omcshane@wk.planet.gen.nz
www.RMAStudies.org.nz

Centre for Resource Management Studies

1104 Oneriri Road, Kaiwaka
Northland 0573, New Zealand
T 64 9 + 431 2775 F 64 9 + 431 2772

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# Further Submission by the CRMS to the Select Committee: Review of the Emissions Trading Scheme. (As requested by Dr Paul Hutchison.)

## 1. Background

Both the US and the New Zealand governments are pondering their commitment to an Emissions Trading Scheme and how best to implement it – or even whether to implement one at all.

Agriculture is a major issue in both countries. New Zealand's agriculture is our major export earner while US agriculture is a major beneficiary of the internal trade in which farm subsidies are exchanged for votes.

However, while New Zealand farmers are faced with buying carbon credits because our ruminants belch methane into the atmosphere, US farmers are selling carbon credits because their grasslands sequester carbon into the soil.

Furthermore, apparently Australian farmers are also able to count their pastures as carbon sinks. The Centre received the following email letter on 18th May:

> *Dear Owen,*
>
> *I was very interested to read your article in the NBR May 15th.*
>
> *I am the founding managing director for Proten Ltd which is a major meat chicken growing and chicken farm builder in Australia. We were a major chicken grower in New Zealand but have migrated to Australia, mainly due to double tax reasons. We still have 99% New Zealand shareholders.*
>
> *I was most interested in the US scientists measuring $CO_2$ from west to east and the Rangeland Soil Carbon Offsets Program.*
>
> *Proten Ltd grows 25% of NSW chickens and 10% of Australia's chickens. We have been faced with a liability of buying carbon offsets [20,000 tonnes] when Australia brings in its Emissions Trading Scheme at a starting point $10/tonne and perhaps rising to $20 or $30, costing us up to $600,000.*
>
> *We use an environmental company to help us in obtaining Development Approvals when we build new farms called GSS Environmental. They are environmental, land and project management consultants. They have done a lot of work on soil carbon uptake.*

*They have come up with a proposal to us to offset this liability by using our spare land in one of the areas we grow chickens which is at Tamworth NSW. We are going to let them do a trial on 2000 acres of land we have at Tamworth surrounding our chicken farms. They will run the trial which involves no cultivation and controlled grazing.*

*GSS has done a lot of work on soil carbon and they are sure they can prove by measuring the carbon uptake under this farming regime that it will more than offset our liability. They are expecting over the trail period of 5yrs that the soil carbon levels will increase to around 25 tonnes per ha. This would more than offset our liability for all of our chicken farms which are based in Tamworth, Griffith, Perth and Bendigo.*

***If this can be proved which GSS is sure it will be it will have huge ramifications for rural New Zealand and Australia.***

*Regards*

*Max Bryant*

It would seem that at least two of our major competitors in foreign markets will be able to take advantage of pastoral soil sequestration to offset their greenhouse gas emissions or even receive actual payments or subsidies.

How can this be?

This submission will argue that these strange outcomes are the result of the history of the development of the hypothesis of dangerous Anthropogenic Global Warming, and in particular the history of the IPCC and its influence on the framework which determined the nature and focus of the scientific advice given to the New Zealand Government.

The end result of this history and framework has been that we have established, albeit unwittingly, a 'New Zealand Paradigm of Climate Science' which is inhibiting the development of local expertise in this multidisciplinary field and leading to perverse policy outcomes.

The idea of a 'scientific paradigm' was first developed by Thomas Kuhn, in his seminal work of 1962, *The Structure of Scientific Revolutions*.[1] The development of Kuhn's idea is succinctly summarized by Professor Frank Paharies, in a study guide which can be found at: http://www.des.emory.edu/mfp/Kuhn.html

He begins by describing Kuhn's understanding of "Normal Science" as follows:

*A scientific community cannot practice its trade without some set of received beliefs.*

*These beliefs form the foundation of the "educational initiation that prepares and licenses the student for professional practice".*

1 Thomas S. Kuhn, *The Structure of Scientific Revolutions,* Chicago University Press, 3rd Ed, 1996.

*The nature of the "rigorous and rigid" preparation helps ensure that the received beliefs exert a "deep hold" on the student's mind.*

*Normal science "is predicated on the assumption that the scientific community knows what the world is like" — scientists take great pains to defend that assumption.*

*To this end, "normal science often suppresses fundamental novelties because they are necessarily subversive of its basic commitments".*

*Research is "a strenuous and devoted attempt to force nature into the conceptual boxes supplied by professional education".*

*A shift in professional commitments to shared assumptions takes place when an anomaly "subverts the existing tradition of scientific practice". These shifts are what Kuhn describes as scientific revolutions—"the tradition-shattering complements to the tradition-bound activity of normal science".*

*New assumptions (paradigms/theories) require the reconstruction of prior assumptions and the reevaluation of prior facts. This is difficult and time consuming. It is also strongly resisted by the established community.*

*When a shift takes place, "a scientist's world is qualitatively transformed [and] quantitatively enriched by fundamental novelties of either fact or theory".*

The Centre submits that New Zealand climate science is locked into a limiting paradigm which is too immature to be classed as Kuhn's 'normal science', but which is sufficiently rigid to inhibit the development of the many sciences which should be brought to bear on the topic if the Government is to be properly informed in its development of appropriate national policy.

## 2. The Scientific Story.

The soil sequestration story begins in 1998, when a team of US scientists (from several institutions within Columbia University's Lamont-Doherty Earth Observatory, Princeton University, and the National Oceanic and Atmospheric Administration) shocked their colleagues by announcing that "more CO2 is taken up by land ecosystems over the United States than is released by industrial activities."[2]

The United States emits about 6.2 billion tons of carbon dioxide into the atmosphere each year, and the researchers had assumed that because the winds blow from west to east, the East Coast concentration of $CO_2$ would be higher than on the West Coast. It turned out to be the other way round.

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2 *North America Absorbing Carbon Dioxide At Surprisingly High Rate, Team Reports*. http://www.columbia.edu/cu/pr/98/19406.html

Give these scientists their due – when their observations challenged their expectation their observations carried the day.

These unexpected findings prompted the establishment of the *North American Carbon Program* (NACP) that drew on the capabilities of eleven participating federal agencies and departments, with expertise in agriculture, ecosystems, natural resources, as well as the oceans and atmosphere.

Since 2003, the NACP has generated a number of major reports on soil sequestration by agriculture and forestry. Sadly my computer searches reveal no reference to any contribution by New Zealand scientists.

One result of this multidisciplinary approach is that US grass farmers are now selling carbon credits generated by carbon sequestration in the soil.

A *Scientific American* essay[3] explains:

> *Rangeland sequestration projects have generated only about 200,000 credits but are on the cusp of a major boom. The rangelands of the American West naturally absorb about 190 million tons of carbon dioxide a year. That's about what 40 coal-fired power plants emit, but there's still plenty of room for improvement. Through its Rangelands Soil Carbon Management Offsets Program, the exchange offers a financial incentive for ranchers to increase the amount of carbon dioxide that is absorbed by their lands. Sun Ranch was the first to qualify.*
>
> *Soil sequestration grass absorbs carbon dioxide the same way trees do, but on a smaller scale. Through photosynthesis, each plant takes carbon from the atmosphere and uses it to build more plant matter. When grass dies or trees are cut down, that carbon is released back into the atmosphere. But grass plants also release carbon out of their root tips to fungi in the soil, says Stephen Porder, who teaches bio-geochemistry at Brown University. "When those roots die or the fungi die, they're eaten by some microbe or worm, and a portion of that carbon gets stabilized," he explains. "It gets stuck onto a clay mineral or a particle and stays in the soil."*

The *Rangelands Soil Carbon Management Offsets Program* encourages ranchers to increase their carbon sequestration by changing their management practices, such as adopting *Zero-Till* soil management and reducing dependence on annual crops in favour of perennials. The first irony is that the *Zero-Till* technology was developed by Dr John Baker at Massey University in New Zealand, with the assistance of funding from the Development Finance Corporation's *Applied Technology Programme*.

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3 "**Carbon-Offset Cowboys Let their Grass Grow**" *Scientific American - Environment*, December, 2008.

The second irony is that New Zealand farms are already based on perennial grasses, which have deeper root systems and sequester more carbon in the soil.

Our own government has been advised that New Zealand farmers have a greenhouse gas 'liability' because of the methane belched into the atmosphere by our ruminants. We have chosen to ignore the sequestration in our soils.

How can it be that our farmers are climate sinners – and have to pay their indulgences, while US farmers are climate saints – and are blessed with further subsidies?

### 3. Agriculture and the Kyoto Protocol.

On Friday, 3 April 2009, 12:59 pm, a Press Release from the United Nations shows that the UN itself is not opposed to the use of soil sequestration of carbon – the 'anti-soil' bias seems to come from 'the New Zealand paradigm'. The Food and Agriculture Organisation (FAO) Assistant Director-General also pointed governments towards an international market in this know-how, which could improve grassland management, independent of the final outcome of the current climate change debate. In promoting soil sequestration, he said:

> *Millions of farmers around the globe could also become agents of change helping to reduce greenhouse gas emissions," said Alexander Mueller, FAO Assistant Director-General on the occasion of the ongoing UN negotiations.*[4]
>
> *By keeping higher levels of carbon in the soil – a process known as "carbon sequestration" – farmers can help reduce carbon dioxide levels in the atmosphere, enhance the soil's resilience and boost crop yields, according to FAO.*
>
> *"Agricultural land is able to store and sequester carbon. Farmers that live off the land, particularly in poor countries, should therefore be involved in carbon sequestration to mitigate the impact of climate change," said Mr. Mueller, who also noted that farmers and their families, particularly in poorer countries, will become victims of climate change.*
>
> *Farmers can alleviate agriculture's contribution to climate change by reducing tillage, increasing organic soil matter and soil cover, improving grassland management, restoring degraded lands, planting trees, altering forage and by sustainable use of animal genetic diversity, using fertilizer more efficiently, and improving water management.*
>
> *However, Mr. Mueller said, "Current global funding arrangements, like the Clean Development Mechanism [CDM] under the Kyoto Protocol, are inadequate and are not offering sufficient incentives for farmers to get involved in climate change mitigation and adaptation.*

4 http://www.scoop.co.nz/stories/WO0904/S00047.htm

> *For example, soil carbon sequestration, through which nearly 90 per cent of agriculture's climate change mitigation potential could be realized, is outside the scope of the Clean Development Mechanism under the Kyoto Protocol.*
>
> ***Neither climate change mitigation, nor food security, nor sustainable development, benefit from this exclusion.***

Rather than accepting this exclusion, surely New Zealand, of all countries, should be challenging the present Kyoto position and developing the science and economic arguments to refute it.

## 4. The Focus on Atmospheric Gases.

The IPCC itself was locked into a paradigm of its own from the outset because its instructions from the UN were to assess the risk of human-induced climate change, rather than make a total assessment of all the causes of climate change, including any human impacts.

The notion of dangerous Anthropogenic Global Warming was first developed as a hypothesis based on the science of atmospheric gases and the effect of greenhouse gases in particular. Consequently the United Nations' IPCC was essentially a group of scientists focusing on atmospheric sciences who naturally built models that reflected their own skills and focus.

The New Zealand Government accepted the IPCC as the authority on all matters to do with climate change, and the way it is has proceeded to develop policy and take advice largely reflects the IPCC's focus on atmospheric science. Consequently, funding has followed these same directions and the role of soils and pastures has been downplayed. While forestry has been part of the mitigation equation the calculations have focused on the exchanges with the atmosphere rather than the impact on the soil below.

It is difficult to find New Zealand scientific papers that address the ability of soils to sequester carbon and which focus on the microbiology of the soil itself. Instead our papers tend to focus on ruminant methane and $NO_2O$ emissions as a result of fertilizer use.

On the other hand international searches immediately turn up papers such as *The Science of Greenhouse Gas Emissions and Grazing Management Strategies: an Investigative/Awareness Report* by Tyrchniewicz Consulting, March 31, 2006,[5] which by the second page is saying:

> *Through appropriate soil management, crop-lands, pastures and grasslands have the potential to sequester carbon dioxide from the atmosphere and trap the carbon in plant material and the soil.*
>
> *Canada's pastures are considered a large terrestrial carbon sink (Baron et al., 2006).*

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5 http://www.jpcs.on.ca/biodiversity/ghg/pdf/discussion_paper.pdf

> *Older long term pastures tend to sequester carbon dioxide at relatively low rates.*
>
> *However through appropriate management and the conversion of cropland to grassland these rates can be increased.*

And on page seven:

> *Carbon sequestration is a result of plants taking carbon dioxide from the atmosphere and using it for plant growth. The carbon sequestration potential of soils comes from increasing soil organic matter. The below ground organic carbon storage is usually more than twice above-ground storage. Grasslands contribute huge quantities of soil organic matter over time, mostly in the form of roots, and much of this organic matter can remain in the soil for long periods.*

Those few New Zealand papers which do address top-soil carbon capture are dominated by papers which focus on the loss of carbon because of agriculture, or the loss of topsoil itself by run-off to the streams and oceans. Chapter 8 of the MfE's *State of the Environment 1997* focused on this problem and this attitude seems to have contributed to our 'climate science paradigm' ever since.[6]

## 5. The Current bias against other fields of Science.

Unfortunately there appears to be a remarkable bias against 'soil carbon sequestration' in NZ.

A Google search under this topic in the US and Canada shows an enthusiasm for the use of pastures as a carbon sink, and a substantial commitment to the science of biological exchanges between soil and atmosphere. American farmers are seen as an ally in the management of the carbon cycle.

On the other hand, a similar search of New Zealand sources turns up papers which focus on the carbon lost from soil, and the soil lost to land as a result of farming in New Zealand. New Zealand farmers are assumed to be at fault and needing to be restrained or penalised.

Some of these CRIs made their own submissions to the Select Committee but it does seem as though Dr Wratt regards the *NZ Climate Change Centre* as little more than a vehicle for the pronouncements of the IPCC.

The *North American Carbon Program* is a different kind of association altogether.

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6 http://www.mfe.govt.nz/publications/ser/ser1997/html/chapter8.7.html

Its diverse membership actually brings together many different research groups as in the *NACP All-investigators Meeting, 2009*.[7] There are many other multi-agency programmes such as the *U.S. Climate Change Science Programme*.[8]

Given our limited resources one would expect our scientific organisations would be plugged into multi-national projects like the *Global Carbon Project,* but while the CSIRO is well represented on this page New Zealand science is absent.[9] We are normally enthusiastic joiners but we are not even represented in the *Ocean Carbon and Bio-geochemistry* group.[10]

## 6. NIWA has an Effective Monopoly on Advice.

Unlike the US government, which adopted a truly multidisciplinary approach, our own Government followed the United Nations' lead, and appointed NIWA (the National Institute of Water and Atmosphere) as its key advisor on climate change.

Dr Wratt, NIWA's Chief Climate Scientist, is General Manager, responsible for climate and climate change work at NIWA. He is a member of the Bureau of the IPCC and a Vice-Chair of the IPCC Working Group One, which assesses the physical science of climate change. He is also Chair of the Royal Society's Committee on Climate Change, and the Royal Society is the 'independent' advisor to the Government on Climate Change. Dr Salinger, a former principal scientist at NIWA, was also lead author of the chapter in the IPCC report that referred to Australia and New Zealand. Such a hegemonic, oligarchic and cosy little club cannot possibly provide the Government with genuine contestable advice.

Dr Wratt also chairs the *New Zealand Climate Change Centre*, "an initiative formed by all of New Zealand's Crown Research Institutes together with Victoria and Canterbury University", (Why not Lincoln and Massey?) The Centre is housed in NIWA, describes itself as a 'virtual organization' and appears to have no publications comparable to those of the *North American Carbon Program*.

The writer has examined the submission to the ETS select committee by the *NZ Climate Change Centre* which is chaired by Dr Wratt, housed in NIWA and claims to be "a joint initiative formed

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7 http://www.nacarbon.org/cgi-bin/meeting_2009/mtg2009_ab_detagenda.pl

8 http://www.climatescience.gov/

9 http://www.globalcarbonproject.org/about/who.htm

10 http://www.us-ocb.org/ or http://www.whoi.edu/sbl/liteSite.do?litesiteid=32992

by all of NZ's Crown Research Institutes together with Victoria University and Canterbury University."

The submission was written by Dr Wratt "in consultation with the Centre's participating organisations." However, an electronic search of the 23 page document (including footnotes and references but excluding the lists of membership) reveals the following:

**References to:**

| | |
|---|---|
| IPCC | 76 |
| NIWA | 5 |
| GNS | 0 |
| AgResearch | 0 |
| ESR | 0 |
| Industrial Research | 0 |
| Landcare research | 0 |
| Plant and Food | 0 |
| Scion | 0 |
| University of Canterbury | 0 |
| Victoria University | 1 (as venue for a conference paper by Dr Wratt.) |

This 'virtual organization' is no match for the American groupings.

## 7. The Consequent Focus on the Atmosphere.

This NIWA monopoly must, at least partially, explain the local focus on the gases released into the atmosphere by belching ruminants, as opposed to the sequestration of carbon in our soils.

This focus on the atmospheric gases also means that New Zealand can be only a 'leader of followers' given that so many groups already focus on the atmosphere. On the other hand, research into the biological exchanges between soils, perennial crops, farms and forests, would build on New Zealand's world-leading platform in agricultural science.

Furthermore, one does not have to read many papers or books on the topic of the climate to realize that an understanding of climate requires an amalgamation of astronomy, solar physics, geology, geochronology, geochemistry, sedimentology, tectonics, palaeontology, palaeoecology, glaciology, climatology, meteorology, oceanography, ecology, archaeology and history – and of course computer modelling. Climate science is surely the ultimate multi-disciplinary field. The advice to Government should reflect this reality.

Two questions need to be asked:

> *1. How did we come to be reportedly the only ratifier of Kyoto to include agricultural emissions? If this is true, who made the decision, and why?*
>
> *2. How did it transpire that the carbon accounting measures laid down under Kyoto deliberately exclude sinks, such as forests, grapevines, kiwifruit vines, etc, and pastoral grasses.*

The Centre does not have the time or the resources to answer these questions but they deserve to be asked, probably most efficiently and effectively by the Ministry of Foreign Affairs and Trade.

## 8. Freeman Dyson's Observations.

In his new book *Many Colored Glass: Reflections on the Place of Life in the Universe* the famous mathematician and physicist, Freeman Dyson,[11] writes:

> *I have studied the climate models and I know what they can do. The models solve the equations of fluid dynamics, and they do a very good job of describing the fluid motions of the atmosphere and the oceans. They do a very poor job of describing the clouds, the dust, the chemistry, and the biology of fields and farms and forests.*

New Zealand is a land of fields and farms and forests, and our economy depends on them.

Dyson continues:

> *We do not know whether intelligent land management could increase the growth of the topsoil reservoir by four billion tons of carbon per year, the amount needed to stop the increase of carbon dioxide in the atmosphere. All we can say for sure is that this is a theoretical possibility and ought to be seriously explored.*

It is time for the Government to take contestable advice from all our relevant CRIs, such as *AgResearch* and the *Institute for Geological and Nuclear Sciences Ltd* (GNS), and both Lincoln and Massey University's specialists, within a framework outside of NIWA, and with its own lines of communication to relevant ministers.

## 9. Punching Above our Weight where it Does Most Good.

While some claim "the science is settled" no one can claim that "all the sciences are settled" and as more scientists from more disciplines bring their research and analysis to bear on the issue of

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[11] **Freeman John Dyson** FRS (born December 15, 1923) is a British theoretical physicist and mathematician, famous for his work in quantum field theory, solid-state physics, and nuclear engineering. Dyson is a member of the Board of Sponsors of The Bulletin of the Atomic Scientists. Dyson lives in Princeton, New Jersey, where he has been for over fifty years. Go to his own home page at: http://www.sns.ias.edu/~dyson/

Climate Change the uncertainties continue to expand. Consequently we need to consider the need to manage the risks that the current presumptions of dangerous Anthropogenic Climate Change may be overturned.

New Zealand can do little to change the climate but has a major role in feeding the world and in developing the sciences that will enable other developing economies to feed their own people. Hence we should be developing a 'no regrets' policy that can deal with any developments in climate science that may transpire.

If it finally transpires that the threat of dangerous Anthropogenic Global Warming proves to be yet another false alarm we shall still have reaped the benefits of an increased depth of understanding of top-soil management and both crop and animal husbandry.

## 10. A New Brand for New Zealand.

Instead of being apologetic, our exporters could supply UK supermarkets with pastoral scenes captioned "Food from the world's greenest greenhouse sinks!" We could also remind our tourists, viewing our green and verdant land, that these may be the most effective greenhouse sinks in the world.

This counter to potential trade threats could be branded "Greening Grass" and draw attention to:

- the carbon-sink capacity of our perennial grasses, which not only absorb $CO_2$ but help convert it to food for the world;
- our scientific and practical experience and expertise in developing pasture grasses; and
- our willingness be a leader in imparting this knowledge to countries who need it, with emphasis on India, China and northerly African states.

In projecting this message to the world, New Zealand could say that whatever we do to try to limit emissions of GHGs will have no effect on the global climate, will limit our ability to export food, and divert our science from further improvements in pasture grass and soil management to less effective areas or to areas where other nations are already concentrating far more resources.

New Zealanders could offer, or sell, this 'Greening Grass' technology and know-how to help feed all the people of the world – a problem that will never go away.

The government could adopt this policy as a precursor to any final decisions on emissions trading or taxes, without being accused of 'doing nothing' while waiting for the outcome of the

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Copenhagen Conference and the Australian decisions. Such a policy might even get at least grudging support from the Green Party for whom topsoil enhancement is a long-standing issue.

### 11. Managing the Hazards of Climate Change.

Regardless of whether the world warms or cools, any genuine threats from such warming or cooling can best be managed by GNS, which has already developed *GeoNet,* an excellent framework for natural hazard management.

This expanded *GeoNet* could also be promoted as a global model for preparation and adaptation to all the hazards of the world.[12] The benefits would be immediate.

### 11. End Note.

This supplementary submission should be read in conjunction with the original document – **Submissions to the Select Committee: Review of the Emissions Trading Scheme,** – so as to place these arguments in their context.

Owen McShane
**Director**
**Centre for Resource Management Studies.**

## APPENDIX I

## It's Time to Break Out of the Paradigm.

Breaking out of the Paradigm of "normal science" is in the great New Zealand tradition of New Zealand science.

Some of us are familiar with the radical theories of Nobel Prize winner, Sir Ernest Rutherford, (the nuclear atom), ANAC Ltd (Particle doping of silicon chips), Nobel Prize winner, Alan MacDiarmid (conductive polymers)[13] Dr Bruce Cain (DNA binding chemotherapy for cancer treatment), Emeritus Professor Sir Graham Liggins, (treatment of babies in the womb), and we can be sure there are many others.

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[12] See Climate Science Coalition submission to the Select Committee on their web page.
[13] http://www.nzedge.com/heroes/macdiarmid.html

New Zealand now has an opportunity to strike out in a new direction, following these historical precedents.

The closest precedent to challenging the current "conventional wisdom" on mitigating the effects of any Anthropogenic Global Warming would appear to be Alan Wilson, the New Zealander who went to UC Berkeley, and demonstrated that we could now learn more about the evolution of species by studying mitochondrial DNA than by digging up fossils.

Here is the first part of what Wikipedia has to say about Allan Wilson:

> **Allan Charles Wilson** (18 October 1934 – 21 July 1991) was a pioneer in the use of molecular approaches to understanding of evolutionary change and reconstruction of phylogenies. One of the great innovators of science, he revolutionised the study of human evolution. He was one of the most controversial figures in post-war biology; his work attracted a great deal of attention both from within and outside the academic world. He is the only New Zealander to win the prestigious MacArthur Fellowship and was short listed for the Nobel Prize when he died[1] at the age of 56. Allan Wilson's scientific achievements were nothing short of profoundly significant.
>
> Allan Wilson was born in Ngaruawahia, New Zealand, and raised on a farm at Helvetia, Pukekohe. He attended King's College in Auckland and excelled in maths and chemistry. After school he gained a BSc from theUniversity of Otago. It was here as a Masters student that Wilson met Professor C.P. 'Mac' McMeekan, a New Zealand pioneer in animal science. He suggested that Wilson further his study in biochemistry instead of genetics.
>
> In 1955 Wilson was invited to do his PhD at the University of California, Berkeley. At the time the family thought Allan would only be gone two years; instead he stayed at Berkeley for 35 years, gaining his PhD in 1961 under the direction of Arthur Pardee, and setting up one of the world's most creative biochemistry labs.
>
> Allan Wilson first came to world attention when he published a paper titled *Immunological Time-Scale For Human Evolution* in Science magazine in December 1967. Together with doctoral student Vincent Sarich, Wilson argued that the origins of the human species could be seen through, what he termed, a "molecular clock". This was a way of dating, not from fossils, but from the genetic mutations that had accumulated since they parted from a common ancestor. The molecular clock estimated the length of time from divergence, given a certain rate of change.
>
> When Wilson, with his then-student Mary-Claire King, and Sarich analysed and compared genetic material of humans and chimpanzees, they found the material to be 99 percent identical.[2] From King's work, using the 'molecular clock' reasoning (bigger differences equate to greater time since their last common ancestor) Wilson deduced that the earliest proto-hominids evolved only five million years ago. Most contemporaryanthropologists, who favoured a date of around 25 million years, dismissed his work as absurd.

In the early 1980s, as his findings for the age of the proto-humans were starting to be more widely accepted, Wilson again dropped a bombshell on traditional anthropological thinking with his best known work with Rebecca Cann and Mark Stoneking on the so-called "Mitochondrial Eve"hypothesis. In his efforts to identify informative genetic markers for tracking human evolutionary history, he started to focus on mitochondrial DNA (mtDNA)—genes that sit in the cell, but not in the nucleus, and are passed from mother to child. This DNA material is important because it mutates quickly, thus making it easy to plot changes over relatively short time spans. By comparing differences in the mtDNA Wilson believed it was possible to estimate the time, and the place, modern humans first evolved. With his discovery that human mtDNA is genetically much less diverse than chimpanzee mtDNA, he concluded that modern human races had diverged recently from a single population while older human species such as Neandertal and Homo erectus had become extinct. He and his team compared mtDNA in people of different racial backgrounds and concluded that all modern humans evolved from one 'lucky mother' in Africa about 150,000 years ago.

This finding was as, if not more, controversial than his 1967 findings. Accepted thinking had various human groups evolving from different ancestors, over a million years in separate geographic regions, but at basically the same rate around the world.
In Europe with Homo sapiens Neanderthals, in Indonesia with Java Man,
in China with Peking Man.

**Again, as in the 1960s, many palaeontologists rejected Wilson's conclusions; fossil scientists were unfamiliar with biochemistry and trusted their own data more than molecular data. It took 20 years to convince palaeontologists of the value of Wilson's theory, but when they did, it married their science with that of genetics.**

By transferring the focus of our research funding away from atmospheric gases to the earth, the rocks and the biological exchanges of agriculture we would be following in our great tradition of bucking the conventional wisdom.

History repeats itself - and this time we have a chance to learn from history.

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# APPENDIX II.

Rural News. 19th May 2009

## WANTED – MORE SOIL SCIENTISTS.

## Peter Floyd

Forgive me if I indulge myself a little in this column.

My lifelong involvement with farming and agribusiness has been immensely satisfying. It started with a stint at Massey, and then on to a South Island high country station where my interest was fostered.

But perhaps the most important influence on my future came during my years at Ruakura under Dr C P McMeekan. It was through him that I learned the value of careful observation, testing ideas, and above all the essential skills of getting alongside farmers to understand the way they view their world so that we could be more help to them.

When I look today at Ruakura and the way it has been hacked about and abused by the so-called 'science reforms', I'm sure McMeekan is turning in his grave.

The old Ruakura was not perfect, but it was farmer-friendly and relevant in a way that today's science administrators will never understand.

New Zealand farming will never prosper long-term through genetic modification of livestock or their fodder, expensive high-input technologies or patented chemicals to solve the problems caused by other chemicals.

It is my 70-year-old considered opinion that the way forward lies in learning from the past. A few generations ago our forefathers cleared the bush and tea-tree scrub and sowed ryegrass and clover if they could afford it, bush-burn if they couldn't. In many areas the soil was poor – hard clay, pumice, and so on – but they persevered and in time grazing animals helped build up a thin layer of topsoil that got a bit thicker and richer each year. Initially, chemical fertilisers helped the process along.

But somewhere along the line the topsoil stopped growing. Was it the over-use of super and potash, the advent of high input dairying with maize crops that needed intensive cultivation and high applications of soluble nitrogen?

If Ruakura still had a full complement of soil scientists perhaps we would have the answer by now, but the science reformers viewed soil science as unnecessary.

Now we have the crazy situation where there are few soil scientists, and those that are still around apparently believe in the carbon saturation idea.

**Fortunately, there is a growing number of eCOGENT farmers who believe otherwise. They are demonstrating that better management of soils, fertilisers, stock and grazing can restart the growth of topsoil, sequestering large amounts of atmospheric $CO_2$ in the process.**

I firmly believe, in time, they will prove the changes they are making now are not only profitable but also better for stock health and will result in healthier food products.

The potential to grow soils and sequester $CO_2$ is huge. With or without the help of scientists these farmers will show that as they grow the soils they will become richer sources of plant food and more resilient in times of stress.

Far from paying carbon taxes, these farmers should be rewarded by the Government for the great job they are doing in helping the country meet its Kyoto commitment. In my opinion, if all farmers grew their soils the Government wouldn't have a problem.

It is exciting for me to be involved with so many good, keen farmers who are pushing ahead with positive change, and it is their enthusiasm and energy that keeps me going. The other thing that sustains me is friendship – the many close and loyal friends I made in those early years have supported me and kidded me along through the decades.

• *Peter Floyd is managing director of eCOGENT. www.eCOGENT.biz Tel. 0800 433 276*