CONFERENCE

Humanising Geography

DANNY DORLING AND
ANNA BARFORD

ABSTRACT: This article is based on the lecture of the same name given by Danny Dorling at the 2006 Geographical Association annual conference in Manchester. That talk presented an argument for humanising geography using illustrations from the Worldmapper project. Here those arguments are extended to show how quantitative data concerning people can be brought to life in order to highlight how risks, resources and rewards are distributed around the planet, and to attempt to feed a geographical imagination that begins to see people everywhere as people, by focusing-in on them around the world and interpreting the numbers on who is where and doing what.

Introduction: Seeing human and physical together

Is it art?

Imagine that you are holidaying in Nuoro, on the Italian island of Sardinia, and decide to visit the Museo d'Arte della Provincia di Nuoro. Expecting to see a collection of paintings, you are surprised when the exhibit is actually a collection of somewhat distorted world maps. 'Is this art?' you might reasonable question. What you are seeing is a collection of some of the maps made by the Worldmapper project, run by researchers at the universities of Sheffield and Michigan. The maps are an outcome of a combination of factors: the development of a new map-making algorithm by Mark Newman (Gastner and Newman, 2004), and the recent availability of unprecedented quantities of data from United Nations agencies. The maps are 'distorted' because the mapped area of each country relates not to its actual land area, but to another variable. In Figure 2, for example, the mapped area of each country is calculated according to the proportion of the world's population that lives in that country. Thus, China and India appear particularly large. The project aims to produce 365 such maps during 2006, and most are already freely available on the internet at www.worldmapper.org. The rest of this article will discuss the project further. It is up to you to decide whether the images belong to art, science, politics or geography.

What you see

Let us start with one image that is both pretty and somewhat strange (Figure 1). It is of the world, but not the world as we are used to seeing it. At the centre of the map – quite a long way above the eye-line on which we usually focus – are the

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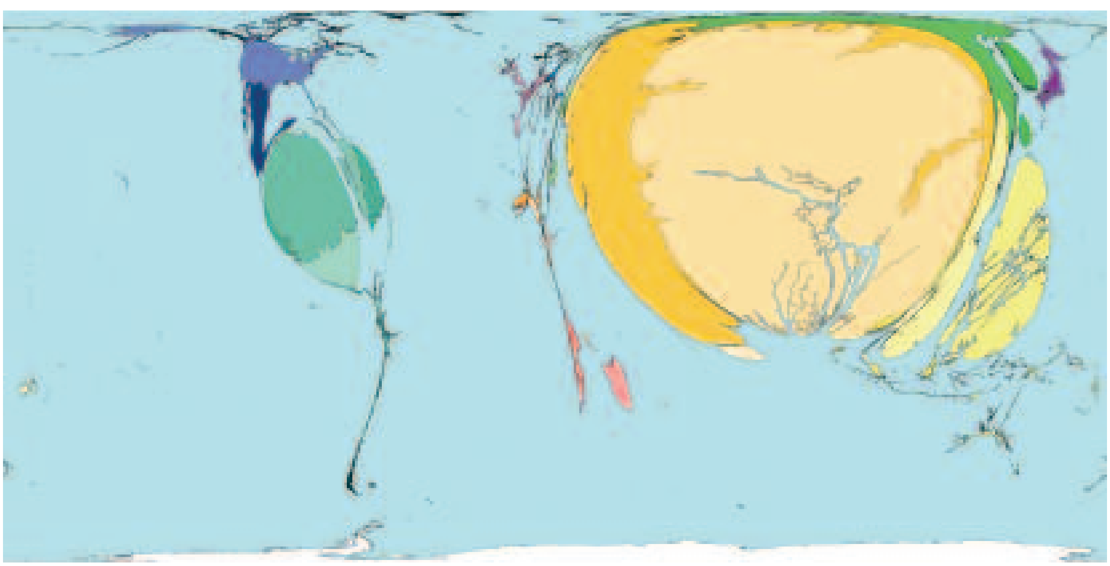

Figure 1: Worldmapper map 251: mortality due to storms 1975-2000 (see www.worldmapper.org). Territory size indicates the proportion of world total deaths due to storms that occurred there. Worldwide storm deaths 1975-2000: 276,000.

islands of Britain and Ireland, displaced from where we usually see them on a conventional world map. But the islands appear very small and seem a little stretched. The eye-line, by the way, is the relative height at which human eyes appear in a human face. Our eyes are over half-way up our faces, thus we tend to focus here first when we look at a person, picture or map. We also see red shades towards the foreground and blues towards the background – that is hardwired into us too, through the rods and cones in our retinas. To feed the imagination with images requires a little knowledge of how eye and brain work together.

Returning to the map, it is likely that, due to our attraction to brighter colours, you probably concentrated on the right-hand side, where the yellows and oranges dominate the land-mass, and, in particular, where the braided river and delta meet the azur sea. 'Just what am I looking at?' is the question the thinking part of your eye-brain complex is asking. The answer is the Ganges-Brahmaputra Delta, the world's largest delta. Upon recognising or learning that, another question immediately demands to be answered: 'Why is this map of the world distorted to show that delta in such detail and the British Isles so small?' No doubt you have an idea, and you probably read the caption on the map. You know it has something to do with deaths from storms. Very few people die due to storms in Britain but many who live around the delta do. If you are good at gauging areas and recognising warped borders, you will see that from 1975-2000, more than half the world total for those recorded as having died due to storms died in the delta area of Bangladesh. You are looking at a map of the dead.

The first person to suggest redrawing the globe to relate territorial area to numbers of the dead was a radical geographer named William Bunge (Bunge, 1966). Bunge suggested distances on the globe be stretched so as to equalise the density of soldiers' graves. In other words, for every mile you walk on a reprojected globe, you walk past the same number of final-resting places of soldiers who died in battle. Berlin and Moscow would form new north and south poles respectively – and we would see over what (land area, literally) all the fighting had been about. Legend has it that he drew a sketch of his idea on a balloon. Here we show how similar balloons might look – but where the redrawn images have been created with the aid of computers and the globe is projected back again onto the plane.

Many different map projections have been devised and used to show the three-dimensional world in two dimensions, e.g. Peters' projection or the Waterman butterfly projection. Maps have also been produced to show the world from different perspectives, such as the south-up map (see www.odt.org for examples of all these). In this article, there are also many examples of world maps where territories have been drawn in proportion to variables other than land area. Other examples can be seen in the works of Michael Kidron and Ronald Segal (1981), Dan Smith (2003) and Desmond Sprujit (2006).

Map reading

Of the quarter of a million people who are estimated to have died as a result of storm disasters between the years 1975 and 2001, over half died in one disaster in one year – 1991 – in Bangladesh. For that year, the United Nations Environment Programme (UNEP, 2006) recorded 138,987 deaths in that one territory resulting from the cyclone of 29-30 April 1991. That event, given that it occurred during most of our lifetimes, is likely to dominate our imagination of what a storm disaster can really mean in terms of human life. The way that the land areas have been represented in Figure 1 enables the reader to see how many died as a result of storm disasters during the last quarter of the twentieth century and also which areas of the world are most vulnerable to such disasters.

For each country of the world, Figure 1 shows its share of worldwide deaths due to storms. However, of equal interest is the total number of deaths due to storms, and the number of deaths due to storms expressed as a proportion of a population living in a place. The number of deaths per million people is an indication of the proportion of families losing their relatives, industries losing employees, society losing its members and fabric, and people losing their lives. The greatest proportionate losses due to storms during the 26 year period from 1975 to 2000 have been among the people of Honduras, in Central America. For every million of the 6.8 million people living in Honduras by 2002, an average of 83 died in storms each year. The Cook Islands in the Pacific Ocean also experienced high rates of loss during this period, with an average of 53 deaths per million people per year. The total population of the Cook Islands is only 18,000 people, so on average less than one person per year dies in a storm.

Of course, average loss rates can obscure as well as reveal. Bangladesh's losses averaged 42 storm deaths per million people per year from 1975-2000, or 6,099 storm deaths a year. Yet it was in the cyclone of 1991 that 88% of all storm deaths occurred in Bangladesh during this period; that was 138,987 deaths in under one month. Another factor that is not revealed by these numbers is *who* dies; as with any other distribution of causes of death, from diarrhoea to murder, certain combinations of age, gender, wealth and location will make an individual more or less exposed to risk. In the case of Bangladesh, the Bangladesh Red Crescent and other agencies found that 90% of the storm victims in 1991 were women and children (Schmuck, 2002).

While the cyclone of 1991 was devastating in and beyond its cost in human lives, because of damaged infrastructure and injuries, it pales in comparison with the 1970 cyclone that hit Bangladesh (known then as East Pakistan). It is estimated that the 1970 cyclone killed over one million people (Lawson, 1999). The ability of people to address the risks posed by 'natural' disasters, and protect themselves to an extent as a result, is partly demonstrated by the ten-fold reduction of the cyclone death toll between 1970 and 1991. Between these dates aid agencies and the government had embarked on what Lawson refers to as an 'extensive programme of cyclone shelter construction'. We cannot draw a world map of deaths prior to 1975 because systematic collection of information did not begin until then. The collection of data is just one tiny part of how we collectively address and begin to mitigate and protect against 'natural' disasters.

Bangladesh is one of the 19 territories in the world where between 1975 and 2000 the number of people killed by storms averaged about 20 per year. Bangladesh had the highest number of deaths, followed by India, the Philippines, Honduras, Viet Nam, China, the United States, Nicaragua and Mexico. In 127 of the 200 territories that are mapped in Figure 1, an average of less than one person per year died in a storm. The differences can be explained with reference to a number of factors; some territories experience more extreme weather conditions than others; some have better facilities to cope when such conditions occur; the population might be concentrated in more or less risky areas.

What the map in Figure 1 cannot do is tell us why the risk of death due to storms is spatially so uneven. To be aware that the risk is uneven we have to have a sense of where people in the world live. To know *why* the risk is so uneven we have to be aware that while deaths relate to the flooding that results from cyclonic storms, they also relate to peoples' differential susceptibility to harm when storms actually hit. Where people are susceptible but storms are very rare, deaths are low, and where storms are frequent but people can afford to be well-protected, deaths are also low. While the other maps in this article do not indicate direct causal relations, they can be used to contextualise the distribution of storm deaths in relation to the distribution of other variables (see Figures 2, 3 and 4).

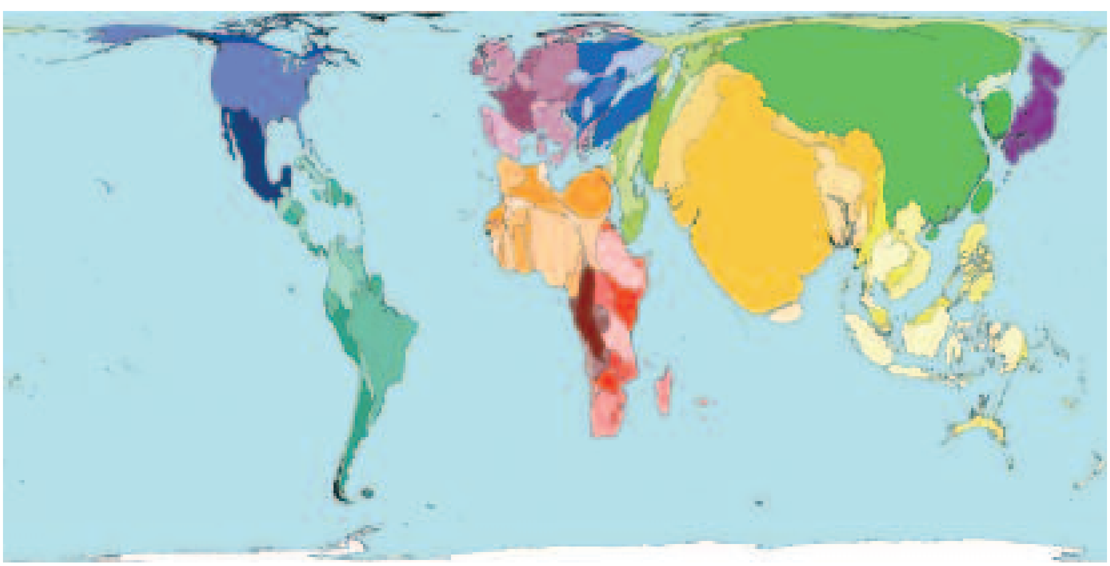

Figure 2: Worldmapper map 002: Population 2002 (see www.worldmapper.org). Territory size shows the proportion of the total world population that lives there. Total world population (2002): 6.2 billion people.

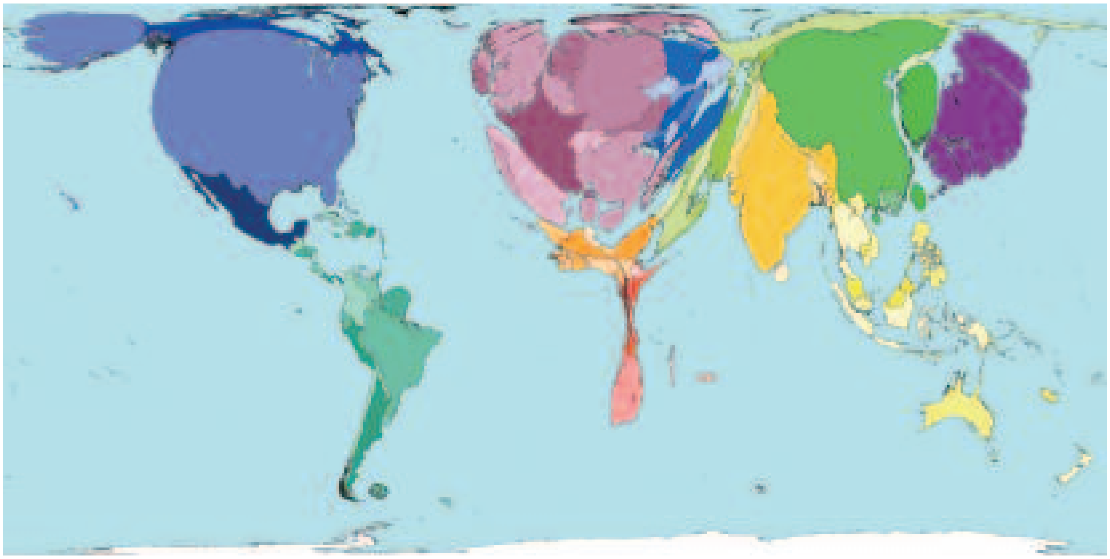

Figure 3: Worldmapper map 170: Purchasing power (see www.worldmapper.org). Territory size shows the proportion of the total world Gross Domestic Product (wealth) when measured in purchasing power parity (which allows for different prices and exchange rates) found there. World total Gross Domestic Product in purchasing power parity US$ in 2002: ppp US$49,000 billion.

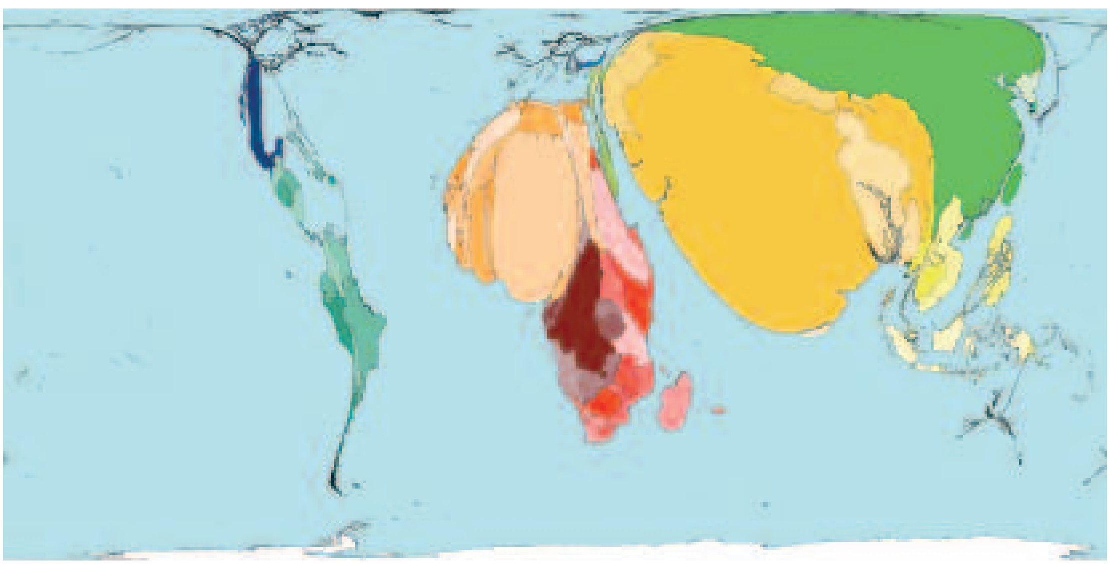

Figure 4: Worldmapper map 179: Wretched Dollar (see www.worldmapper.org). Territory size shows the proportion of the world population living on a dollar a day, or less, that lives in each territory. World population living on less than $1 a day: 1 billion people.

Humanising geography

A democracy of mapping

When we draw a map in which all lives lost in a particular way over a particular period of time are given equal prominence, the effect inevitably de-personalises the individual. The person you might know who lost their life in a storm contributes a speck of colour to the map. Seeing human lives in specks of colour requires great leaps of imagination, but leaps we have been making for millennia. Painting with ink-jet printers is not fundamentally different from blowing paint onto cave walls (in fact the mechanics are uncannily similar). Here is the reaction of one of the earliest human cartographers to what he saw when his then state-of-the-art ink-jet printer leapt into life:

> Sometimes peculiar things happened during the lengthy work with analyses, comparisons, drawing, checking. It sometimes seemed as if the red symbols and yellow ground colour of the urban landscape faded away and were replaced by forests, lakes and fields, criss-crossed by roads, which turned out to be filled with streams of sleepy early-morning travellers in cars, buses and trains, on their way to work in the towns. There were times when the coloured areas on the colour ink-jet map were suddenly obscured by white summer clouds which seemed to scud in from nowhere between the map and the author's eyes, and among which he could glimpse the sparkle of the sea by the coast, the rivers which rolled down to meet it, the towns and villages and people. Sometimes old people materialized out of the map of Norrland and observed with melancholy the exodus of the young towards the coast and the south. From the diagrams which display households suddenly appeared a throng of people who with muted voices told of their lives, of their loneliness, of their joy in their children and of their hopes on their behalf. (Szegö, 1984, p. 20)

When Szegö looked at his mechanically produced map, he imagined some of the human activities that lay behind the colours and symbols. Most of us probably do the same; we may recognise a map as a representation of what we know or wish to find. At the same time though, maps do of course have a direct influence on how we imagine our position in the world and our position in relation to others. They also help us to imagine the nature of places of which we have little or no direct experience. A map is likely to be a more vivid depiction of a place than the raw data on which it is based.

Our imagination of distant places draws on a number of sources, including news stories and first-hand experiences, yet both of these may be flawed in different ways. For example, some aspects of life that are mappable, such as income levels (wealth), may not be 'visible' on the ground. An example of this invisibility is Robert Chambers' (1983) explanation of how the rural poor remain 'unobserved' even by those with an interest in meeting them. To paraphrase: the people most likely to be encountered are those who live near to roads; are already involved in some 'development' project; with whom relationships already exist; or who are accessible and involved in social affairs. These people are not usually the most disadvantaged. Further, given that observers or visitors from outside the place of study tend to prefer making visits in clement weather, they are likely to encounter a situation in which people are better-off than they would be in poorer weather conditions; also, they may encounter a natural reticence to discuss personal details relating to income, whether the income is very small or very large.

Geography is a subject which has long been associated with exploration and expeditions – a tradition which continues today, often in the form of small-scale fieldwork, generally conducted with more self-reflection and awareness than was often the case in the past (see Cochrane, 1998). In human geography, such fieldwork can only ever involve small numbers of people and may be concerned to seek something akin to Max Weber's *versteben* (or empathetic understanding, see Swedberg, 2003). The end-result is detailed knowledge about very few people – hardly a viable base from which to draw conclusions about the many, or from which to make generalisations. Nevertheless, such detailed studies, when placed within the context of existing knowledge about a place, contribute a good deal to our understanding.

As noted earlier, a table of raw statistical data may not convey as vivid or meaningful a picture of living conditions around the world as the maps derived from that data are able to. Similarly, some would argue that statistical data and methods of analysis cannot contribute much to the cultural geographer's understanding of shared values and behaviours in relation to space, place and environment (Shurmer-Smith, 2002). Nevertheless, the collection of mass data on a large scale and relating to a wide range of variables is essential to our understanding of the world – an understanding that is particularly enhanced when the data are used to create maps which enable us to see a range of variables relatively and simultaneously.

Democracy of numbers?

Statistics are often viewed with suspicion, and rightly so. A number may appear to be a straightforward, indisputable fact, but we need to consider its origins – the definitions used, the data collection techniques used, the assumptions held, and the financing made available to produce it are all relevant to its meaning and value. A common mistake is to assume that all statistics are therefore useless in themselves, or at least dangerous or ambiguous, but it is only through the recognition and understanding of the 'background' to numbers that their true value can be appreciated. Put another way, statistics are the arithmetic of politics.

Consider the international statistics used to generate the maps in this article. It is a monumental task for the United Nations agencies (from which the map data is sourced) to compile statistics for every territory in the world – especially given the number of places where, for example, there may not be enough clinics to test for HIV in order to assist people, let alone to provide for the secondary aim of collecting numbers. Given the huge scale of the task, it is necessary for estimates to be made by those who compile the numbers. Sometimes the findings from a small-area study may be generalised to an entire country or there may be no data at all. Our ethos is to use these numbers, while being transparent about our own calculations and estimates, thereby demonstrating that similar work may be undertaken by the majority of people reading this. All these assumptions are documented on the website where the maps are also available (www.worldmapper.org).

An example of a case where a huge amount of estimation is required is that of the extinction of species. The map of species at risk (Figure 5) shows each territory re-sized according to the proportion of all unique species which are at risk that live there. Of course there are many elements of 'species at risk' to be specified and considered before the map can be fully understood. We can only start to discuss where species are most threatened once it is decided where to draw a line between one species and another. That is not a simple decision. There is not always an obvious distinction in nature – rather, the distinction between species is a distinction that we humans write onto the natural world (for a free source on some of these issues, see Foucault, 1969). Having defined species, and tried to understand the map, we are then faced with the question 'What does "at risk" mean?'. To answer this we must know what the species are at risk from (in this case it is extinction). All this must be considered before addressing the issues of recording and reliability of the numbers. Hopefully, Figure 5 has kindled your imagination. Why is the Caribbean so large, and which are those islands off Africa?

New species are being discovered all the time. In February 2006, a group of scientists working in the Foja Mountains of Indonesian New Guinea discovered a new species of the honeyeater bird, more than 20 new species of frog, five new species of palm and four new species of butterfly (BBC News, 2006). There are probably thousands of species at risk which will become extinct before being discovered. Almost certainly these will be plants, fungi, or small and largely unattractive insects. We have probably counted most of the larger, apparently cuddly land-dwelling creatures. Other species may be thought to be extinct when in fact they are actually thriving, undiscovered.

If our maps somehow humanise geography, they certainly humanise the geography of species at risk, through the processes of defining, counting and locating that are necessary in order for a map to be drawn. Locating poses a particular challenge, not least because territorial boundaries are political constructions, and are therefore unstable and changeable. They can also deflect our attention from sub-national variations, and

Figure 5: Worldmapper map 269: Species at risk (see www.worldmapper.org). Territory size shows the proportion of all known species at risk that live there. Total number of unique species at risk in 2004: 24,495.

tempt us to reify countries in preference to other, perhaps more meaningful, entities for human collection, such as cities and their hinterlands (Taylor, 2005). Clearly, mapping distributions of variables in relation to territorial boundaries has particular value in human geography, given that the inhabitants of a bounded territory are subject to the same laws, and experience certain common cultural influences and values. Obviously, animal and plant species are not subject to such constraints and can move freely across international boundaries, yet the collection of data about them is in itself constrained by boundaries. For example, those new species mentioned previously were found in Indonesian New Guinea but are also likely to be found on the eastern side of the island, in Papua New Guinea. Nation-states are only 'natural' spatial units for mapping a very few aspects of human geography. However, statistically ('state-istically') we are often forced to use them for many international comparisons and so have to make the best use of them we can, while being aware of their limitations.

Maths behind the maps

The maps included in this article were created by an algorithm which was developed for the Worldmapper project by the physicist Mark Newman. Newman and his former doctoral student, Michael Gastner, developed this algorithm based on the physics of diffusion and heat transfer. The basis of this method is that every count of the variable being mapped is given the same area, and the territorial boundaries expand or shrink to fit around the proportion of the world total that is found in that territory. Newman's work is original and crucial to the Worldmapper project; some of his works are listed in the references at the end of this article (see Gastner and Newman, 2004; Dorling, Barford and Newman, 2006).

As well as employing Newman's algorithm we have had to develop techniques for estimating missing data when international agencies do not do so. For example, we have some data on income distributions within many territories, from which, and assuming log-normal income distributions, we can generate more information – and do. The estimation of missing information is discussed in greater detail elsewhere (see Dorling, Barford and Newman, 2006), but it is important to note here that without full datasets world maps cannot be drawn.

Humanising the physical

Changing the shape of the physical land area of territories in order to depict various aspects of the lives of the people that live in them is, in a sense, to 'humanise' the shape of the world. But humanising is not just about depicting humans – we are tied to our physical surroundings, so what is mapped is related to both the human and the physical. The idea of a complete human/physical split within geography is misconceived. Our physical environments affect our livelihoods, trade, agriculture and life chances, and vice versa. That said, the focus of much of the physical geography research undertaken in British universities is often of only tangential relevance to people's daily lives.

A world map enables us to show elements of the human and the physical world which complement or influence one another at a particular time in history: to take one trivial example, is there not some link between the high net fruit exports from South America and the high rainfall received in the fruit-producing areas of that continent? In this section, the focus is on such human–physical links, using maps then enables us to study these linkages in new ways, making connections across space.

Fruit

People use the physical environment (soils, sun, rainfall), the human environment (infrastructure, irrigation schemes, land tenure, wealth), and operate from within a particular territory (laws, currency, exchange rates, trade agreements). All these elements and more affect the map of world fruit exports (Figure 6). However, what the map cannot tell us is that it is as much – if not far more – the demand for fruit and the power of those who demand it that is responsible for its warped shape. The mass production and export of fruit is a very recent phenomenon. British supermarkets now stock varieties of fruit that our ancestors had neither seen nor heard of less than a hundred years ago. Pause for a moment and allow this map to start your thinking – why is it like this? You need context, you need a sense of history, and it helps to have some idea of how the world now works and why; but you also need something to fire your imagination.

South American territories export twice as much fruit as territories in any other region, except for Western Europe. Net exports are shown in Figure 6 when positive; that is when more is exported than is imported. As almost every territory within South America has positive net fruit exports, many appear on the map here. This is also the reason why the regional net totals of exports for South America are so significant; whereas, as a region, Western Europe is not a net exporter. Note also that territories located more than 50 degrees of latitude north are rarely net fruit exporters. The map of fruit imports – not shown here, but on the website – helps further to explain why you are seeing what you are seeing.

Forests

The definition of forest used by the World Bank is 'land under natural or planted stands of trees'. In the Solomon Islands, more than 90% of the land was forested in the year 2000, making these islands the territory with the most forest cover in the world (see Figure 7). In contrast, no forests were recorded in Malta in 2000. As was the case in 1990, the largest areas of forest in 2000 were found in the Russian Federation, Brazil and Canada.

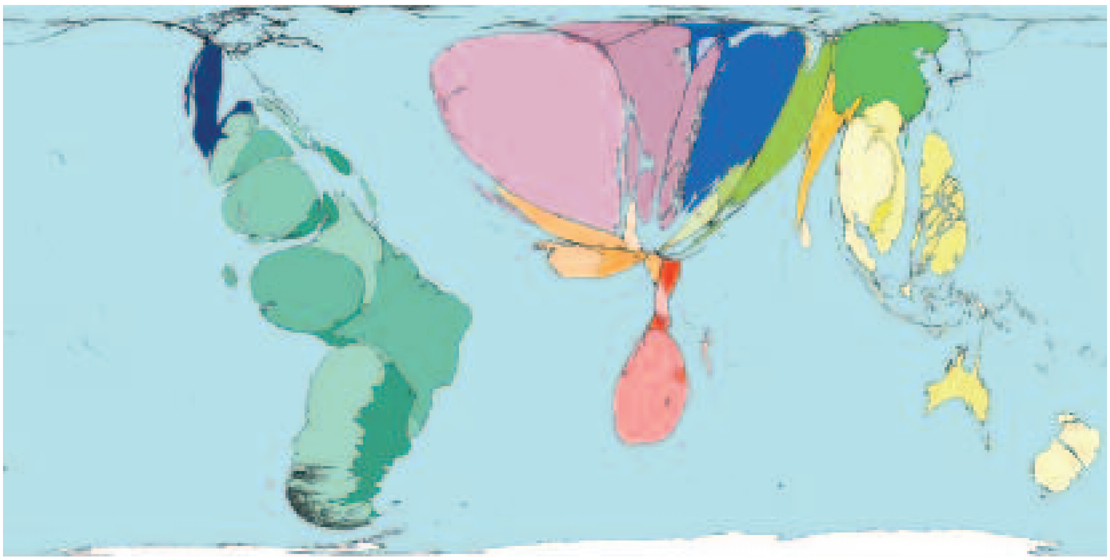

Figure 6: Worldmapper map 041: Net fruit exports (see www.worldmapper.org). Territory size shows the proportion of all net exports of fruit measured in US$ earned that come from there. Value of all net fruit exports worldwide in 2002: US$ 20 billion.

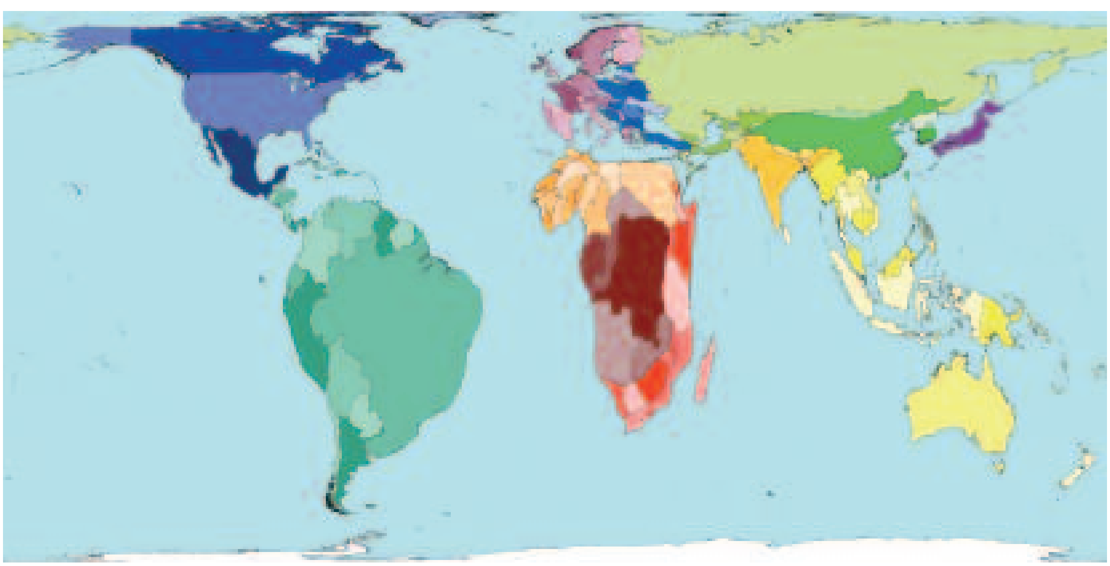

Figure 7: Worldmapper map 106: Forests 2000 (see www.worldmapper.org). Territory size shows the proportion of all forests that were found there in the year 2000. World forest cover in 2000: 38.7 million km².

Deforestation is widely discussed as a problem – it is argued that, among other things, it leads to soil erosion. The forest loss map (Figure 8) seems to suggest that many territories in the northern hemisphere have good forest protection records, but when this map is compared with the map of forests in 2000, it is apparent that many of these territories have very little forest left to protect! It is a little hypocritical for those in such places to demand that others should protect their forests having destroyed most of their own. Also, many of the wooden items bought in the UK are likely to come from places where deforestation is considered to be a problem: just because it is not an issue in our own country does not mean that we are not connected. Then there is also the matter of what materials are available to a local population for fuel and building materials: if there is a good supply of oil, coal, gas or other renewable sources of energy then these are likely

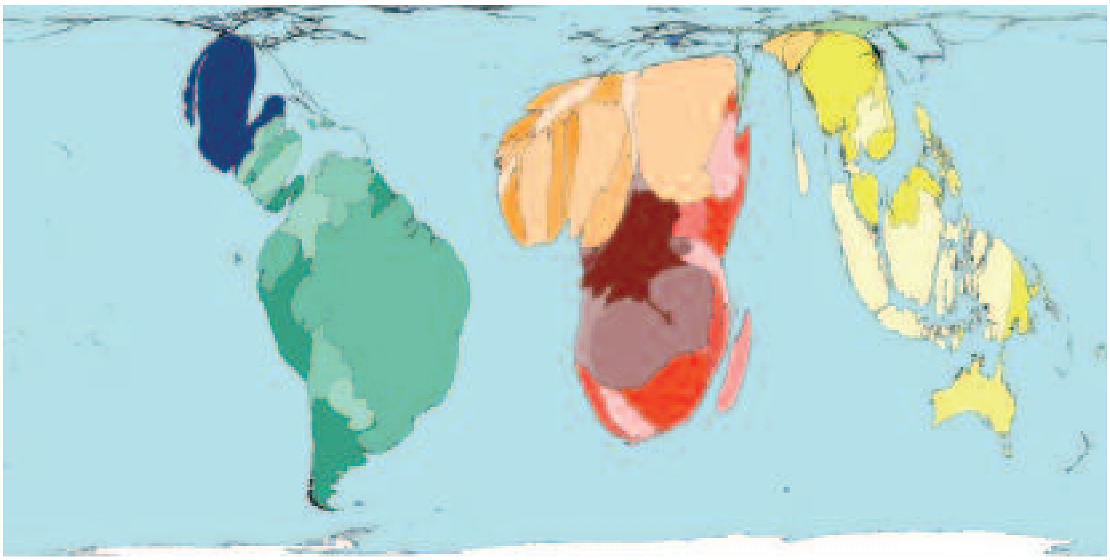

Figure 8: Worldmapper map 108: Forest loss (see www.worldmapper.org). Territory size shows the proportion of all net forest loss between 1990 and 2000 that occurred there. Worldwide decrease in forest cover: 1.3 million km².

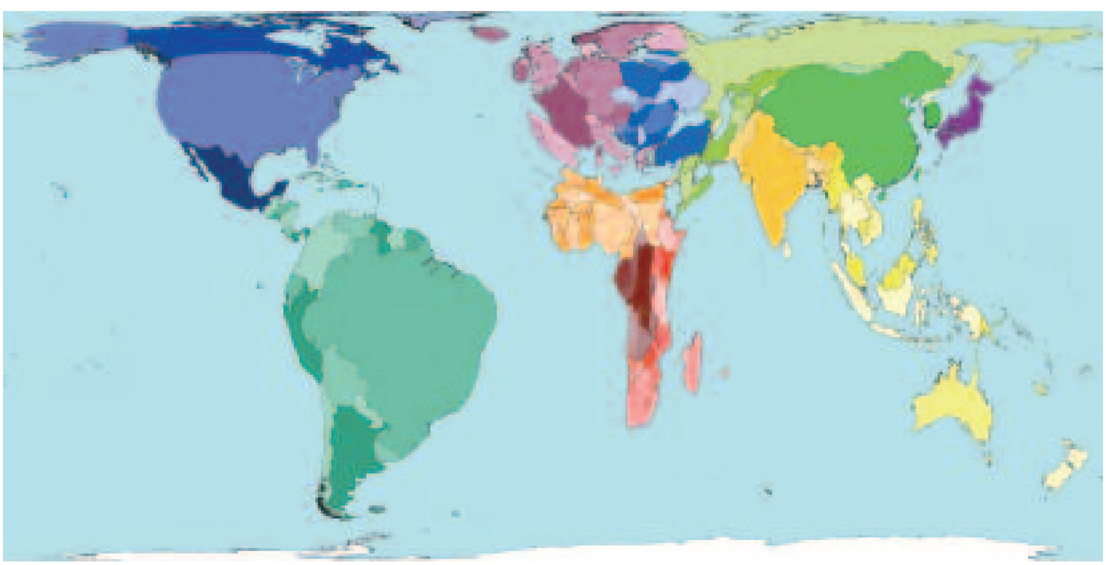

Figure 9: Worldmapper map: Biocapacity (see www.worldmapper.org). Territory size shows the proportion of total biocapacity that is found there. Biocapacity of the world: 11,091 million Gha (Global hectares).

to be used; otherwise, wood is still needed as a fuel for cooking and heating, and as a building material. In addition, deforestation is necessary to create extra farm land. What the map shows is a snap shot of one issue only; without knowing the context of each territory in terms of its relationship to other territories and to other issues, the picture we see is necessarily limited.

If the net forest loss of all territories between 1990 and 2000 is summed, we find that 31% occurred in South America and 21% in the Asia Pacific region. Worldwide, territories with net forest loss lost 1.33 million km^2 of forest over this ten-year period. Even so, in 2000, South America still had the largest forested area in the world. Obviously, the more forest area there is, the more it is possible to lose. Japan had neither forest loss nor forest growth in the period between 1990 and 2000. In Africa, the area covered by forest was reduced by 550,000 km^2 in the 1990s. This included the loss of forests that covered 11.4% of Zambian land.

Biocapacity

Biocapacity (mapped in Figure 9) is a measure of how much food and fibre can be produced per unit of area (e.g. one hectare) in a territory. The biocapacity of an area of land is, of course, affected by both physical and human factors: sun, water, soil, technology (tractors, fertilisers, pesticides), labour, and so on. The amount of fuel that a territory can supply is also included in biocapacity indices. Again, both physical and human determinants are involved, such as the existence of oil reserves and the capacity to exploit them. Taking the example of Iraq, figures for 2002 indicate that the country has a low biocapicity, despite its position in the once 'fertile crescent' and its large oil reserves. In this case, the reasons are clearly connected to human factors: most importantly war (see the Worldmapper website for more information).

Ecological footprint

The last map (Figure 10) relates to what is in a sense the inverse of biocapacity – namely the ecological footprint. The impact we make on our environment is summarised in our ecological footprint. Footprint per person is calculated using the consumption levels of food, fibre and energy. The resulting figure can then be multiplied by the population of a territory, and the ecological demands of the territory can then be compared with those of other territories. The bigger the territory appears on the map, the bigger its footprint. Car use, consumption patterns and climate all affect the ecological footprint, as does the ability to command goods. It may not matter that our favourite fruit does not grow in the continent in which we live because, provided there is sufficient wealth and demand we can import it. International trade thus allows ecological footprints to greatly exceed the biocapacity of a territory. However, the populations of some territories are unable to command large quantities of food, fibre and fuel

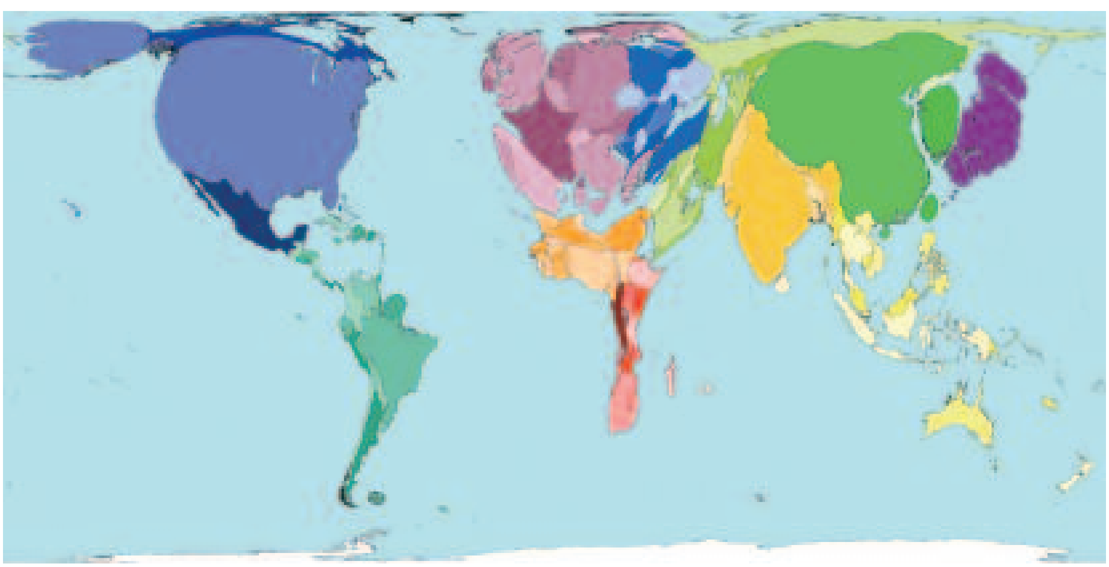

Figure 10: Worldmapper map: Ecological footprint (see www.worldmapper.org). Territory size shows the proportion of the total world ecological footprint that can be attributed to there. Ecological footprint of the world population: 13,423 million Gha.

from others, so their footprints are smaller. Brazil, for example, has a relatively large biocapacity and quite a small proportion of the world footprint. Japan is the opposite.

Conclusion

The maps in this article represent a small sample of those produced for the Worldmapper project. Mapping statistics in new ways like this can stimulate fresh, even novel, insights into a range of issues of concern to geographers. By viewing the world's geography in original ways, we are forced to challenge some of our assumptions. We are also made aware of the way in which our perceptions of, and the stories we tell about ourselves and others, are very much conditioned by conventions in the gathering and representation of information.

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