



HAND PRINT™  
action towards  
sustainability

## Have you Sequestered your Carbon?



### **A Share-Net Resource Book**

Reading-to-learn curriculum materials to support  
Mathematics, Technology, Natural Sciences,  
and Language learning areas



# Acknowledgments

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Knowledge and activity support materials have been adapted from various sources including the Internet, and web addresses have been provided for readers to access any copyright materials directly.

For this particular resource book, a big thank you to Lawrence Sisitka who willingly shared his materials and knowledge of carbon sequestration and gave valuable advice. Thank you also to the *Independent* newspaper, Great Britain, for permission to use their copyright material in this resource book.



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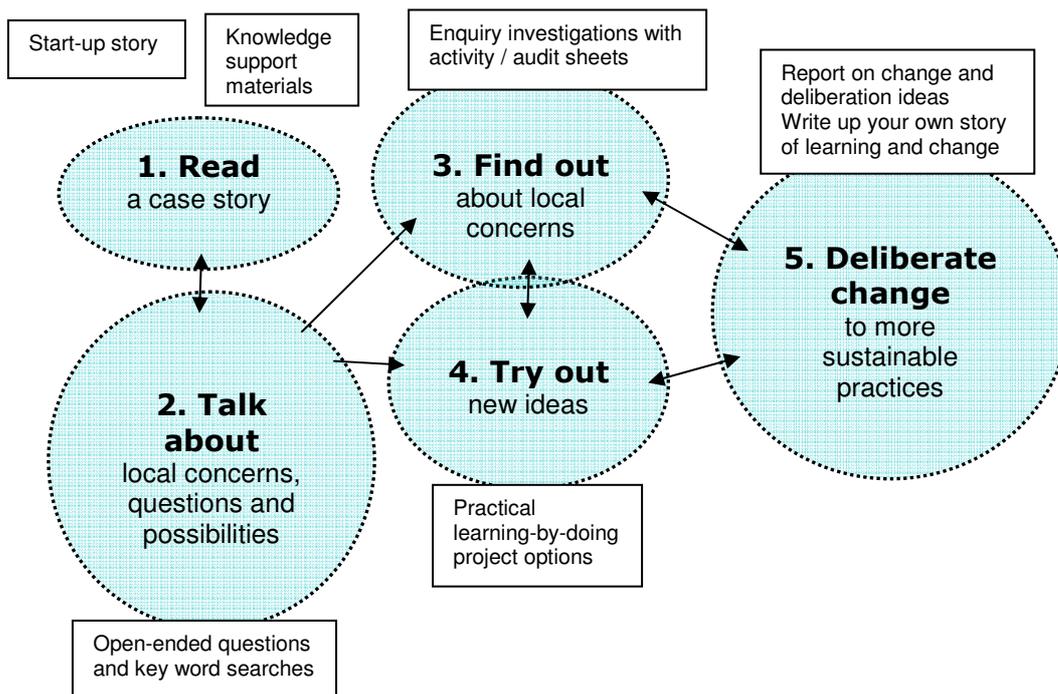
## RESOURCE BOOKS

The **Handprint Resource Books** have been designed for creative educators who are looking for practical ideas to work with in the learning areas of the National Curriculum. The focus is on **sustainability practices** that can be taken up **within the perspective that each learning area** brings to environment and sustainability concerns.

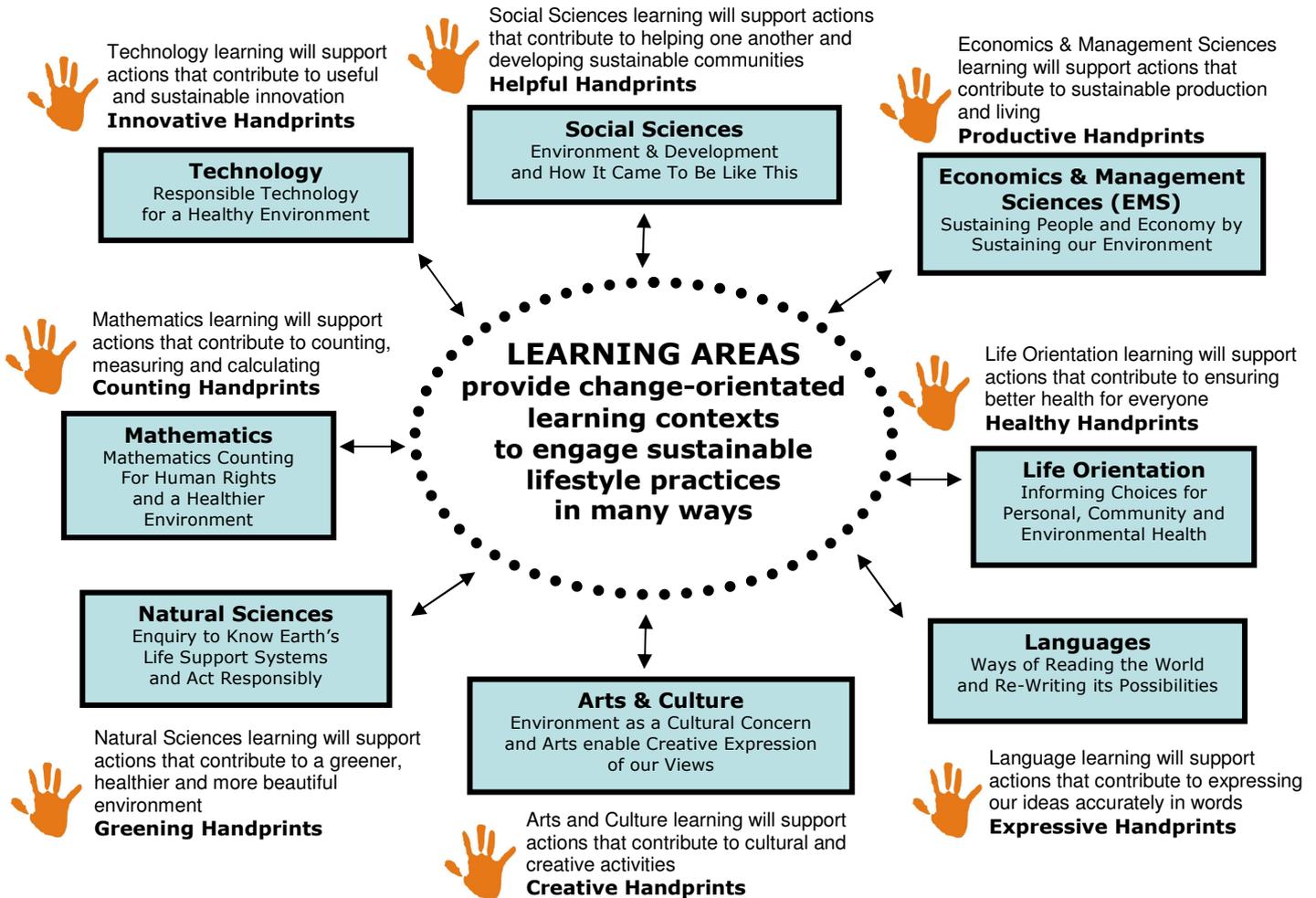
The resource books are intended to provide teachers with authentic start-up materials for change-orientated learning. The aim is to work towards re-imagining more sustainable livelihood practices in a warming world. Each start-up story was developed as a **reading-to-learn** account of environmental learning and change. Included are copies of the knowledge resources that informed those involved in the actual learning experiences described here. Working with local cases of learning and change has allowed us to develop the resource books around **locally relevant knowledge resources** and **practical learning activities** that relate to our African context. We are grateful to teachers and Eco-School support groups who have willingly shared their learning experiences and activities.

The **Handprint Resource Books** are an attempt to work from authentic cases of environmental learning and change. They combine some of the best teaching and learning tools that are being used to support change-orientated learning in the everyday realities of our South African schools. The resource books include:

1. **Start-up stories** with **knowledge support materials** (*Reading for information to build up a picture*)
2. Questions to **talk** about (*Talking to clarify issues and to plan local enquiry*)
3. Tools to **find out** about local concerns (*Writing about and reporting on local issues*)
4. Things to **try out** (*Writing up and reporting on what has been tried out*)
5. Ideas to **deliberate** (*Discussing, weighing up and recording decisions that will allow us to 're-imagine and re-write' our sustainability practices in a warming world*).



# Change-orientated learning & the curriculum



The activities in this book can be used to support learning in the **Natural Sciences, Technology, Mathematics** and **Language** learning areas, and can contribute to the development of **Greening, Innovative, Counting** and **Expressive Handprints**.

Teachers should consult the learning outcomes and assessment standards and should adapt the activities to suit their grade requirements.

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## Have you sequestered your carbon?

### Key words

Carbon dioxide  
Greenhouse gases

Climate change  
Phytoplankton

Deforestation  
Sequesterate

Global warming



Ever since the film, 'An Inconvenient Truth' by Al Gore, the problem of climate change has been taken very seriously. It's on the news, and I often see articles on climate

change in the *Mail and Guardian* newspaper which my dad buys every week. I therefore wasn't surprised when we started exploring climate change in our natural sciences class. But it's great. I have learnt many interesting things. At first it was distressing because the problem seems SO huge, but by the end of our week exploring this, I realized that we can each make a significant difference. Our class has already begun to do this. It's always exciting to realize that you as an individual can do something to improve the world.

Our teacher divided our class into two groups. Each group had to research a problem about global warming. I'd already seen a number of articles on global warming so I suggested to my group that we read a variety of newspapers to see what we could find. One article we found in the *Independent, UK* was terrifying; it told of the horrors of deforestation (**SM 1**). We learnt that deforestation is the second biggest contributor to carbon emissions. I was amazed that in the next 24 hours deforestation will release as much CO<sub>2</sub> into the atmosphere as 8 million people flying from London to New York. Flying is a big contributor to global warming. My cousin has even promised never to go on another aeroplane again, now that she

understands the impact of flying. What is the impact of 8 million people flying, I wondered? The other interesting thing we learnt is that countries that experience a lot of deforestation, are ranked very high when we compare the amount of greenhouse gases pumped by different countries into the atmosphere. For example, Indonesia, which is one of the main countries experiencing deforestation of their tropical forests, is ranked third, only behind America and China, in the amount of greenhouse gases it produces.

The other group found an article on the effects of phytoplankton (**SM 2**) on absorbing and storing (or sequestering) carbon. Their article was also frightening because it looked at how phytoplankton, which act as an important carbon sink (i.e. they absorb carbon) are threatened by a number of different things, mostly linked to climate change. For example, the oceans are losing fixed nitrogen because they are getting warmer. Nitrogen is a fertilizer for phytoplankton, so they begin to suffer and die. Our teacher explained that this is a 'positive feedback loop' – global warming is heating up the oceans which affects the phytoplankton's ability to survive. Phytoplankton absorb the carbon dioxide that is one of the main greenhouse gases contributing to global warming. Less phytoplankton will mean more global warming. It is a positive feedback because each effect in the chain reinforces itself. (*The word positive can be confusing, because it sounds like it is something you would want. But in this example the positive feedback is reinforcing something damaging. It is*

therefore something you don't want to happen).

After the two groups shared this unhappy news, our teacher told us we were going to work out how much carbon we each contribute to the atmosphere. This is what she called our 'carbon footprint'. She read through something she gave to each of us, on the things that contribute to our carbon footprints (**SM 3**). We then went to the Internet to find out how to calculate our carbon footprints. Transport seems to have a big impact. People who walk or cycle a lot and don't fly much, often



have lower carbon footprints than those who fly a lot and drive in big cars, especially 4x4s.

After all this bad news, our teacher divided us into our two groups again, and gave us the task of researching positive things that can be done about global warming. Our group came across another article, in our local newspaper, common in subtropical thicket. The article said that spekboom can "capture between 2 and 4 tons of carbon per hectare per year". That sounds like a lot of carbon. The other group found a very inspiring story called "The man who planted trees" (**SM 5**). We're still not sure if it's true, because it sounded too good to be true. The story describes how one man, through planting trees, was able to change a whole landscape to one overflowing with life. This story and the spekboom article really inspired our class! We decided to take spekboom cuttings and plant them in our school grounds. After four months most of them have survived and seem to be growing well. We also planted eight trees and hope that each year more will be planted. Imagine we could turn part of our playground into a forest.

### Glossary

**Carbon dioxide:** a gas that has no colour or smell. It naturally occurs in the atmosphere but its quantities have increased dramatically in the last two hundred years as humans have burnt fossil fuels, such as oil. It is the most important greenhouse gas, which means it contributes the most to global warming.

**Climate change:** otherwise known as global warming, although it doesn't always mean this. Some parts of the world might actually cool down. The greatest problem is that there will be increased unpredictability of weather systems due to the increased energy in the system.

**Deforestation:** cutting down forests which changes the way ecosystems function.

**Global warming:** an increase in the world's temperatures, which also means more droughts, floods and other disasters. This is caused by an increase in greenhouse gases.

**Greenhouse gases:** gases which absorb the sun's heat and therefore contribute to the greenhouse effect. The main greenhouse gases are carbon dioxide, water vapour, methane and nitrous oxide.

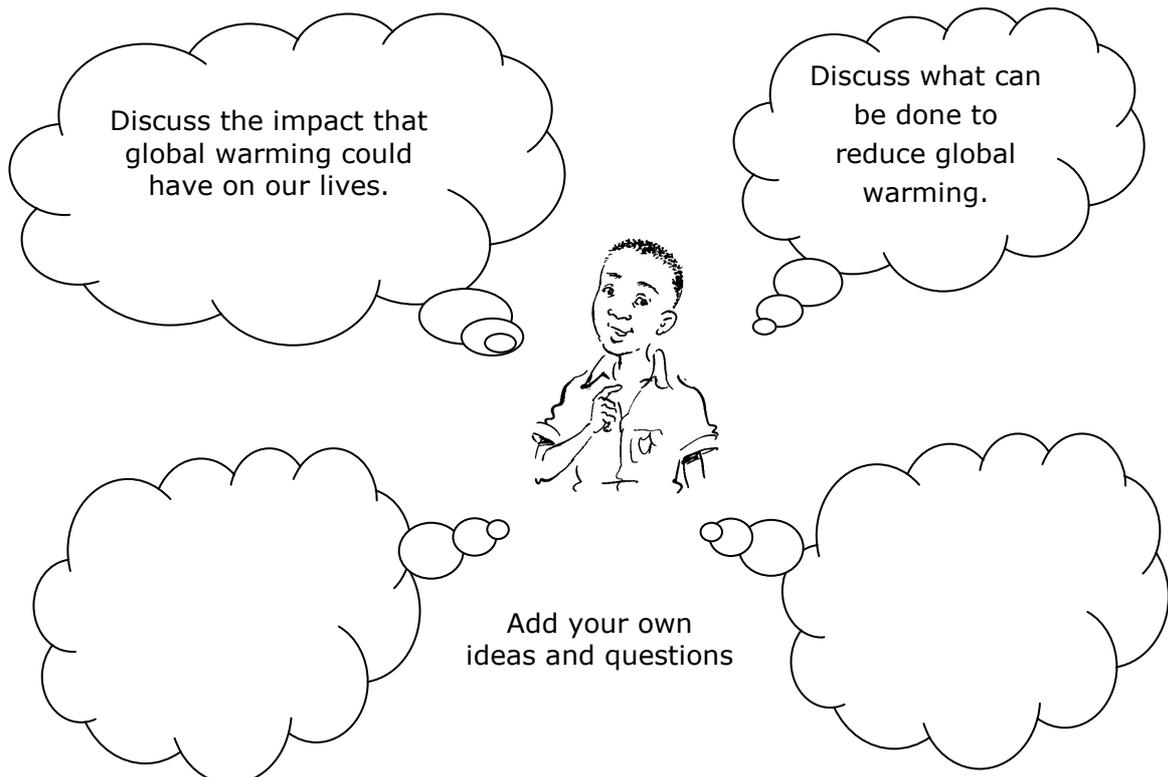
**Phytoplankton:** very tiny plants that you can't see without a microscope that live in the ocean and absorb a lot of carbon. They are often algae.

**Sequester:** to take (or confiscate) something for safekeeping. Carbon sequestration means to capture carbon from the atmosphere and store it in the form of plant tissue.

## Comprehension Questions

1. What is the second biggest contributor to global warming?
2. What is negatively impacting phytoplankton?
3. What does a carbon footprint mean?
4. How much carbon can spekboom capture in a year?
5. What, if any, are the horrors of deforestation to you? **(SM 1)**
6. Can you describe what a positive feedback is, based on **SM 2**?
7. What things contribute to one's carbon footprint? **(SM 3)**
8. Would you call the spekboom a 'wonder plant', and if yes why? **(SM 4)**
9. How did one person transform a landscape?
10. Was this story about the man who planted trees inspiring to you, and if so, why was it inspiring? **(SM 5)**

## Discussion Points



## FINDING OUT ACTIVITY

**Activity 1:** Find out the family carbon footprint of each learner. Use **SM 3** to guide you in what aspects of one's lifestyle to analyse critically. If you have access to the Internet you could look at the many excellent sites, highlighted in **SM 3** that help you calculate your carbon footprint.

## TRYING OUT ACTIVITIES

**Activity 1:** You could either get your learners to plant spekboom cuttings in the school playground, or else you could start a tree planting project. Use **SM 6** to help you.

**Activity 2:** Your class could do a carbon footprint exercise – use **SM 7** to guide you.

## DELIBERATION IDEAS



To deliberate is to think carefully about, to consider, to discuss in a focused way, to weigh up and debate. Here are some ideas to support this process in your learners.

Lead a discussion with your learners on whether planting trees is enough. Discuss what practical things we can start doing as part of our everyday lives.

- What can your **school** do practically to reduce your carbon footprint? (car pooling is one option – see **SM 8**)
- What can your **class** do practically to reduce your carbon footprint?
- What can **individual learners** do practically to reduce their carbon footprints? Get each learner to outline a personal plan to help reduce these. Things to include in the plan could include being careful about what they buy, including goods with less packaging; planting trees; considering various ways of using less energy e.g. putting a blanket over the geyser so it doesn't lose heat; cycling and walking more and driving less; joining a car pooling system; using public transport.



## Deforestation: The Hidden Cause of Global Warming

by Daniel Howden

In the next 24 hours, deforestation will release as much CO<sub>2</sub> into the atmosphere as 8 million people flying from London to New York. Stopping the loggers is the fastest and cheapest solution to climate change. So why are global leaders turning a blind eye to this crisis? The accelerating destruction of the rainforests that form a precious cooling band around the Earth's equator, is now being recognised as one of the main causes of climate change. Carbon emissions from deforestation far outstrip damage caused by planes and automobiles and factories.

The rampant slashing and burning of tropical forests is second only to the energy sector as a source of greenhouse gases according to a report published today by the Oxford-based Global Canopy Programme, an alliance of leading rainforest scientists. Research shows that deforestation causes up to 25 per cent of global emissions of heat-trapping gases, while transport and industry account for 14 per cent each; and airplanes make up only 3 per cent of the total. "Tropical forests are the elephant in the living room of climate change," said Andrew Mitchell, the head of the Global Canopy Programme. Reducing these catastrophic emissions can be achieved most quickly and most cheaply by halting the destruction in Brazil, Indonesia, the Congo and elsewhere. No new technology is needed, just laws and incentives that make the trees worth more living than cut down.

Most people think of forests only in terms of the CO<sub>2</sub> they absorb. The rainforests of the Amazon, the Congo basin and Indonesia are thought of as the lungs of the planet. But the destruction of those forests will in the next four years alone pump more CO<sub>2</sub>

into the atmosphere than every flight in the history of aviation to at least 2025.

Indonesia became the third-largest emitter of greenhouse gases in the world last week. Following close behind is Brazil. Neither nation has heavy industry on a comparable scale with the European Union, India or Russia and yet they easily produce more greenhouse gases than all other countries, except the United States and China. What both countries do have in common is tropical forest that is being cut and burned with staggering swiftness. Smoke stacks visible from space climb into the sky above both countries, while satellite images capture similar destruction from the Congo basin, across the Democratic Republic of Congo, the Central African Republic and the Republic of Congo.

According to the latest audited figures from 2003, two billion tons of CO<sub>2</sub> enters the atmosphere every year from deforestation. That destruction amounts to 50 million acres - or an area the size of England, Wales and Scotland felled annually. The remaining standing forest is calculated to contain 1,000 billion tons of carbon, or double what is already in the atmosphere. If we lose forests, we lose the fight against climate change. Forests offer the "single largest opportunity for cost-effective and immediate reductions of carbon emissions". Forests also produce most of the rainfall worldwide and act as a thermostat for the Earth. Forests are also home to 1.6 billion of the world's poorest people who rely on them for subsistence.

Howden, D. May 14, 2007. Deforestation: The Hidden Cause of Global Warming. The Independent/UK



## DISAPPEARING PLANKTON

The ability of the oceans to absorb carbon dioxide may be at risk. Presently oceans are absorbing about 2 billion tons of carbon annually. A report in *Nature*, August 1995, suggests that the oceans may be losing fixed nitrogen, an essential fertilizer that allows phytoplankton to grow.

Phytoplankton absorb and fix carbon that is then transferred to the deep ocean. If in fact the oceans are losing nitrogen as they warm, they will tend to absorb less carbon, boosting the rate of carbon dioxide buildup in the atmosphere.

Plankton are a major carbon sink in addition to the forests, other green plants, the permafrost, the earth's soil and atmosphere. Plankton take in about half of all the world's CO<sub>2</sub>, using the carbon for growth, while releasing oxygen during the process of photosynthesis. During the past 20 years there has been a stark decline, more than 9%, in primary production of plankton, while in the same period plankton of the North Atlantic has decreased by 7%. Less plankton means less carbon uptake. Watson W. Gregg, a NASA biologist, says that the greatest loss of phytoplankton has occurred where ocean temperatures have risen most significantly between the early 1980's and the late 1990's. In the North Atlantic summertime sea surface temperatures rose about 1.3 degrees Fahrenheit during that period, Gregg said, while in the North Pacific the ocean's surface temperatures rose about 7/10ths of a degree. (*San Francisco Chronicle*, David Perlman, Science Editor, October 6, 2003).

In the Arctic, loss of sea ice associated with warming could result in the diminution of phytoplankton populations. This could lead to 'knock-on effects' throughout the Arctic food chain, including declines in the numbers of several key prey species of cetaceans, such as copepods and plankton-feeding fish, including Arctic cod, a key prey species for narwhal and beluga whales. Warming and the attendant ice melt might result in greater stratification of the water column and decreased nutrient resupply, limiting the growth of phytoplankton populations that are a critical link in the cetacean food chain in the region.

### Reference

Ecobridge. Climate Roulette: Loss of Carbon Sinks & Positive Feedbacks. Downloaded on the 25<sup>th</sup> November, 2008. [http://www.ecobridge.org/content/g\\_cse.htm](http://www.ecobridge.org/content/g_cse.htm)



# CARBON FOOTPRINT CALCULATOR

## What is our 'Carbon Footprint'?

Every time you switch on a light, drive your car, run water or put out your rubbish, you're making a decision that affects the environment. Natural resources – water, coal, oil, land and fresh air – will run out if we use them up at a rate faster than they can replenish themselves. There are many indications that this is already happening. Each person living day to day on earth has a carbon footprint, producing carbon emissions directly or indirectly, which have a combined negative long term effect on the environment.

The good news is that you **can** make a difference. Every kilowatt-hour (kWh) of electricity you avoid, saves over a kilogram of carbon dioxide that would otherwise be released into the atmosphere. Carbon dioxide (CO<sub>2</sub>) is the number-one contributor to global warming, a process that scientists say has led to a rise in global average temperatures by over half a degree Celsius over the past 30 years and could raise the earth's temperatures by 1,4 – 5,8° C by the end of the century. Installing an 11-watt compact fluorescent light (CFL) in place of a 60-watt incandescent light bulb will save 570 kWh over the life of the compact fluorescent – saving more than 570 kg of CO<sub>2</sub>.

## The following needs to be considered when determining your household's carbon footprint:

- The country in which you live - electricity CO<sub>2</sub> emissions are very high in SA.
- The type of home you live in. The larger the home, the bigger the footprint.
- The transport that you use and how much you travel. For example, if you travel by train to Barcelona you will use 40kg of carbon compared to 277kg if you went by plane (have a look at <http://www.seat61.com/CO2flights.htm>).
- Your personal habits.

## Negative impacts

- Your lifestyle - heating, air conditioning, appliances and lighting setup.
- Bad habits such as leaving lights and appliances on (even on standby), and having deep baths.
- Driving with only you in the car, or unnecessarily using 4x4s, e.g. in town. Flying has a high carbon footprint.

## Positive impacts

- Using green technology - solar heating, photovoltaic panels or renewable energy.
- Use of public transport.
- Good habits such as reducing, reusing and recycling, having short showers, switching off lights and appliances.
- Planting trees.

These are some of the most carbon producing activities:

- Travel, particularly by air, private car and heavy trucks.
- Power generation, particularly from fossil fields, e.g. coal.
- Deforestation (think about the things you consume that contribute to this).

- Heavy industry producing the many goods we think we need.

**Did you know?**

One ton of CO<sub>2</sub> emissions occupies 556m<sup>3</sup> of space at 25°C at standard pressure. An Olympic size swimming pool is 2500m<sup>3</sup>. The average South African household consumes 12.81 tons of CO<sub>2</sub> per year. This can fill almost three Olympic size swimming pools.

**Useful Carbon Footprint Web Resources:**

Carbon Clear <a href="http://www.carbon-clear.com">http://www.carbon-clear.com</a>	Carbon Counter <a href="http://www.carboncounter.org">http://www.carboncounter.org</a>
Earth Day Network Footprint Calculator <a href="http://www.earthday.net/footprint/index.html">http://www.earthday.net/footprint/index.html</a>	Climate Care <a href="http://www.climatecare.org">http://www.climatecare.org</a>

**Reference**

Smart Living Handbook <http://www.capetown.gov.za/en/EnvironmentalResourceManagement/EnergyEfficiency/Pages/CarbonFootprintCalculator.aspx>



## **THE CARBON ISSUE**

### **SPEKBOOM WONDERBOOM**

**Makana Enviro-News 70 for Grocott's Mail**

**Tuesday 28 October 2008**

Spekboom, that amazing shrub, common in much of the bush (or more properly 'Subtropical Thicket') in the Eastern Cape, has long been valued by both animals and people. Called 'spekboom' by the Boers because of the similarity of the pale pulpy 'flesh' of the sapwood to bacon fat, this plant can quite literally be a life-saver. One of the plant's names 'Elephant Food' indicates that it is highly prized by elephants. It is indeed favoured by them, perhaps because of the moist, fleshy leaves and stems, which retain water even in the driest periods. Fortunately spekboom can take a fair amount of hammering by elephants and other indigenous game, as they tend to browse from the top down. Unfortunately goats browse from the ground up, and the plant does not respond so well to this. Humans, too, can use the leaves of the plant (which have a slightly astringent but not unpleasant taste, similar to sorrel) to quench thirst on hot days. In the past, lactating Xhosa mothers ate the leaves to stimulate milk production, particularly in dry periods.

Recently spekboom has been cast as something of a 21<sup>st</sup> century miracle plant as it appears that it is spectacularly good at sequestering carbon dioxide from the air and storing the carbon in its tissues, something our over-carboned world is crying out for. Work carried out in the Eastern Cape by the Subtropical Thicket Restoration Programme (STRP), and more recently the Rhodes Restoration Research Group (R3G), has shown that the plant, in fairly dense stands, can

capture between 2 and 4 tons of carbon per hectare per year. The figures do vary considerably depending on a number of factors. The bottom line is, however, that subtropical thicket, especially when dominated by spekboom, is at least as effective at capturing carbon as tropical rainforest. And this means money, or at least the potential for income to be earned through 'carbon trading'. The current price is between 10 and 20 Euros/ton of carbon, so a quick calculation shows that planting spekboom could earn landowners (private or communal) up to 80 Euros (R1000)/hectare, with potential for considerably more in the future. (Unfortunately it can't be claimed if the bush is already there naturally!). There is now talk of the potential for both job creation and income generation in the poorer rural areas of the province, as planting is quite labour intensive. Whether the financial benefits will actually match the livelihood and cultural values of goat-keeping to poor rural families remains to be seen.

Of course, if we are concerned about climate change, and wish to make our own contribution, there is nothing to stop us replacing some or all of the non-indigenous shrubs in our gardens and in our hedges with spekboom. It is incredibly easy to plant – just break off a bit and stick the soggy end in the ground, and it has an 80% chance of growing. And we can feel that we are doing at least a little bit to restore the balance of life – unless, of course we then get on another airplane!



## **THE MAN WHO PLANTED TREES**

*In order for the character of a human being to reveal truly exceptional qualities, we must have the good fortune to observe its action over a long period. If this action is devoid of all selfishness, if the idea that directs it is one of unqualified generosity, if it is absolutely certain that it has not sought recompense anywhere, and if moreover it has left visible marks on the world, then we are unquestionably dealing with an unforgettable character.*

About forty years ago I went on a long hike, through hills absolutely unknown to tourists, in that very old region where the Alps penetrate into Provence. At the time I undertook my long walk through this deserted region, it consisted of barren and monotonous lands, at about 1200 to 1300 meters above sea level. Nothing grew there except wild lavender. After walking for three days, I found myself in the most complete desolation. I was camped next to the skeleton of an abandoned village. I had used the last of my water the day before and I needed to find more. Even though they were in ruins, these houses all huddled together made me think that there must at one time have been a spring or a well there. There was indeed a spring, but it was dry.

It was a beautiful June day with plenty of sun, but on these shelterless lands, the wind whistled with an unendurable brutality. I had to move my camp. After five hours of walking, I still hadn't found water, and nothing gave me hope of finding any. Everywhere there was the same dryness, the same stiff, woody plants. I thought I saw in the distance a small black silhouette. On a chance I headed towards it. It was a shepherd. Thirty lambs or so were resting near him on the scorching ground. He gave me a drink from his gourd and a little later he led me to his shepherd's cottage, hidden in the valley. He drew his pure tasting water from a natural, very deep hole.

This man spoke little. This is common among those who live alone, but he seemed sure of himself, which seemed remarkable in this land shorn of everything. He lived in a real house of stone, from the looks of which it was clear that his own labor had restored the ruins he had found on his arrival. His roof was solid and water-tight. His household was in order, his dishes washed, his floor swept, his rifle greased; his soup boiled over the fire; I noticed then that he was also freshly shaven, that all his buttons were solidly sewn, and that his clothes were mended with such care as to make the patches invisible. He shared his soup with me, and when afterwards I offered him my tobacco pouch, he told me that he didn't smoke. His dog, as silent as he, was friendly without being fawning.

It had been agreed immediately that I would pass the night there, the closest village being still more than a day and a half farther on. Furthermore, I understood perfectly well the character of the rare villages of that region. There are four or five of them dispersed far from one another on the flanks of the hills, in groves of white oaks at the very ends of roads passable by carriage. They are inhabited by woodcutters who make charcoal. They are places where the living is poor. The families, pressed together in close quarters by a climate that is exceedingly harsh, in summer as well as in winter, struggle ever more selfishly against each other. Irrational contention grows beyond all bounds, fueled by a continuous struggle to escape from that place.

The shepherd, who did not smoke, took out a bag and poured a pile of acorns out onto the table. He began to examine them one after another with a great deal of attention, separating the good ones from the bad. I smoked my pipe. When he had in the good pile a fair number of acorns, he counted them out into packets of ten. In doing this he

eliminated some more of the acorns, discarding the smaller ones and those that that showed even the slightest crack, for he examined them very closely. When he had before him one hundred perfect acorns he stopped, and we went to bed.

The company of this man brought me a feeling of peace. I asked him the next morning if I might stay and rest the whole day with him. He found that perfectly natural. He let out his flock and took them to the pasture. Before leaving, he soaked in a bucket of water the little sack containing the acorns that he had so carefully chosen and counted.

I noted that he carried as a sort of walking stick an iron rod as thick as his thumb and about one and a half meters long. I set off like someone out for a stroll, following a route parallel to his. His sheep pasture lay at the bottom of a small valley. He left his flock in the charge of his dog and climbed up towards the spot where I was standing. I was afraid that he was coming to reproach me for my indiscretion, but not at all: It was his own route and he invited me to come along with him if I had nothing better to do. He continued on another two hundred meters up the hill. Having arrived at the place he had been heading for, he began to pound his iron rod into the ground. This made a hole in which he placed an acorn, whereupon he covered over the hole again. He was planting oak trees. I asked him if the land belonged to him. He answered no. Did he know whose land it was? He did not know. He supposed that it was communal land, or perhaps it belonged to someone who did not care about it. In this way he planted his one hundred acorns with great care.

After the noon meal, he began once more to pick over his acorns. I must have put enough insistence into my questions, because he answered them. For three years now he had been planting trees in this solitary way. He had planted one hundred thousand. Of these one hundred thousand, twenty thousand had come up. He counted on losing another half of them to rodents and to everything else that is unpredictable in the designs of Providence. That left ten thousand oaks that would grow in this place where before there was nothing. It was at this moment that I began to wonder about his age. He was clearly more than fifty. Fifty-five, he told me. His name was Elzéard Bouffier. He had owned a farm in the plains, where he lived most of his life. He had lost his only son, and then his wife. He had retired into this solitude, where he took pleasure in living slowly, with his flock of sheep and his dog. He had concluded that this country was dying for lack of trees. He added that, having nothing more important to do, he had resolved to remedy the situation.

I told him that in thirty years these ten thousand trees would be magnificent. He replied very simply that, if God gave him life, in thirty years he would have planted so many other trees that these ten thousand would be like a drop of water in the ocean. He had also begun to study the propagation of beeches and he had near his house a nursery filled with seedlings grown from beechnuts. His little trees, which he had protected from his sheep by a screen fence, were growing beautifully. He was also considering birches for the valley bottoms where, he told me, moisture lay just a few meters beneath the surface of the soil. We parted the next day.

The next year the war of 1914 came, in which I was engaged for five years. An infantryman could hardly think about trees. With the war behind me, I found myself with a small bonus and a great desire to breathe a little pure air. Without any plan, I struck out again along the trail through that deserted country. The land had not really but in the distance, I perceived a sort of gray fog that covered the hills like a carpet. Ever since the day before I had been thinking about the shepherd who planted trees. Ten thousand oaks, I thought, must really take up a lot of space.

I had seen too many people die during those five years not to be able to imagine easily the death of Elzéard Bouffier, especially since when a man is twenty he thinks of a man of fifty as an old codger for whom nothing remains but to die. He was not dead. In fact, he was very spry. He had changed his job. He only had four sheep now, but to make up for this he had about a hundred beehives. He had gotten rid of the sheep because they threatened his crop of trees. He told me (as indeed I could see for myself) that the war had not disturbed him at all. He had continued imperturbably with his planting. The oaks of 1910 were now ten years old and were taller than me and than him. The spectacle was impressive. I was literally speechless and, as he didn't speak himself, we passed the whole day in silence, walking through his forest. It was in three sections, eleven kilometers long overall and, at its widest point, three kilometers wide. When I considered that this had all sprung from the hands and from the soul of this one man - without technical aids - it struck me that men could be as effective as God in domains other than destruction.

He had followed his idea, and the beeches that reached up to my shoulders and extending as far as the eye could see bore witness to it. The oaks were now good and thick, and had passed the age where they were at the mercy of rodents. He showed me admirable stands of birches that dated from five years ago. He had planted them in the valley bottoms where he had suspected, correctly, that there was water close to the surface. They were as tender as young girls, and very determined. This creation had the air, moreover, of working by a chain reaction. He had not troubled about it; he went on obstinately with his simple task. But, in going back down to the village, I saw water running in streams that, within living memory, had always been dry. It was the most striking revival that he had shown me. These streams had borne water before, in ancient days. The wind had also been at work, dispersing certain seeds. As the water reappeared, so too did willows, osiers, meadows, gardens, flowers, and a certain reason to live.

Beginning in 1920 I never let more than a year go by without paying a visit to Elzéard Bouffier. I never saw him waver or doubt, though God alone can tell when God's own hand is in a thing! I have said nothing of his disappointments, but you can easily imagine that, for such an accomplishment, it was necessary to conquer adversity; that, to assure the victory of such a passion, it was necessary to fight against despair. One year he had planted ten thousand maples. They all died. The next year, he gave up on maples and went back to beeches, which did even better than the oaks.

In 1933 he received the visit of an astonished forest ranger. This functionary ordered him to cease building fires outdoors, for fear of endangering this *natural* forest. It was the first time, this naive man told him, that a forest had been observed to grow up entirely on its own. At the time of this incident, he was thinking of planting beeches at a spot twelve kilometers from his house. To avoid the coming and going - because at the time he was seventy-five years old - he planned to build a cabin of stone out where he was doing his planting. This he did the next year.

In 1935, an administrative delegation from Water and Forests went to examine this 'natural forest', including a deputy, and some technicians. Many useless words were spoken. It was decided to do something, but luckily nothing was done, except for one truly useful thing: placing the forest under the protection of the State and forbidding anyone from coming there to make charcoal. For it was impossible not to be taken with the beauty of these young trees in full health.

I saw Elzéard Bouffier for the last time in June of 1945. He was then eighty-seven years old. I had once more set off along my trail through the wilderness, only to find that now, in spite of the shambles in which the war had left the whole country, there was a motor coach running between the valley of the Durance and the mountain. It seemed that the route was taking me through entirely new places. I had to ask the name of a village to be sure that I was indeed passing through that same region, once so ruined and desolate. The coach set me down at Vergons. In 1913, this hamlet of ten or twelve houses had had three inhabitants. They were savages, hating each other, and earning their living by trapping: physically and morally, they resembled prehistoric men. The nettles devoured the abandoned houses that surrounded them. Their lives were without hope, it was only a matter of waiting for death to come: a situation that hardly predisposes one to virtue. All that had changed, even to the air itself. In place of the dry, brutal gusts that had greeted me long ago, a gentle breeze whispered to me, bearing sweet odors. A sound like that of running water came from the heights above: It was the sound of the wind in the trees. And most astonishing of all, I heard the sound of real water running into a pool. I saw that they had built a fountain, that it was full of water, and what touched me most, that next to it they had planted a lime-tree that must be at least four years old, already grown thick, an incontestable symbol of resurrection.

Furthermore, Vergons showed the signs of labors for which hope is a requirement: Hope must therefore have returned. They had cleared out the ruins, knocked down the broken walls, and rebuilt five houses. The hamlet now counted twenty-eight inhabitants, including four young families. The new houses, freshly plastered, were surrounded by gardens that bore, mixed in with each other but still carefully laid out, vegetables and flowers, cabbages and rosebushes, leeks, and celery. It was now a place where anyone would be glad to live. From there I continued on foot. On the lower flanks of the mountain, I saw small fields of barley and rye; in the bottoms of the narrow valleys, meadowlands were just turning green.

It has taken only the eight years for the whole country around there to blossom with splendor and ease. On the site of the ruins I had seen in 1913 there are now well-kept farms, the sign of a happy and comfortable life. The old springs have once again begun to flow. The brooks have been channeled. Beside each farm, amid groves of maples, the pools of fountains are bordered by carpets of fresh mint. Little by little, the villages have been rebuilt. Yuppies have come from the plains, where land is expensive, bringing with them youth, movement, and a spirit of adventure. Walking along the roads you will meet men and women in full health, and boys and girls who know how to laugh, and who have regained the taste for the traditional rustic festivals. Counting both the previous inhabitants of the area, now unrecognizable from living in plenty, and the new arrivals, more than ten thousand persons owe their happiness to Elzéard Bouffier.

When I consider that a single man, relying only on his own simple physical and moral resources, was able to transform a desert into this land of Canaan, I am convinced that despite everything, the human condition is truly admirable. But when I take into account the perseverance, the greatness of soul, and the selfless dedication that was needed to bring about this transformation, I am filled with an immense respect for this old, uncultured peasant who knew how to bring about a work worthy of God. Elzéard Bouffier died peacefully in 1947 at the hospice in Banon.

### **Reference**

Giono, J. 1953. The man who planted trees. Translation from French by Peter Doyle  
[http://www.perso.ch/arboretum/man\\_tree.htm](http://www.perso.ch/arboretum/man_tree.htm)



## HOW TO PLANT A TREE

### How do you plant a cutting?

- Some species can be grown from cuttings taken towards the end of the growing season.
- Select a healthy shoot from the current year's growth.
- Cut a straight 25cm section directly above a bud at the top and below a bottom bud. Clean the leaves off the cutting, leaving only four at the top.
- Bury two thirds of the cutting into free draining soil or sand.
- Water regularly.
- Plant several cuttings at a time, to make sure at least one survives.
- If available, cuttings can be dipped into root hormone mixture to help rooting.
- Some trees can sprout from truncheons (thick cuttings 5-7cm in diameter and 2-3 metres long). Plant lots of truncheons in a row to make a living fence.

### How to plant a tree

- Plant trees from containers when they have become as big as their containers.
- Plant trees on a cloudy day and never in the sun during the hottest part of the day.
- Prepare the ground, removing unwanted plants.
- Always keep bare tree roots damp while planting.
- Dig a hole large enough to take the roots and some compost. A 1 meter square hole is a good size. It is important that the hole is square. A round hole will cause the roots to become ring bound.
- When planting, spread the roots and fix in soil or soil/compost mix, firming well as you progress; do not add soil above the previous soil line on the stem.
- It is a good idea to add compost and other nutritious additions to the hole.
- Carefully dig around the roots of your tree.
- Hold the seedling by its leaves and gently lift the roots out, supporting the ball of soil around its roots.
- Plant the tree into the hole without bending the roots.
- Plant the tree so that only the first two leaves are above the ground.
- Make the soil firm around the tree.

### Reference

(Adapted from) PACE. A step by step guide to planting a tree from seed. Action sheet 49. [www.paceproject.net](http://www.paceproject.net). (This Action Sheet was compiled by Nancy Gladstone.)



**6. Travel:** Poisonous gases and substances released by cars include carbon dioxide, nitrogen oxides, hydrocarbons and lead which contribute to climate change, acid rain and smog.

**How do you get to work/school/college?**

- a) Walk      b) By bicycle      c) By taxi      d) By car

**Add up all your points!!**

- Question 1: a) – 10 points      b) 20 points  
Question 2: a) – 10 points      b) 0 points      c) 5 points      d) 10 points  
e) 20 points  
Question 3: a) – 10 points      b) 0 points      c) 5 points      d) 10 points  
e) 20 points  
Question 4: a) – 10 points      b) 5 points      c) 20 points  
Question 5: For each answer: A, B, C, D a) Never: 20 points b) Sometimes: 5 points c) Often: – 10 points  
Question 6: a) – 10 points      b) 0 points      c) 5 points      d) 20 points  
Question 7: a) – 10 points      b) – 10 points      c) 5 points      d) 20 points

**Your final carbon footprint score**

- Score less than 25: Green footprint (you have a TINY ecological footprint)  
Score from 26-55: Yellow footprint (you have a small ecological footprint)  
Score from 56-90: Blue footprint (you have a medium ecological footprint)  
Score from 91-140: Orange footprint (you have a large ecological footprint)

**Reference**

Adapted from Share-Net

## CAR SHARING



Greenwheels is a new Grahamstown-based online service that provides a free space for students, lecturers and residents to reduce their CO<sub>2</sub> footprint and organise carpooling for end-of-term travels, out-of-town visits and even trips on and off campus.

Benefits? - Cheaper travelling; safer travelling; taking a stand against cooking and destroying our planet and home.

Visit <http://zebra.rucus.net/greenwheels> and sign up NOW! It's an even more right thing to do than paying your TV license.

**FACT:** High levels of atmospheric carbon dioxide are causing unnatural global warming.

**FICTION:** There is nothing you can do about it. (Thanks to Karen Douglas of Greenwheels for this contribution. And from a national web-based care-share initiative ([www.carshare.co.za](http://www.carshare.co.za)), for those longer journeys)

### Hitch a ride with Car Share SA

A new online service aims to reduce road congestion and the resulting carbon emissions on our roads by encouraging South Africans to car pool. Known as Car Share South Africa, the service is the brainchild of Capetonian Michelle Bainbridge. "The whole idea for Car Share started one day when I was sitting in traffic and looking around at all the cars around me. I discovered that the majority of the cars had only one person in each. It would make so much sense if we could car pool," says Bainbridge who commutes daily from Somerset West to Stellenbosch.

Similar car share / car pooling services have long been popular in the USA and the UK, with the former having already established carpool lanes on their roads.

While there are pockets of car-poolers around South Africa, the concept has not neared its potential in part due to the lack of an organised network of those needing and those offering rides.

Bainbridge's online service is free of charge and works as a connection point for people looking for other people travelling in the same direction, throughout South Africa. The site also allows users to seek or offer cross-border rides.

Globally, carpooling is seen as the easiest way to address the issue of CO<sub>2</sub> emissions from cars. According to Bainbridge, carpooling has the potential to reduce carbon emission by a third.



## Handprint resource books available from Share-Net

<b>TITLE</b>	<b>LEARNING AREAS COVERED (BROADLY)</b>
 <b>1.</b> Reusing Shower and Bath Water	Language Natural Sciences Technology
 <b>2.</b> The Buzz on Honey Bee Economics	Language Natural Sciences Social Sciences Technology Economics & Management Sciences
 <b>3.</b> Have you Sequestered your Carbon?	Language Natural Sciences Technology Mathematics
 <b>4.</b> Did you Grow your Greens?	Language Natural Sciences Social Sciences Life Orientation Arts & Culture
 <b>5.</b> Clearing Invasive Weeds	Language Natural Sciences Technology
 <b>6.</b> The Secret of a Spring	Language Natural Sciences Social Sciences Life Orientation Technology Mathematics
 <b>7.</b> The Secret of the Disappearing River	Language Life Orientation Social Sciences Economics & Management Sciences
 <b>8.</b> Creative Garden Design	Language Natural Sciences Technology
 <b>9.</b> Recycling, Waste Reduction and Creative Re-use	Language Social Sciences Life Orientation Arts & Culture Technology Economics & Management Sciences
 <b>10.</b> Worming Waste	Language Natural Sciences Technology
 <b>11.</b> Growing Mother-tree Seedlings	Language Natural Sciences Technology
 <b>12.</b> Rooibos: a Biodiversity Economy at Risk	Language Natural Sciences Economics & Management Sciences

Many more Handprint resource books are in the planning stages. These resource books and many others for teacher educators and teachers are available electronically in pdf format on [www.tessafrica.net](http://www.tessafrica.net). The Handprint resource books can also be downloaded from [www.handsforchange.org](http://www.handsforchange.org).

The adaptive use of these resource books for educational purposes is encouraged. Anyone wishing to develop their own resource or adapt one, can contact Share-Net [sharenet@wessa.co.za](mailto:sharenet@wessa.co.za) for a version in Microsoft Word.



HAND PRINT™  
action towards  
sustainability

*This handprint is of a 10-year-old girl, Srija, from a school in Hyderabad, India, who was involved in a project taking action for sustainability. Her handprint can be taken as a symbol for positive action.*

## Increase your handprint. Decrease your footprint.

Human impact on the Earth has tripled since 1961 and our human footprint is now 25% bigger than the planet can support. In other words we are using 25% more natural resources and services than the planet can create and provide. The 'Ecological Footprint' is one way to measure what area of land and water the whole human population requires to produce the resources it consumes and to absorb its wastes, and we now need 25% more area than is available on the whole planet. This means that the planet is simply being damaged beyond what it can repair, and this cannot continue without causing very serious threats to all life, including our own.

Education is a key way to achieve the changes we need to live in a manner that the planet can support. Environment and Sustainability Education (an environmentally focussed approach to Education for Sustainable Development – ESD) is a move away from seeing education just as a means of producing the skills to carry on doing what we are doing. It develops the abilities needed to address the big issues affecting the planet, and builds the capacity in communities to make important decisions about their future. Environment and Sustainability Education calls for action.

The Handprint is one measure of Environment and Sustainability Education action. The idea is to decrease the human footprint and to make the world more sustainable. The Handprint is a new approach or 'tool' being developed by the Centre for Environment Education (CEE), in Ahmedabad India, with many partners across the globe. The purpose of the Handprint is to help measure **positive action for change** at different levels. We all need to decide **what we can do** at the individual, community, national and global level in order to increase our Handprint, and decrease our Footprint.

**“Through our actions, we add substance and vigour to the quest for sustainable living.”**

The Ahmedabad Declaration 2007: A Call to Action, 4th International Conference for Environmental Education



[www.handsforchange.org](http://www.handsforchange.org)