

Teaching footprints

Source: Adapted from Heath, 2002, pp. 75—8

The metaphor of the ecological footprint provides a powerful teaching tool to involve students in quantifying their global impacts. It also provides an opportunity to develop numeracy within the geography curriculum. The concept was introduced by Wackernagel and Rees (1996). The ecological footprint is a quantitative method designed to calculate the area of land to produce all that is required for an individual's consumption. It takes into account the land required to supply the resources we consume such as food, timber and energy, the land we live upon and the land taken to absorb our outputs such as pollution and waste. The impact of our footprint is not only local, but is imprinted on all areas of the Earth from where we obtain our resources or emit our waste.

While the mathematical modelling behind the calculation is complex, the footprint offers a number of opportunities for students at each key stage. The metaphor could simply be used to stimulate an array of effective visual displays to illustrate the idea of our environmental impact on the Earth. Our classes produced effective mosaic style collages using colour images of nature overlaid by black and white newspaper cuttings formed into footprints. In addition, footprint calculations have been produced for several countries. This provides opportunities for comparisons and can lead into themes relating to global inequalities, interdependence, sustainable development and personal global responsibility. For instance the USA has an average per capita footprint of 12.2ha, compared to the UK's 6.2ha and India's 1.1ha. If the whole world lived to the UK level, theoretically we would require the equivalent of four to five extra planet Earths to live on. At a regional level the footprint of London is said to be 125 times the area of the city (Pacione, 2001). From this we can immediately appreciate how the impacts of a community spread out across the global landscape.

Calculating footprints

Before considering our own footprint size it is useful to have a benchmark against which to consider it. We began by calculating the fair global footprint. This is based on the idea that there are 12.4 billion hectares of bio-productive land on Earth, which need to be shared between 6 billion people. An equal distribution would give each person approximately 2ha. This calculation assumes that humans utilise every centimetre of the Earth. However, we had to consider what proportion of the planet we would allot for the 25 million other species on Earth and adjust our fair footprint accordingly!

Country	Population in 1996	GDP (million US\$)	Ecological footprint (hectares/capita)
USA	269,439,000	7,100,007	12.2
Australia	18,141,000	337,909	8.5
United Kingdom	58,431,000	1,094,734	6.2
Japan	125,769,000	4,963,587	5.9
Argentina	35,219,000	278,431	3.7
Brazil	161,533,000	579,787	2.5

China	1,232,456,000	744,890	1.8
Egypt	63,497,000	45,507	1.7
India	949,997,000	319,660	1.1
Ethiopia	56,789,000	5,722	0.8
Bangladesh	120,594,000	28,599	0.6

We were now ready to move onto the activity that I believed had the greatest impact on the students: the possibility of calculating their own ecological footprint. Students used a short questionnaire that appeared in *New Scientist* (2001) from which they could estimate their individual footprint sizes.

We then used a website (<http://www.mec.ca/coop/communit/meccomm/ecofoot.htm>), to discover their footprint sizes more accurately. There are a number of such interactive websites that convert a student's answers into his or her footprint size. By answering just 13 relatively straightforward multiple-choice questions (Figure 1) the website provided a breakdown of each student's food, energy, transport and total footprint. While we should be cautious about the accuracy of these figures, they do provide a starting point from which to explore several issues and to help students to develop opinions about their personal impact on the world. Initially, the students were interested in how their footprint size compared with their classmates. To enable comparisons to be made we inserted the results into a spreadsheet and presented them as a graph. This graph was projected on to the main classroom screen. Students then began trying to explain the differences, for example, they noticed that one student with a high footprint travelled a long way to school each day by car.

Using our benchmark the students were able to calculate the difference between the fair global footprint and our own. The footprint calculator on the website also calculated the number of extra planet Earths that would be required for each size of footprint if the whole world survived on each student's footprint size. This image probably had the greatest impact on the students who began to consider the sustainability of their levels of consumption. For some this may have helped them appreciate for the first time that the Earth contains finite resources. The average footprint of the class was in the region of 7ha. If the whole planet lived at our standard of living, we would require approximately five extra planets Earths.

Extending the activity

To extend the activity, it is possible to calculate the footprint from a variety of different perspectives. Students at Clifton High School recently completed work based around village life in rural Kenya. The students then answered the questionnaire on the website based on an imaginary village chief's lifestyle (derived from information taken from Waugh and Bushell, 1992). Many students were surprised just how much the footprint figure dropped. The comparison of this result with their own footprint led to a whole-class discussion about global inequalities and raised issues relating to population and resources.

I also encouraged the students to identify which of their actions had the greatest impact on their ecological footprint. When they learn about issues such as pollution, global warming and ozone depletion students can easily become bewildered and demoralised in the sense that everything they do has a negative environmental impact.

Section 1: Food	Section 2: Transport	Section 3: Housing
<ol style="list-style-type: none"> 1. How often do you eat animal-based products (including meats, eggs, dairy and fish)? 2. How would you describe your average daily food intake in calories? 3. How much of your purchased food is thrown out rather than eaten? 4. How much of the food that you eat is locally grown, unprocessed and in-season? 	<ol style="list-style-type: none"> 5. How much do you drive each year, on average (either as driver or passenger in a car)? 6. On average, how often do you drive with someone else (either in your car or theirs)? 7. What kind of fuel efficiency does your car get (put the average if you drive several cars)? 8. On average, how many kilometres do you travel on public transportation (bus, rail) each week? 9. How many hours each year do you spend flying? 	<ol style="list-style-type: none"> 10. How many people live in your home? 11. How big is your home in metres squared? 12. Does your home use electricity from a green electricity provider? 13. Do you use energy-efficient appliances and lightbulbs?

Figure 1: Outline of the questions used on one of the footprint calculator websites. Each has around five multiple-choice answers to select from making it easy to use with students.

It is important to put things into perspective by identifying the kinds of actions that have a significant impact on the planet and where small changes in behaviour can make a substantial difference to these impacts. The footprint helps us to achieve this. By changing just a single answer within their questionnaire the students were able to compare the revised footprint calculation with their original one. The students quickly discovered the considerable impact even small changes in their use of cars and aeroplanes had on their footprints.

Students who are interested in developing this work further should be encouraged to explore the model itself in more detail. They could calculate more accurate figures using a spreadsheet footprint calculator (for use in *Excel*) which is freely downloadable from the world wide web (see Websites) There are also other methods of calculating one's environmental impact including the *EcoCal* developed by Going for Green and the *Carbon Calculator* sponsored by the DETR, both accessible via the internet (see Websites).

Follow-up

As a follow up activity we read an article from the *New Internationalist* magazine (2000) about a couple that had changed their lifestyle specifically to reduce their footprint size to 0.4ha (1 acre). This proved highly thought provoking, since in order

to reduce their global impact, the couple had decided to not have children. While most students felt this was an extreme decision, it did help them to appreciate the level of their own responsibility towards determining their footprint size. Students then considered the kinds of actions and the extent to which they would be prepared to change their lifestyles as a result of their understanding of ecological footprints. This work can be based around the principles of reduce, reuse, repair and recycle resources, and can be set in different contexts. For example, buying organic food and items with less packaging from the supermarket can help reduce an individual's footprint; at home and school we can turn off unwanted lights and thus avoid wasting resources.

A fun way to conclude the scheme of work is for students to use a variety of materials to produce posters which explain to others about global ecological footprints and what can be done to reduce our global impacts.

Conclusion

Footprint calculations support students in developing a higher level of environmental consciousness. It serves to engage and motivate students in global environmental issues and provides a result to which students can personally relate. Footprint calculations help to access a whole range of environmental, developmental and ethical themes and add an interesting numeracy component to the geography curriculum. They can also be integrated into units of study on citizenship, for example, students can investigate what their local community feels about global issues and devise ways of promoting the reduction of footprints.

References

- Anderson, A. *et al.* (eds) (2001) Self-destruct (supplement), *New Scientist*, April.
- Pacione, M. (2001) The future of the city — cities of the future, *Geography* 84, 4, pp. 275—86.
- Merkel, J. and Sherwood, E. (2000) Little feats, *New Internationalist*, November, 329 (see www.oneworld.org/ni/issue329/lillte.htm).
- Wackernagel, M. and Rees, W. (1996) *Our Ecological Footprint: Reducing human impact on the earth*. Canada: New Catalyst Press.
- Waugh, D. and Bushell, T. (1992) *Connections*. Cheltenham: Stanley Thornes.

Websites

The following websites all offer methods of calculating one's environmental impact:

The *Carbon Calculator*: <http://www.carboncalculator.org/>

The *EcoCal* calculator: <http://www.tidybritain.org.uk/webs/gfg>

The *Excel* version of the footprint spreadsheet calculator can be found at:
http://www.rprogress.org/resources/nip/ef/ef_household_evaluation.xls

This Footprint website contains information on and links to related sites:
http://www.rprogress.org/progsum/nip/ef/ef_main.html