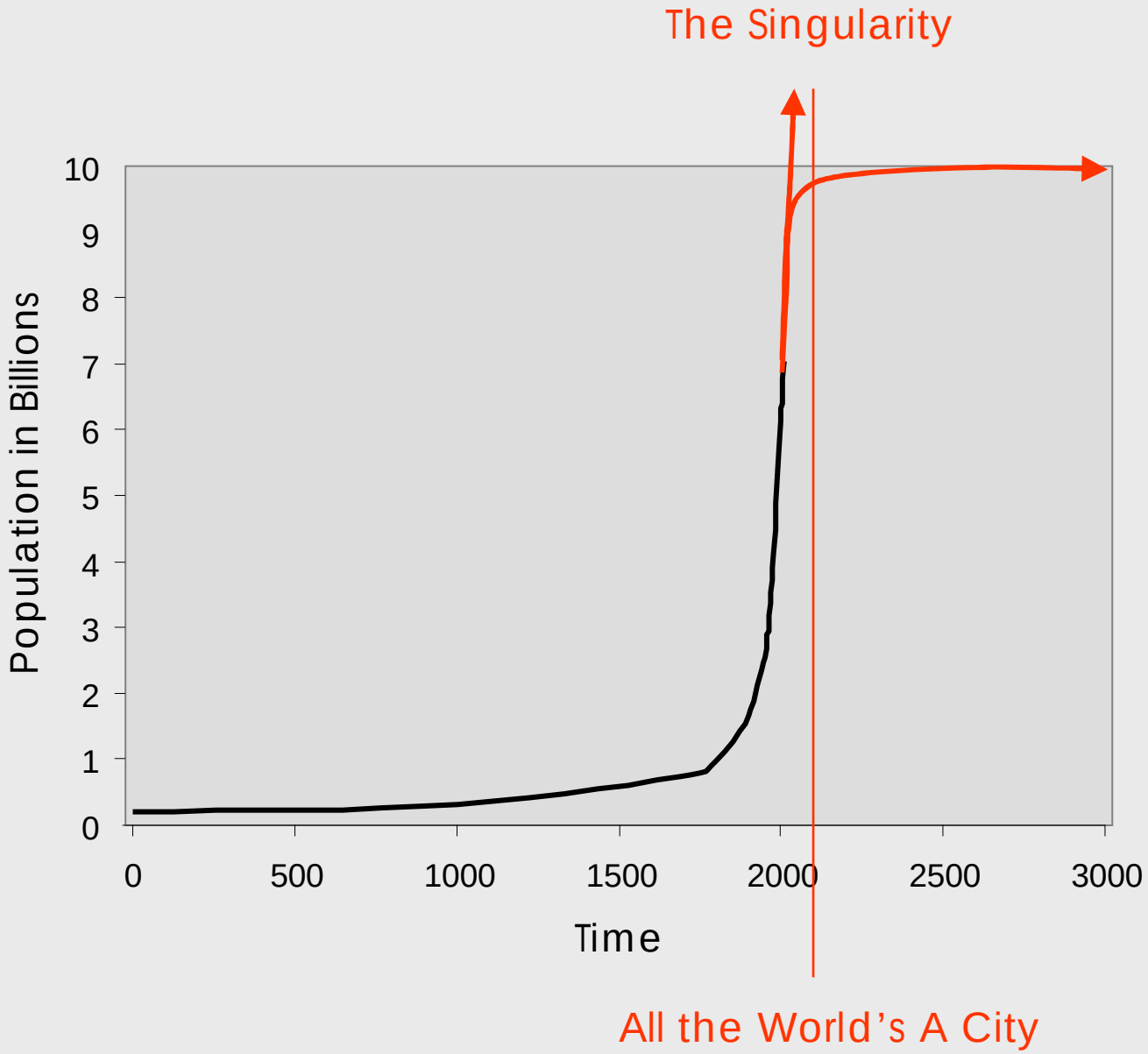
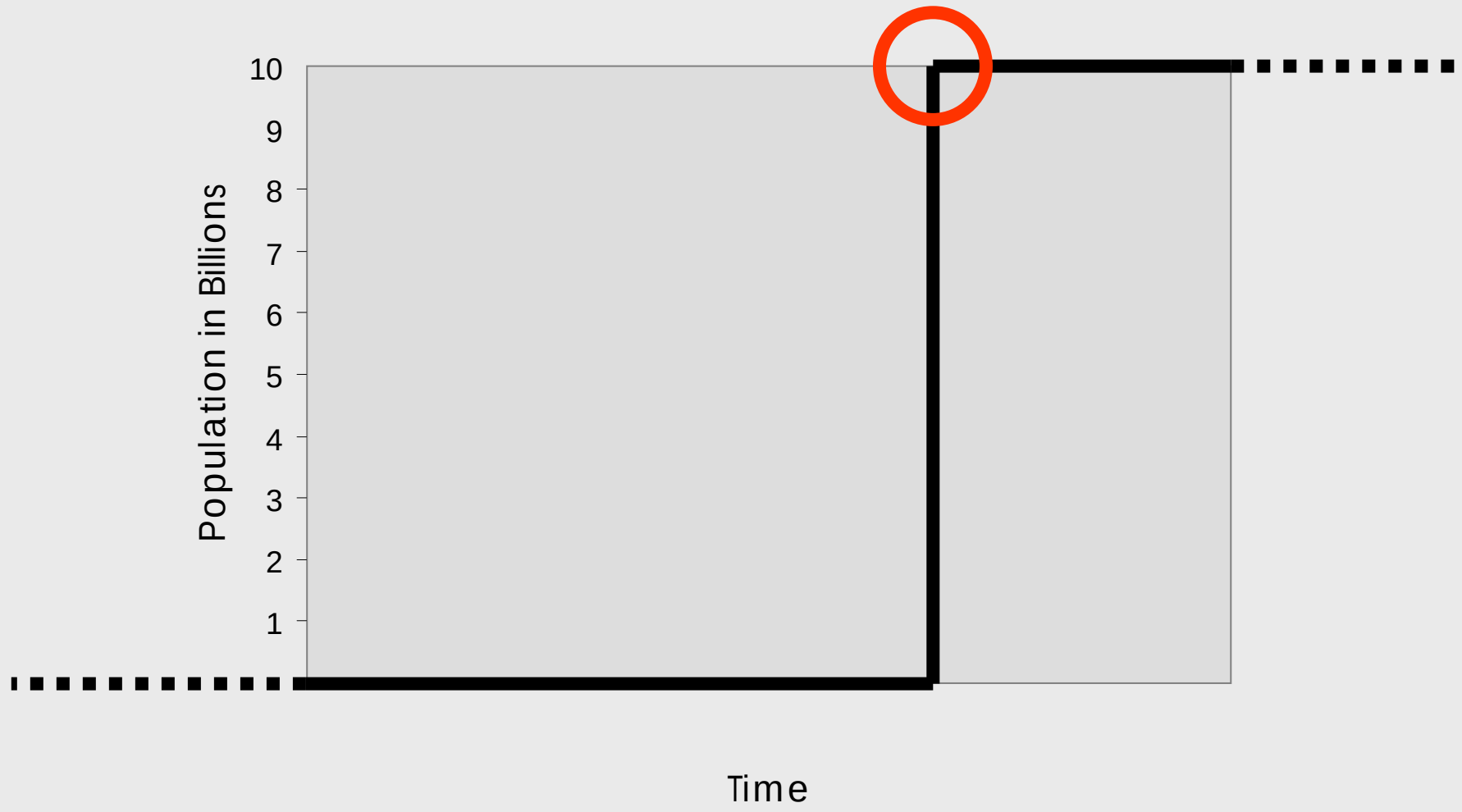


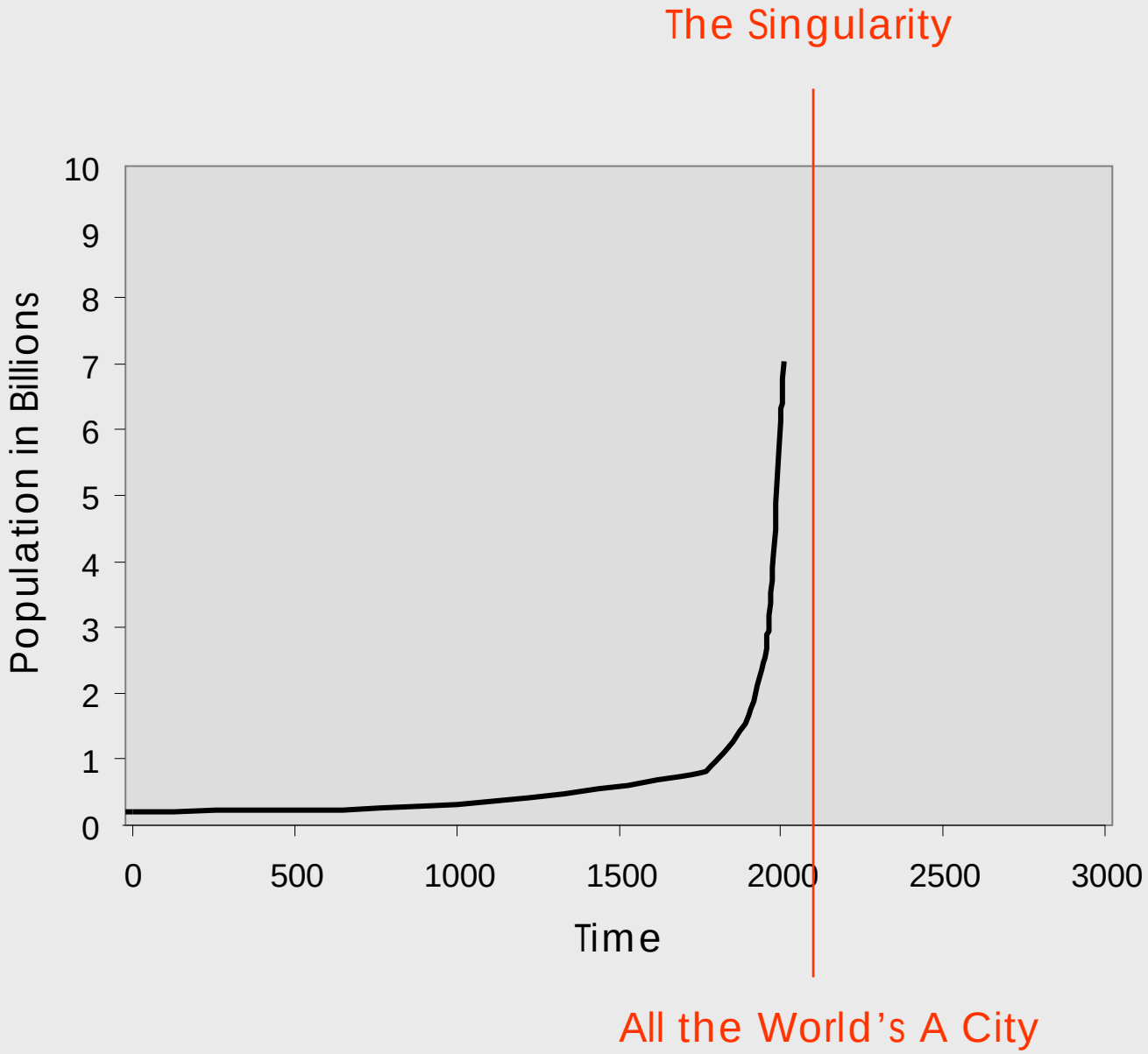
All the World's A City: Defining the Future City



All the World's A City: Defining the Future City

Population is slowing to a steady state, this is the demographic transition but more and more people are living in cities

This can't go on
Something has to give



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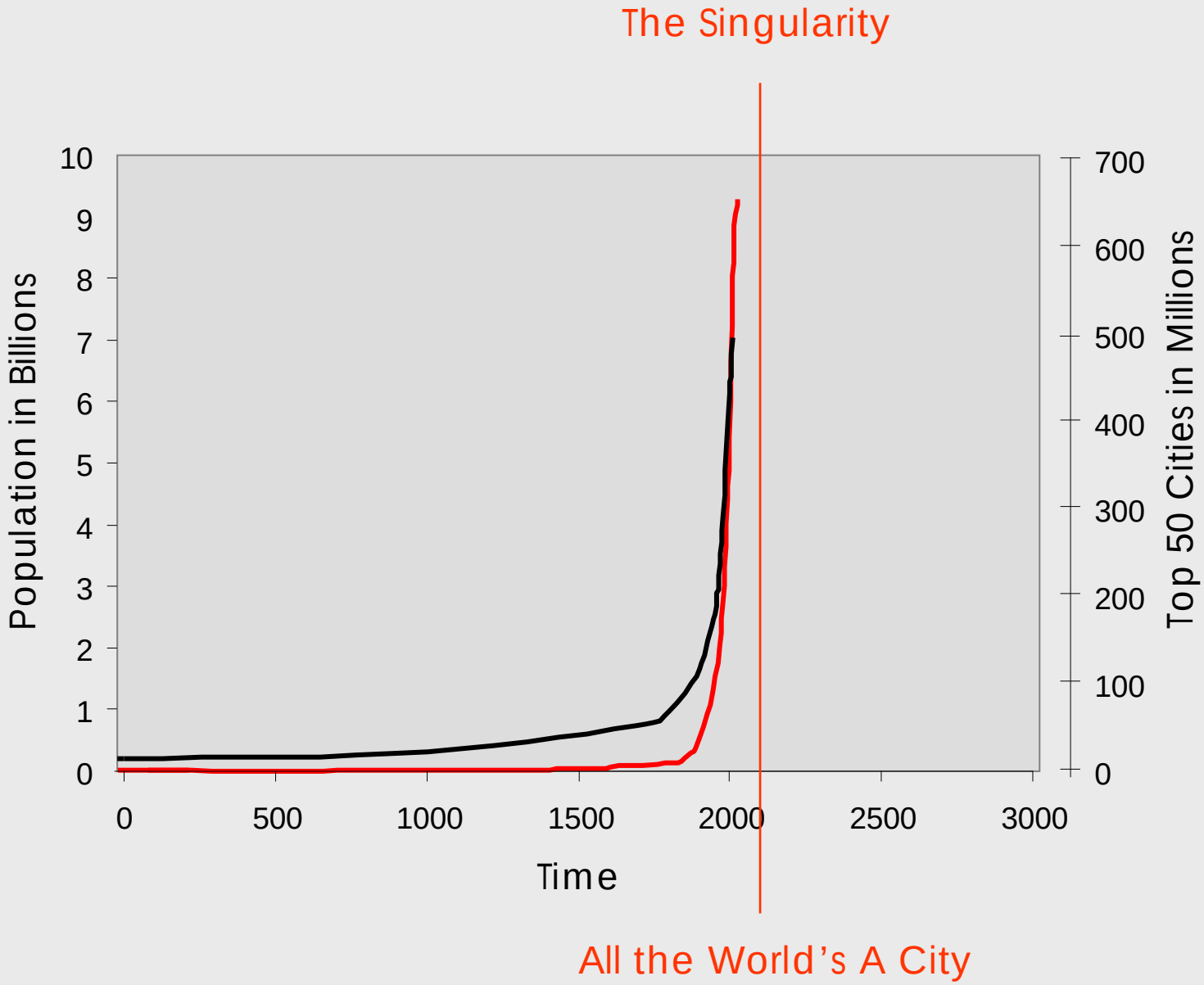

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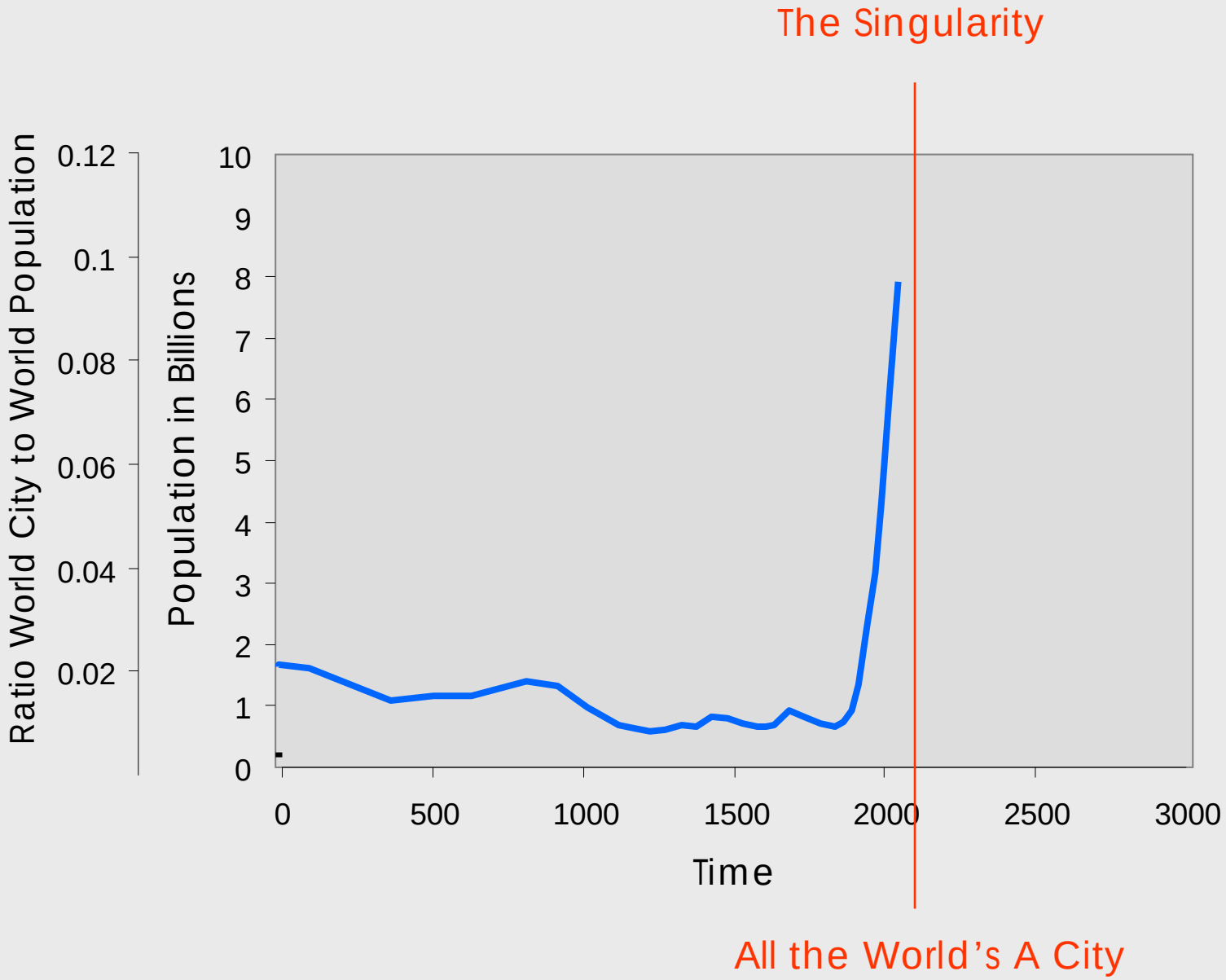

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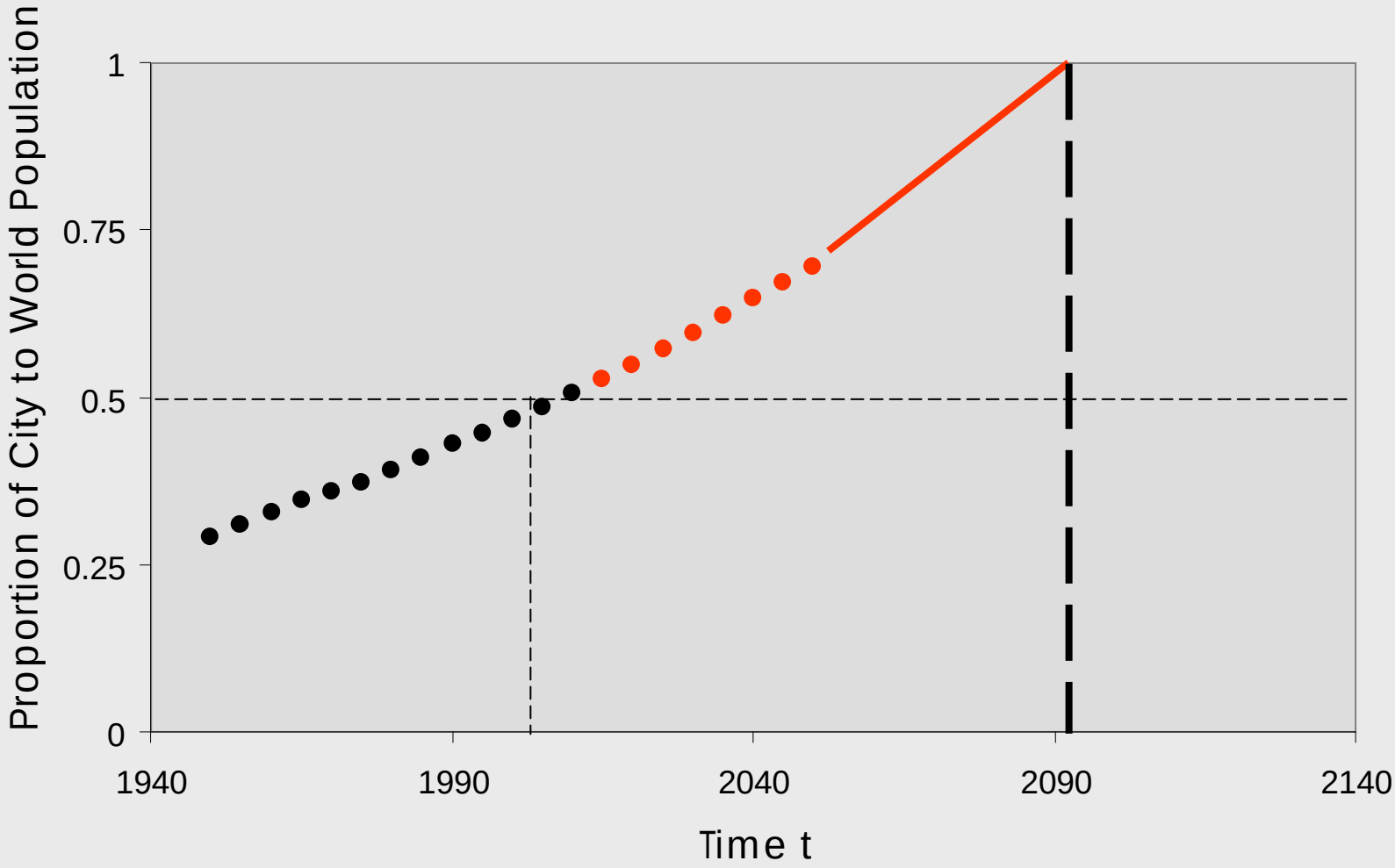

Proportion of City to World Population
1
0.75
0.5
0.25
0
1940
1990
2040
2090
2140
Time t

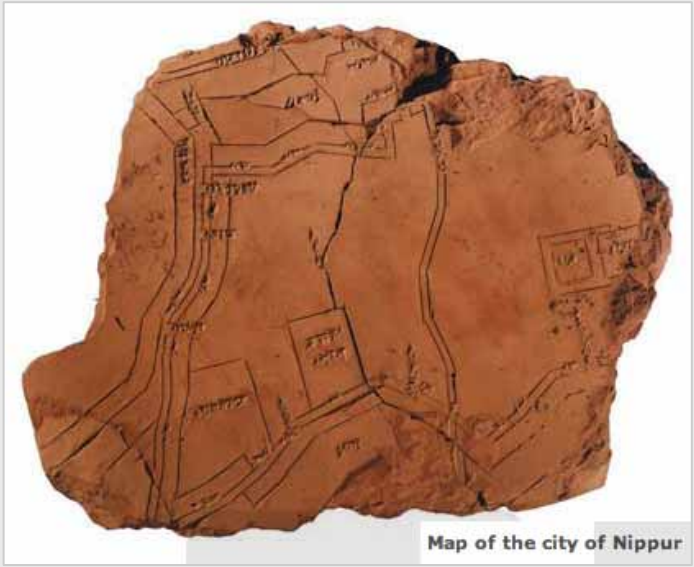
So what happens when all the world's a city –
will we still speak of cities?

Of course, but this still poses an enormous and increasing problem about what a city actually is

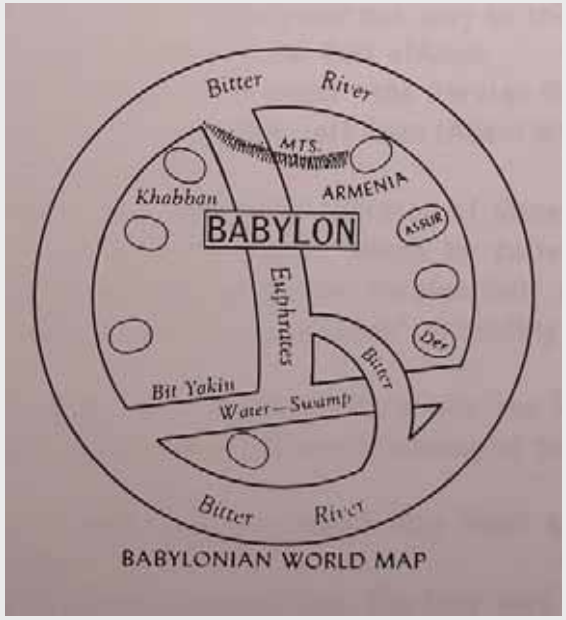
Take the example of Chongqing, a city on the western Yangtze. It reportedly has reached 32 million.

In fact, defining a city's boundaries is incredibly difficult, and this city sits in a very wide hinterland

For most of history, cities have been tight compact affairs – bounded, walled, contained – for defensive purposes as well as based on limited technologies to travel long distances



Map of the city of Nippur

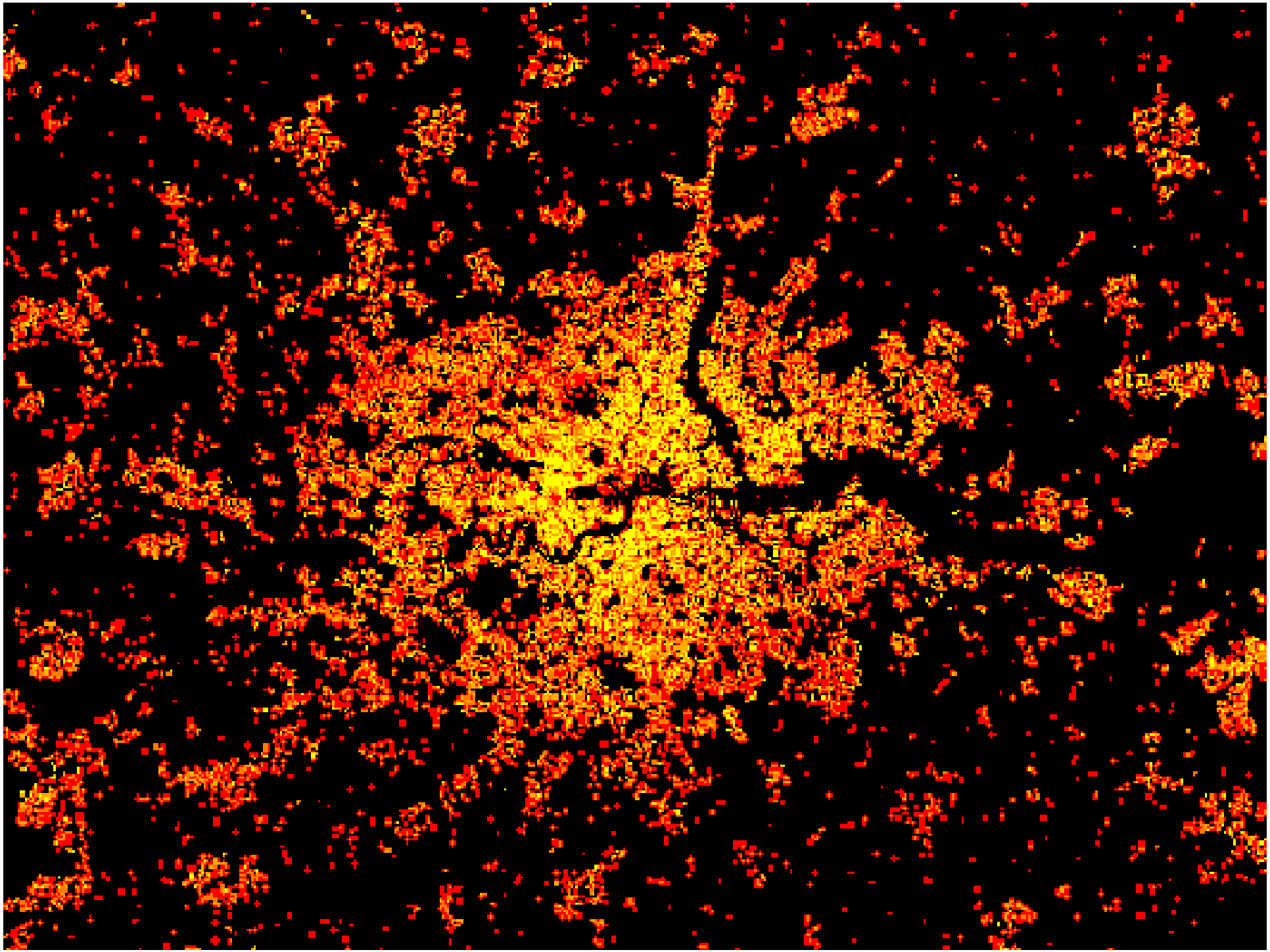


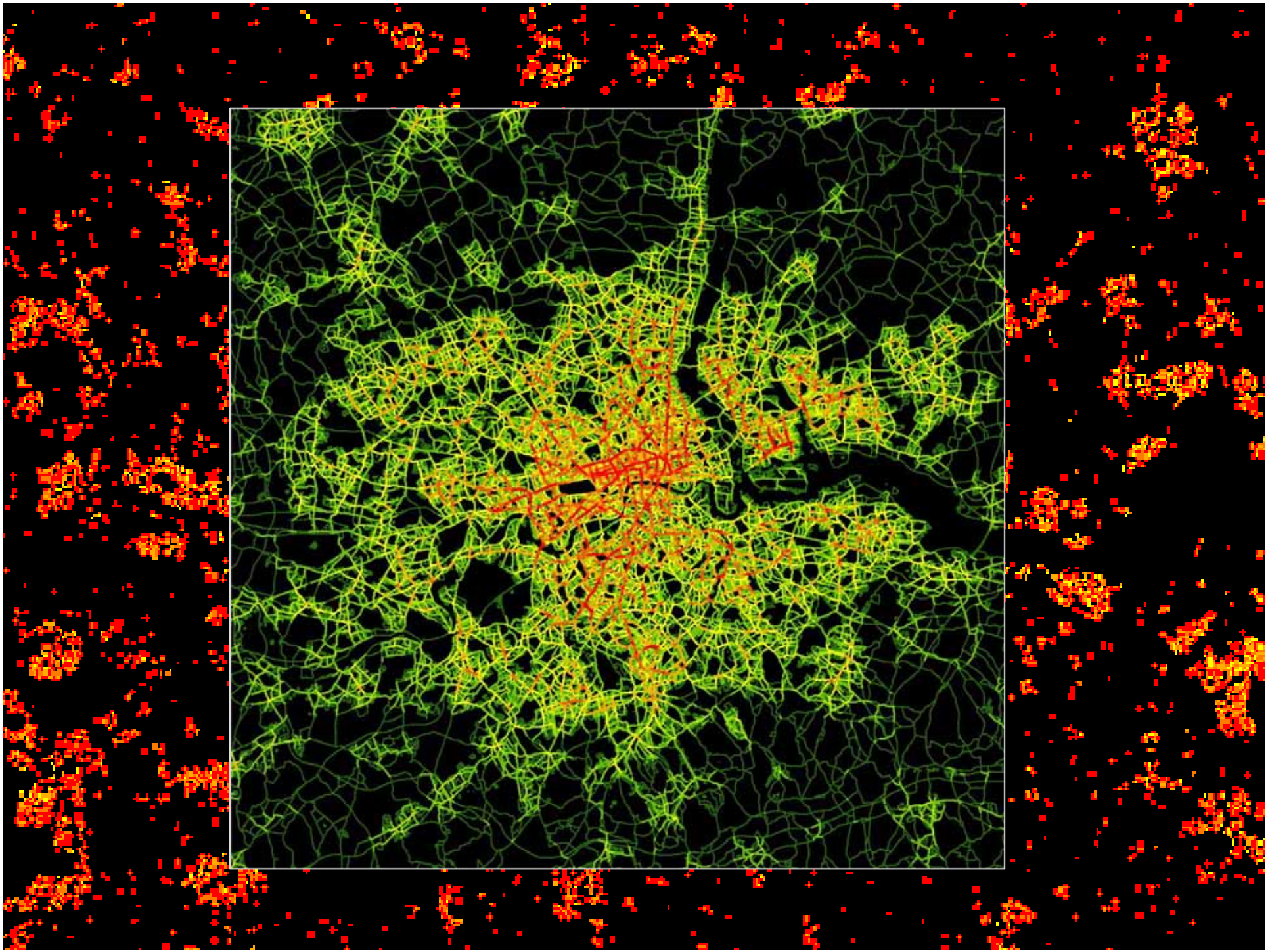
BABYLONIAN WORLD MAP

All the World’s A City: Defining the Future City

When we began to develop technologies that could move us farther than the horse and cart – mechanical technologies – the internal combustion engine, towns began to grow beyond 1 million, the limit in the ancient world

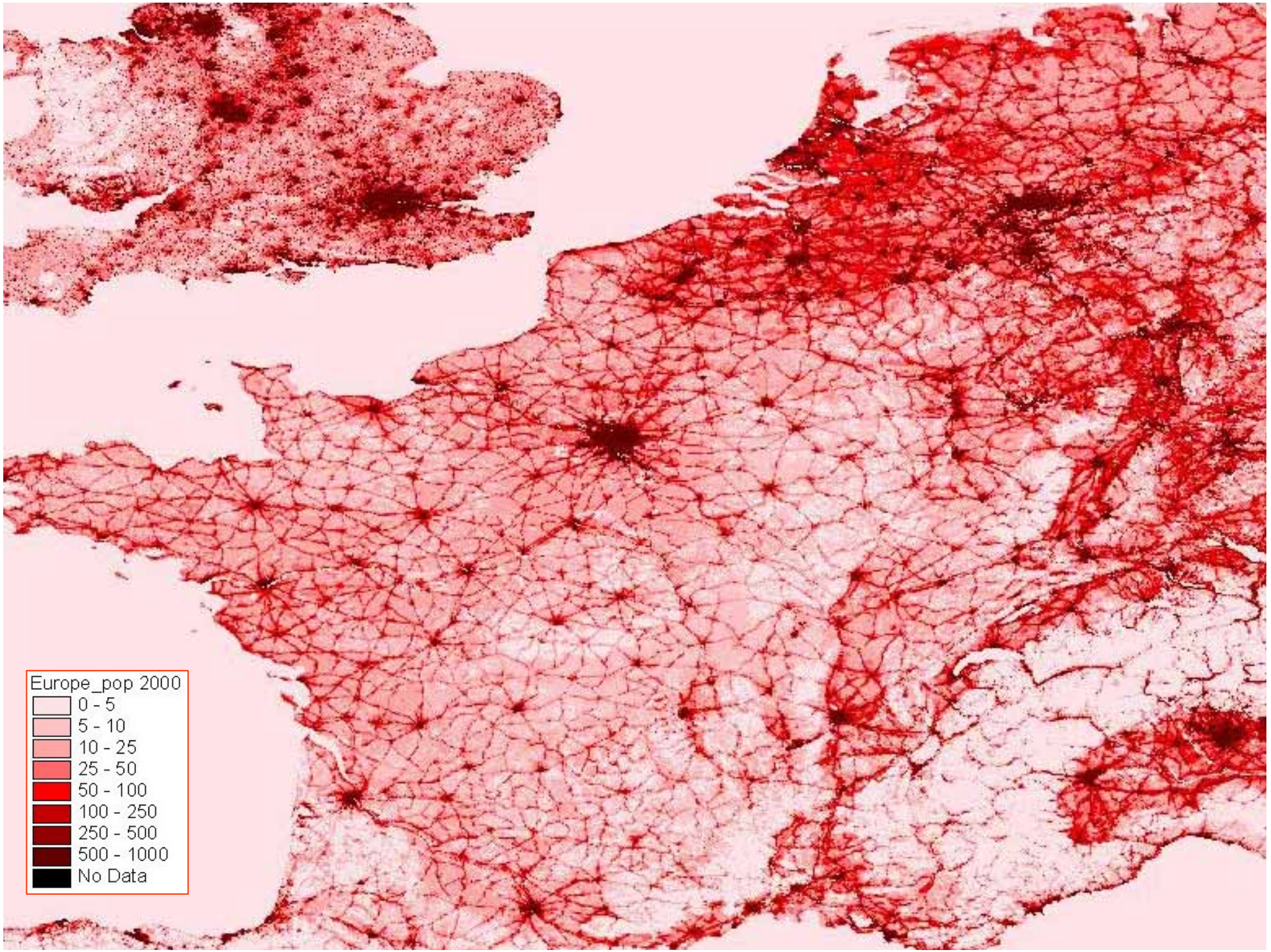
London was the first city to reach 2 million. The story of the last 200 years is well known. First the walls went, then the suburbs came, then national networks, then a global spreading out – all blurring what a city actually is.

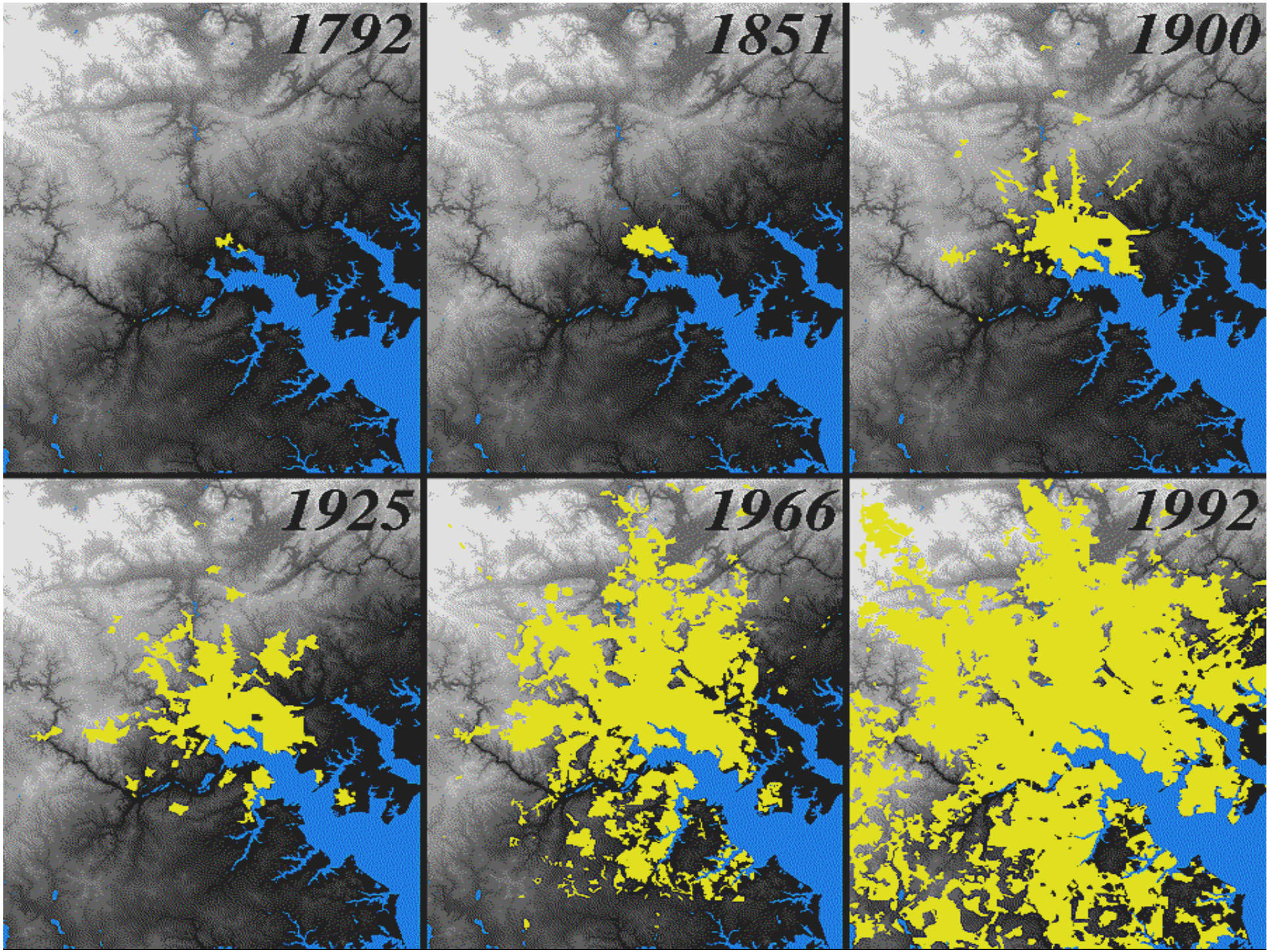




How do we then draw boundaries when cities merge into one another? What then is a city if most of its wealth like London's is generated globally

Density and connectivity are key.


Europe_pop 2000
0 - 5
5 - 10
10 - 25
25 - 50
50 - 100
100 - 250
250 - 500
500 - 1000
No Data


1792
1851
1900
1925
1966
1992

Before I show you how we can still define cities, I need to note two properties of systems of cities, from our ‘new science of cities’ that measures the way they grow and scale

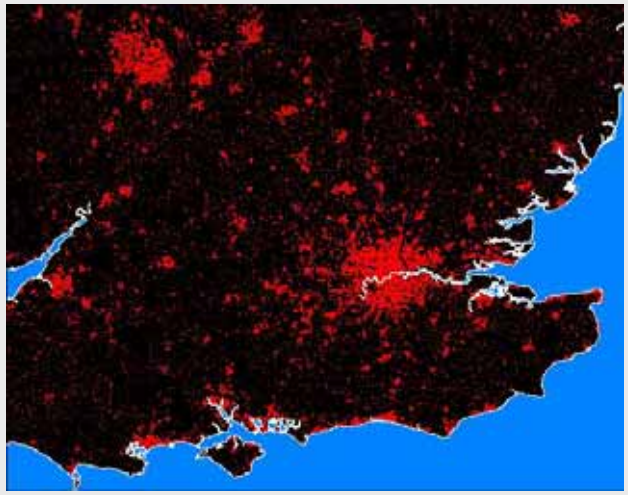
First we must note that as cities get bigger, they tend to grow richer more than proportionately to their population size: This is positive allometry. The Santa Fe complexity group have demonstrated this for US

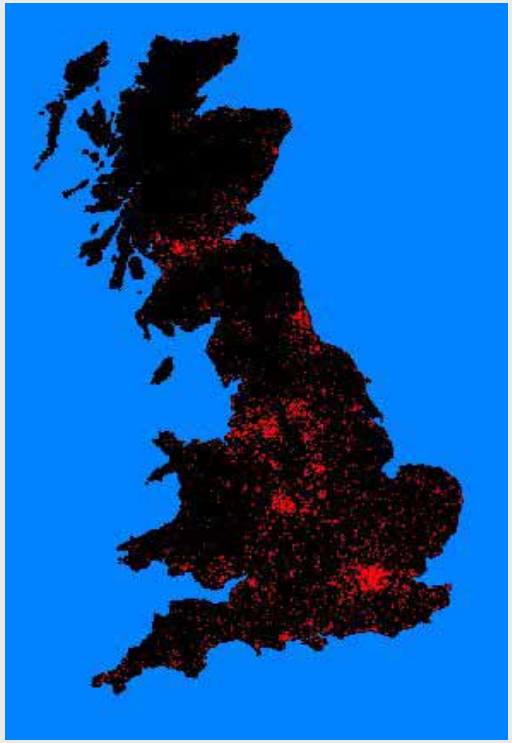
It is no more or less than what Alfred Marshall, the great economist, said about cities in the late 19th century; cities generate ‘economies of scale’

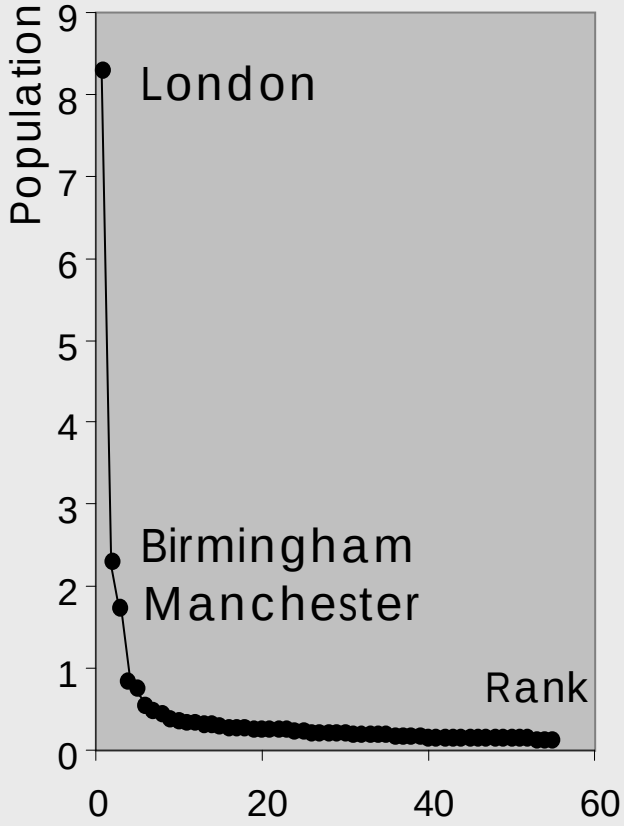
But in the UK?

We have found that cities do not super-scale by income with size. London of course is a massive outlier. But it appears to examine performance, we cannot separate one city from another. They are all of one piece

The second puzzle is that at any time period when we rank cities in terms of their population size, they follow what physicists call a ‘power law’. You have a small number of big cities and a very large number of small: a long tail.







Here it is for the UK

So what does this all mean? Well if all the world's a city, and it is impossible to define boundaries around individual cities, then does all this break down, and we just have one big city?

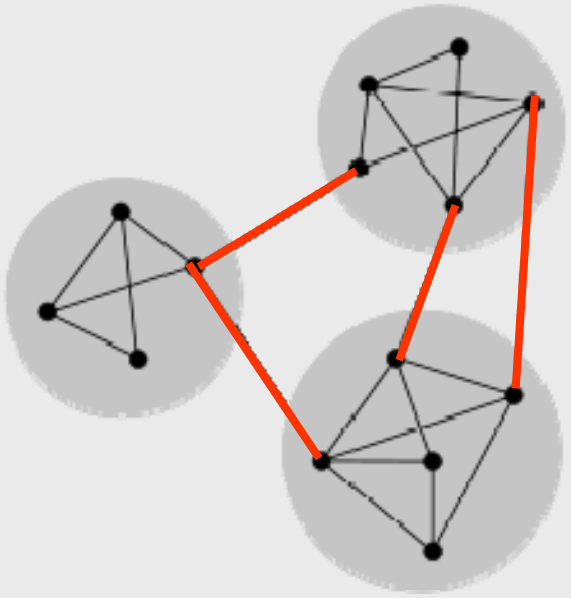
Yes and No!

Even if the world is all of one piece in terms of a ‘city’ in 2100, there will be differences within the fabric – this is true already, but it will be increasingly difficult to partition the fabric

And the idea of urban economies of scale – agglomeration – will be increasingly hard to detect.

Let me end showing by defining cities from ‘all of one piece’

Let us cut the longest links – those that are greater than distance threshold – so that we partition the network into clusters



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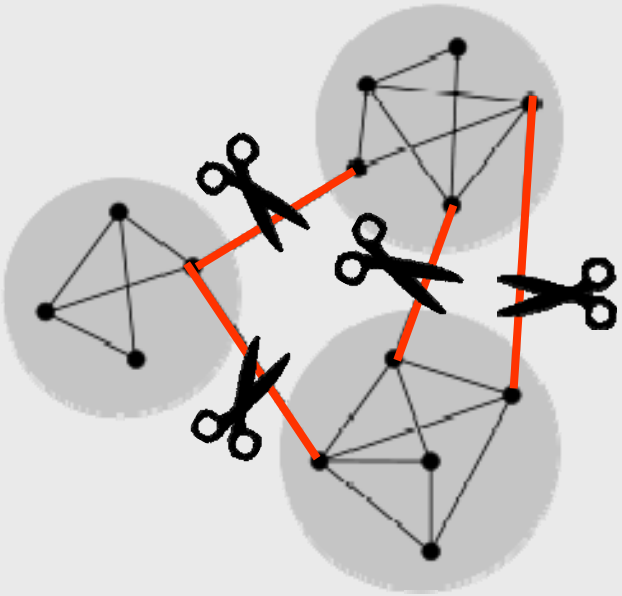
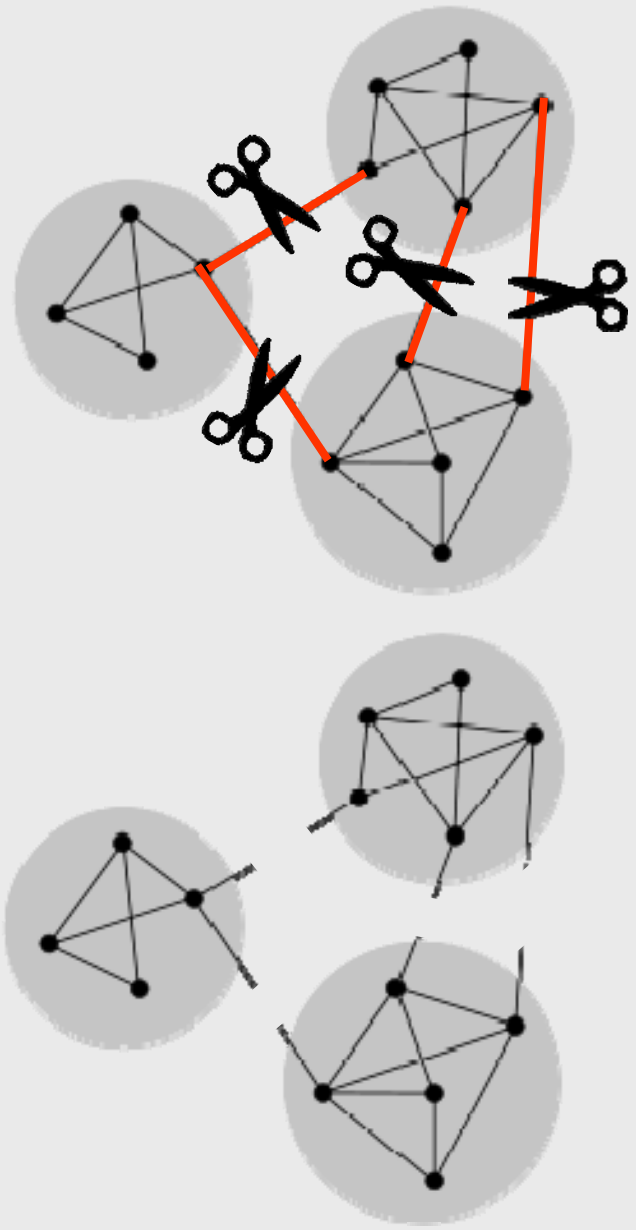
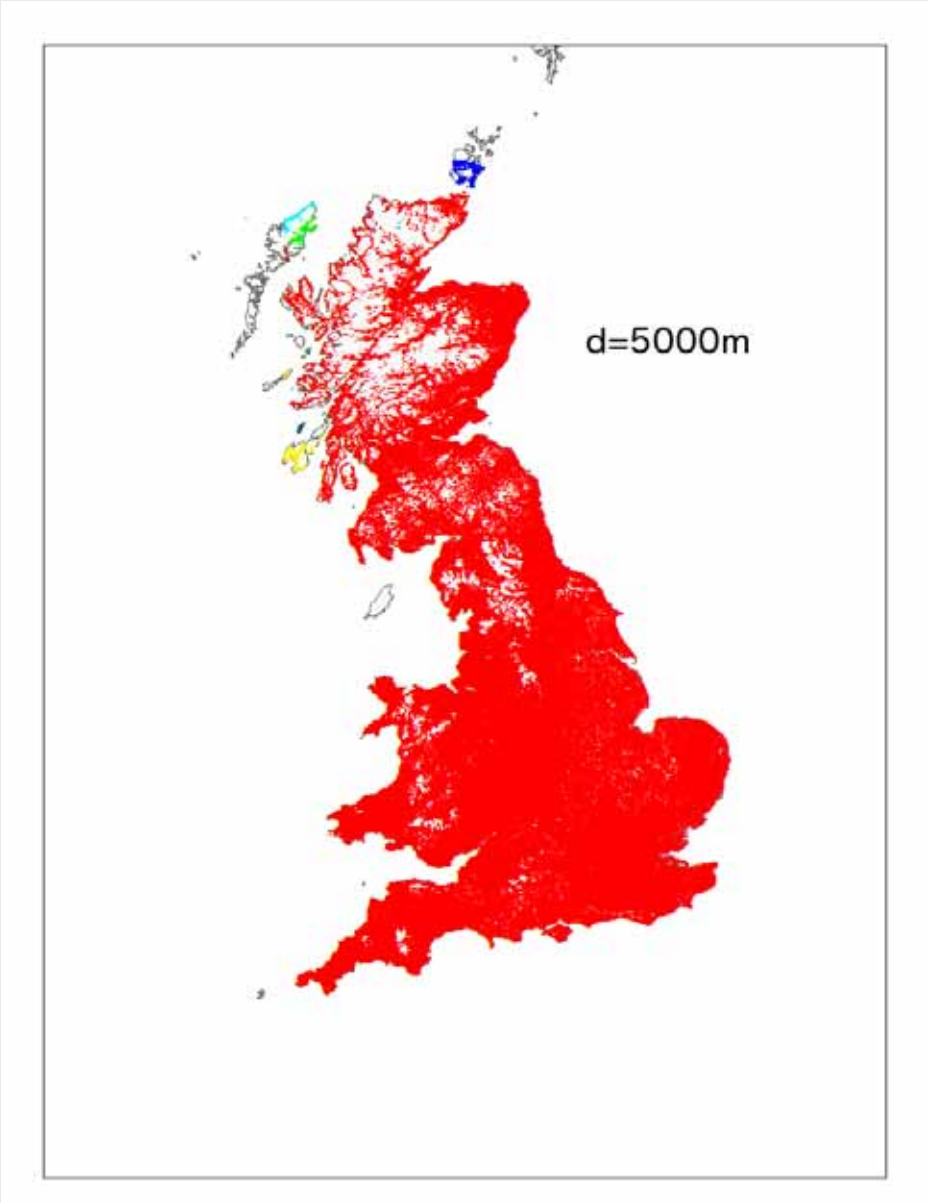


Let us cut the longest links – those that are greater than distance threshold – so that we partition the network into clusters

And of course we can keep on doing this successively pruning the network

We will do this for the UK based on all the road links





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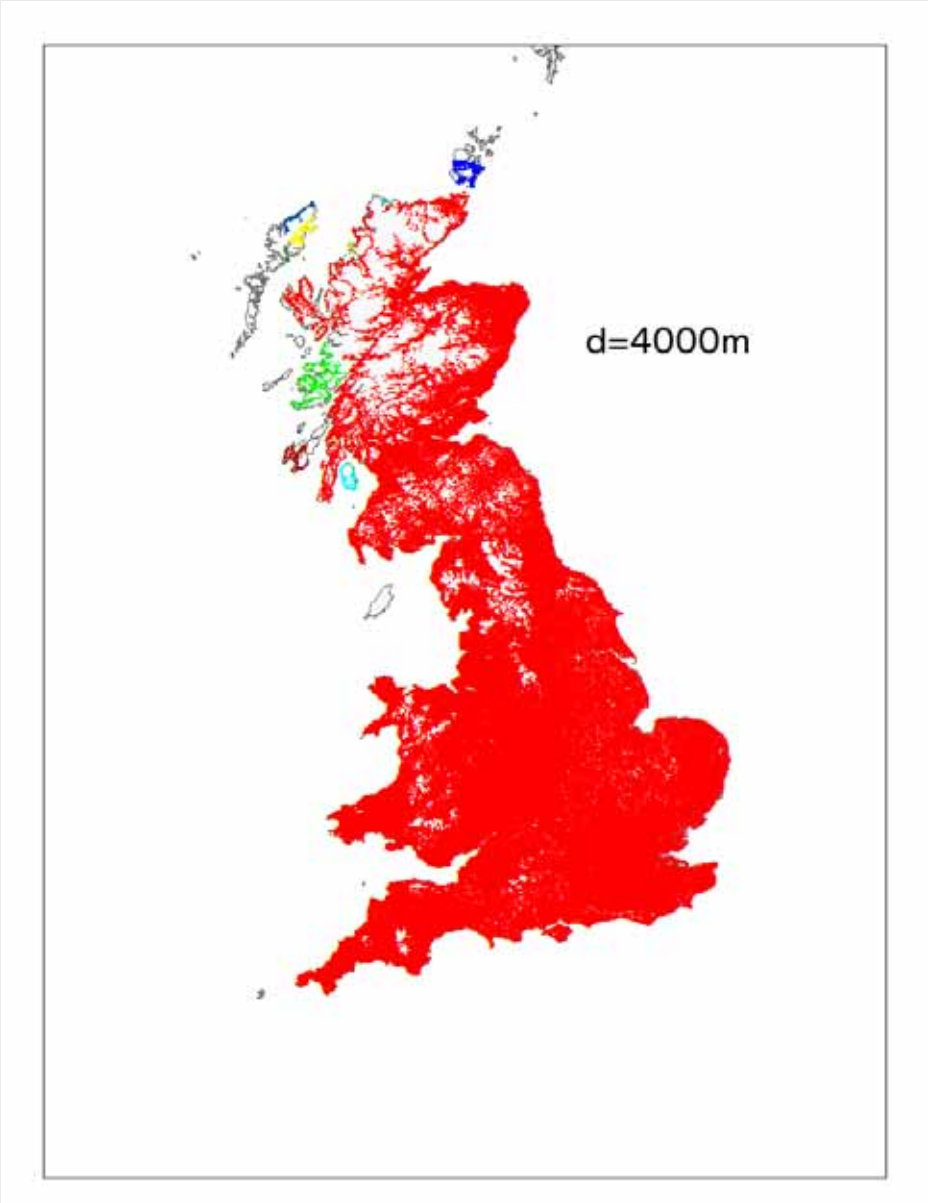

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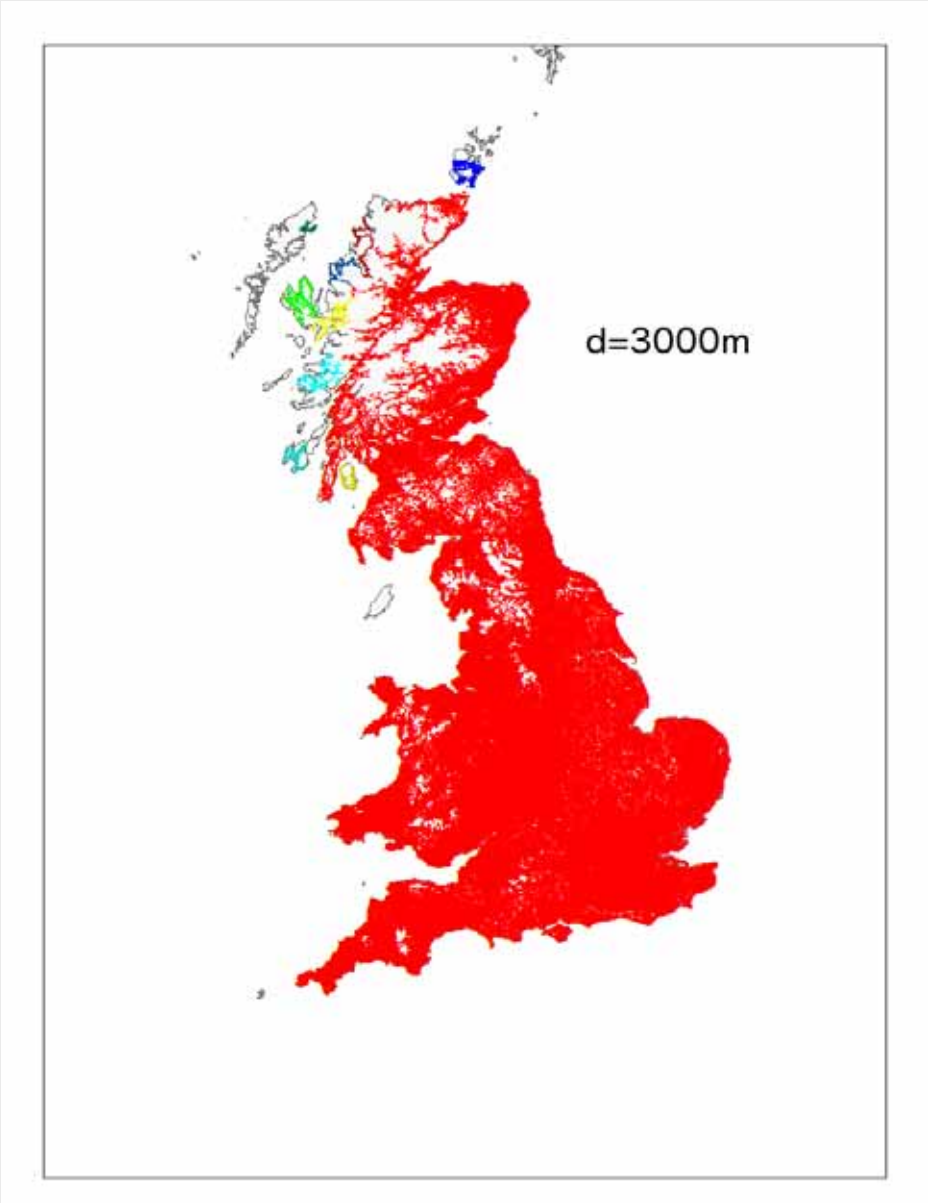

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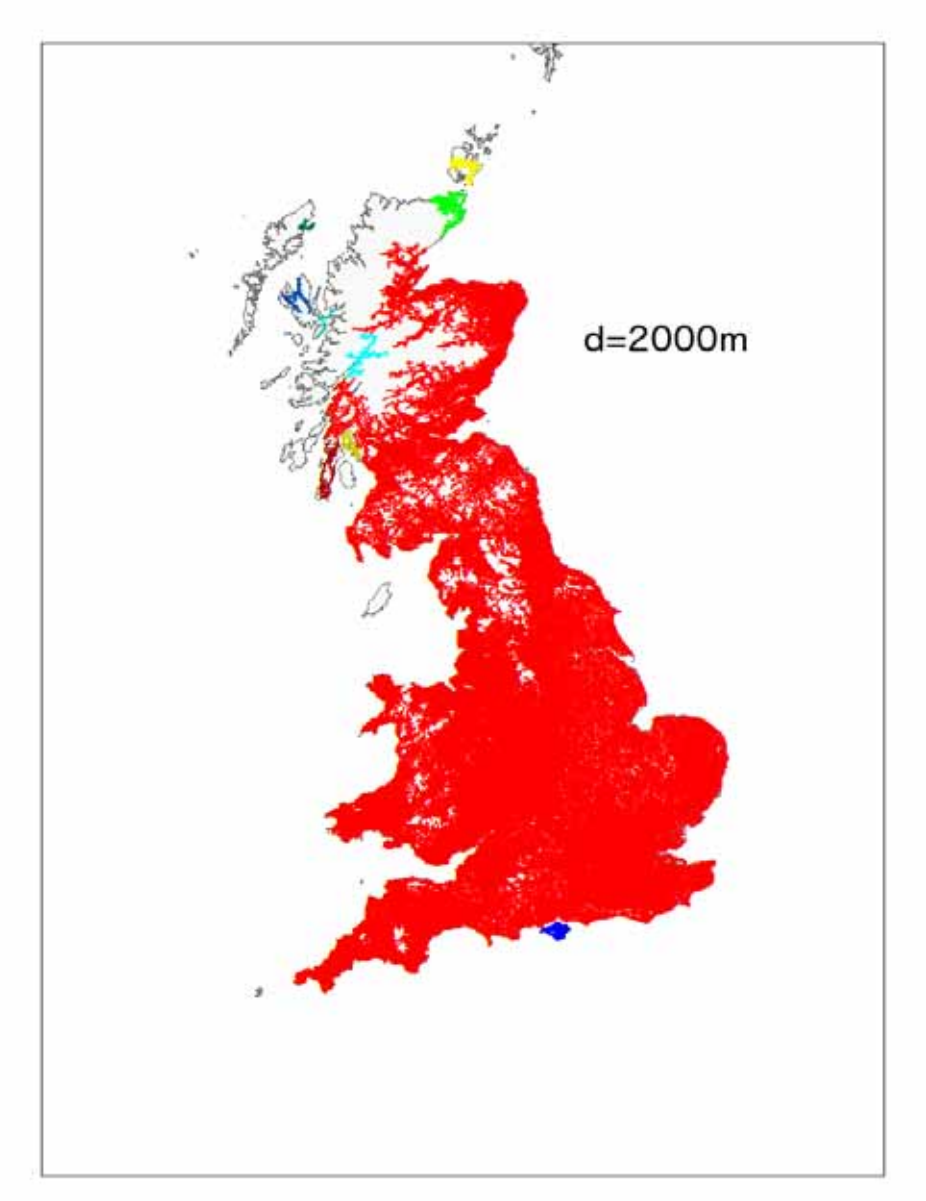

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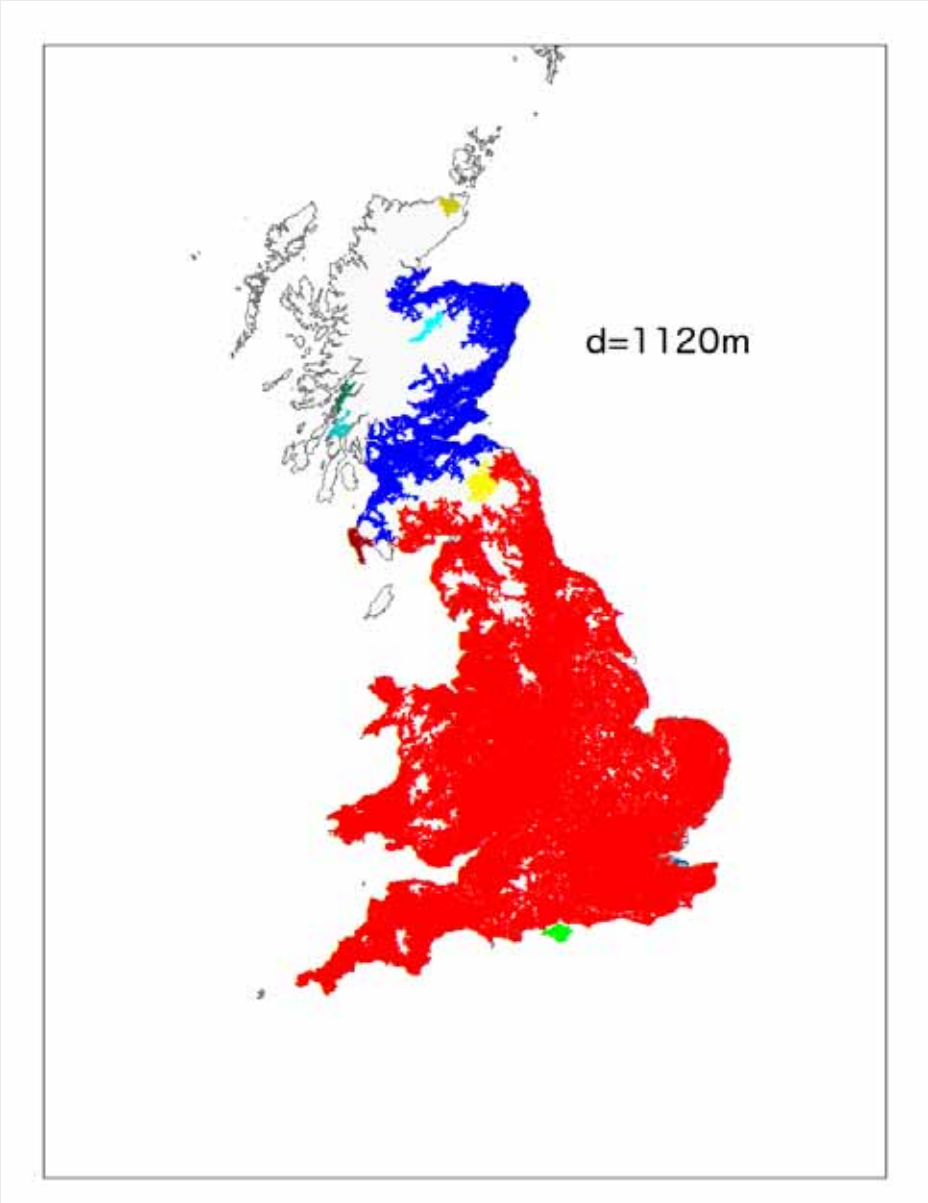

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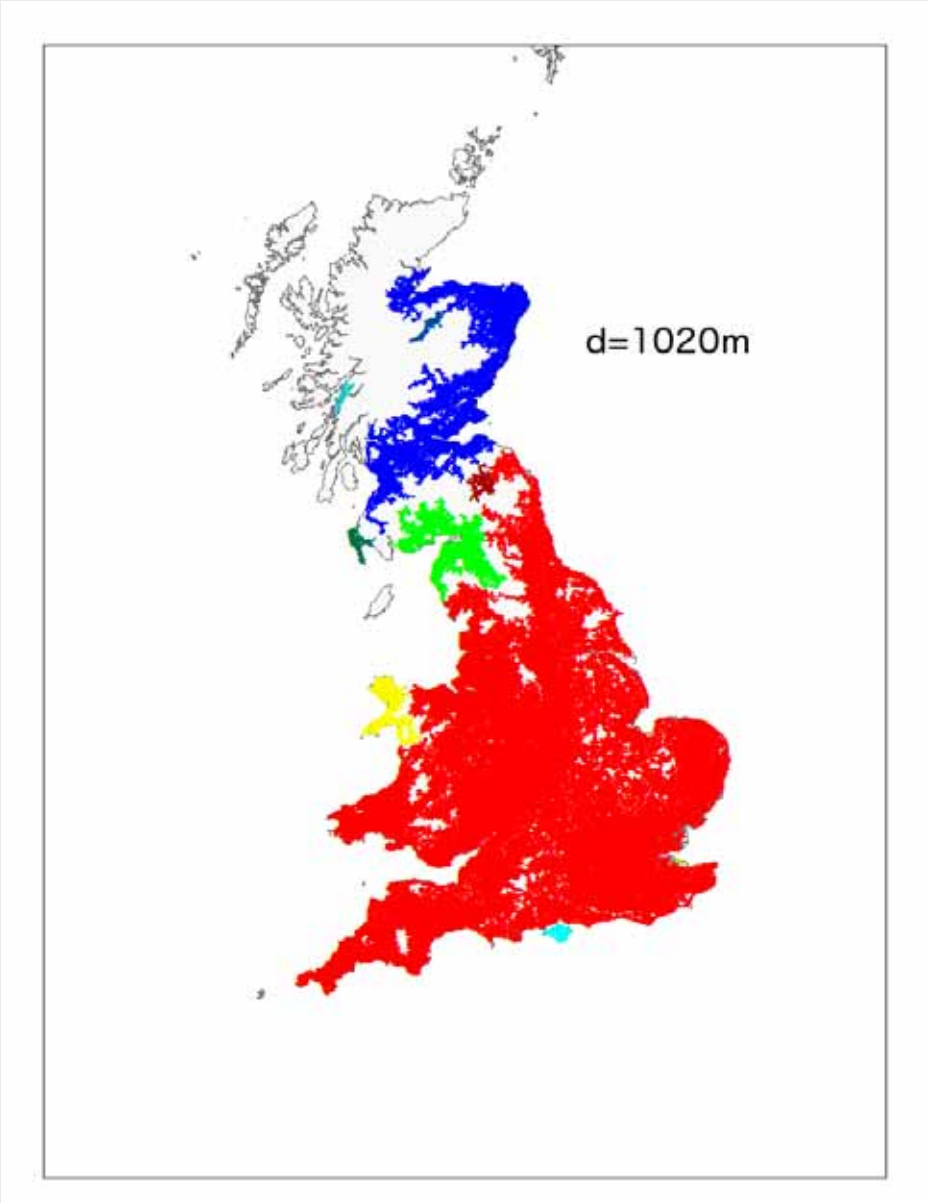

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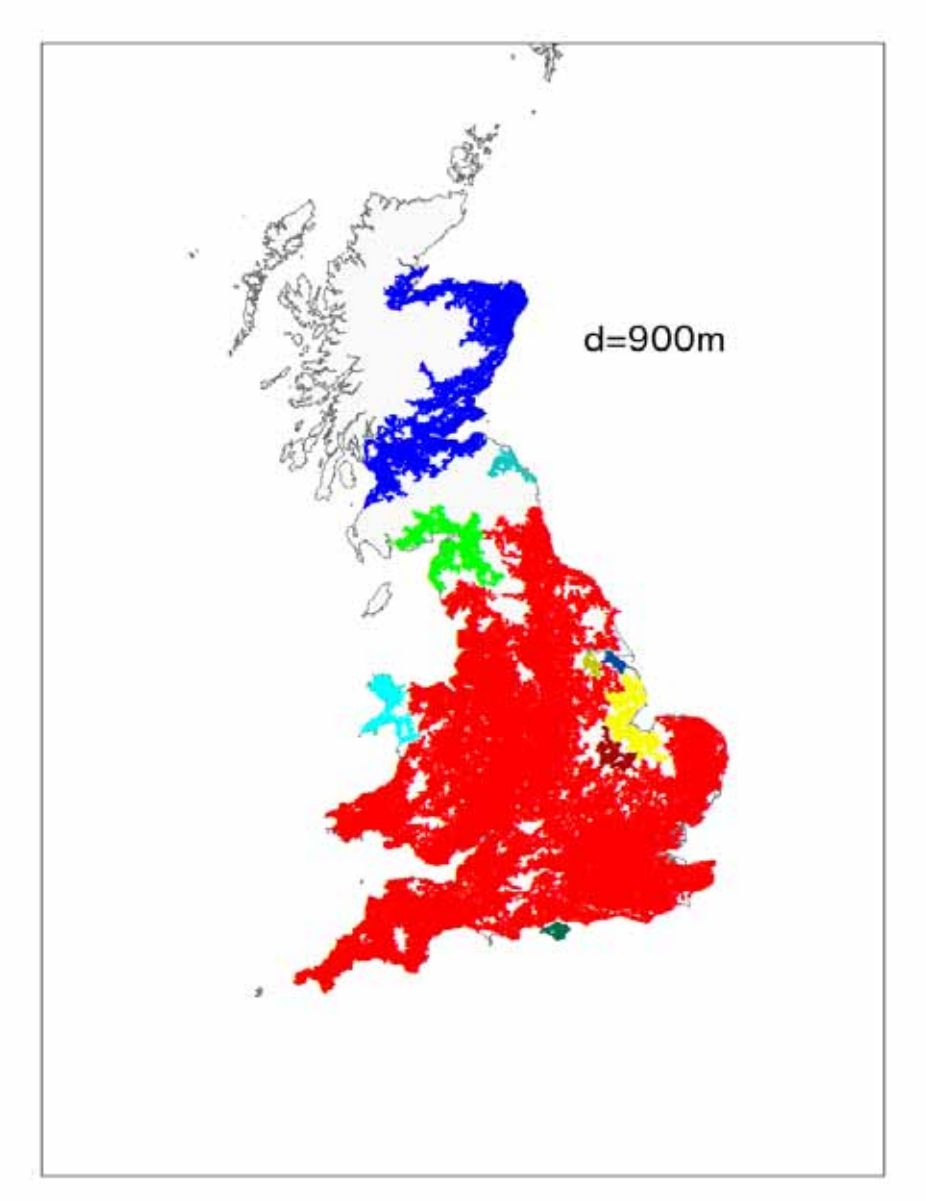

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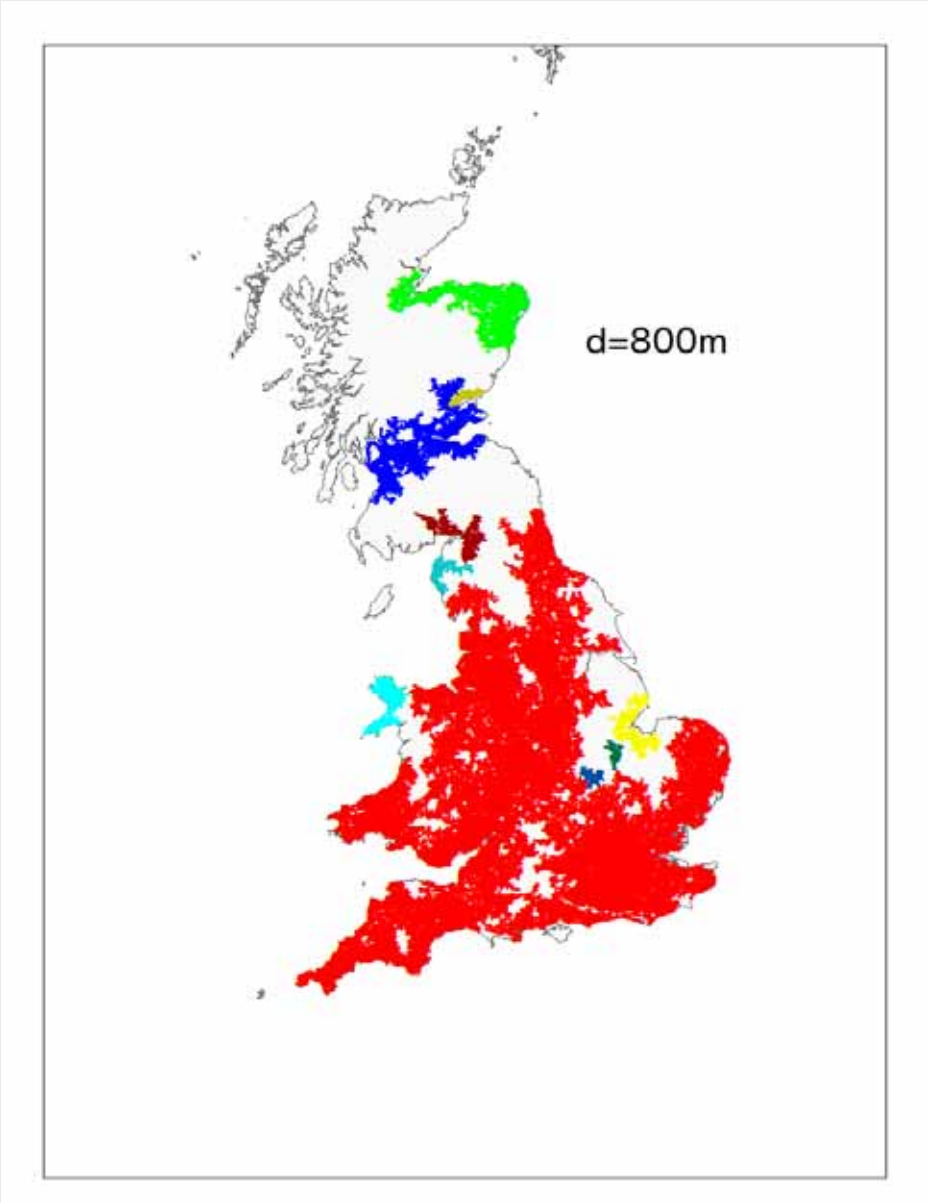

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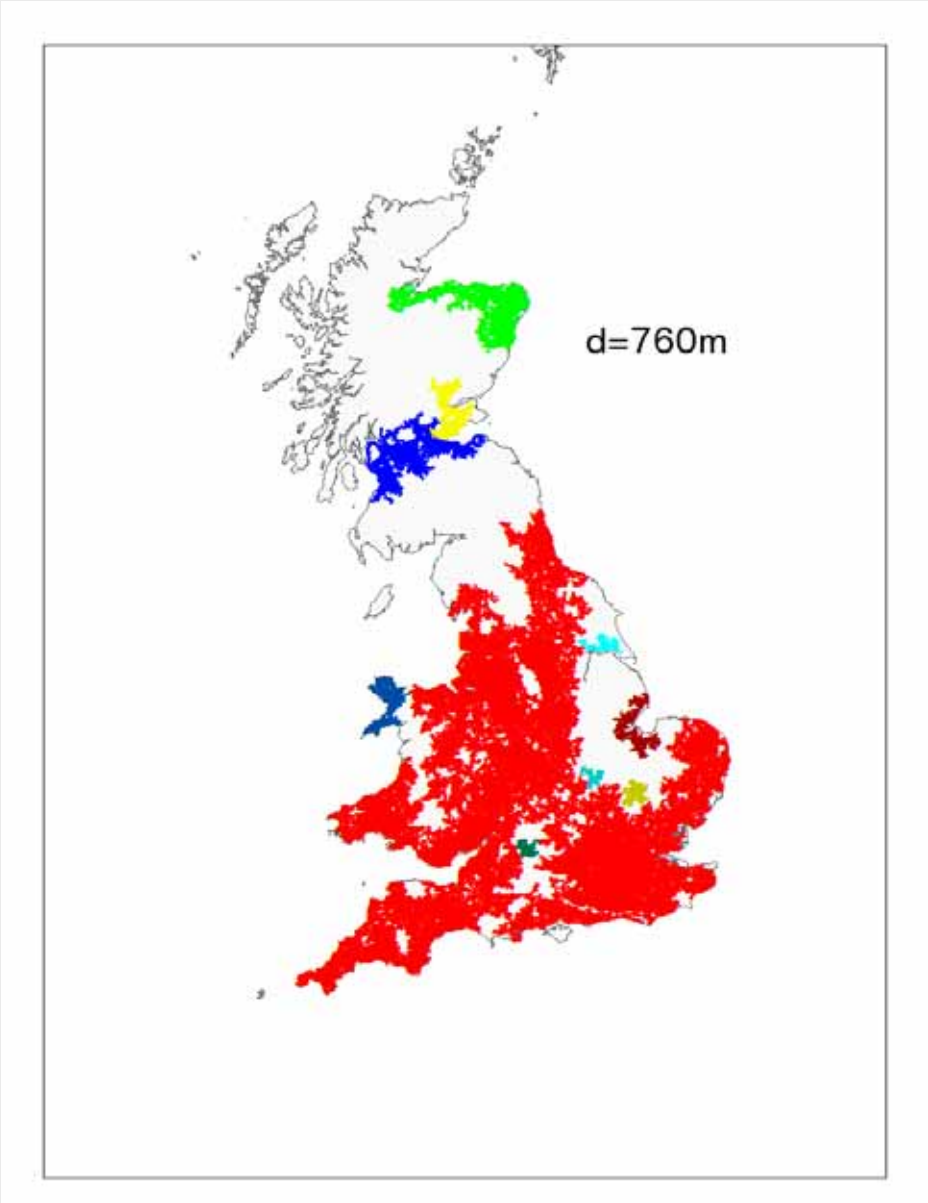

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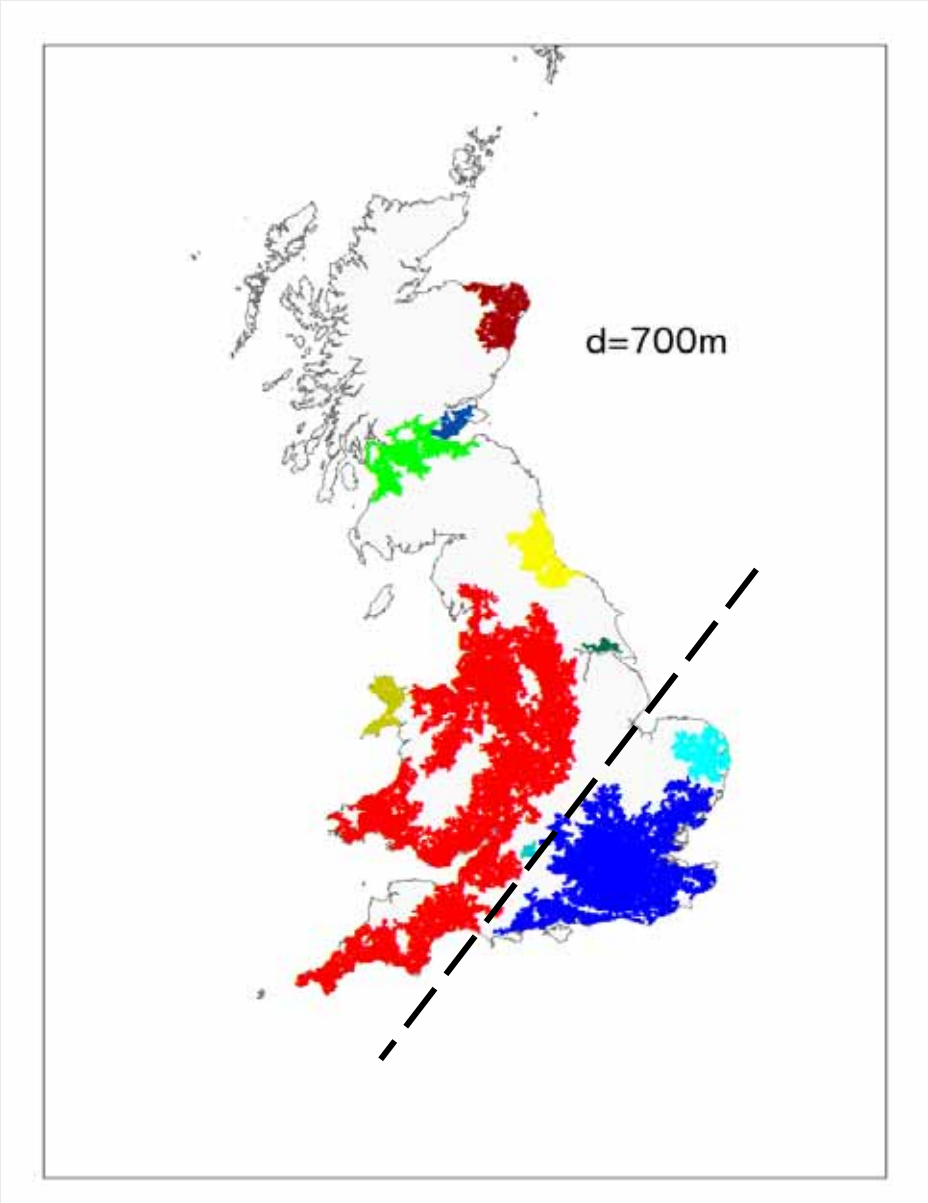

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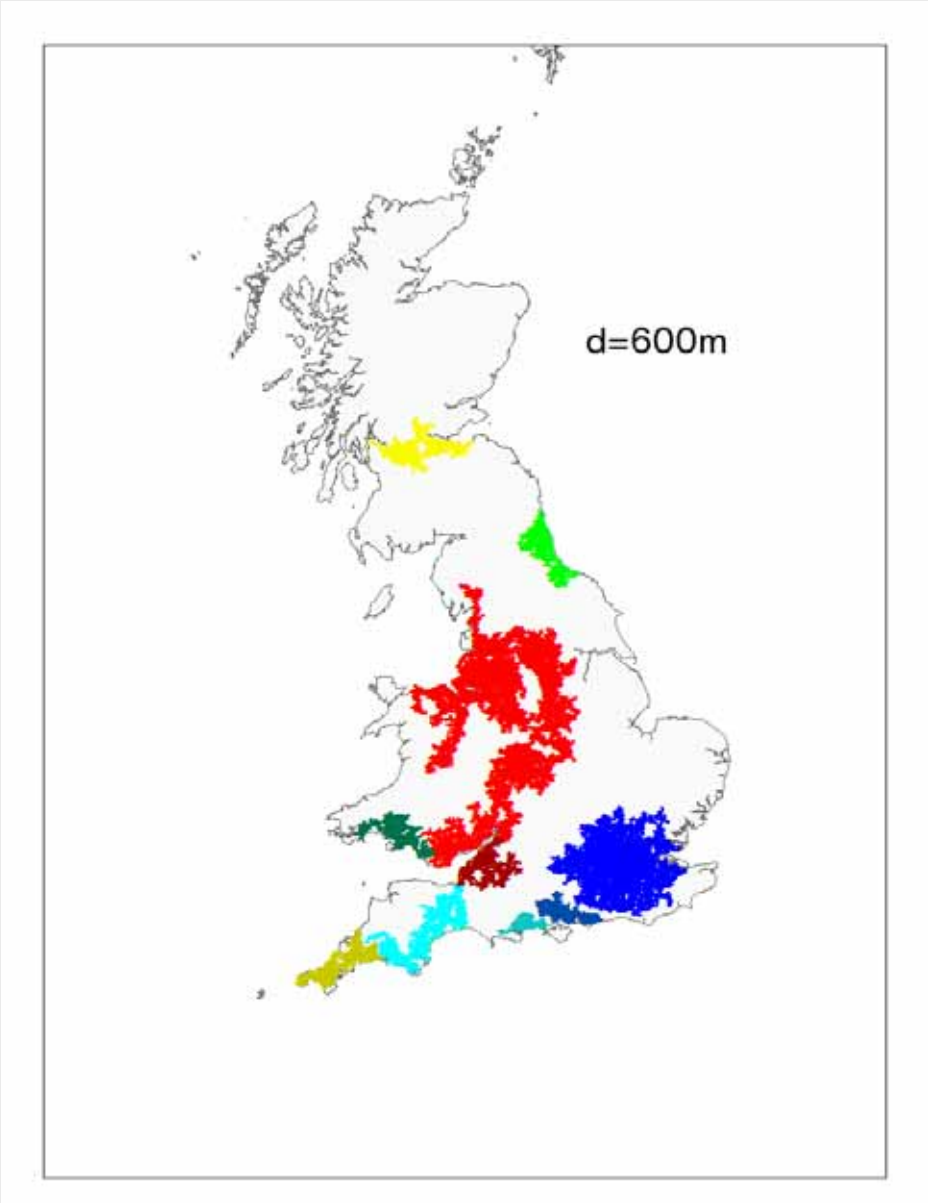

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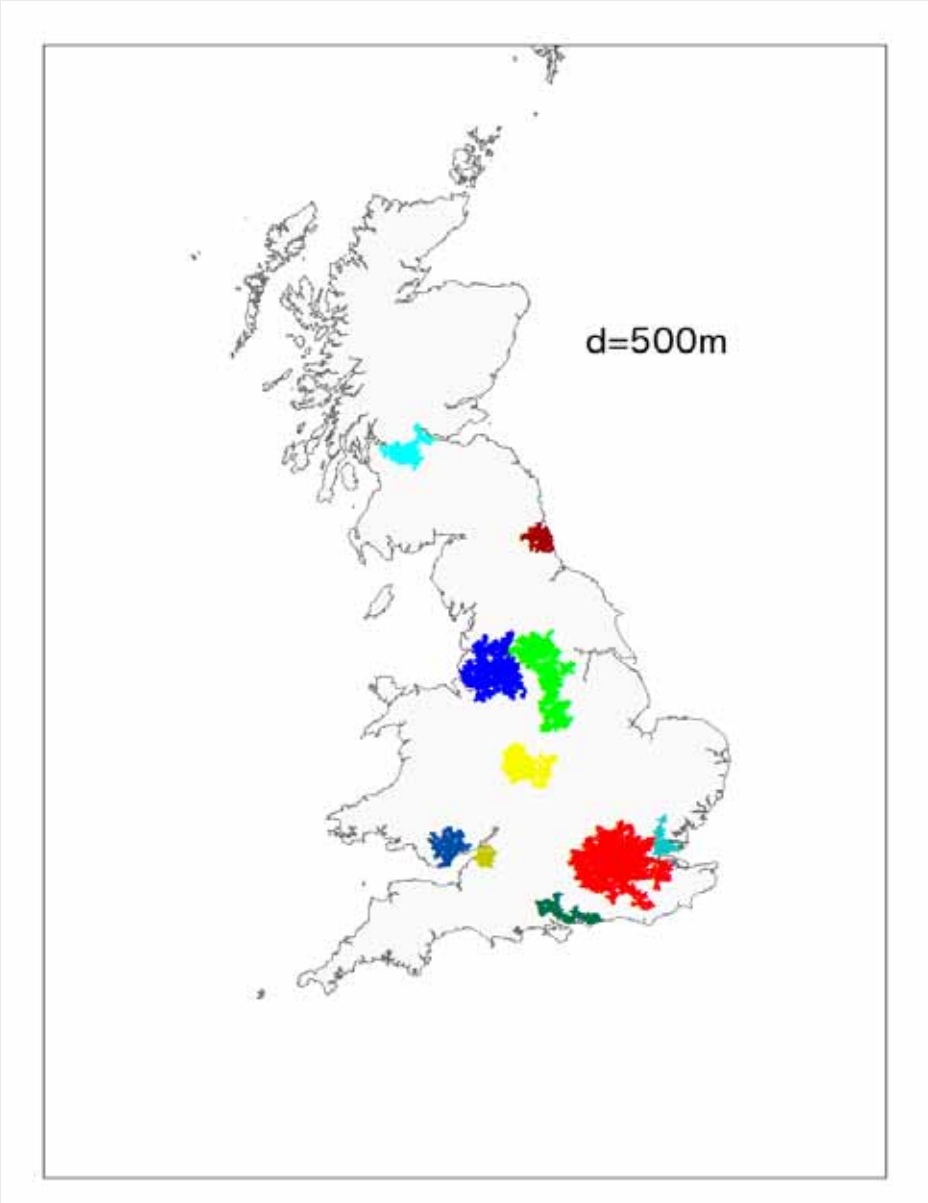

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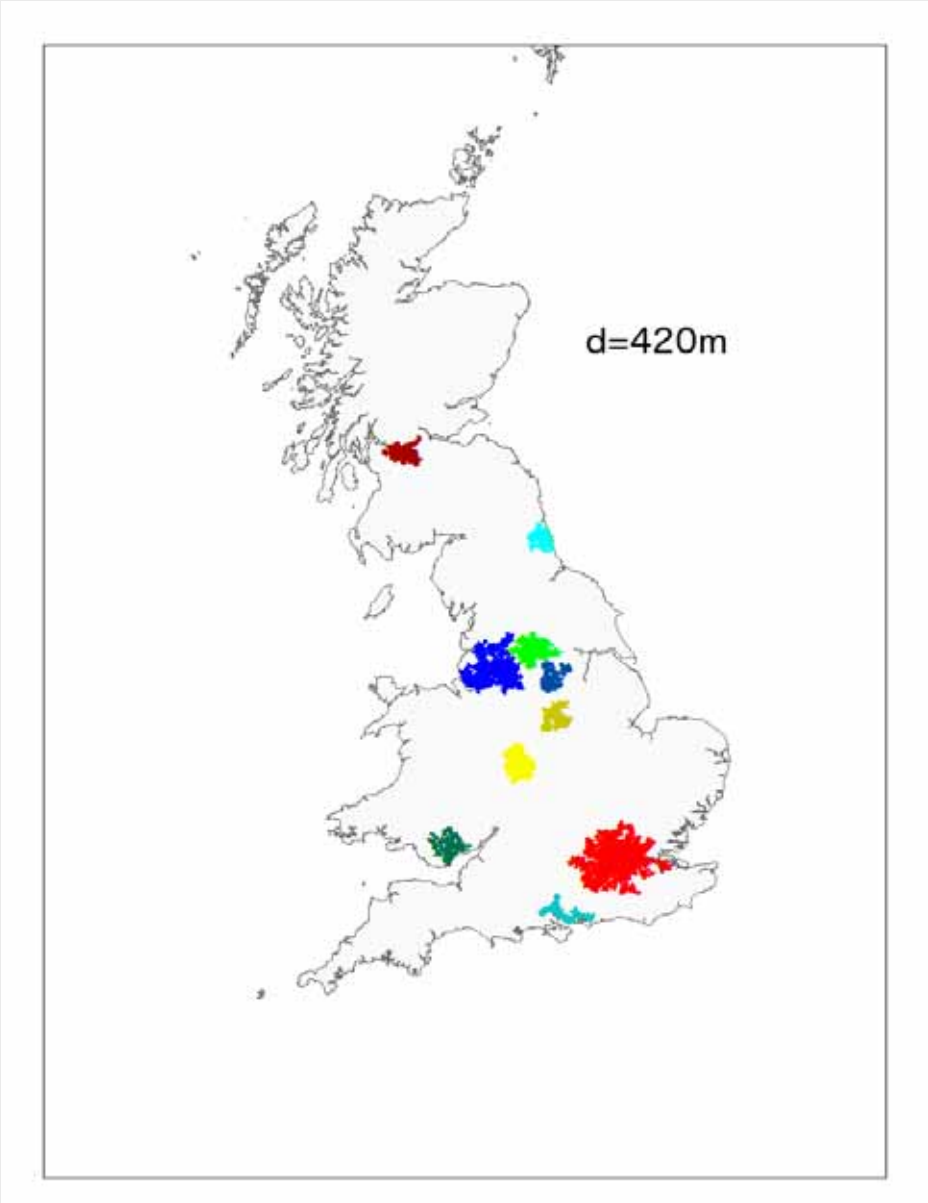

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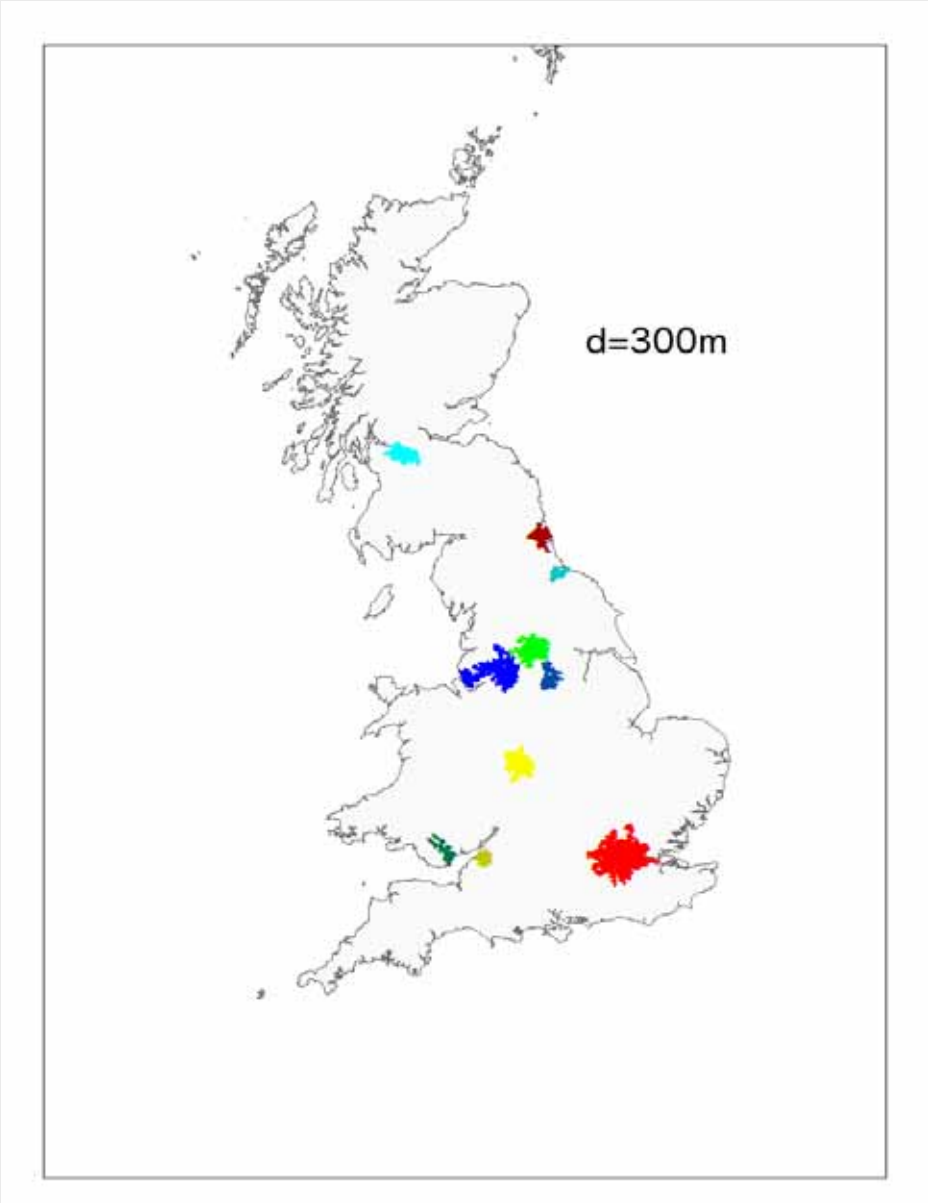

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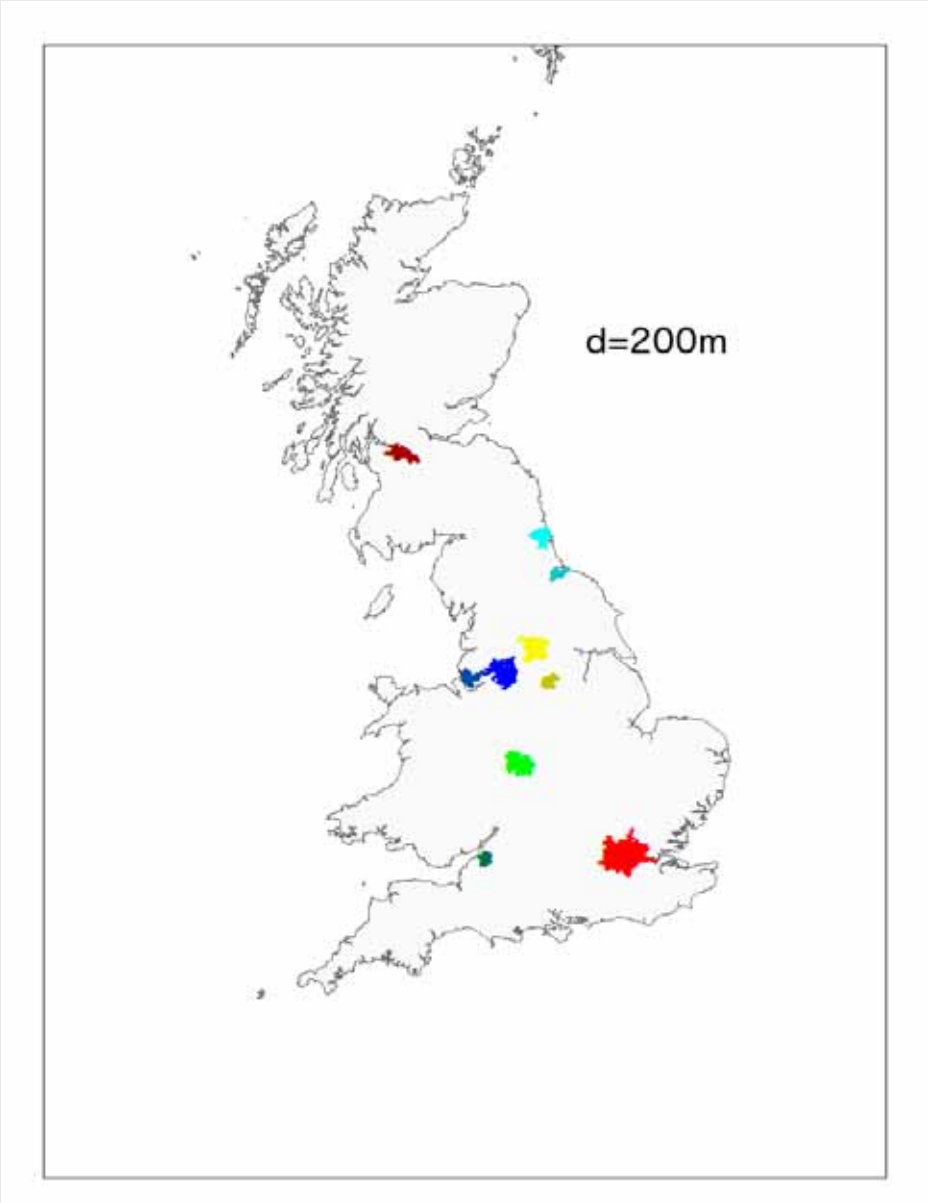

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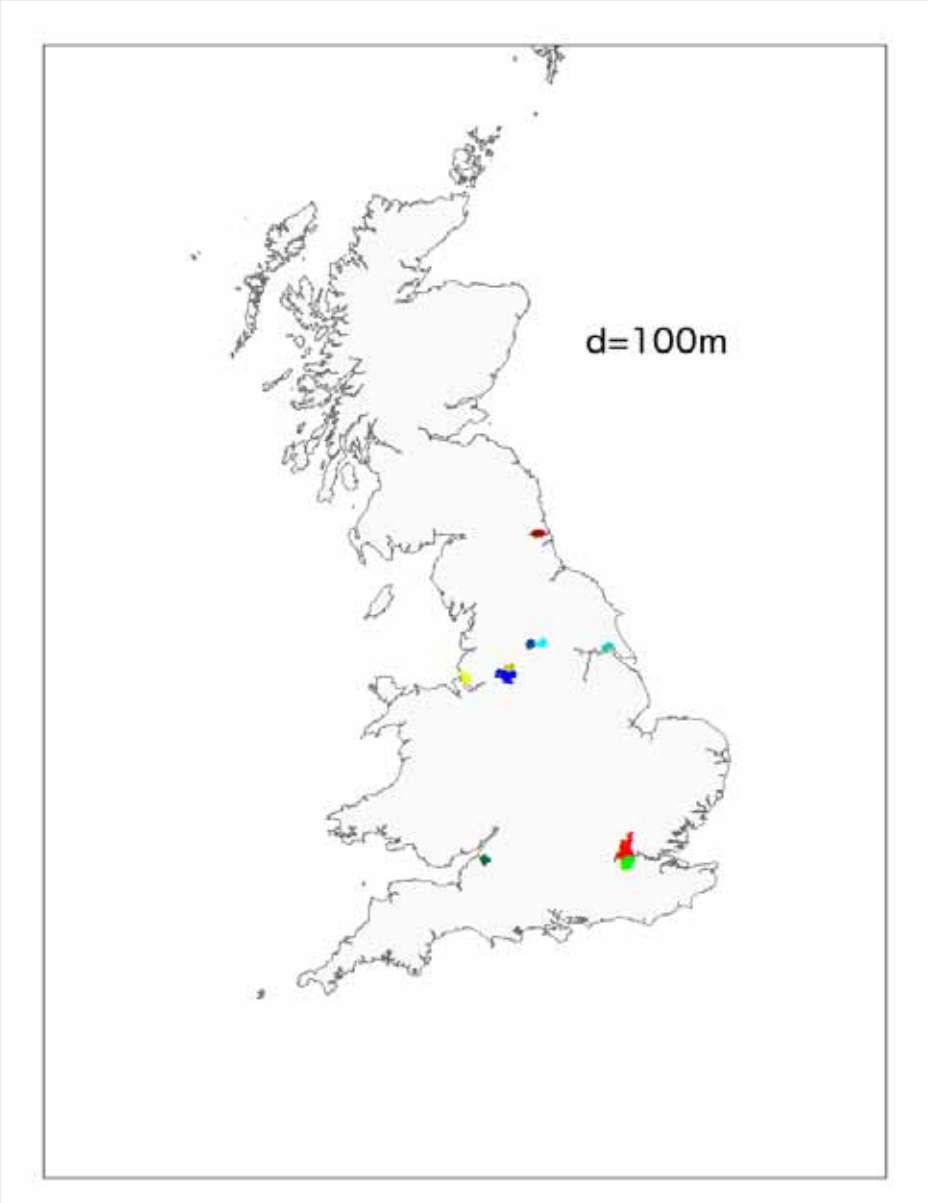

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Thank You

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