ISSUES CONCERNING MECHANISMS FOR GLOBAL WARMING

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Abstract

Scientific limitations in the application of climate models to address global warming are identified. Consideration of mechanisms is used to compare the applicability of an increase in atmospheric CO2 and desertification through agriculture as being causes for global warming. New physical processes that promote vegetation development are identified where these reinforce the view that global warming arises through desertification caused mainly by agriculture. Implications for remediation and the next step forward are identified.

Introduction

Scientists have been successful in convincing most governments that global climate change is occurring, and that the changes are a result of human activities and therefore anthropogenic. The human activities were initially linked to the burning of fossil fuels because of the increase in atmospheric CO2, but this was expanded to any human activity that produces gases predicted to have an insulating effect in reducing the rate of radiant loss of energy from the earth.

This success has produced many ramifications, such as many more scientists joining the band wagon in supporting the views and using them to 'explain' a great diversity of observations on biota and the physical environment. Such a shift is inevitable where an issue is given such importance as it dictates the funds available for research. The impetus has been such that any who disagree with the views are labelled sceptics.

The obvious questions that arise are:

- Is the global climate changing?
- Is the change anthropogenic?
- Is the change caused by activities that increase atmospheric greenhouse gasses?
- Are those that disagree with the suggested consensus sceptics?

Less obvious considerations involve alternate causes and mechanisms for global warming.

Climate Change

The global climate has always changed and will continue to change. Any anthropogenic effect is therefore superimposed on natural fluctuations. The addressing of climate change is therefore highly complex with most considerations being outside the scope of what could be affected by human activities. The climate change considered here is therefore essentially

restricted to recent changes considered to be anthropogenic, and is referred to as global warming.

Identifying the existence of climate change is difficult because of the large spatial and temporal patterns and variability. Identifying change depends on comparing observations made at different times where the core measurement issue is how to obtain reliable averages for comparison. This is simplified for some atmospheric variables, such as levels of CO2, as a single point measure effectively provides a large spatial average due to atmospheric mixing. However, point measures on the land for variables such as rainfall and soil moisture are useless on their own. Obtaining reliable comparisons depends on having measures that provide useful spatial averages.

The seemingly innocuous term useful has profound implications for scientific analysis because many of the processes being addressed respond non-linearly to the variables being measured. With non-linearity's the use of a simple spatial average is inappropriate and can give highly misleading results. For example, a 1km pixel used to characterise vegetation in global models represents a spatial average but the functioning can be very different for pixels that have the same apparent amount of vegetation. The functionality of the $1km^2$ area is very different where one half of the pixel is vegetated and the other half bare compared to where the entire pixel is uniformly vegetated[1]. Pixels identified as being equivalent in having the same level of greenness can perform very differently.

This need to address non-linearity's in processes is the key reason for the profligate use of models in addressing global warming. However, use of such models does not resolve the need for appropriate averaging in measurements. Indeed, the limited availability of appropriate measurements limits the applicability of all climate models.

Given the measurement issues the main certainty in global warming is the increase in atmospheric CO2 that was identified as occurring over half a century ago. The next addition to known changes was an overall increase in ambient temperature. The small magnitude of change and the high spatial and temporal variability's make this less certain than for CO2, but with results derived using satellite technologies it appears that this can now be considered to be occurring.

Rainfall is a key climatic variable that some suggest is decreasing. The issue is that while rainfall has decreased in some areas it has increased in others and this makes the net global change difficult to determine. The well documented examples of rainfall decline are regional rather than global.

Stream flows are a more reliable indicator of water availability than rainfall because of the inherent spatial averaging, and there is mounting evidence that stream flows have been decreasing. However, stream flows are not uniquely or linearly related to rainfall. While stream flows provide an indication of climate change they cannot be simply interpreted as indicating a change in climate.

Anthropogenic Change

Some consider that the forces involved in the global climate are of such magnitude that climate cannot be significantly affected by human activities. This is despite the many examples where

[1] While 1km pixels are typically more heterogeneous in including components such as water and roads the algorithms used focus on the amount of green vegetation. They provide a reasonable arithmetic average for green vegetation.

human activities have been shown to alter climate. The examples invariably involve desertification associated with agriculture. The land use typically involves the removal of perennial vegetation and its replacement with a rotation of annual crops and bare ground. As the system degrades the cropping is typically replaced with grazing wherein the livestock effectively keep the land denuded of vegetation. In the extreme the land becomes desert, as exists in north Africa and parts of northern China.

This progression from native vegetation to crop to grazing to desert occurs where the soils and climate were initially suitable for cropping. On poorer lands cropping is generally absent but the grazing of the native vegetation by livestock has the same effect in denuding the perennial vegetation and eventually producing desert.

Such changes have occurred on all continents but, as many such changes arose with ancient civilisations, they are poorly documented. All that is known is that once fertile lands became barren and the civilisations failed when they could no longer produce the food essential for their survival.

An important feature of such change is that it can be reversed, and it has been. However, such reversal is the exception as the land use pressures increase with the decline in production. Attempts are made to maintain production to support the existing population where these accentuate the degradation. The degradation continues even where the population declines.

Another important feature of the degradation is that it need not self repair when the land use is abandoned. The degradation was caused by human intervention and human intervention is usually needed to achieve remediation within a reasonable time frame. The theoretical basis for this is given in the paper on Controls on the Development of Vegetation (Tunstall 2008), where this theory is based on, inter alia, observations that plants tend not to recruit in bare areas[2]. The potential for self repair depends on many factors but is strongly determined by the level of degradation.

The symptoms of desertification of increased temperatures and decreased water availability are occurring with the current global climate change. However, the question as to whether this global change is a result of the combined effects of regional occurrences of desertification is unresolved.

The extent of vegetation clearing and land denudation through human activities is the greatest there has ever been. Agricultural areas have been greatly extended to compensate for the loss of productivity of traditional agricultural lands as well as to address the increasing population. Moreover, current 'best practice' agricultural methods typically involve the maintenance of bare land except when a crop is planted, with the extents of such areas being large to achieve economies of scale. A reasonable cover of green vegetation may only exist for a few months each year and for the rest of the time the crop land is intentionally maintained as a desert[3].

Logically any regional change in climate will result in a global change as this is inevitable unless there is equal compensating change elsewhere. Compensating changes can occur but, as changes in different areas are rarely equal or balancing, a regional change will usually produce a change in the overall global average.

[2] Lack of plant recruitment in bare areas is essentially self evident. However, this lack has generally been attributed to water when the cause additionally relates to effects of interactions between plants and soil on nutrient availability.

[3] A fallow occurs between crops but the modern trend has been to maintain a fallow devoid of vegetation, mainly with ploughs but increasingly using chemicals.

While regional change will almost invariably affect the global situation this does not address the issue of whether all of the regional characteristics of desertification can apply globally. From the processes involved it would be expected that they can, as with the production of higher global temperatures being expected to affect plant growth and rainfall everywhere. However, it cannot be determined if the global system will reach a critical point where it continues to degrade without ongoing increase in the causal impacts.

From existing knowledge it would be expected that desertification of multiple regional areas could combine to produce self sustaining degradation of the global system. However, as with conclusions from climate models examining the effects of increased atmospheric CO2, this conclusion represents speculation rather than knowledge.

Greenhouse Gasses

The main identifier of climate change is atmospheric CO2 which has been increasing for over 5 decades. Those working on photosynthesis were aware of the increasing trend in the 1960s. This increase has typically been linked with the burning of fossil fuels but the level of increase is commensurate with the loss of organic matter from agricultural soils, and its timing accords with the expansion of clearing, and the development of farm mechanisation and use of chemical fertilisers. That is, the pattern of increase in atmospheric CO2 generally mirrors developments associated with mechanisation, and virtually any aspect of this development is positively correlated with the increase in atmospheric CO2.

The ability to correlate atmospheric CO2 with a large number of human activities does not identify that it is causal in global warming. The increase in atmospheric CO2 is a symptom and alone cannot be used to identify the cause of climate change. In law it represents circumstantial evidence and is therefore not proof.

It is difficult to determine how atmospheric CO2 became identified as the cause of global warming. It can be traced back to what was effectively a casual suggestion that has subsequently been promoted by some scientists that know about climate, and many that don't, as being the cause. To many the case is closed when the whole case rests on a simple correlation.

While the correlation has been dressed up in climate models to achieve greater respectability it is still a correlation and can never be proof. The models serve to identify that the suggested mechanism is plausible but do not demonstrate that the system is functioning as they suggest. The models are essentially descriptive in describing how the system is thought to work.

With appropriate application of the scientific method there is a need to test the reliability of outputs from the models. However, this is not possible except in a very general way. The detailed tests conducted serve only to test components of the models, such as the sensitivity and reliability of particular functions, where such tests cannot identify the reliability or applicability of the overall model and its outputs by way of predictions. This situation is inevitable where interactions occur that are incompletely known or understood and hence cannot be reliably accounted for. However, other inevitable deficiencies have the same effect, such as limited knowledge of the extant processes, and limitations in the information used to drive the models.

The best test of the models currently available is to compare general outputs with general observations. Results from models based on atmospheric CO2 being the cause of global warming fail this simple test as the changes are occurring more rapidly than predicted. There

is therefore something fundamentally wrong with the models, and/or with the assumption that atmospheric CO2 is causal in global warming.

The general response to this situation has been to identify that things are more drastic than previously thought hence more resources are needed for research. The inference is that the resources are needed to do more of the same. There has been no attempt by the modelers to step back and reconsider as for them there is no apparent alternate explanation. This situation is compounded by the loud chorus from those with little or no knowledge of climate that are concerned about the effects. The pressure is on to show that the models work.

The global climate is a complex system due to the numerous variables and interactions. Such systems are difficult to study but different approaches provide differing levels of reliability. The typical physical approach is to extrapolate from the known to the unknown where that has very low reliability in such circumstances. A more reliable approach is to analyse the whole to identify the extant factors. While the whole is being studied with climate modeling the extant factors are pre determined by the constraints associated with the models. The models are predictive rather than analytic. By defining CO2 as being the cause the problem is being solved by definition, and the modeling serves only to justify that decision.

Sceptics

A concise dictionary definition of a sceptic is a person who doubts the truth of accepted facts, ideas etc. With this definition all scientists should be sceptics as change only arises through questioning the status quo. Logically therefore, no scientist is in a position to label another scientist as a sceptic as they should all be in the same boat[4]. Why then are scientists that question global anthropogenic climate change and atmospheric CO2 as being the cause regarded as sceptics when scientists that support such views are not?

The issue resolves into what is regarded as being correct. Many promoters of atmospheric CO2 and other greenhouse gasses as being the cause of global climate change have convinced themselves that they are correct and, based on this assumed knowledge of the truth, they have adopted the high moral ground. They deem as sceptics any non conformists with rules they have set. The rules do not relate to adherence to the scientific method but to the acceptance of an unsubstantiated point of view.

The situation is the same as with any strong dichotomy in views with opinions differing depending on which side of the fence one is on. In this confrontation those assuming the high moral ground accuse dissidents of not understanding the science, while some dissidents rightfully identify that the moralists have not complied with basic requirements of the scientific method. The impasse would be resolved by a test that demonstrates that CO2 is the cause but such a test is logically impossible.

This situation has been reinforced by the politics. By convincing governments they are right the scientists have initiated large social change. While such change can be difficult to initiate it is more difficult to stop once initiated, and deleterious aspects can essentially only be addressed by redirecting activities. However, even redirection is difficult because those that consider themselves to be in positions of power and influence have a vested interest. The issues of right and wrong become distorted into the need to be seen to be right, which in some cultures is referred to as saving face.

[4] Application of the term depends on a difference which cannot exist if all are the same.

Any semblance of realism has been lost in the presentation of a correct position. A theory that cannot be proven has been presented as fact such that all establishment scientific efforts are now being expended at showing that the theory is correct and speculating about the implications. Dissidents are not funded.

Such bias in funding is common in science as research funds are related to community perceptions of need. However, with climate change the monetary significance goes well beyond research with a carbon tax being imposed under the guise of emission trading schemes (ETS). The ETS have not been presented as a tax through being structured to allow industry to profit from them but, in being mandated by governments, they represent a compulsory tax on producers of atmospheric carbon[5].

Development of ETS raises several issues, such as the effectiveness of economic solutions in addressing environmental issues[6], and the profiting and likely profiteering of industry and governments from the compulsory addressing an issue fundamental for life. For the community the key issue is will they provide a remedy, as scientifically there is no evidence that they will. No evidence has been presented that demonstrates that CO2 is the cause of global warming, and there is no observational evidence that reducing atmospheric CO2 can provide a remedy. The belief that reducing atmospheric CO2 will provide a remedy arises from predictions deriving from climate models of unknown applicability.

The required realism is that no one really knows the cause(s) for the suggested anthropogenic climate change hence no one has presented a solution to global warming that has a well established and proven (tested) basis.

An issue arises later in this presentation whereby establishment scientists identify themselves as being sceptics in relation to suggestions considered outside normal science, such as the paranormal. Given the definition of the term sceptic this is a gross misuse of the word as the establishment scientists are defending the current convention rather than questioning it. However, it serves to illustrate the penchant of some scientists to claim the high moral ground and to put down those that disagree with them. Logic has no place in such considerations as the focus is on the promotion of beliefs.

Alternate Mechanisms

Stability in complex systems is typically dynamic in arising through the counter play between interacting forces. A change from a stable condition can arise with a change in one of more of the forces but the general tendency is for a change in one to be compensated for by changes in the others. Stability arises through negative feedbacks.

Ongoing change can arise with negative feedbacks where a force continues to change, as is suggested in global warming with an ongoing increase in atmospheric CO2. The speculation on things becoming worse derived mainly from the assumption that human activities will continue to increase the levels of atmospheric CO2. Hold the atmospheric CO2 to current levels and the situation is considered to be OK.

Continuous unconstrained change in a forcing variable can arise in natural systems but is uncommon. The main reason for an ongoing change arises where a positive feedback develops so as to override the negative feedbacks that naturally produce stability. The change then

[5] The tax will ultimately be paid for by the public but only after it has increased markedly due to profit margins and administrative overheads.

[6] Economics cannot provide environmental solutions. Economics is only of consequence when a biophysical solution has been identified.

continues indefinitely, or until the positive feed back becomes muted by the changes it produces. As positive feedbacks arise through change promoting greater change the situation of a positive feedback becoming muted is a long time coming.

Observations of overall system performance can provide insights as to which mechanism is operative. Without positive feedbacks the degree of change in outcomes tends to be directly proportional to the level of change in the causal factor, and hence is linearly correlated. With a positive feedback the rate of change increases with increase in the causal factor thereby producing a non-linear relationship between change in the causal factor and the outcome. Indeed, the change can become self sustaining whereby outcomes continue to change without the existence of the perturbation that initially produced the instability.

In complex systems both mechanisms can operate concurrently. However, the difference between them is so marked that their relative dominance can often be detected. Logically the occurrence of expansive non-linearity between inputs and outputs evidences positive feedback, while linearity identifies the effective absence of positive feedbacks. The absence is identified as being effective rather than real as the linearity can arise through negative feedbacks compensating for changes in positive feedbacks.

The change in outcomes is essentially proportional to the change in CO2 with atmospheric CO2 as the forcing variable. Moreover, the change is identified as being reversible. Reduce the levels of atmospheric CO2 and something resembling normality will be resumed, albeit with delays.

With desertification caused by agriculture the change produces more change as there are strong positive feedbacks. A critical point can be reached whereby the change is self sustaining with the system continuing to degrade when the causal impact is removed. The system does not self repair or even become stable but continues to degrade.

Given the complexities of the global system being addressed the differences cannot be expected to be as clear cut as described. However, the differences are so marked that there should be little confusion as to which mechanism applies.

A key feature of climate models is that observed changes are now occurring more rapidly than predicted. This is despite the short period of the use of models for such predictions. This situation is a clear indication that the mechanism for change incorporated in the models is fundamentally wrong[7]. The deficiency cannot be resolved through improved models or improved measures as it requires a complete rethink of the situation. The indications are that there is a strong positive feedback that has not been incorporated into the models.

The required rethink will be difficult to achieve because of the inertia associated with vested interests. The initial response to such questioning is typically that the science is sound when in this instance the suggested science is simply technology. Indeed, the basic scientific requirement for testing cannot be met as the outcomes are unknown. The models are being used to project what the outcomes might be without there being any means of testing whether the predictions are right.

The basic approach being used in the climate models is to incorporate realistic mechanistic functions developed on known (existing) circumstances. The assumption is that an ability to simulate existing circumstances provides a reliable means of predicting the future even when

[7] As errors typically compound with time, short term predictions must be correct for longer term predictions to have any validity.

the future is outside the range of existing observations. The predictions of climate change represent extrapolations into unknown territory.

The implications of this situation are well known. Predictions are most reliable when centered within the range of observations used to make them. The reliability decreases markedly towards the extremes of the observations, and then greater than exponentially beyond. Extrapolations outside the range of observations are inherently highly unreliable regardless of whether the model is considered mechanistic or not.

This situation is compounded in complex systems due to the occurrence of interactions as non-linearity's are then the norm. The models cannot be properly tested for known situations hence there is no chance of determining their reliability with extrapolations. The belief that the extrapolations have value represents an act of faith that only exists because of inadequate consideration of the logic of what is being done.

The Need to Know

An assumption with the use of climate modeling to address global warming is that all extant factors are known: We know the underlying physics so the requirement is to arrange it appropriately and drive it with suitable observations to obtain realistic and reliable predictions. The difficulty with this assumption is that there is no way of showing that it is right. Indeed, when addressing new territory it will invariably be wrong so the issue then becomes the extent to which the inevitable deficiencies in knowledge negate the conclusions.

Fundamentally the issue is, how do you know that what you know is all that you need to know? Logically one never can, but it is possible to identify situations that cannot be explained on the basis of existing knowledge. That is, knowledge can be shown to be deficient. This logic is central to the operation of the scientific method.

One purpose in addressing the degradation of farming systems (Tunstall 2008b) was to highlight deficiencies in scientific knowledge of the functioning of vegetation. Many general and specific observations exist that cannot be explained with existing physical and biological constructs. For global warming the indications are that vegetation is either obtaining more water than provided through known mechanisms such as rainfall, or that its water use is dramatically less that identified through measurement. Similarly, but much less clearly, vegetation appears to be obtaining nutrients from an unknown source.

Observations exist that provide information relevant to both issues. Dew ponds evidence the accession of atmospheric water other than through rainfall, while orbitally rearranged mono-atomic elements (search ORMES and ORMUS on the web) represent a means of nutrient production. However, these have essentially been ignored by mainstream science because they cannot be explained using current physical constructs.

Dew ponds, and associated air wells, have been addressed by scientists to a limited extent with the mechanism typically identified as involving condensation[8]. This is despite the absence of any reliable tests that demonstrate that condensation applies. Condensation has been identified because it is the only known physical process that provides a plausible explanation. The suggested science involves shoehorning observations to fit existing theories when in science the reverse applies. In science theory is developed to fit observations.

With technical use the term to the atmosphere condensation applies to the situation where the concentration of a gas exceeds saturation and some condenses as a liquid. The dew point is the temperature at which the air is saturated with water vapour.

Ignoring finer points, such as measurements affecting what is being measured, observations represent fact. Theories, models, or any other constructs are artifacts constructed to provide generalisations, and to be valid must accord with the observations. Disagreement between observation and theory is used to identify that a theory is false. This is the fundamental requirement of the scientific method whereby knowledge is advanced through disagreement between theory and observation being used to identify deficiencies in the theory. If current physical knowledge cannot account for the phenomena observed with dew ponds then the deficiency lies in the knowledge of physics.

The above contrasts with the position of self proclaimed sceptical scientists who disregard observations not accounted for by current scientific theories. Their requirement is that the observations be proven when this is diametrically opposed to the operation of the scientific method. It is an example of claiming the high moral ground by setting the agenda and expecting others to comply with that agenda.

It does appear that vegetation is accessing water in an unknown way. Cacti can grow in narrow fissures in large solid rock where rain falls only once or twice a year. In this situation there is no possibility of the water required for growth being obtained from soil stores. Caper bushes grow in cracks in vertical stone walls in the old City of Jerusalem where their water requirements similarly cannot be supplied by rain. Shrubs persist across central Australia despite the very low and highly intermittent rainfall. When appreciable rainfall occurs most of its use can be accounted for by the growth of ephemeral plants. In the highly seasonal climate of northern Australia perennial plants can begin to grow before the onset of the first rains despite the soil being dry. Eucalypts in Canberra in the autumn of 2009 began to grow despite the drought conditions, and they developed the best canopies observed. Such phenomena have long been known, the issue relates to the provision of a convincing explanation as to how such situations can arise.

The significance of an ability of vegetation to access atmospheric water other than through rainfall is profound for global warming, and its occurrence would dramatically change the energy balance calculations used in climate models. Additional to such direct effects there would be indirect effects associated with the occurrence of vegetation promoting rainfall.

The description of the mechanism for controls on vegetation development (Tunstall 2008a) was based on nitrogen as the associated mechanisms are well known. However, the paper was written with the knowledge of two additional mechanisms that naturally promote vegetation development through positive feedbacks that are of at least equal importance in vegetation development. One is the direct accession of atmospheric water by plants[9], the other is the production of specific elements in the soil (ORMES). In combination these three processes provide the very strong positive feedbacks involved in desertification through agriculture, with water appearing to be paramount.

There is already sufficient knowledge to justify the discarding of atmospheric CO2 as being the cause for global warming. There is also already sufficient information to justify acceptance of desertification caused by agriculture as being the likely cause, particularly given the ability to reverse the effects of desertification. However, a change in opinion is unlikely to occur until the mechanisms associated with direct accession of atmospheric water by plants are elucidated as the change represents too great a step into the unknown for most scientists to countenance.

[9] The evaporation of water to the atmosphere through plants is transpiration, thus water taken in from the atmosphere by plants would be inspiration. To avoid confusion with existing usage the term adopted is ginspiration. A more general term for the process that is not limited to plants is indensation.

Desertification through Vegetation Degradation

Vegetation development promotes greater vegetation development through positive feedbacks. Conversely, vegetation degradation can promote further vegetation decline. Reduce the vegetation and there is less input of organic matter into soils. This reduces water and nutrient retention where these losses further reduce vegetation development.

A similar situation appears to arise with direct accession of atmospheric water by plants. Degradation to the vegetation directly reduces the water available for plant growth, and the reduction in evaporation of water by plants reduces the regional rainfall. While the reduction in direct accession of water occurs locally the reduction in rainfall is regional. Local impacts can affect the region, with the magnitude of the regional effects depending on the severity and extent of local impacts.

There is likely an effect on rainfall additional to, but linked with, the reduced evaporation from plants. Condensation of water in the atmosphere occurs around nuclei, and is strongly promoted by organic forms such as the Aerobacter bacterium. As these bacteria grow in plant leaves it appears that vegetation promotes the nucleation of atmospheric water into drops sufficiently large to fall as rain. This effect would be regional.

While vegetation removal reduces rainfall other human activities can have the same effect. Droplets that form around atmospheric pollutants do not become sufficiently large to fall as rain, and atmospheric pollution as been shown to decrease rainfall.

The above demonstrates the occurrence of many factors that can operate separately or through flow on effects, all of which combine to produce observed outcomes. The prime cause of global warming is identified here as being perturbation to the direct accession of water by vegetation[10], but it is not necessarily the only cause. Also, there are secondary mechanisms or flow on effects, such as reduced rainfall. Rainfall will decline with reduced accession of water by plants where this will have a flow on effect in further reducing the development of vegetation. This flow on effect through rainfall identifies how regional impacts can combine to produce a self sustaining global decline.

Symptomatic Treatment

With atmospheric CO2 identified as the cause of global warming the main solution identified is to limit production of greenhouse gasses, particularly CO2, and to sequester carbon by whatever means possible. If atmospheric CO2 is a symptom rather than the cause, as it is almost certain, then these treatments represent social placebos. They can be used to placate the public through something being done even though there is no means of demonstrating that it is in any way useful.

While the use of a placebo can sometimes be beneficial in this case it would be damaging. The enormous effort expended on the placebo would produce no benefit but would prevent the development of effective treatments. Moreover, as the climate would continue to degrade there would inevitably be an expansion in agriculture involving further clearing and accelerated degradation of existing agricultural lands. That is, implementation of carbon sequestration as a cure for global warming would accelerate its development.

One method of carbon sequestration is beneficial regardless of whether the cause is atmospheric CO2 or desertification, that of increasing the levels of soil organic matter in agricultural lands. Soil organic matter can only be increased by developing the vegetation

[10] The perturbation involves vegetation degradation, mainly through agriculture with cropping and grazing.

where vegetation development is the key to addressing desertification. However, achieving the requisite vegetation development on agricultural lands would involve a massive change to current agricultural practices.

What Next

Experience in addressing dryland salinity identifies the rocky road ahead, where that saga is chronicled in a series of papers on the ERIC web site. Scientists attempted to maintain their beliefs regardless of the evidence, where this was strongly promoted by the nexus between them and their sources of funding. Administrators that provided the funds cannot be seen to be wrong and hence seek justify positions they have promoted. Every means was used to achieve that end, with the most benign being to only fund those that supported their position. Such reactionary response to critical comment greatly inhibits the initiation of correctional change.

The current situation with global warming is identical to the early phase of the focus on dryland salinity in Australia. Whether the concordance continues has yet to be seen. With dryland salinity some scientists have changed their focus but there are notable bastions of intransigence. The funds to address salinity have greatly reduced, and those remaining have been substantially redirected to revised activities. The resistance arises from those that benefited from the prior situation and loose from any change.

The changes that arose occurred gradually without publicity as it takes time for establishment scientists and administrators to reinvent themselves. In this instance it appears that administrators were largely responsible for correctional changes which they achieved through the allocation of funds.

Further information relevant to global warming will be progressively released subject to the practical constraints of resources. The focus will be on the physics associated with the mechanisms for direct accession of atmospheric water by plants (indensation) and the production of ORMES (element generation). While these mechanisms are completely separate they have commonalities in the underpinning physics.

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