

Chapter 10

Climate, the natural environment and agriculture

Chapter 10	295
Climate, the natural environment and agriculture.....	295
1. Quick summary	297
2. Introduction.....	297
3. Purpose.....	298
4. Background	298
4.1. Press release	299
4.2. What is climate?.....	300
5. Climate change – the evidence	300
5.1. Global warming has increased temperature.....	300
5.2. Global warming has increased evaporation	301
5.3. Global warming has increased rainfall	301
6. The environmental consequences	303
6.1. Changes in rainfall in the southern and western Cape	303
6.2. Climate change in the Western Cape	306
6.3. Global warming will not result in desertification	308
6.4. Global warming will not remobilise the Kalahari sands.....	309
6.5. Global warming will not result in a loss of habitat and species.....	312
6.6. Global warming will not result in a threat to fynbos biomes.....	313
6.7. Global warming will not result in a threat to Karoo biomes.....	313
6.8. Global warming will not spread malaria.....	314
6.9. Global warming will not increase eutrophication.....	316
6.10. Global warming will not increase soil erosion	317
6.11. Global warming will not increase health problems	317
6.12. Global warming will not increase droughts	318
6.13. Global warming will not increase floods.....	318
6.14. Global warming will not threaten water resource management	318
6.15. Global warming will not increase poverty.....	320
6.16. There is no evidence of adverse changes due to global warming..	320
7. The agricultural consequences.....	321
7.1. Global warming will not adversely affect agriculture	321
7.2. Global warming will not result in a drop in food production	321
7.3. Global warming and the lack of evidence.....	321
7.4. Global warming and failed prediction models.....	322
7.5. Global warming alarmism is irresponsible	322
8. The remedies?.....	322
8.1. Replacement of coal-fired power stations.....	323
8.2. Better water resource management.....	323
8.3. Disaster management	323
8.4. Agricultural diversification	323

8.5.	More energy efficient transport	324
8.6.	More energy efficient housing models	324
8.7.	Technology transfer	324
9.	Proof of the pudding	324
10.	References	325
10.1.	Principal reference	325
10.2.	Other references and further reading	325



Figure 1. Sesriem area of the Namib Desert after the rains. This photograph illustrates the remarkable resilience of desert vegetation to wide variations in climate. Photo by Lutz Ebrecht, 24 February 2006.

1. Quick summary

The policy followed by the Department of Environmental Affairs and Tourism and the climate change alarmists, of excluding all those who hold different views on the subject, is not the way to go. South Africa will suffer very serious consequences if a large sector of the scientific community is deliberately barred from participation in this issue, and not given the opportunity to express their views. Whether these views are correct or not should be the subject of a healthy scientific debate, or better still, the whole issue should be the subject of an independent, multidisciplinary commission of enquiry. There are no indications that this is likely to happen.

This is my contribution on the environmental and agricultural aspects. My studies demonstrate with a high degree of confidence that there is no foundation for most of the alarmist claims. Much is at stake both financially, as well as the scientific integrity of the scientists and their institutions.

2. Introduction

Alarmist claims are being made regarding the consequences of global warming on the natural environment. If these alarmist views are correct, then South Africa will be in a very serious position in the years ahead, and we will almost certainly be heading into a recession with all that this implies for the prosperity of our nation. Why has no South African authority deemed it necessary to carry out independent studies, or appoint an independent commission of enquiry on such a grave issue?

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 and issued assessment reports in 1990, 1995 and 2001, with the fourth assessment report due next year, (2007). More money and more scientific effort have been spent on climate change research than in any other scientific field. Yet today, 18 years after the establishment of the IPCC, the only meaningful effects of global warming have been the melting of polar ice sheets (contested); the retreat of glaciers (some have advanced); and the melting of the snows on Mt Kilimanjaro.

Hardly a day passes without 'evidence' that the global temperatures continue to increase. The evidence includes dramatic photographs of melting polar glaciers as they enter the sea as they have done for the past millions of years. But here the evidence stops. Despite repeated statements that global temperatures are higher now than ever before in human history and longer, why is there no evidence of the postulated dire consequences at tertiary level? [The primary level is temperature changes, the secondary level is changes in the oceanic and atmospheric energy redistribution systems, and the tertiary level is all the consequences of activity in the primary and secondary processes.]

There have been no scientifically proven, meaningful, adverse changes in any environmental processes or agricultural responses that can be attributed to unnatural climate change.

Why is there no evidence to support the dramatic warnings issued by the IPCC over the past 18 years and the Department of Environmental Affairs and Tourism (DEAT) during the past two years? The answer is the complete inability of the climate alarmists to **demonstrate** (as different from postulate), the existence of the

mechanisms that drive the linkages between global warming and the postulated consequences at tertiary levels.

As demonstrated in previous chapters of this report, the basic assumption of climate change theory that global climate operates within a closed system unaffected by variations in solar activity, is fundamentally in error. Conclusions based on global climate model (GCM) outputs that do not accommodate the well-documented, regular, multi-year behaviour in the hydroclimatic processes, are fundamentally in error.

This is an extremely serious situation. In my opinion the South African authorities and the people of this country are being seriously misled by the lack of knowledge of the fundamental requirements of scientific research and the application of scientific knowledge. [See Appendix A.] Refusal to consider, let alone discuss these differences, can only result in tarnished images and fruitless expenditures.

3. Purpose

The following extract is from the joint statement issued in June 2005 by eleven national academies of science of the USA, United Kingdom, France, Russia, Germany, Canada, China, India, Italy, Brazil and Japan titled: *Global response to climate change*.

The projected changes in climate will have both beneficial and adverse effects at the regional level, for example on water resources, agriculture, natural ecosystems and human health.

South Africans will search in vain for details of the beneficial effects of changes in climate in the public pronouncements of the DEAT and its scientific advisers.

The purpose of this chapter is to inform readers that, based on my detailed studies during the past four years, my long experience and the wealth of data available in South Africa, there is no evidence to support the theory that climate change resulting from human activities will have a measurable, undesirable effect on the natural environment or agricultural practices.

My criticisms are not directed at the authors and writers, but at their assumptions and conclusions on an issue that everybody agrees, is of great national and international importance.

Please realise that these alarmist pronouncements are having the very opposite effect to that intended. The recent widespread rains have completely undermined their basic theory that global warming will result in a 'warmer and drier' climate over most of the African subcontinent, especially now when the countryside over most of southern Africa is 'wetter and greener' than at any time in human memory. No thinking person can possibly agree with the unfounded statements and predictions by the climate alarmists described below. The most important question that readers should ask themselves when reading this chapter is 'where is the evidence?'

4. Background

The following are extracts from the editorial of the SA Journal of Science March/April 2001.

The evidence for global environmental change, which grows weightier and more convincing with each new generation of experimental results, has been

apparent for nearly two centuries. Even the concept of the atmospheric greenhouse effect is not new...and the Swedish scientist Arrhenius concluded that the amount of carbon dioxide in the atmosphere had a direct effect on global temperature as long ago as the 1890s. What is new however, is that studies of global environmental change have come to occupy a central place in modern science, and the recognition that humans are to blame for global warming.

Why the expression 'humans are to blame'? This demonstrates the totally biased views of the environmentalists. What do they suggest? Should we all revert to the situation that existed before the industrial revolution improved the quality of human life? There are no religious faiths that proclaim that human beings do not have the right to exist and multiply. We as human beings are fully entitled to exploit the natural resources of this earth. Most governments have legislation in place to prevent over-exploitation.

In the case of southern Africa, it is argued that regional change is mainly the consequence of natural driving forces of global change, modulated substantially by anthropogenic influences.

If science is to make its unique contribution to policy decisions concerning economic and social development, it must be reliable, well argued and understandable. This is especially the case with global environmental change. The stakes are high. In January this year, the UN's Intergovernmental Panel on Climate change declared human activities to be responsible for most of the global warming of the past few decades. That should be enough for the politicians to heed what the scientists say, and for the scientists to ensure that they are heard.

My problems with the editor when I attempted to ensure that my views were heard are described in an earlier chapter. So much for the editor's lofty words. There are many 'scientific' journals that share this philosophy. As I demonstrate in this report, there is a very real possibility that science and scientists will be discredited when their alarmist predictions are demonstrated to be grossly exaggerated and have little scientific merit.

Now we can return to reality.

4.1. Press release

On 5 May 2005 the Office of the South African Minister of Environmental Affairs and Tourism (DEAT) issued a press release titled *South Africa braces for impacts of climate change: major conference to be held in October*. Many local newspapers and magazines carried excerpts from the release in articles on climate change. The emphases are mine.

It contained a statement that:

The simple truth however is that the climate is everyone's concern, as over the next 50 years it may well define the worst social, economic and environmental challenges ever faced.

It went on to say that:

Climate change could lead to provinces such Mapumalanga, Limpopo, the North-West, KwaZulu Natal and even Gauteng becoming malaria zones by 2050. In less than 100 years, the research indicates that thousands of plant species may well be extinct starting with a massive reduction in the distribution of fynbos and succulent Karoo biomes. With clean water resources becoming increasingly scarce, small-scale agriculture as likely to be hard hit with less rainfall in certain regions and too much in others. In short, climate change will intensify the worst effects of poverty through losses

in biodiversity, agriculture, health and almost every sector of society. The government climate change response strategy kicks off with a series of events in October, including a conference of African scientists with a national conference on climate change.

Other postulated threats were rising sea levels and expanding deserts. No solutions were offered. If this view is sound, then South Africa is on the brink of an environmental and economic disaster. **I can hardly think of a more alarmist statement of national policy.**

4.2. What is climate?

Strangely, there is no clarity on the definition of 'climate' itself. Nor does the principal climate change literature attempt to distinguish between causes and consequences. For example, the authoritative IPCC's *Summary for Policymakers* (2001) makes no attempt to define climate.

Similarly, the authoritative book by Houghton, who was closely involved with the IPCC, *Global warming. The complete briefing* (2004, p2) defines climate as '*The climate of a region is its average weather over a period that may be a few months, a season or a few years. Variations in climate are very familiar to us.*' This is not very helpful.

Why do climate change scientists find it so difficult to introduce their readers to the simple cause-effect relationship that should be the core of their studies, and more importantly in their public pronouncements? The sequence is as follows. Increasing industrialisation and the use of fossil fuel driven transport, results in increasing discharges of undesirable gasses (principally carbon dioxide) into the atmosphere. This creates a greenhouse effect. The suppression of outgoing radiation results in a warming of the global atmosphere. This warming is evident in the observed melting of polar ice sheets and continental glaciers. It is this warming not the greenhouse gas emissions (GGEs) themselves that is the cause of other consequences. This is the primary process. So far so good.

All too often, climate change scientists then continue by maintaining that the observable increase in temperature is 'proof' of the undesirable consequences. This is not so. These linkages at tertiary level have to be established. I have found no observational support for these linkages in South Africa.

Another concern is the gap between conclusions reached in peer-reviewed papers in narrow fields of interest, and the selective and exaggerated general conclusions that are quoted in media releases. It is the public via the political decision makers who have the final say. But the public do not read the professional journals and have to rely on the media for this information. This situation is wide open for manipulation by uncaring scientists and politicians alike.

5. Climate change – the evidence

5.1. Global warming has increased temperature

In their paper *Temperature trends in South Africa: 1960-2003* Kruger and Shongwe (2004) reported that 23 of the 26 climate stations analysed showed positive temperature trends. Two warm phases were identified: the first was from the mid-1930s to the late 1940s, and the second was from the early 1980s to the end of the period of study. The trends in the annual mean temperature were at the lower end of the range 0,1 to 0,3 °C per decade. This is hardly more than the difference between the

temperature at the top of the hill behind me and the bottom of the valley in front of me.

They also found that the trends had not themselves increased during the past decade. This is notwithstanding the IPCC (2001) statement that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record. Nevertheless, the increase in South African temperatures correlates well with the global trend.

5.2. Global warming has increased evaporation

Solar radiation is converted to heat energy when it strikes a heat-absorbent surface such as water, soil and vegetation. If water is present, its temperature will increase and some of the additional heat energy will be converted to latent heat of evaporation as water is lost to the immediate atmosphere. [See the energy cycle diagram in a previous chapter.]

Incoming solar radiation drives the system. Its effects can be reduced by cloud cover, but never increased. Evaporative loss is also dependent on the movement of warm, dry air across the water surface. This also has an upper limit. Taken together, there is a maximum, upper limit to evaporation losses from open water, soil and vegetation. This maximum is approached in hot, dry, cloudless conditions.

My studies of 1176 years of data from 20 representative observation stations showed that there was an increase at 14 stations, no change at two stations, and a decrease at four stations.

In a paper discussed later in this chapter, it is stated that GCM outputs predict a quadrupling of the evaporation over a large, semiarid region of the African subcontinent. Quadrupling of evaporation losses in a semiarid region is physically impossible and casts serious doubts on the reliability of the GCMs and the knowledge of those who accepted the results.

5.3. Global warming has increased rainfall

Rainfall over the southern parts of the region (*southern Africa*), as a whole has shown no large systematic linear trends during the twentieth century. (*Tyson and Gatebe 2001.*)

We note that the assertions made (*by Prof. Alexander*) are, perhaps, not surprising given the approach used to analyse the data. For example, to analyse mean annual rainfall (MAP) over South Africa is to ignore the fact that the region is subject to strong climatic gradients, responding to widely differing atmospheric processes on different sub-annual time scales and compounded by highly variable landscape.

(*From a letter with ten signatories to the editor of Water Wheel of May/June 2004 in response to my earlier viewpoint article **Climate change: there is no need for concern.***)

I was the first person to report a sustained increase in the rainfall over South Africa based on a study of 7141 years of district rainfall data. This contradicts the statement by Tyson and Gatebe that there has been no change. Why was my observation of an increase challenged by the spurious arguments in the letter to the editor of Water Wheel? Surely this is good news. This denial of the beneficial consequences of global warming has become a trademark of climate change protagonists.

In 1948, forty years before the establishment of the IPCC, the Department of Irrigation published a 160-page memoir by the civil engineer D.F. Kokot titled *An investigation into evidence bearing on recent climatic changes over southern*

Africa. It contained 418 references, including reports by early travellers and missionaries. He found no evidence of a general decrease in rainfall or river flow despite increases in CO₂ emissions. **He concluded that there was no evidence of a linkage between CO₂ emissions and rainfall over South Africa.**

The report of the Desert Encroachment Committee appointed by the Minister of Agriculture was published in 1951. [Note that this investigation was undertaken in a drought period preceding the 1954 reversal.] This was a thorough multidisciplinary report by a team of South Africa's leading scientists. **They concluded that there was no evidence of a general decrease in the rainfall in South Africa that could be attributed to climate change.**

In 1993 the University of Pretoria hosted a discussion group organised by the Department of Water Affairs and Forestry (DWAF) on the possible effect of climate change on water resources. Differences of opinion were expressed, but **one of the conclusions was that climate change was likely to increase rainfall, not decrease it.** This conclusion was eight years before the IPCC (2001) policy statement.

The results of my recent investigations show that there has been a sustained increase in the mean annual rainfall over South Africa from 497 mm to 543 mm during the 78-year period of continuous district rainfall records. This agrees very well with the IPCC figure of a worldwide increase of between 0,5 to 1% per decade during the 20th century. My observation is reinforced by the concurrent increase in open water surface evaporation, which increases atmospheric water content. This leads to the conclusion that any additional global warming will further increase the annual rainfall over South Africa, not decrease it. This is in accordance with current international observations and opinions. This fact negates climate change scenarios that postulate a general decrease in rainfall over most of southern Africa and the countries to the north.

Over almost the whole of South Africa the annual rainfall consists of a mixture of discrete high and low rainfall events. But it is the high rainfall events that saturate the soils, sustain natural vegetation, provide moisture for agricultural crops and generate river flow. The low rainfall events make a minimal contribution to these processes. An increase in rainfall variability will result in an increase in rainfall from high rainfall events **and will therefore be beneficial.**

The claims that the seasonal and daily properties of rainfall may have been adversely affected by climate change despite the general increase in rainfall are illogical. This is firstly because the increase is the consequence of the increase in the frequency of beneficial, widespread, heavy rainfall events, and secondly because the ability to detect change decreases rapidly with decrease in time and space scales.

Elementary physics

Then there is the matter of elementary physics and logical deduction. Surely, everybody knows that an increase in global temperature must result in an increase in evaporation from the oceans, lakes, dams, rivers, vegetation and the soil. It is equally obvious that all this excess moisture must return to earth in the form of increased rainfall. **There is no theoretical or observational justification for the assumption that global warming will decrease South African rainfall.** The global climate models are fundamentally in error.

6. The environmental consequences

The extracts quoted in the beginning of the sections below are mostly from the DEAT press release quoted above. This is necessary to avoid the response that I have misquoted or misunderstood them.

I start this section with the much-publicised claims of dramatic consequences of global warming on the natural environment in the south-western Cape and all human activities that could possibly be affected by it. The imaginations of the writers have no bounds.

Thereafter I continue with responses to the various components of the DEAT's alarmist press release.

6.1. Changes in rainfall in the southern and western Cape

How important is the omission of references to increases in rainfall in the South African climate change literature? Fig. 2 is an analysis of the annual rainfall for District 5 in the centre of the south-western Cape region. (See Fig. 3 below.)

A very clear increase in rainfall is evident in both the histogram and the cusp shape of the accumulated departure plot. There is also a statistically significant 20-year periodicity. There is an indication of an accelerated increase after 1972. None of this very important climatological information was provided in the studies discussed below.

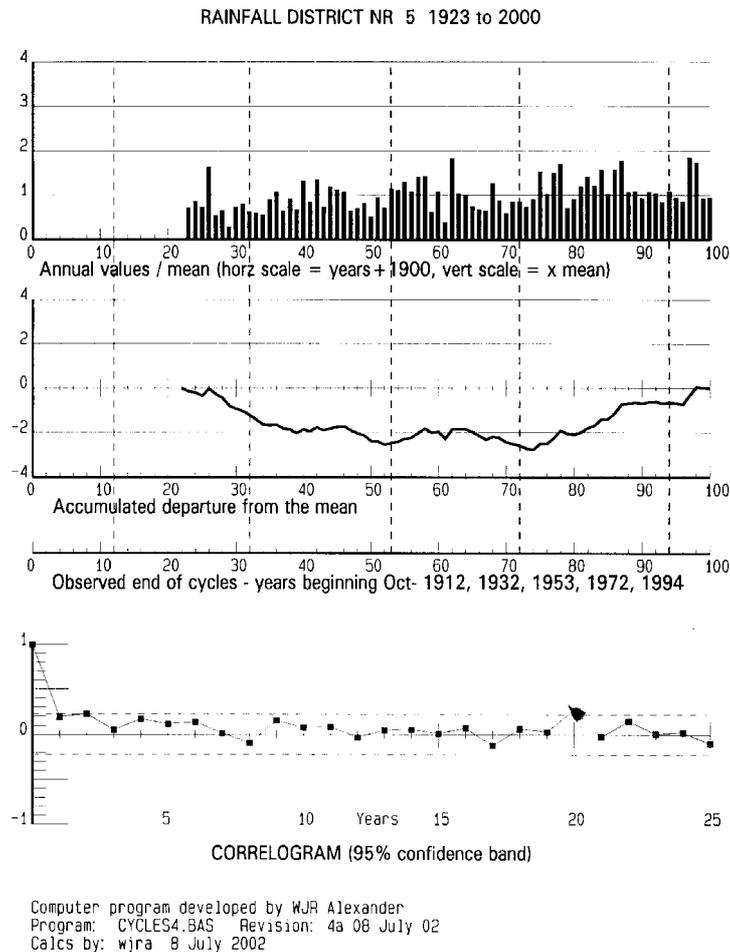


Figure 2. Annual rainfall for District 5 in the Western Cape from 1923 to 2000.

During January 2005 the SAWS kindly provided me with the recently revised district rainfall data for the period 1940 to 2004. This is shorter than the previous record from 1923 to 2000. Other than Districts 14 (no data for the 1950s) and 58 (Lesotho) the analyses are complete.

I carried out a few calculations using the data supplied by the SAWS. It only took about four hours. I analysed the data for districts 1 to 20 in the western and southern Cape, which include the fynbos and the succulent Karoo regions. (See Fig. 3 below.) I divided the data for each district into three equal 21-year periods. These were from 1940 to 1960, 1961 to 1981, and 1982 to 2002 (inclusive). The use of 21-year periods neutralises the effect of the statistically significant 21-year periodicity in the data, which in turn is directly related to corresponding changes in solar activity.

Two years 2003 and 2004 were omitted in the first round of analyses. I then selected the lowest of these two remaining years and compared them with the ranked data. For example, the rainfall in District 1 for 2003 was the 5th lowest during the 65 years of record. The results are shown in Table 13. The rainfalls are in millimetres.

Fig. 3 below shows the location of the South African rainfall districts. Fig. 4 shows the percentage increases in rainfall in the 20 districts within the south-western Cape. Table 1 shows the progressive increase in rainfall during the period of record. **This information completely negates the view that future conditions in the southern and western Cape will be drier than at present.**

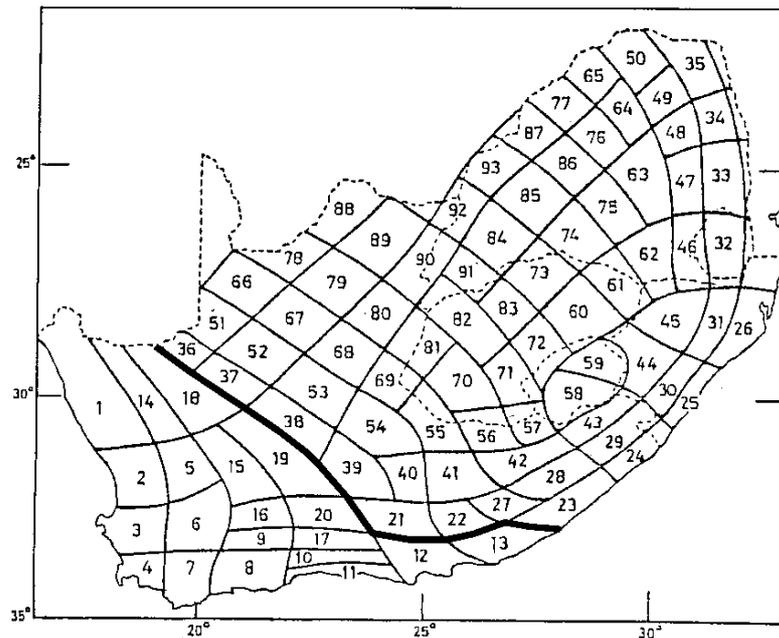


Figure 3. Rainfall districts in the western and southern Cape.

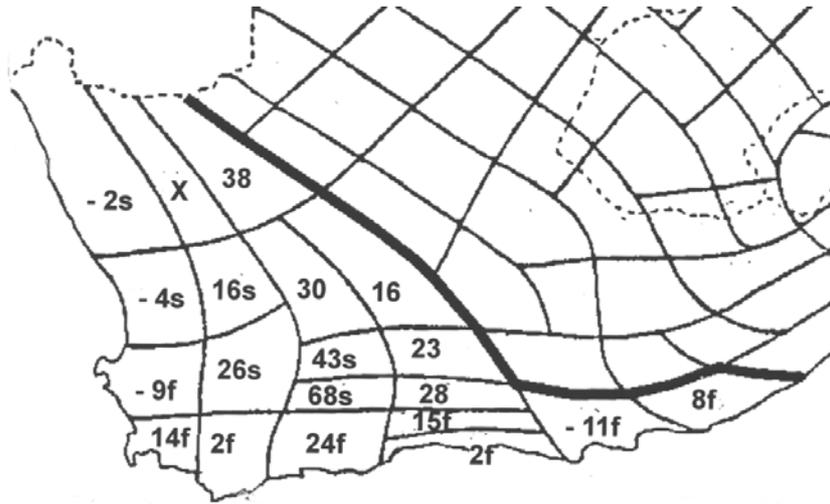


Figure 4. Percentage increase in district rainfall in the SW Cape, 1950-1992. (Negative values indicate decreases.)

The letters 's' and 'f' indicate districts where succulent Karoo and fynbos biomes occur in Fig. 4 and Table 1. Note the substantial percentage increases in the annual rainfall in all but four districts in Fig. 4 and Table 1.

Note the wide range of rainfall conditions where these species thrive. Authors of the alarmist reports failed to provide this information or the equivalent annual temperatures.

Table 1. Mean annual district rainfalls (mm) in the western and southern Cape					
District	1940-1960	1961-1981	1982-2002	% change 1950-1992	Rank of 2003/04
1 S	157	143	154	- 2	5
2 S	268	224	256	- 4	8
3 F	546	468	497	- 9	5
4 F	909	922	1038	14	4
5 S	208	219	241	16	5
6 S	248	262	312	26	10
7 F	396	381	402	2	17
8 F	398	451	495	24	56
9 S	164	244	275	68	28
10 F	254	293	293	15	33
11 F	748	723	761	2	44
12 F	536	606	478	- 11	10
13	592	671	640	8	12
14	X	726	794	X	X
15	143	187	186	30	9
16 S	143	178	205	43	37

17	180	210	230	28	7
18	96	130	132	38	3
19	175	228	203	16	6
20	185	213	227	23	18
Avr	334	374	391	17.1%	16

Interpretation of the facts

The midpoints of the 21-year sequences are 1950, 1971 and 1992. The details in the table demonstrate the following:

- There was a 17% (57 mm) increase in regional rainfall during the 42-year period 1950 to 1992, and a greater increase during the whole period of record.
- Only four districts showed a decrease in rainfall during the period of record.
- The other 15 districts with complete records all showed increases within the range of +2% to +68%.
- The regional rainfall showed a consistent increase from the first to the second to the third periods.
- In not a single district was either the 2003 or 2004 rainfall the driest on record. For the region as a whole, the average of the worst of these two years was only the 16th lowest on record.

This very simple analysis showed that except for the three districts (1, 2 and 3) along the west coast, and the single district (12) on the south coast, all other districts in the western and southern Cape, including those in which the fynbos and large areas of the succulent Karoo are located, exhibited consistent increases in rainfall during the period of record.

The SAWS weather station at Cape Agulhas at the southernmost tip of the African continent also recorded an increase in temperature during this period. Furthermore, it is reasonable to assume that CO₂ has also increased. If all three of these principal elements that affect plant growth have increased for the past 65 years, what is the basis for the NBI authors' alarmist predictions? Furthermore, if the rainfall analysis shows that there has been a sustained increase in rainfall during the past 65 years, and that this increase will continue as long as global warming continues, what weight should be placed on the allegation that:

In less than 100 years, the research indicates that thousands of plant species may well be extinct starting with a massive reduction in the distribution of fynbos and succulent Karoo biomes. (DEAT 5 May 2005.)

The information above clearly illustrates that these alarmist predictions have no substance.

Finally, why did these scientists not carry out the simple analyses described here using the district rainfall data that has been available since the 1970s? The analyses would have taken less than a day to perform, and do not require any mathematical expertise other than simple arithmetic. **This would have demonstrated the unreliability of global climate models and consequent invalid conclusions in their papers.**

6.2. Climate change in the Western Cape

With the above in mind, consider the detailed, 155-page report *A status quo, vulnerability and adaptation assessment of the physical and socio-economic effects*

of climate change in the Western Cape prepared by 15 authors from seven institutions in June 2005, (Midgley et al 2005). Under normal circumstances this report should carry heavy weight. Unfortunately a single fundamental issue on which the report is based is demonstrably false and completely undermines the scientific integrity of the report and all the conclusions drawn from it.

The very foundation of the report is that global warming will result in a reduction in rainfall over the entire region. This assumption is based entirely on global climate model outputs, whereas a simple analysis of the long rainfall records of the many rainfall stations in the region shows that there was a general increase in rainfall during the past century. It follows that rainfall will continue to increase as long as global temperatures continue to rise.

The following are brief extracts from the introductory section of the report. The emphases are mine. **References to a drier future climate are patently false, as future climate in this region will be wetter, not drier.**

In this study we have carried out a broad reassessment of the vulnerability of the Western Cape to climate change impacts using a wider range of climate scenarios from more sophisticated climate models ...

The future climate of the Western Cape is likely to be one that is warmer and drier than at present according to a number of current model predictions.

A future that is warmer and possibly drier, will encompass a range of consequences that will affect the economy, the livelihoods of the people and the ecological integrity of the Western Cape region.

Projections for the Western Cape are for a drying trend from west to east... **[My analyses demonstrate the opposite. See Fig. 4 above.]**

In a warmer and drier future, the competition for fresh water will increase steeply.

The vulnerability of estuaries to warming and drying is particularly acute ...

The impact of climate change manifested by a warmer and drier climate is likely to be a progressive impoverishment in species richness ...

A drier environment would restrict the spread of alien invasive species ...

The combination of increasing water scarcity, and rising temperatures will also regularly affect sectors of the economy that are particularly dependent on ecosystem goods and services, for example agriculture, forestry and fishing.

All that the authors should have done was to spend an afternoon plotting the rainfall data on graph paper and they would have noticed the very clear **increase** in rainfall in the region. Claims of future water scarcity as a result of global warming have no foundation.

Economic sectors such as insurance, banks (through the underlying secured assets), transport and communication infrastructure and construction may all be affected to some degree by climate change.

Regrettably, this all-inclusive statement illustrates a complete ignorance of how modern society functions.

Climate variability has been linked to variation in solar activity, i.e. the sunspot cycle, (Houghton et al (2001). However, recent analyses by Foukal et al (2005) have called this hypothesis into question, citing the small variation of solar output (0.8%) that can be attributed to the sunspot cycle and the relatively poor ability of instruments to measure accurately these variations.

In 1889, more than 100 years ago, the Knysna forester D.E. Hutchins reported as follows in his book *Cycles of drought and good seasons in South Africa*.

This confirmation comes from the Cape Town Observatory. The returns for thirty years from the Cape Town Observatory show a close correspondence between sun-spots and temperatures the maximum of temperature lagging a year behind the minimum of sun-spots. (p17).

At Cape Town, the correspondence between the mean rainfall and mean sunspot frequency has long been an established fact. (p25).

For these reasons we ought to consider the Cape Town Observatory rainfall figures as of great importance to ourselves, an importance enhanced by the fact that they go back to the year 1842. For the three cycles comprised in the period 1842 to 1875 the mean annual rainfall at the Royal Observatory, Cape Town, was: –

During Minimum Sunspot years	21.05 inches.
“ Intermediate “	23.59 “
“ Maximum “	27.95 “

Given all this information, based on records extending back as far as 1842, why did these **fifteen** scientists choose to quote an overseas author's claim that no linkage existed when the linkage was demonstrated by a Knysna forester more than 100 years ago? All that was needed was for one of these authors to study the rainfall and temperature records and possible linkages with sunspot activity. Instead they chose to rely on an overseas author who was obviously ignorant of the well-documented, synchronous linkages that have been reported in South Africa and internationally for more than a century.

Refer also to my earlier chapter on climate and solar activity.

It would be a tragedy if the 149-page report: *A status quo, vulnerability and adaptation assessment of the physical and socio-economic effects of climate change in the Western Cape* is accepted without question by the national and provincial authorities. There is a very real possibility of a backlash once it becomes obvious that the basis of the report and the proposed costly and intrusive recommendations have no foundation in science or reality, and are unsupported by large sections of the scientific community.

The organisations listed in the above publication should also take note of the damage that this publication and exclusion policy will do to their scientific integrity. They are: South African National Biodiversity Institute; CSIR Environmentek, Stellenbosch and Pretoria; Climate Systems Analysis Group, Department of Environment and Geographical Sciences, University of Cape Town; de Wit Sustainable Options CC (Pty) (Ltd); and Energy Research Centre, University of Cape Town.

The following sections continue with the broader South African situation.

6.3. Global warming will not result in desertification

The drier parts could even resemble the Sahara, and South Africa could end up looking like Mauretania, Mali and Chad, where desertification is so serious, the camel is the most reliable form of transport. (*Introduction to Futures of the Karoo conference 1978.*)

In 1925 the Department of Agriculture published a detailed report *The great drought problem of South Africa*. The report was presented by a five-person commission of

enquiry appointed by the government in 1920. Details are provided in a previous chapter.

The following quote from the study is repeated here.

...the Commission states that two points seem firmly established: firstly that a large portion of South Africa was dry long before (*settlers from Europe*) arrived, as evidenced by the name "Karoo" and by the highly specialised drought-resisting flora of that region; and secondly, that since then enormous tracts of the country have been entirely or partly denuded of their original vegetation...(*as a result of poor farming practices.*)

The simple unadorned truth is sufficiently terrifying without the assistance of rhetoric. The logical outcome of all is 'The Great South African Desert' uninhabitable by man.

This is the first reference to the desertification of the sub-continent – a recurring theme that continues to the present day.

In 1953 J. Acocks produced his Veld Types map of South Africa and the phrase of the 'marching desert' became popular. The government introduced several measures such as stock reduction schemes, while farmers introduced rotational grazing procedures. The situation is now under control.

In the 1970s, despite all the scientific evidence to the contrary, the World Meteorological Organisation predicted that the rainfall over large areas of South Africa would decrease **as a result of global cooling**, and desert conditions would prevail.

A conference on *The future of the Karoo* was held in Graaff-Reinet in November 1978. I was one of seven invited speakers. The title of my presentation was *Man, water and the soil*, (Alexander 1978a). The reason for the conference was the alarm caused by the report by the World Meteorological Organisation.

According to the World Meteorological Organisation, our beautiful land is turning into a desert. They say the Karoo is expanding at such an alarming rate that by 2050, it could reach Mafeking and Vereeniging in the north, East London in the east and Barkly West in the west.

The drier parts could even resemble the Sahara, and South Africa could end up like Mauretania, Mali and Chad, where desertification is so serious, the camel is the most reliable form of transport, and the remaining arable lands cannot support the population, so hundreds of thousands die of starvation and disease.

I informed the conference that the fears were groundless. The only camels in South Africa are in the zoos.

6.4. Global warming will not remobilise the Kalahari sands

The following is an example where the lack of elementary knowledge and unjustified reliance on global climate models, led to a completely false alarmist view. The claim was that there would be a progressive desertification of a huge area of southern Africa, including the whole of Botswana and large areas of South Africa, Namibia, Zimbabwe, Angola and Zambia, during the present century as a result of uncontained climate change. This claim was made by Thomas, Knight and Wiggs (2005) in their article in *Nature* *Remobilization of southern African desert dune systems by twenty-first century global warming*. It is very impressive on the surface with 17 figures and 29 references.

The Kalahari sands are the most extensive body of sand in the world. They stretch from Upington in the south, beyond the Caprivi and into Angola and Zaire in the

north. They include eastern Namibia, virtually the whole of Botswana and western Zimbabwe. The climate ranges from near desert conditions in the south, grasslands in the middle and dense woodlands in the high rainfall regions in the north.

My favourite travelling companion for many years was Lester King's *South African scenery. Textbook of geomorphology* (1963), and more recently A.B.A. Brink's *Engineering geology of southern Africa* (1985). Both of them deal with the Kalahari dunefields in some detail. I have travelled extensively through this area, and have many photographs showing the vegetal cover. I have also conducted an extensive study of the geomorphology and vegetal cover of the Caprivi by helicopter and by boat. This is within the region covered by the authors.

This is a quote from Brink (p175).

Of great interest because of their extremely widespread occurrence are the superficial cover sands and fossil dunes, which attest to the presence of an enormous sand sea at a late stage of the history of the Kalahari basin. Today these sands are mobile only where there are regular sources of fresh sediment, such as in proximity to the channels of major exotic rivers where disturbance has taken place. Elsewhere they are stabilised by vegetation, which in north-eastern Botswana, Angola, western Zambia and Zaire is often thick bush or even tropical forest.

The annual rainfall over north-eastern Namibia is between 500 mm and 1000 mm and increases northwards into Angola. The authors' Fig. 1 shows the rainfall to be in the range 400 to 800 mm. This can by no means be considered to be a desert! In other words, rainfall is not the limiting factor for vegetation. It is the porous soil that is unable to retain moisture. From this it follows that a reduction in rainfall will not result in a corresponding reduction in vegetation.

My major problem with the reasoning of the writers of the article, and others, is the over simplistic views that they express. Rainfall will decrease, therefore the vegetation will die, therefore the sand will be exposed, therefore the winds will blow the sand over wide areas of southern Africa. It is all the unaddressed 'therefores' that are the problem.

Here are some of the views expressed in the paper.

Empirical data and model simulations established that the interplay between dune surface erodibility (determined by vegetation cover and moisture availability) and atmospheric erosivity (determined by wind energy) is critical for dunefield dynamics. This relationship between erodibility and erosivity is susceptible to climate change impacts. They used simulations with three global climate models and a range of emission scenarios to assess the potential future activity of three Kalahari dunefields. They found that, regardless of the emission scenario used, significantly enhanced dune activity is simulated in the southern dunefield by 2039, and in the eastern and northern dunefields by 2069. By 2099 all dunefields are highly dynamic, from northern South Africa to Angola and Zambia with very serious consequences to the peoples of this vast region.

All these conclusions rested on the basic assumption that the existing vegetation would be destroyed by climate change. Without the removal of the vegetation the sand in the fossil dunes cannot be eroded and transported by wind activity. The destruction of the protective vegetation is the central issue, but was completely ignored in the paper.

To assess twenty-first century dunefield dynamics they developed a methodology for using General Climate Model (GCM) data and an indexed measure of surface erodibility and erosivity. Monthly GCM outputs were used to assess future changes in intra-annual dune activity.

Their findings showed that dunefields are likely to experience significant reactivations as a consequence of twenty-first century climate change. There were uncertainties within the modelled Kalahari scenarios but the general trend and the magnitude of the possible changes in the erodibility and erosivity of dune systems suggested that the environmental and social consequences of these changes will be drastic.

In northern and eastern areas dunes are heavily vegetated, including mixed deciduous woodland in places, owing to higher precipitation levels. How can climate change possibly reduce this to a desert? Precisely what changes in rainfall and evaporation did the authors postulate will lead to eradication of all the natural vegetation over this huge area of southern Africa and lead to the claimed 'catastrophic' results?

It is only in a single paragraph that rainfall and evaporation changes are mentioned for the first and only time in the paper although these are the key factors in the whole process. This is what it said. Note the very large differences in the outputs from the different GCMs.

The first GCM predicted the **doubling of potential evaporation** over southern Africa, [this is physically impossible] by 2100 but no mention is made of rainfall.

An older model predicted a **50% decline in summer rainfall** in the northern areas accompanied by a **quadrupling of potential evaporation**. [Both impossible.]

A newer model predicts a **50% increase in rainfall** and a **smaller increase in potential evaporation** but the potential evaporation still exceeds the rainfall.

Now at last the penny dropped. Because their assumption is so fundamentally absurd and incomprehensible I missed it all along. The writers maintained that because all models predicted an increase in potential evapotranspiration that exceeded any change in rainfall in all scenarios, this would result in the destruction of all the protective vegetation even if the rainfall increases by 50%, i.e. to more than 1000 mm per annum in the northern areas. They clearly did not understand the meaning of the word 'potential'.

If reference is made to the annual evaporation map of South Africa in a previous chapter of this report where evaporation is expressed as a multiple of the annual rainfall, it will be seen that open water surface (i.e. potential) evaporation exceeds rainfall over virtually the whole of South Africa. The authors were apparently blissfully unaware of this fact, and assumed that if potential evaporation exceeds the rainfall, no vegetation can survive. This is the foundation on which their paper is based.

I do not for one moment believe that in an area that presently receives an annual rainfall between 500 and 1000 mm; and is well vegetated; will lose all its vegetal cover; exposing the underlying readily erodible sand; which will cause the dunes to be reactivated and invade large areas of southern Africa – all because the GCMs predict an increase in potential evapotranspiration.

An alternative explanation is that the relationship between erodibility and erosivity is susceptible to climate change impacts, and that these changes will result in the remobilisation of the fossil dunefields. This cannot be so, as the dense vegetal cover will prevent any wind erosion on the required scale.

There is no believable foundation for the claim that:

...changes in the erodibility and erosivity of the dune system (*arising from climate change*) suggests that the environmental and social consequences of these changes will be drastic.

I have travelled extensively through this area and will include photographs of the vegetation in my accompanying PowerPoint presentations. No reasonable observer would agree that these extensive, well covered, Kalahari sands could by any means be converted into a treeless, sandy desert within a matter of decades.

I have dealt with this paper in some detail as it is an example of unfounded conclusions based on a lack of knowledge of the critical processes published in a widely respected journal. In the light of the seriousness of the claims, one would have expected a much more robust and watertight presentation. Claims such as these are then quoted as being reliable because they have passed through the peer-review process. They are subsequently used by organisations such as GreenPeace and the WWF to further their own agendas.

6.5. Global warming will not result in a loss of habitat and species

In less than 100 years, the research indicates that thousands of plant species may well be extinct starting with a massive reduction in the distribution of fynbos and succulent Karoo biomes. (DEAT 5 May 2005.)

As the issue relates to global warming, it is natural to consider temperature as the dominant variable of interest. This in itself is a problem because temperature is a measure, not a process. Temperature has to be associated with something. In this report it is assumed that temperature refers to air temperature close to ground level unless defined otherwise. It should also be noted that:

- The changes in temperature postulated in the IPCC documentation are very small when considered against the high, natural, hour-to-hour, day-to-day, year-to-year and multiyear variability over most of South Africa. How can changes in the **average temperature** of the order of 0,1⁰C to 0,3⁰C **per decade** possibly result in the wholesale loss of habitat and species?
- It is rainfall, not temperature that determines the habitability of our planet, including animal and plant species. Those species that thrive in hot, dry regions have adapted to the harsh and highly variable temperature and rainfall conditions.
- In the arid regions, local heat energy is primarily derived directly from solar radiation, not ambient air temperature. **Ambient air temperature acts as a coolant, not a heating mechanism.**
- The role of increase in CO₂ concentrations in the atmosphere is also of interest as CO₂ is beneficial to plant growth.

Therefore, it is essential that concurrent changes in all four driving processes, temperature, rainfall, direct solar radiation and CO₂ be included in the prediction models. This is by no means a simple exercise or experiment. The complex interrelationships between the driving variables and the responses are themselves highly variable. The authors below made no attempt to develop prediction models that incorporated these variables and processes. Their sole criterion was a postulated increase in average annual air temperature.

The second aspect that is not sufficiently accommodated in these studies is the highly variable nature of temperature on all time scales from minutes through to decades. Indigenous species have adapted to this variability, so temperature changes of the

order postulated in climate change scenarios are very small in relation to the daily ranges of temperature in vulnerable regions.

The third aspect is the stated or implied ‘delicate balance of nature’ when the very opposite is true. Nature is inherently robust, not delicate, and is never in a state of equilibrium. **The harsher the climate, the more robust the species that inhabit it.**

The fourth aspect relates to shortcomings in analytical methodology based on abstract process theory.

It needs no more than a glance at the daily weather forecast on TV to note that the predicted (IPCC 2001) increase in global temperature of between 1.4 and 5.8 °C during the next 100 years is only a fraction of the difference between the daily maximum and minimum temperatures at any specific place in South Africa. The postulated temperature increase is also of the same order as the difference in climate between Johannesburg and Pretoria North. It is very difficult to accept that this small increase in the **average annual temperature** could result in the wholesale destruction of habitat and species.

The following are comments on two papers by National Botanical Institute scientists and co-authors, in which it is concluded that global warming could endanger the survival of the Cape fynbos and succulent Karoo species. These two consequences of global warming have been used to justify the view that global warming could cause irreparable damage to these biomes and habitats, and that large public expenditures to counter global warming are thereby justified. **These issues must therefore be considered very seriously.**

6.6. Global warming will not result in a threat to fynbos biomes

There are several disturbing features in the Hannah et al (2005) paper *The view from the Cape: extinction risk, protected areas, and climate change* in which the threats to the fynbos species are described. The first is that the phrase ‘climate change’ is repeated many times and is the main theme of the paper, but nowhere is ‘climate’ defined. The only climatic property referred to is air temperature but nowhere are the changes in temperature quantified. There is no reference at all to sustained increases in rainfall described in this technical report, although its role must surely be at least equal to, if not greater than changes in air temperature. There are no maps to identify the location of the threatened areas, or maps of mean annual temperatures or rainfall. These omissions can only create doubts in the minds of concerned readers.

The second is that the projected changes are derived from down-scaled global climate model (GCM) outputs. The GCMs are not even capable of producing reliable results of the rainfall for the southern and western Cape as a whole let alone for small areas. It has been predicted that rainfall in this region will decrease whereas there were substantial increases in the past and these increases will continue as long as global temperatures keep increasing.

These omissions must raise doubts in the minds of impartial observers.

The title of the paper and references to climate change should have referred to temperature changes, not climate changes. The two are not synonymous.

6.7. Global warming will not result in a threat to Karoo biomes

Similarly, Musil et al (2005) in their paper: *Lethal effects of experimental warming approximating a future climate scenario on southern African quartz-field succulents: a pilot study*, describe a limited experiment where the air temperature in

the immediate vicinity of the plants was forced to rise by enclosing them in 18 transparent hexagonal open-top chamber arrays.

There is no reference to the effect of rainfall other than a single sentence:

Change predicted future warming and aridity trends sufficient to cause large reductions in species richness in Mediterranean climate Fynbos and Succulent Karoo biomes...(*My emphasis.*)

But rainfall has increased over most of the area and will continue to increase in future, so the reference to aridity trends is incorrect and unsubstantiated. This obviously casts doubts on the validity of the conclusions.

Nor is there any mention of the fact that these chambers prevented the movement of air in the immediate vicinity of the plants. This is essential for the transpiration and consequently the movement of fluid through the plants. The enclosure of the plants must inevitably have an adverse effect by suppressing this essential process. This was not mentioned in the paper.

The next unreported issue is that the ambient temperature in the Karoo is directly related to solar energy input and not the influx of air from elsewhere. Visualise an experiment where two spanners (say) are placed next to one another. One in the shade of a shrub and the other in the sun next to it. If the temperatures of the two spanners are measured, they will be very different from one another. This is because the temperature of the one in the shade is controlled by the ambient air temperature and the one in the sun by solar radiation.

Another personal experience is that all our houses on construction projects in the Karoo had corrugated iron roofs. The sheets would expand when the sun shone and contract when a cloud passed in front of the sun. It was quite noisy, and we used to say that the roofs were 'talking' to us. Clearly the heat from solar radiation was considerably more than the ambient air temperature. All proof that was needed was to move in and out of the shade on a sunny day.

In hot, dry, arid regions movement of the ambient air **acts as a coolant** and is unrelated to the effects of global warming. The plants in the enclosures died because they were cut off from the cooling effect of surrounding air movement, not because of the increase in temperature. What then is the effect of the postulated increase in temperature arising from global warming when most of the heat energy in arid regions is directly from solar radiation and the ambient air acts as a coolant and not a heating mechanism?

In addition to the above, it must surely be obvious to anybody who has lived in the Karoo or observed the environmental processes, that it is the temperature extremes that determine the survival of plant life, not the annual averages.

The authors stress that this was a pilot project. It was based on 18 small chambers that excluded all movement of cooling air, at a particular site, and specific plant species. **But that is not how it was interpreted by the South African authorities. This is very important as the public and the decision-making authorities, in my opinion, are being seriously misled by these grossly unscientific experiments.**

6.8. Global warming will not spread malaria

Climate change could lead to provinces such Mapumalanga, Limpopo, the North-West, KwaZulu Natal and even Gauteng becoming malaria zones by 2050. (*DEAT press release 5 May 2005.*)

It has been claimed that global warming will result in the spread of malaria to areas where it is not present in South Africa. When I was a child living outside Durban I slept under a mosquito net. I slept under a mosquito net again during WW II at Tripoli on the edge of the Sahara desert. A year later I contracted malaria south of Florence in Italy. A few months later I slept under mosquito nets again on the Adriatic coast of Italy, which experienced winter snows. There could hardly be a greater climatic contrast between the heat of the Sahara Desert and the snows of Italy.

Climate change scientists must surely be aware of the thorough study by Paul Reiter *Climate change and mosquito-borne disease* published in 2001. The twenty-page report has 189 references. He provides interesting historical information on the prevalence in northern hemisphere cold climates as well as the DDT fiasco. Malaria occurred throughout Europe during the Ice Age of the 16th and 17th centuries. I contracted it in Italy in 1944. Since then it has been eradicated from Europe.

Reiter's concluding comment was:

The natural history of mosquito-borne diseases is complex, and the interplay of climate, ecology, vector biology, and many other factors defies simplistic analysis. The recent resurgence of many of these diseases is a major cause for concern, but it is facile to attribute this resurgence to climate change. The principal determinants are politics, economics, and human activities. A creative and organised application of resources is urgently required to control these diseases regardless of future climate change.

I have also received a lot of information from professional colleagues. Returning closer to home, only 16 deaths were reported in South Africa in 1974. Thereafter DDT was banned, and twenty years later the death toll rose to thirteen thousand as a result of the banning. Another personally interesting statistic is that in KwaZulu-Natal in 1932 when I spent my nights under a mosquito net, the annual death toll was between 10 000 and 22 000. Malaria was later eradicated by the reintroduction of DDT.

I have been informed that most countries in southern Africa either already have DDT spraying programmes or are about to introduce them. Where DDT has been introduced there has been a dramatic decrease in the incidence of malaria. There is also no evidence that DDT is harmful to human beings. The Department of Health has produced figures showing the numbers of cases and deaths per annum for the Northern Province, Mpumalanga, KwaZulu-Natal and the rest of South Africa for the years 1999 to 2004. For South Africa as a whole, the total deaths were 406, 458, 119, 96, 142, 89, and 36.

In a recent press release (5 May 2005) the public were informed that global warming could lead to provinces such as Mpumalanga, Limpopo, the North West KwaZulu-Natal and even Gauteng becoming malaria zones by 2050. What then is the basis for this claim that climate change could result in a reintroduction into areas in South Africa where it was once prevalent but has since been eradicated by chemical and other control measures?

The question then arises. Did those who made this alarmist statement make any effort to study the wealth of literature on this subject, or even more importantly, discuss the issue with South African experts in this field? If not, then why not?

6.9. Global warming will not increase eutrophication

The following extracts are from a viewpoint article by Hart, Ashton and Allanson: *Is climate change really no concern. A call for a more holistic vision.* (Water Wheel May/June 2004.) I was not given the opportunity to respond at the time.

Will Alexander's viewpoint article suggests that climate change is of no environmental concern. Flying in the face of contemporary opinion is a brave call. But we believe it is erroneous. It simplifies, even trivializes, an issue that affects humanity at large, and demands debate.

As a prominent water resources engineer, Will Alexander cannot be unaware of thermal stratification events in standing waters, and the eutrophication threats to our national water resource base. Yet his conclusion disregards any consideration of the impacts of warming on these crucial issues.

Temperature plays a ubiquitous role in ecology. It is a prime determinant of habitat suitability for living organisms, and serves as the singularly most important abiotic dimension of ecological niche for virtually all living organisms.

I am familiar with the eutrophication problem in many of South Africa's dams. I was directly involved with the implementation of control measures for a number of years, including the control of aquatic weeds. I have examined more dams, lakes and rivers in southern Africa than most aquatic scientists.

As shown earlier in this chapter, the rate of increase in air temperature in South Africa was within the range of 0,1 to 0,3 °C per decade. **This is equivalent to the increase in the temperature from 9 am and 10 am on a sunny day!** Did these writers really expect Water Wheel readers to believe that this very small increase in average temperature of a water body will have the postulated serious consequences?

Did they expect readers to believe that there would be progressive increase in the eutrophication or other undesirable biological activity of a series of dams on a river with their different temperature regimes, for example from Grootdraai Dam to Vaal Dam to Bloemhof Dam on the Vaal River? Or from Midmar Dam to Albert Falls Dam to Nagle Dam to Inanda Dam on the Mgeni River? Pongolapoort Dam located in northern KwaZulu Natal lowveld is probably the warmest, large, freshwater body in South Africa. Are eutrophication and other undesirable biological processes greater in this dam than in any other dam in South Africa?

If these progressive deteriorations are indeed present, why were these not quoted as examples instead of referring readers to *'the veritable arsenal of information documenting these effects'*?

The same applies to biological activities in a river system. The water temperature will change progressively from the upper to the lower reaches of a river. Are we expected to believe that the natural biological activities change from acceptable to unacceptable along the length of the river as the temperature increases?

The implication that increases in average water temperature are undesirable, is unacceptable within the context of the very wide range of temperatures experienced in South African rivers from east to west, and from north to south, and from day to day.

The growth of undesirable aquatic weeds such as water hyacinth is largely independent of temperature. I have observed this problem in the dams and lakes from Lake Malawi in the north, Kariba Dam on the Zambezi River, through to Hartbeespoort Dam near Pretoria and the Nahoon River near East London, all of which have different temperature regimes.

I was accused of trivialising an issue that affects humanity at large, so let me provide an interesting observation. The growth of floating water hyacinths in the nutrient rich Hartbeespoort Dam had become a serious problem for recreational activities, although these plants had a beneficial effect of suppressing dangerous algal growth. Responding to public pressure, the Department of Water Affairs agreed to kill the plants by aerial spraying. Academic limnologists warned that the dead plants would sink and decay thus deoxygenate the water in the dam. They predicted that this would result in massive fish deaths. In the event, the dead plants remained floating until they were completely decayed and not a single dead fish was found.

6.10. Global warming will not increase soil erosion

It has been claimed that climate change will increase soil erosion, and maps have been produced showing that soil erosion is greatest in the high rainfall areas. My earlier studies showed that there has been a decrease of sediment transport in rivers as well as sediment deposition in dams due to active anti-soil erosion measures. A walk along the hiking trails of the high rainfall areas of the eastern escarpment from the Drakensberg in South Africa all the way through to the Rift Valley in Malawi will show crystal clear streams and no evidence of active soil erosion.

Soil erosion is a natural geomorphological process. It is the result of a sequence of processes, each of which has to be satisfied before the next occurs. The sequence starts with the degradation or removal of overlying protective vegetal cover. As global warming will result in an increase in rainfall this will increase vegetal cover, not diminish it, and consequently decrease the rate of natural soil erosion where no other factors are present. In those cases where the protective material has been removed, this will expose the underlying material. The exposed material must be erodable. If it is solid rock it will not erode. At the other extreme dispersive soils are highly erodable. Thereafter there must be a detaching and transporting medium, either flowing water or less frequently, wind.

The velocity of the water must be capable of detaching and transporting the unprotected and erodable material. This is a complex process. Steep slopes result in high water velocities and therefore high erosion potential. However, steep slopes have to consist of non-erodable material otherwise they would have been flattened by natural erosion long ago. Only when all four conditions have been met can soil erosion occur.

There is no linkage between soil erosion and climate change.

6.11. Global warming will not increase health problems

Climate change will have a major impact on our people with health problems like increased cancer rates. Waterborne diseases will increase. (*DEAT 15 December 2004.*)

The postulated changes in climate will be no more serious than moving from Johannesburg to Pretoria, or from Pietermaritzburg to Durban, or vice versa. The principal risk of incurring skin cancer is exposure to solar radiation, not an increase in temperature. The risk of contracting waterborne diseases such as cholera is associated with poor hygiene, not climate.

6.12. Global warming will not increase droughts

Changes in temperature and precipitation regimes in future, particularly in respect of extreme drought and flood conditions, will have profound effects. (Tyson and Gatebe, 2001.)

It has been postulated that global warming will result in an increase in the frequency and magnitude of droughts. The study of the concurrent properties of the annual hydrometeorological data series was the main thrust of my recent studies. Sequences of wet and dry years in both rainfall and river flow are natural phenomena that have been observed and reported since biblical times. I found no support for the view that global warming will increase the likelihood of droughts in southern Africa. Such increases that may have been observed are the result of variations in solar activity.

6.13. Global warming will not increase floods

Any temperature or rainfall record shows a large variability. The inevitable result of variability added to higher average temperatures (meaning higher evaporation) and higher average rainfall will be a greater number and greater intensity of both droughts and floods. (Houghton 2004.)

First of all, notice the concurrent increases in all three processes – temperature, evaporation and rainfall. This is in accordance with South African observations. It is in contrast with GCM predictions of a decrease in rainfall notwithstanding an increase in the other two processes.

Droughts and floods are fundamentally different hydrological phenomena and are not processes at two ends of a continuous scale. The principal concern regarding droughts is the long sequences of years of deficient rainfall whereas for floods is their short duration (measured in hours), magnitude.

Major floods in southern Africa are highly destructive, largely due to the steep slopes of the rivers and exposure to widespread, severe flood-producing rainfall events, including tropical cyclones and equally destructive cut-off low-pressure systems. Consequently research on floods has received more attention than in most other countries of the world. The floods recorded in the 1850s remain the highest on record in several rivers. In 1856 the Mgeni River overflowed its banks and flowed across the centre of Durban and into Durban harbour.

Climate change does not feature in research on floods as any change, should it be present, would be overwhelmed by the natural variability. (See Alexander 2002b *Statistical analysis of extreme floods*.) Claims have been made that the world-wide increase in the loss of life and damage by floods is the result of global warming. This is not so. They are the result of increases in the vulnerability, as population growth forces disadvantaged communities to occupy flood-prone areas. This has been my personal experience and is well supported in the literature on natural disasters. Details are provided in earlier chapters of this report.

6.14. Global warming will not threaten water resource management

As a consequence mainly of anticipated changes in precipitation, the UKTR95 scenario for 2050 shows decreases in annual runoff of the order 0-40% over much of South Africa. From a perspective of water resources management however, equally significant changes to those of mean annual runoff are increases of 10-20% in the interannual CV of runoff. These increases could add to the cost and complexity of managing water resources by requiring increased storage capacities as well as more stringent reservoir operating rules in regard to releases in dry years. (Schulze, Meigh and Horan 2001.)

The certainty of prolonged and intense water restrictions. (DEAT 15 December 2004.)

The paper by Schulze, Meigh and Horan: *Present and potential future vulnerability of eastern and southern Africa's hydrology and water resources* (2001), is an excellent example to illustrate the unanimous views of the world's leading scientists in water resource analyses with whom I have discussed the issue, that climate change scenarios are no more than untested hypotheses that have no place in water resources development and management.

In southern Africa in general, and South Africa in particular, we have a wealth of routinely observed hydrometeorological data. Many rainfall records exceed 100 years in length and many river flow records exceed 80 years in length. Yet this wealth of data is totally ignored by these authors who rely solely on the outputs of global climate models and simplistic rainfall and runoff model assumptions for their analyses.

In the abstract of their paper it is stated that:

This paper presents a synthesis of water as a vulnerable resource in space and time under present climatic conditions by assessing various rainfall, evaporation and runoff indices in the region. Further, uncertainties regarding this already high-risk natural environment are compounded by superimposing elements of potential climate change for a year 2050 scenario over the region.

The following are some of the views that are discussed in the paper that are far removed from reality.

Figure 3d in the paper shows an increase in annual potential evaporation for the 2050 scenario of **between 4% and 8%** for the whole of Botswana, Namibia and eastern Zimbabwe i.e. the area covered by the Kalahari sands. The GCMs used by Thomas et al (2005) discussed earlier in this chapter, predicted increases of **between 200% and 400%** for the same region. These order of magnitude differences in GCM outputs illustrate the fundamental shortcomings of global climate models. In both cases, it would have been a simple arithmetic exercise to determine historical trends based on real world data, and extrapolate them into the future.

The coefficient of variation (CV) is quoted several times in the paper to describe variability in the context of water resources. *'The inter-annual variability of precipitation, as measured by the coefficient of variation (CV,%) is an important consideration in water resource planning.'* This is an unacceptably simplistic characterisation of the statistical properties of rainfall and river flow. These properties are addressed in several chapters of this report and in the wealth of South African and international publications on water resource development.

In Fig. 4 (c) of their paper, they map the **drought risk index** as the ratio of the tenth percent to the fiftieth percent of the annual runoff. However, no relationship exists between drought risk and annual runoff, as the most important property of a drought is its duration.

In their Fig. 4 (d) they map a **flood severity index** as the ratio of the 50-year: 2-year, 1-day runoff. It is well known that the flood-producing runoff per unit area of a catchment decreases with increase in catchment area. The ratio between the 50-year and 2-year, 1-day unit runoff will vary along the length of a river and is not a regional characteristic. (See Alexander 2002b, *Statistical analysis of extreme floods.*)

A reduction in rainfall is predicted for the whole of South Africa by 2050. This is contrary to the IPCC (2001) scenarios as well as my observation of an increase in rainfall during at least the past 78 years. Rainfall will continue to increase as long as global warming increases, whatever the cause. This is another example of questionable GCM outputs that were not verified by comparison with real world observed data.

The resulting decrease in river flow by 2050 is equally questionable.

As a consequence mainly of anticipated changes in precipitation, the UKTR95 scenario for 2050 shows decreases in annual runoff of the order 0-40% over much of South Africa.

This is a dramatic prediction with far reaching consequences. It was followed by an equally alarming prediction.

From a perspective of water resources management however, equally significant changes to those of mean annual runoff are increases of 10-20% in the interannual CV of runoff. These increases could add to the cost and complexity of managing water resources by requiring increased storage capacities as well as more stringent reservoir operating rules in regard to releases in dry years.

Fortunately, there are no observational grounds to support these alarmist claims that are based solely on GCM predictions and questionable rainfall-runoff models.

The authors' conclusions are not surprising as they do not reference a single publication on hydrology or water resource development in South Africa, other than to publications from their own organisation. This is despite the numerous publications on this subject during the past 50 years right up to the present day. (For example Alexander 1985 *Hydrology of low latitude southern hemisphere land masses* and *Management of the water resources of the Republic of South Africa* issued by DWAF in 1986.)

No water resource practitioner would even remotely consider designing or operating water resource development projects based on GCM scenarios applied to simplistic rainfall-runoff model assumptions. This is particularly in the light of the availability of a wealth of routinely recorded data, and sound analytical methods based on advanced time series analyses, and not on primitive coefficients of variation.

6.15. Global warming will not increase poverty

In short, climate change will intensify the worst effects of poverty through losses in biodiversity, agriculture, health and almost every sector of society. (DEAT 5 May 2005.)

The inclusion of 'poverty' is a typical alarmist tactic. Poverty is unrelated to these factors. The action required to counter the unavoidable and continued increases in greenhouse gas emissions will increase poverty, not reduce it. This is dealt with in detail in the previous chapter on climate and natural disasters.

6.16. There is no evidence of adverse changes due to global warming

Evidence exists to suggest that variability and extremes in the southern parts of southern Africa may be increasing especially in the drier, western parts. Between 1931 and 1990, the intensity of extreme events has increased significantly over South Africa. (Tyson and Gatebe 2001.)

It has been stated that signs of adverse climate changes have already been observed in South Africa. I have not found any in the hydrometeorological processes other than those described in this report. Climate, as well as the natural environment that

responds to it, are in a continuous state of flux on all time and space scales. As I have described in this report, it is a major and time-consuming exercise to distinguish between natural variability and variability that is the consequence of human activities. If undesirable changes are assumed to be present, then the question remains whether or not they are of sufficient magnitude to require incorporation in practical applications where most other components have uncertainties of the same order.

7. The agricultural consequences

7.1. Global warming will not adversely affect agriculture

Maize, wheat, sugar and cotton lands will shift and change, our famous southern Cape vineyards are likely to shrink, fungal rusts, weevils and worms, along with parasite-vectoring mosquitoes are likely to change or otherwise change their distribution ranges – either in space and/or in time. (*Hart, Ashton and Allanson 2004*)

Regrettably, the Minister was poorly advised by the climate alarmists, as each and every one of the above predictions is false. For example, the claim that the Cape vineyards will shrink in size has very serious economic and social implications. The public and scientists in other disciplines have every right to request details of the basis for these serious claims as well as both the climate and the environmental models used to determine these changes, so that they can be independently evaluated. I have tried to obtain this information but have not been successful.

An essential requirement of all scientific research is that the methodology must be transparent and reproducible by others. A second, and equally essential requirement is that the computer programs must be calibrated using real world data and must be capable of replicating historical sequences. This information has also been withheld from the public.

The reasons are obvious. The allegations are false.

7.2. Global warming will not result in a drop in food production

There will be a drop in food production including an estimated drop of 20% in grain production. (*DEAT 15 December 2004.*)

The 2004/05 maize harvest was the biggest since 1994 and there was a surplus of 4 million tonnes. Maize farmers are now seriously considering using maize surpluses for the production of ethanol for use as a fuel.

The two most important climate-related factors that influence agricultural productivity are temperature and rainfall. The predicted temperature increases arising from global warming are of the order of 1⁰C per decade. This is of the same order of magnitude as the natural increases between 9 am and 10 am on a sunny day. Their influence on agriculture, if any, will be undetectable against the natural daily changes.

7.3. Global warming and the lack of evidence

My fundamental objection is that the climate alarmists have not yet produced an ounce of verifiable, statistically significant evidence that proves that the adverse effects of climate change i.e. reduction in rainfall or river flow or increase in floods and droughts, are already taking place. This is despite the steady increase of greenhouse gas emissions during the past 100 years.

7.4. Global warming and failed prediction models

The predictions that rainfall will decrease in future are based on unreliable global climate models that failed to predict the droughts from 2002 to 2005, or the floods of early 2006. How then can any reliance be placed on their predictions of ‘a warmer and drier’ future when almost the whole of southern Africa is wetter and greener than at any time in memory?

Climate change alarmists do not even acknowledge the existence of the alternating sequences of wet and dry years that have been known since biblical times, and are well-reported in the hydrological literature. What reliance can be placed on their dire predictions of future decreases in rainfall?

7.5. Global warming alarmism is irresponsible

Climate alarmism will result in an increase in despondency among South Africa’s farming community. Land values will drop in areas where the alarmists have predicted adverse climate changes. Farmers may unnecessarily change their farming practices to less lucrative crops. This alarmism is highly irresponsible.

South African farmers are well aware of the increasing agricultural competition internationally, and the extent that some countries will go to in order to protect their own agricultural industries. Environmental organisations such as Greenpeace and the WWF are already exerting pressure on South African government agencies to take action to limit the use of coal for power generation. This will result in consequent ripple effect on South African agriculture, industry and the national economy.

Should the South African government refuse to comply with the demands by these crackpot organisations, we can be very sure that they will quote the doom-and-gloom prophecies of South African climate alarmists, in order to persuade other countries to ban agricultural imports on the grounds that South Africa is polluting the global atmosphere.

These alarmists and their followers are more interested in research money in their pockets than any loyalty to South Africa. **It is time that they are called to account by an independent commission of enquiry before they cause any more damage by their false, unscientific and unprofessional alarmism.**

Scientists and scientific institutions that spread these alarmist views that have no foundation in fact, bear a heavy responsibility to the South African public who put their trust in them and finance their research. Conscientious scientists have an equal responsibility to expose these machinations for what they are.

I can assure readers of this technical report that the vast majority of engineers and scientists in all disciplines, including agriculture, totally disagree with the views and tactics of these extremists.

Finally, farmers would be ill advised to take any of the dire predictions made by climate change scientists into account when planning or operating their farming activities.

8. The remedies?

Major parts of the climate system respond slowly to changes in greenhouse gas concentrations. Even if greenhouse gas emissions were stabilised instantly at today’s levels, the climate would still continue to change as it adapts to the increased emission of recent decades. Further changes in

climate are therefore unavoidable. Nations must prepare for them. (*My emphasis.*)

(From the joint statement issued by eleven national academies of science: *Global response to climate change*. June 2005.)

South Africa's report *A national climate change response strategy for South Africa* was submitted to the UN Conference of the Parties who signed the Kyoto protocol at Buenos Aires in December 2004. The following comments are on postulated actions required to reduce the impact of global warming that were proposed in the report. **Regrettably they also reflect a lack of knowledge on these issues.**

8.1. Replacement of coal-fired power stations

The writers of the report were critical of the use of lower grade coal for power generation in South Africa.

The use of lower grade coal was criticised because of postulated greater emissions of dangerous greenhouse gasses. Visualise the following laboratory experiment. Burn a measured amount of pure carbon in a flask. The two products will be heat energy and CO₂. Now add some sand to the same amount of carbon and repeat the experiment. Exactly the same amount of CO₂ and heat energy will be produced. The inert sand will be a by-product. There will not be any increase at all in CO₂. Technology exists to trap any other noxious gasses that may be produced.

To suggest that South Africa should cease using lower grade coal because this contributes to global warming, demonstrates the researchers' lack of understanding, irresponsibility, and careless disregard of the consequences to South Africa's economy. The costs involved in converting to other sources of energy, which will also be more expensive to electricity consumers, can be far better used to fight poverty, malnutrition and disease.

8.2. Better water resource management

This statement is offensive coming from those who have little experience in this subject. Refer to the comprehensive and well-illustrated book *Management of the water resources of the Republic of South Africa*, published by the Department of Water Affairs in 1986 and previous chapters of this report.

8.3. Disaster management

There is no evidence to support the view that climate change will increase the frequency and magnitude of natural disasters. It is the vulnerability to these disasters that is increasing, not the magnitudes of the events themselves. I discuss this in detail in my report commissioned by the United Nations IDNDR secretariat titled *Risk and society - an African perspective*, (Alexander 1999), and in the previous chapter of this report.

8.4. Agricultural diversification

It is stated that South Africa is particularly vulnerable to climate change because a large portion of the country's agricultural production consists of maize farming. The document proposes that South African maize farmers should consider changing to other crops as long duration droughts will occur during the next three decades which will make maize farming unprofitable.

Let us have a closer look at this comedy of errors.

The statement that South African maize farmers should consider changing to other crops, as long duration droughts will occur during the next three decades, which will make maize farming unprofitable, is both false and irresponsible. Imagine the following scenario. As a result of the report farmers switch to sunflower seed production, which is more drought resistant. Maize, which is the staple food for tens of millions of people, has to be imported from overseas at a higher cost. Current sunflower seed producers face financial ruin as a result of the over-production of this commodity.

All of this is a consequence of the unfounded imagination of a few irresponsible scientists who flatly refuse to provide the basis for these alarmist views, so that they can be tested by others and exposed for what they are.

8.5. More energy efficient transport

Reduction in fuel consumption has long been a target of vehicle manufacturers. This will increase the cost of transport, particularly to the poorer communities who live far from their places of employment.

8.6. More energy efficient housing models

This is an absurd suggestion for South African conditions.

8.7. Technology transfer

The transfer of technology and skills from the developed to the developing nations was recommended. I have been closely involved in technology transfer for most of my career. There have been many well-meaning but misguided recommendations based on the transfer of mild climate technology to arid climate conditions. This technical report is a good example of material that is new to science that comes from a developing nation. South African scientists in this field have made the mistake of blindly following northern hemisphere science and assuming that it is relevant to South African conditions without carrying out their own evaluations.

9. Proof of the pudding

As I write these notes the rivers are running, dams are filling and the countryside is wetter and greener than it has been for decades. (See Fig.1 on p2 above.) These widespread sub-continental rains, that are the third highest on record in some regions, were not predicted by the South African Weather Service or other climatologists. This extraordinary event completely negates the unfounded and pessimistic views of the climate change lobbyists who predicted that future climate would be 'warmer and drier' than at present.

Nevertheless, droughts follow floods as night follows day – a fact that has been known since biblical times. South Africa will indeed face a crisis in the years ahead as we exhaust our water resources. Conflicts between the need for water to sustain the quality of human life and to sustain the environment will pose serious challenges. Solutions will have to be sought.

The policy followed by the Department of Environment Affairs and Tourism and the climate change alarmists, of excluding all those who hold different views on the subject, is not the way to go. South Africa will suffer very serious consequences if a large sector of the scientific community is deliberately barred from participation in this issue, and not given the opportunity to express their

views. Whether these views are correct or not should be the subject of a healthy scientific debate, or better still, the whole issue should be the subject of an independent, multidisciplinary commission of enquiry.

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