Resolving Climate Change

How the wicking bed can help us mitigate and adapt to climate change

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Summary

The wicking bed is an innovative technology, essentially a new agricultural system, which increases production with significantly less water, reduces chemical run off and sequesters carbon into the soil.

It provides a level of protection against extreme weather events, particularly droughts but also against heavy rainfall and floods which are already occurring with climate change. The benefits of being able to recycle waste and minimize water pollution are of significant importance.

In addition to benefits for the individual farmer, it has profound global implications. It enables developing countries to sequester significant amounts of carbon so they can continue to grow their economies without increasing their emissions.

Carbon trading would enable farmers in developing countries to adopt the technology at virtually no net cost.

This removes one of the major blocks to obtaining an international agreement on climate change.

A plan of how China could quickly adopt this technology is given. As China acts as a lead nation for the developing world adoption in other countries should follow rapidly.

The amount of carbon which can be sequestered is far greater than conventional agricultural systems such as no till farming and controlled traffic. This naturally challenges some of the conventional thinking on soil carbon capture. Independent scientific research is therefore required to justify these claims and to enable accreditation for carbon trading.

Arrangements have been made for the Chinese Academy of Agricultural Science to undertake research into the best way that the wicking bed technology could be adopted in China. However funding is needed to carry out this vital work.

Contents

Part 1 examines the problems of obtaining International agreement on climate change, examining the special position of developing countries.

It looks at the dramatic increase in both global population and production and concludes that in future the growth in emissions will come from the developing countries. In the age of electronic communication even the poor are informed about the affluence of the West making it impossible for the governments of developing countries to slow economic growth to reduce emissions. The wicking bed provides a way for developing countries to relieve poverty by growing their economies while still reducing their emissions.

It also looks at the apathy that has crept into the public perception of climate change in the West. It argues that to most people a couple of degrees of warming are neither here nor there. Security of food production is however an issue of concern to most people. The wicking bed, which can provide secure food in a changing climate, would focus public attention onto an immediately available remedy.

Part 2 looks at the issues of carbon capture in the soil and challenges some of the conventional views in the light of new technology. While improved farming techniques such as no till farming and controlled traffic have achieved wide spread support from the scientific community there is a commonly held view that the amount of carbon captured is not significant in comparison with the global emissions of carbon from our industrialized society.

This view does not take into account the various mechanisms for embedding carbon into the soil. Simply mixing organic waste into the soil may not necessarily embed the carbon into the soil, but by managing the decomposition process large amounts of carbon can be embedded.

It argues that climate change is just part, albeit an important part, of a society which is degrading its environmental base on which civilization depends. By embedding what is currently considered waste from our forests and urban centers into the soil, wicking beds provide a much higher carbon capture occurs than solely through the reprocessing of farm waste.

Part 3 is a history of the development of the technology. To many people, particularly decision makers in the political scene, wicking beds are a new technology, which could result in them being regarded with caution.

By tracing the history of the wicking bed back over a 35 year project on soil regeneration and growing crops under adverse climatic conditions, aids the credibility of the technology.

Part 4 looks at implementation, with particular reference to China. Farmers in developing countries are generally poor and would have some difficulty in adopting a new technology such as wicking beds, which involves some upfront costs. Carbon trading, which would follow from accreditation, would virtually pay for these upfront costs so farmers could essentially adopt wicking beds for free. There would also need a support structure while learning the new technology. In China local Governments are well geared to provide this support structure.

China is a lead country and wide spread adoption should occur in other developing countries once the system is established in China.

Part 5 analyses the action plan. At this moment the technology has reached a degree of maturity all financed by private commitment. However, to introduce this technology on a large scale to the developing countries requires the resources that only Governments can provide. Here we look at the very first stage; a commitment of $500,000 to the Chinese Academy of Agricultural Science to study the implementation in China.

Part 1 Obtaining International Agreement on Climate Change

The changing world

It has taken 43 years for the world's population to double. But population has been growing for centuries while continued advances in technology have prevented catastrophe. In that 43 year period the world production has increased 8 fold. Personal wealth has (on average) increased 4 fold; most people are better off and better fed than they have ever been. Even the percentage of people suffering extreme poverty has declined (but unfortunately the absolute number has increased).

Technology has shown that Malthus was wrong with his predictions of doom and gloom. However the dramatic increase in wealth has resulted in major environmental costs. Climate change resulting from our emission of green house gases is probably the greatest threat for the future but is just one of many threats.

While food production has kept pace with the increase in population this has largely been achieved by the increasing use of fertilizers, irrigation and genetics. This has been at the cost of soil structure.

Over vast areas of the world's farm land the organic content of the soil has been dramatically reduced: - the soil is less productive and more prone to erosion. In some areas, admittedly limited at the moment, this is so extreme that the soil has become unable to support food production and suffered erosion. This is certainly a warning for us on what could happen if we continue to degrade our soils. This agricultural system also leaches valuable nutrients and pollutes our rivers.

Water plays a key role; we are now highly dependant on irrigation for food production. We have exhausted all readily available supplies of irrigation water and as the population continues to increase we face dangers of lack of food, while sewage, agricultural run off and waste threaten our supplies of drinking water.

We can not put global warming into a little box and say this is one problem. Global warming, food supply, drinking water, sewage and waste disposal and the problems of our mega cities are all inter related.

The wicking bed technology was initially developed to provide sustenance food in poor countries suffering from erratic rainfall. But it has a far greater role to play, it is more productive, growing more food with less water, it reduces run off and embeds carbon into the soil.

The world needs new technologies which will enable us to enjoy the benefits of increased affluence without the adverse effect on our environment. The wicking bed is such a technology, but developing the technology is pointless unless it is widely adopted.

Externalities

The problem (which is also the problem at the heart of global warming) is externalities. The costs of polluting are not born by the polluters and the rewards of clearing up the pollution will not automatically flow to a poor farmer.

We can say with absolute certainty that a poor farmer in a developing country is not going to spend the little money he or she has on adopting wicking beds just so the rich countries can continue with their affluent, energy-burning, lifestyle.

Climate change is global, it does not matter whether the green house gases come from the US, China or Nigeria, the effect is the same. Similarly it makes no difference where the carbon is extracted from the atmosphere, as long as it **is** extracted. Solutions require global action and getting this global consensus is one of the blocks to solution. Developing countries play a key role and any solution must be relevant to their situation.

While the objective is to introduce an innovative technology which will help us live in a more sustainable way, it is no good just writing about the technology. This has already been done and details of the technology are readily available on my web site www.waterright.com.au.

The aim is to jump the gap from having a developed technology to world wide application, so rich and poor can share the benefits. This can only be done by governments acting in unison to fight a common problem. To show this may be done by spending some time looking at the politics of global warming. Hopefully this will put the application of the technology into perspective.

Copenhagen 1 Global technology

The information revolution

Copenhagen presented a block between the developed and developing countries. I want to look at this block from my own experiences.

I never cease to be amazed how far the information revolution has spread.

I first went to India many years ago with a preconceived idea of what to expect. I was very wrong. True I was troubled by the slums of what was then Bombay but among all the squalor people sat around watching television. That's right, among the old sacking, tin and cardboard buildings there were TV's. Humans have a powerful desire for entertainment and to know what is going on. They were aware of what was happening in the rest of the world.

I found the favelas or slums of South America were equally troubling yet amongst all this squalor some people were driving up-market BMW's. The Government had provided them with alternative housing but some preferred to rent this out and buy a car.

I spent time in Ethiopia looking for ways to provide sustenance food for the starving. Of course the local people were interested, they were hungry and needed to be fed but this was not their long term ambition.

What they really wanted was to get a son or daughter to University to get a good job. Strong family ties meant security in later life. A few succeeded and got jobs in the West and sent money home. Other returned and set up businesses based on their new found technology.

Poor countries do not get richer uniformly; they develop a middle class with the poor clamoring to cross the line to the middle class. Nowhere is this more evident than in China.

On my first visit, many years ago, the bicycle was supreme, and then later came the electric scooter in vast numbers. Now it is the car, but not just some locally built micro-car as you might expect in a developing country but BMWs and Audis.

My image of China is of an affluent lady driving a 7 series BMW along a 6 lane highway, weaving from lane to lane as she chats on her mobile phone but watched by an old man probably from some remote rural area collecting rubbish on his tricycle. He is aware and wants the better life; may be not for him but at least his son.

The internet is now universal: - people understand the lives of the rich even if it is just from watching soap operas on TV or the web. A century ago the rich could get away with their extravagant life style because the poor were unaware. The information revolution now means the poor are informed. The rules of the world have changed.

Lifting people out of poverty

China's economic progress has lifted more people out of poverty than possibly any other action on earth. This is a model for other developing countries that will inevitably follow suit.

How does this relate to global warming? With the advent of modern communications and travel even the poorest people are informed about the lifestyle of the more affluent in both their own country and in the West. They want that lifestyle just as much as people in the West want to hang onto it.

It is just not realistic for the West to expect developing countries to reduce economic progress, which alleviates poverty, just so they can comply with demands from the affluent West for them to curb emissions. It simply will not happen in the way the West wants.

No Government in a developing country can resist this pressure for their people to become more affluent. As more people cross the line into the middle class the demand for energy increases and the Government have no option but to build more power stations.

No doubt if the West could provide green technology, say solar thermal with night energy storage at a cost similar to coal fired power stations, they would adopt green technology. But if there is no other option they will install coal fired power stations. This is happening right now.

Conventional power station

Geothermal power station

Developing countries - dominating green house gases

In the future, without a change of strategies, we can expect that the dominant source of green house gases will be the developing countries as they mature. (Bjorn Lomborg has predicted 70%)

For example every month China builds power station capacity equivalent to the entire generating capacity of Australia. Green house gases are not just increasing; the ***rate*** at which they are increasing is also going up. We are not winning the war against global emissions.

Even if the industrial countries adopted all the available green technology, global emission of green house gases will still continue to increase, that is unless ways are provided for the developing countries to cut net their emissions.

The failure of Copenhagen was because the West missed three key points.

Firstly, in the future green house gas emission will be dominated by developing countries.

Secondly, governments in developing countries cannot resist the irresistible force of their populations for a better life and are demanding equity with the West.

Thirdly, unless the West provides the technology for the developing countries to manage their green houses gases, everyone will suffer the consequences of global warming.

Technology must be developed to enable developing countries to reduce their net emissions while simultaneously reducing poverty.

But we already have one technology -
the wicking bed - which is developed and ready to go.

We just need a way to introduce this to developing countries. This is the focus of this plan.

Copenhagen: 2 Skeptics and public perception

The skeptics

I want to talk about the influence of the skeptics both at Copenhagen and in creating what appears to be a worldwide apathy about global warming. Surveys of public attitude show that interest in global warming has plummeted from a high in the middle of the last decade. We need to ask why.

It is natural that there are skeptics about global warming, change on any subject will be resisted by some and adopted by others.

With global warming there are powerful groups who have a vested interest in maintaining the status quo. They adopt the classic approach of formulating an opinion and then looking for any piece of scientific evidence that supports that case. This is a very effective approach which has had an influence way beyond what is deserved.

There is little doubt that the skeptics' propaganda has had some effect, but the cause runs deeper. The advocates for action on global warming must bear some of the blame. Before the financial collapse a key strategy to combat global warming was the various carbon trading schemes which would create a flow of wealth to entrepreneurs who could sell carbon offsets.

There was this magical belief that simply by making it profitable for people to innovate it will somehow happen. But the public naturally asked what these wonderful innovations may be and there was little effort to offer any explanation.

The crash in the image of market forces

The financial crash has made many people suspicious of relying on market forces and asks the obvious questions “what is going to happen physically, just where are the carbon credits going to come from?”

It is pretty obvious to most people that the solution being offered were totally inadequate to make any serious reduction in global green house levels, while the developing countries continue to pump more green house gases into the atmosphere.

Denial to despair

Many people just thought the whole problem was too difficult and just gave up thinking about global warming altogether. The classic route of denial to despair. They mentally put it on the shelf hoping something would turn up. “It is too big and too scary to think about so let’s get on with life while it is good.”

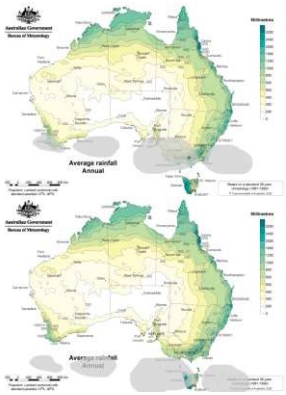
Another factor was the focus on the 2 degree target. The fact is that many people think that 2 degrees is totally trivial or may be even a good thing. Most parts of the world have a range of temperatures up to 40 degrees. On this scale 2 degrees is insignificant or even welcome if you live in a cold region.

The advocated of action on Global warming have simply made a totally awful job of presenting the problem in a way which is relevant to the majority of people. Saying there has been a measured 0.8 C temperature rise and this is likely to rise to 2 C or more at some distant point in the future has little impact and is not a rallying call for action.

Making global warming relevant to the population at large

If we want action the story has to be made relevant to people. The population may not be too worried about the odd degree of temperature rise, but they can certainly be motivated by the impact on food security and price. Let us look at how the information could be presented in a way more relevant to people.

The world can be split into climatic zones; -
1) the wet tropics which are have reliable and predictable rain all year
2) the dry tropics with summer rain
3) the desert band which only receives freak, but often large, rains
4) the winter rainfall zone
5) the polar regions.



It is clear and unambiguous (such that even the climate skeptics cannot argue against it) that these zones have moved; - on average about 200 kilometers (BOM) .

This means that areas that were once good agricultural land with reliable rainfall have now moved into the dry zone with erratic freak rains. This climate shift is affecting food production right now.

The public may not be too bothered about a 0.8 C temperature rise; they certainly are concerned about food.

Another major impact on food production is caused by the reduced snow fall and earlier melts. Many people do not recognize just what a benefit snow is.

It stores huge quantities of water in the mountains in the winter and as summer approaches it melts and provides irrigation water. Melting snow from the Himalayan mountains provides water and food for billions people.

The severity of storms has increased causing death and major damage to agricultural production.

Droughts are now more prevalent causing loss of food production and dramatic bush fires.

These are real problems and are occurring now, they may get worse in the future but they are today's problems. The wicking bed can help resolve or mitigate these problems. We can change our agriculture to cope but we must take action.

This is a clear message which the public can respond to. It offers practical solutions that the public can relate to and support.

Part 2 Reducing and absorbing green house gases

The forgotten catch in the climate debate

Vegetation is highly effective at removing carbon from the atmosphere. It does not appear to be generally recognized that vegetation absorbs some thirty times all man made emissions.

The power of vegetation to remove carbon from the atmosphere may be high, but the rate of absorption is virtually balanced by an equally dramatic return of carbon to the atmosphere.

This is an incredibly important but little published statement and it is pays to make sure the full implications are recognized.

With an understandable logic, the conventional focus has been on increasing absorption e.g. planting more trees. The preferred option is for the carbon to be captured permanently, for example, wood used in building or furniture.

The question 'what can we do to slow or stop the flow of carbon dioxide back to the atmosphere?' is rarely asked, yet this is the by far the largest flow of carbon into the atmosphere.

It is often reported that the largest emitter of carbon is coal fired electricity generation. This is not strictly true; the largest emitter by far is decomposing vegetation. The reason why it is not generally considered is that this is carbon that has already been extracted from the atmosphere, therefore there is no net gain, it does not count. But it counts just as much as any other carbon molecule.

Carbon is carbon; it makes no difference where it came from. Slowing the rate of return of carbon to the atmosphere is just as effective as taking more out by, for example planting more trees.

Plants are already extracting large quantities of carbon dioxide converting this to complex organic molecules and storing energy. This is happening right now at no cost or inconvenience to us.

The problem is that photosynthesis produces complex organic molecules which contain large amount of energy. This is after all what makes coal and oil so valuable. However because they contain so much energy there is a tendency for them to release their energy and breakdown into simpler but more stable molecules like carbon dioxide and methane.

This follows naturally from the laws of thermodynamics which says that a system will always tend to the most stable state (increasing entropy). Just as water always runs downhill - carbon systems always tend to the most stable state, usually carbon dioxide, with the release of energy.

We quite rightly worry about the amount of green house gases we release to the atmosphere by burning fossil fuels. Of course we should make major efforts to reduce our emissions. But we pay very little attention to the simple fact that the release of carbon dioxide from the decay of organic waste far exceeds man made emissions and is by far the largest contributor to green house gases.

The simple fact remains that we could resolve global warming by simply slowing the rate at which organic wastes breakdown and returns carbon dioxide to the atmosphere.

This simple statement receives virtually no attention in the global warming debate for reasons which are difficult to identify. It may be that the importance of this concept has not been fully appreciated or it may have been written off as an idea which is just too complex and difficult to resolve.

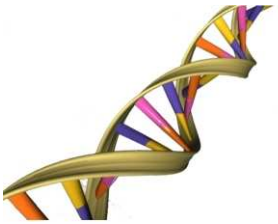
There is a mistaken argument that it does not matter that organic waste is being returned to the atmosphere as it simply returning carbon that has already been extracted.

The level of atmospheric carbon is not a static problem, like water in a water tank which simply fills with water.

It is dynamic, with large amounts of carbon entering and leaving the atmosphere. It is like a river which will rise if extra water is added, by say a tributary receiving local rainfall.

This is what has happened with manmade emissions; a small extra input upsets the dynamic balance thereby raising the level. Reducing the rate of return of atmospheric carbon will lower the level.

The decomposition of organic waste



Vegetation contains complex organic molecules which contain high levels of energy which is easily released.

This is precisely what happens when vegetation is burned, with almost all the carbon being converted to carbon dioxide. Similar results can happen with the deadly combination of oxygen and UV light. It may be slower and less spectacular (and indeed unnoticed) but organic waste left on the surface will decompose by molecular decomposition converting almost all the organic material to carbon dioxide.

Organic material under the ground where it is protected from UV light will be attacked by micro-organisms, particularly aerobic bacteria. The conventional high temperature composting process, powered by high temperature aerobic bacteria, is effective at releasing the energy and hence carbon dioxide. There are however residues, complex but stable molecules, generally referred to as humus, which are thermodynamically stable and improve soil quality.

Low temperature aerobic composting will retain a higher percentage of carbon. Immersion in water leads to anaerobic decomposition, typically by bacteria or algae with the release of methane, a more potent green house gas than carbon dioxide but a potential source of alternative energy in biodigestion.

Fungi are particularly effective decomposers which, while still releasing some carbon dioxide to provide their energy source, are particularly effective at improving soil quality.

They form large underground structures and the tips of their hyphae excrete enzymes which penetrate soil particles, bonding organic matter and the soil together. The result is a strong open soil structure highly beneficial for plant growth and with the organic material locked into the soil particles.

Macro soil organisms are also effective decomposers which again may leave stable residues.

The humble earth worm, for example has bacteria in its gut for decomposition, which again releases carbon dioxide but it also releases a chemically stable glue which lines the outside of its burrows which stabilizes and aerates the soil.

Micro organisms (with the exception of some algae) cannot use photosynthesis to produce energy and depend on the breakdown of the complex molecules to provide their energy source.

It is impossible to stop all carbon being released back to the atmosphere but it is possible to capture a significant proportion. Clearly this proportion is critical. The chemically stable residuals after the energy has been extracted are what really matters.

It only requires 3% of the carbon in vegetation to be permanently captured to balance human emissions. Atmospheric carbon is dynamic, with large flows into and out of the atmosphere. The carbon captured does not even have to be permanently retained; all that is required is for a floating balance to be achieved.

To summarize: - all methods of decomposition release energy and carbon dioxide, this is inevitable, but some methods such as burning, release virtually all the carbon while other methods, such as fungi, will only release a small amount of energy and leave a remainder of stable organic material. This stable organic material can be embedded in the soil creating a highly productive organic rich top soil.

Attitudes to overcome

The role of vegetation in sequestering carbon and embedding in the soil has not captured the imagination of those concerned with global warming.

Science has shown that in many agricultural soils the current carbon level is often half that of virgin soil, e.g. soil that has not been degraded by agriculture.

Many people believe that we can restore the carbon level back to the original levels by changing our agricultural practices, for example by no till farming and controlled traffic but we cannot store more carbon than the original level.

Let me quote from the UK Royal Society report in 2001;-

"Our current knowledge indicated that the potential to enhance the land carbon sink through changes in land management practices is finite in size and duration. The amount of carbon that can be sequestered is finite in size and duration. The amount of carbon that can be sequestered in these sinks is small in comparison to the ever increasing global emissions of greenhouse gases. Projects designed to enhance carbon sinks must therefore not be allowed to divert financial and political resources away from restructuring of energy generation and use (e.g. increased use of renewable energy) technological innovation (e.g. increased fuel efficiency; sequestration at source) and technological transfer to less developed countries."

The Royal Society is a highly prestigious organization and was giving soil carbon the big thumbs down!

This is the conventional wisdom which may be true of the technology existing at the time (2001) so the Royal Society may have been correct when they wrote their report. But there are now ways of capturing far larger quantities of carbon into the soil so we have to work on reversing this traditional thinking.

Industrialization in the developing countries means there is very little chance of reducing global emissions, at least in the short term. Carbon capture in the soil enables developing countries to grow their economy without increasing emissions and can bridge the chasm between developing and developed countries.

Examining the soil carbon debate

Soil is second only to the oceans as a carbon sink. The amount of carbon in the soil far exceeds atmospheric carbon. We only have to look at the Savannah belt stretching around the world in both hemispheres to see soil many meters deep holding large amounts of carbon. This has been building up over many years.

Look at all the coal and oil we use causing global warming: this has all originated from vegetation which has extracted carbon from the atmosphere and then degraded it in a way that has conserved the carbon.

It may be true that conventional methods of soil carbon capture may only have limited effectiveness, but we should not look at the current state, but what could be achieved with innovative technology.

Looking at farms where soil conservation has been established often shows the soil level is over 300 mm higher than the level on adjacent properties using traditional farming. We can increase the carbon stored by both increasing the proportion stored in the soil and the depth.

The Royal Society was only looking at farming methods method which rely on incorporating waste organic material from the crops. It did not consider external inputs.

However carbon can also be sequestered by growing carbon crops or incorporating external sources of organic waste. This greatly increases the soils capacity to capture carbon.

When organic material is added to the soil the natural microbiology will use this as an energy source and release either carbon dioxide or methane to the atmosphere; - this is inevitable. But a certain amount of the organic material will end up as chemically stable residues which can become locked into the soil. These residues are what we need to focus on, not the component which is readily broken down and re-enters the atmosphere.

These residues can build up very large volumes. Every mm. of carbon stored over the farm area of China equates to a gigatonne of carbon stored.

It is time to rethink soil carbon afresh.

Part 3 History of developing new technology

Let me first tell you about some of my experiences over the years with soil.

In the late seventies, now some thirty-five years ago, Australia suffered immense dust storms with millions of tonnes of topsoil being simply blown away, some reaching as far as New Zealand.

I asked myself how the world would feed itself if we lost all our top soil. This prompted me to set up a series of experiments to find out how to regenerate top soil. These experiments have been going on virtually ever since but with a changed emphasis as the understanding developed.

Science indicated that the natural rate of regeneration of soil is very slow, just millimeters per century. Nature has evolved its own way of converting bare ground into soil.

The pioneering species which we generally think of as weeds start the process. They have a variety of mechanisms, some have prolific seeds, often sticky or with barbs which can get started on the hard bare ground. Other propagates by sending out tentacles; cobblers' pegs and bindi weeds are examples in my region. Generally these have shallow roots and the plants have a short life but they start to convert the surface layer of a few mm.

Next a new variety of weeds, such as dandelions and thistles, come along. These put down deep tap roots, breaking the soil down a little bit deeper, typically 300 mm. These are followed by specialist tough grasses, then shrubs like the acacias and finally the large trees get established until a full ecosystem has developed. This is a long and tedious process taking centuries to fully develop a deep top soil.

After much experimenting I found it possible, using the appropriate techniques, to regenerate top soil to a depth of some 300mm in four years. My test site was a block of land with a heavy clay soil which had been completely denuded of top soil. The challenge was to find a way of converting the clay into productive soil. I started my experiments using the classic scientific process.

I divided the block up into small areas which I used to test any system of regeneration I could identify, ranging from methods of tilling, chemical additives, different types of vegetation etc with just one variable per area.

The experiments failed with no method giving any worth while improvement in soil quality. Just mixing chemicals or organic material into a barren ground is simply not effective. Even after several years there was no integration of the organic material with the parent soil. In one experiment I mixed sawdust with clay and after five years I dug up the area to find it virtually as I had first created it. Similarly the classic soil regenerators like gypsum and the sulphur based chemicals were ineffective.

It is no wonder that people, including the Royal Society, are skeptical about carbon capture in the soil.

My next attempt worked on the hunch that it required a combination of techniques to regenerate the soil and I started again with a multi variable approach, hoping to use the Taguchi multi variable method to analyze the results. Again, initially this did not work, but gradually a successful mix evolved.

After many experiments I found it was possible to regenerate soil within a few years but it required a combination of factors. Having some form of continuous vegetation is important together with maintaining the right soil moisture level.

It was clear that developing and maintaining the micro biology was critical. Managing the soil moisture level so the microbiology could develop was a critical part of the process.

Controlling the moisture level led me to a life long interest in managing water, a crucial issue with global warming.

My experiments leading to a method of regenerating top soil was innovation, and did not follow the classic scientific approach of controlled variables. It was more a series of trials testing out hunches until a working solution was found.

Of course since those early experiments we now have developed a much better understanding of how microbiology generates soil. We know the crucial role that fungi play, for example how mycorrhizal fungi form a link between plant roots and the soil. Other fungi have hyphae which are so fine that the pressure at the tips, with the aid of enzymes can penetrate mineral particles. These form a three-dimensional matrix which adds stability and structure to the soil.

The need for innovation

There is a quote which says;-

A scientists looks as what is and says "Why?"

An innovator looks at what is not and says "Why not?"

Innovation and science need to work together. Innovation may start from a scientific basis but often takes leaps into areas of ignorance where science would fear to tread. Sometimes there is an end product, process or system which works and is useful.

The scientific approach often enters the scene again providing an understanding why the innovation works, or more usually why components of the innovation work. This of course leads to improvements. This pattern has occurred throughout the history of technology.

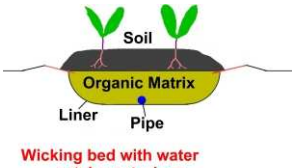
The global warming scene has been dominated by science, establishing that it is real and predicting the consequences. Now we need innovation to find solutions. The wicking bed is such an innovation. Now we need science to refine and establish credibility for the technology.

The wicking bed

In another twist to the story I was asked to go to Ethiopia to see if I could develop a method of growing sustenance food in times of drought.

The key problem was not so much a lack of rain but its variability. A cheap method of storing water was needed which led to the concept of the wicking bed.

The wicking bed was developed as a way of growing crops with reduced and erratic rainfall.



Wicking bed with water catchment wings

In essence a subsurface organic sponge contained within a water proof liner allows nutrient rich water to wick up to the root zone, giving high productivity with minimal water loss by evaporation or seepage beyond the root zone.

This not only saves significant quantities of water, (up to 50% saving have been reported by practical growers) but it also reduces the need for fertilization and the contamination of ground water and river pollution.

Practical experience shows that the organic material becomes integrated into the soil structure. The moist conditions are particularly beneficial for the development of fungi; - known to be effective in integrating organic material into the soil. There is a high rate of carbon sequestration.

Wicking bed could be a low cost but powerful tool in the battle against global warming.

Steps in making a simple wicking bed

1) dig a trench
2) fill with water to ensure level
3) lay in liner and pipe work
4) fill with organic material


1


2


3


4

Decomposition is largely by a combination of anaerobic bacterial and fungal action as the organic material is subject to a wet and dry cycle. This naturally gives a lower rate of return of carbon to the atmosphere.

The limitations of the amount of carbon absorbed into the soil appear to depend of the available supply of organic waste, rather than the capacity of the soil to absorb carbon.

Part 4 Implementation

External inputs

The potential global implications of the wicking bed technology are so profound that it is appropriate to present a picture of how this technology may be implemented for the benefit of humanity.

Farms always produce organic waste and this can be augmented by growing plants as a further source of organic waste.

However to take full advantage of the technology to sequester carbon from the atmosphere, organic waste must be imported from other sources, particularly forests and urban centers.

These often have other benefits. Clearing debris from forests reduces bush fires. Recycling urban waste reduces a disposal problem.

Scale of the operation

It is important to get an idea of the scale of the operation required to sequester useful amounts of carbon from the atmosphere. When the beds are initially constructed they need some 2,400 cubic meters of organic waste per hectare. This is expected to sequester some 480 tonnes of atmospheric carbon per hectare.

If we take China as an example: - to sequester 8 gigatonnes of atmospheric carbon would require an initial area of some 17 million hectares, or about 32% of China's irrigated farm land.

In subsequent years the rate of sequestration drops, but we can see a clear pattern that the amount of carbon sequestered is not limited by the capacity of the soil to embed carbon, which is very large. The critical issue is the availability of organic material.

There are also logistical problems. In China there are some 200 million farms. We could expect at least 25% of these would be actively involved in sequestering carbon. There is a major problem in educating and training these farmers, and providing the infrastructure to supply the equipment and skills to make the wicking beds and supply the organic waste. Also there is the issue of finance: although this could largely come from carbon trading but again that is a complex issue for the average farmer.

To create an organization from scratch to provide all these services would be a major undertaking which could take many years to develop. However local governments already have the required infrastructure in existence.

An opportunity for local Governments

The major source of this organic waste would come from land which is normally controlled by local Governments; forests and park lands.

Local Governments are singularly well placed to help resolve global warming and our environmental problems. They manage our forests and parks, where this process of absorbing, then releasing large volumes of carbon dioxide back to the atmosphere, occurs.

Local Governments, particularly the large municipalities in China's mega cities, are daily faced with the problem of disposing of large amounts of waste.

To the Governments this is an unwelcome difficulty and expense, yet by simple changes to the way we manage our waste this can be turned into a major environmental benefit and with the advent of carbon trading provides a valuable source of revenue for the authorities.

By simply changing the management of waste streams local Governments can play a crucial role in resolving global warming, aid the environment and improve food production and make money at the same time.

Many of the methods of waste disposal have been selected based on criteria which were appropriate before global warming became an issue. Incineration, land fill and aerobic and anaerobic composting all have disadvantages. The new technology of the wicking bed offers major environmental and economic benefits particularly with carbon trading.

The waste must be processed to the required quality. This requires sorting and blending of waste streams. Two grades are likely to be required.

The first would be a relatively refined blend of wood chips and urban waste for food production. This would be used in conventional wicking beds.

The second blend would be used for non food application and would contain a significant proportion of sewage sludge. This would be used in wicking beds for farm and ornamental trees which are then used as a source of wood chips for use in wicking beds for food production.

Trees can be grown in a first stage wicking bed using unhygienic waste to produce hygienic organic material. Here we are growing Easter Acacia, a fast growing legume which is trimmed to use in food producing wicking beds.

Sorting of waste is becoming more common. It is now normal, at least in Australia, to sort recyclables from non-recyclables. Progressive councils are now introducing a third stream specifically for organic waste, which includes household food and garden waste.

Sewage is a further potential but problematic source of supply. The risks of pathogens, heavy metals and other toxins have resulted in sewage being banned for agricultural use in many countries. Wicking beds can be used in this two-stage process to enable the use of sewage and exploit this valuable but problematic resource.

In the first stage a controlled blend of waste stream, including sewage is used to grow suitable non-food plants and trees. This could be in an agricultural, forestry or park setting. These plants growing in a highly productive environment can be regularly pruned to provide a non-toxic supply of organic material for the second wicking beds stage which is used for food production.

The wicking bed is a low cost way of sequestering carbon, there is some initial set up cost after which subsequent operating cost may actually be reduced. The inevitable adoption of carbon trading, or at least applying some cost to carbon pollution, is now making it financialy beneficial to adopt wicking beds.

The revenue from carbon trading would allow local authorities to provide a service to local farmers where they could install wicking beds and supply the organic material.

This would increase the farmer's income, improve soil quality, reduce run off and remove green house gases from the atmosphere.

Local authorities are generally well equipped with the appropriate machinery for easy installation. They also have the skills to manage the carbon trading on behalf of the farmers.

Instead of waste being a problem for the local authorities it enables them to provide a valuable service to the community.

Part 5 action plan for sustainability

Key points

Global warming has forced humanity to realize that its activities impact the planet.

Emissions from developing countries continue to grow and will soon be the largest source of anthropogenic green house gases.

The much needed global agreement on climate change will only be achieved if the impasse between developing and developed countries is removed.

Degradation of our top-soils - even without climate change - is a threat, but coupled with droughts and wild weather the threat to food production is severe. Al Gore has pointed out that the atmosphere is only a few kilometers thick. Our top soil which is often only 300mm thick provides our food and is degrading around the world.

Compensating for lack of organic matter in the soil by chemical input only works up to a point. After that point agriculture turns into hydroponics which, when the externalities of providing the chemical diet for the plants are considered, makes it totally unsustainable.

The rich can always afford to buy food; the poor are the ones to suffer from food shortages.

The wicking bed system sequesters carbon and builds up the quality of the soil. The system is more productive that conventional agriculture, uses less water, and using the raised bed version offers some protection from flooding and from wild weather.

An upfront cost restricts adoption by poor farmers in developing countries. Even a low carbon price of $10 would cover the material cost. Carbon trading would allow farmers in developing countries to sequester large amounts of carbon to offset their own countries' emissions. It would also allow the developed countries to trade in real carbon which reduces net global emissions (as opposed to virtual carbon which is often a feature of current trading schemes).

There is no question that the world must eventually move to genuine green energy production, and there is no suggestion that the wicking bed capturing carbon in the soil should provide an excuse to continue with carbon polluting power generation. But it will take time for the worlds infra structure to change to low emissions. The wicking bed provides a way of reducing net global emission while this transformation occurs.

The wicking bed technology has been developed over many years from my private resources. Fortunately I had built up Australia's leading exporter of technical software which meant I was in a position to invest my time and money into the early high risk phase of developing this technology.

I have put a great deal of time (and money) into sustainable agriculture which has lead to the development of the wicking bed. This is now a reasonably mature technology in the sense that we know how to build and manage them for improved food production. It is in wide use by environmentally sensitive growers in Australia, and is proving highly successful even in the desert regions of Australia.

Like any technology there is always room for further innovation and improvement but right at this moment we have a working system.

This could be used globally for the benefit of the world population, particularly the food threatened poor and if used on a large enough scale reduce carbon emissions.

However, for the technology to become widely accepted and form part of the carbon trading scene it first need independent revue and accreditation.

The time is now for me to hand this technology over so that the world can benefit.

How to get started

I have had negotiations with Professor Xuebin Qi at the Chinese Academy of Agricultural Science at their Water Research Institute in Xinxiang, Henan Province

The authour and Professor Xuebin Qi
at the Water Research Institute Xinxiang

He has agreed to carry out the necessary research and testing so the technology can receive the independent assessment which is required for international recognition and accreditation.

Now they need funding of $500,000 for the academy to undertake their research so we can move to the next step of this important technology.

This report is the basis for this fundraising. Technical details have been deliberately minimized in the report but are available on my web site www.waterright.com.au together with details of my background and profile.

If you have an interest in assisting please contact me on colinaustin@bigpond.com