From: Robert Vincin

Subject: Darling River Water submission

Senator the Hon Simon John Birmingham,
Parliamentary Secretary to the Minister for the Environment

Dear Senator Birmingham

As discussed this morning with your people

Attachments cover science researched published data on Murray Darling nothing short of reparation to those conditions will see "water" flow.
The Missing sink paper tabled by Hon Robert Hill UNFCCC COP 6 saved article 3.4 for Australia to become the Worlds" CO2e sink (for serious income fees. ($160B pa)

There is a route to totally repair not only the catchment /basin but in so doing generate such income to engage the unemployed and build (rebuild) the Rural sector. I would prefer to stay in Australia to lower Global CO_2e rather than return to PRC and now at the request of UN to Africa. Well planned Australia could reduce its debt within 5 yrs. I wrote direct action green Corp with The PM 95 see attached e g (Adelaide Review June 95) We planned what I am now doing for PRC since 2005 and shortly with Africa for the UN ($160b-220b pa-pa)

- Scan#3 Personal letter from Hon Tony Abbott. (We go back to when I was Branch secretary to Hon John Howard 1995 advising him how to win the Greens and his environmental plan)
- NB the visual scan8 was built ~~up~~ down 5 level chasing the erosion water down the gully now called a river (There was no river system Vincin) see visual 4 for facts
- Scan 4 how the water courses were 1860
- Scan 5 the Macquarie "River" in flood sketch by Mitchell note "width"
- Scan 8 Junction Murray Darling reed junction 2 boat lengths wide I full flood. Water seldom reached captive Lake Alexandrina
- There was no River system AGSO 1995 CSIRO 99 visuals attached

Best wishes to the panel on the most scientific demands any-body will ever face to restore a sustainable future. Just covering the essential raw foundation data to draw a base understanding will be considerable. *(It took me 25years of serious spare times study to read Mitchell, Sturt, Oxley, Cunningham Brothers et al as invited special collection reader [Mitchell Library] of hand-written manuscripts to comprehend the facts prior my publications.)*

Robert Vincin

Submission by Robert Vincin.

Understanding the need by the Commonwealth to review the need for water distribution arrangements around and from the water course The Darling River review every ten years!

- Recognising the 1901 constitution covering water cannot be amended without a return by the people to the polls
- Appreciating the good will of the Minister and Secretariat in seek greater “access” to water for ACT et al
- The constitution correctly granted insoluble water-rights to in-ground and adjacent to “flow to property owners”.
- The Commonwealth and the expert panel to the Secretariat also correctly highlights the insoluable link to climate change has to the baseline assets of mankind and all living matter-**Soil-Water-Vegetation-Atmosphere** understanding all else but commodities!

Supporting the obvious need for “more” water unto landholder and towns (and City) in the greater Murray Darling catchment and, as one who (and likely only person) to have

(1) Studied the original European Explorers of the greater Darling Murray water catchment [a] hand written reports to Governors including, sketches (and photo (from 1865) [b]) your next step/s holds the future of not only this our generation but indeed, those that might follow.

(2) 1995 Invited by the then UNUSG to sit on UNCTAD UNFCCC founding panels to design the low-zero cost to lowering CO_2e build-up. We included in Kyoto protocol the essential fact that, as coal burning is de-facto volcanoes such NOX SOX emissions via the Sun’s radiation become life essential nitrogen and sulfate for all living matter to breathe and sequester & UNFCCC sinks in time the vegetation generating oxygen, again.

(3) The attached visual is atypical of access to the then flow of the watercourse see note [b] attached

(4) Believe in climate change or not, even those tied to the head of a board table need to comprehend, mass land clearing across the planet has at present irrevocably altered transpiration of (rain) water hence starvation of historical flows and sadly aquifer and ground water recharge. Added to this is mass sand migration

(5) Conversely the mass clearing of land acts as, the most significant upper atmosphere heat reflector and CO_2 and CH4 emissions (still). This preheats income Sun’s heat!

(6) As a correspondent with the appointed UN Secretary Generals (SG) and USG) for the past 30 yrs I remain privy to global issues often not published.

(7) 3.5 billion+ people live with often only 1 meal a day, with little clothing or shelter, in mostly in anthropogenic deserts. All beg for food fodder and a home.

(8) Critically for and on behalf of the “historians of tomorrow” and citizen of today you in the Expert Panel must explore and report on all aspects opportunities adding to a return to “historical nature sustainability”

Say, appreciating the above and attached represents a part of science historical environmental evidence, to start the following is a simple plan [c] This is based upon what other nations abiding by the array of UN science and fact

(A) HALF the WORLD + lives in Poverty and anthropogenic deserts. *What comes first; take more non existing flow to engineer to potable water, or, restore rainwater?*

(B) Australia likely will not “find the money” to implement any part of your panel’s findings for at least 10year. By then another panel will redo the past 3 panel’s findings.

(C) Assume for a page or so the funds are available to apply the findings of the panel![d]

The vision; ample water food fodder forestry meeting the Secretary’s The Ministers and Commonwealth set goal

- Critical is the water flow to the catchment as I detailed to Prime Minister Howard[(e)]" to rebuild water to aquifers and ground water demands an all embracing plan including return of perpetual historical rainwater from coast to catchment/s.
- To deliver water flow to catchments in general it is critical to restore transpiration from the evaporations of the sea.
- Well planned and designed incorporating the 2-4% of Earth's CO_2e sequestering vegetation[(f)] that converts such to become soil soil-carbon the placements also lowers salt and, secures essential microbes flora fauna [(g)]
- As per [(b)] attention needs to be "repaired". To "lift the mean flow level back to surface flush".
- If the same is applied across the nation including the Kosciusko Range sustainable flows of water to reservoirs can support water to Canberra.
- The flows closer to surface flush in Darling Murray catchments will recharge aquifers and ground water.
- Avoidance of "franking and like" is mandatory as ancient access to and from aquifers will transfer the chemicals and like including salt to the surface. This is critical for the Greater Liverpool Plains catchment and Namoi Catchment
- By default planning the correct vegetation planting such will be a CO_2e sink hence well planned such can be traded on the global "carbon trading" market I helped write 96-02 hence funding.
- Detailed 3D modeling papers and OHP can be tabled to show solution/s.

Best wishes to the panel on the most scientific demands any-body will ever face to restore a sustainable future. Just covering the essential raw foundation data to draw a base understanding will be considerable. *(It took me 25years of serious spare times study to read Mitchell, Sturt, Oxley, Cunningham Brothers et al as invited special collection reader [Mitchell Library] of hand-written manuscripts to comprehend the facts prior my publications.)*
Another 6 years and travelling the planet 100times to aid in writing Kyoto protocol
Robert Vincin

(a) There was no river system Vincin 1995 Murray Darling workshop Wagga Wagga 1999 Second stream management Adelaide the papers a result of 25 years of study of all (all) first European Explorers hand written reports on the interior to the Governors. It cover conclusion of the degradation of the land by fire-stick burning and its impact on soil depth and water loss and salt to surface. (aatached)
The flow seldom reached the Lake Alexandrina. The lake was not open to the sea.
(b) A photo atypical of towns along flow. While a latter-day coloured visual I have a multitude of original hand drawn visuals 1830-69. Most see the visual and way the series of 4 wharves is to allow for flood when in fact they were built progressively to chase the eroding gully down. If one does not study history and geography one is doomed to repeat it.
(c) Contrary to the views of one Government advisor on climate change these are facts; believe in climate change or not the overwhelming evidence is anthropogenic deserts reflect increased heat to the upper atmosphere and globally the mass loss of vegetation has irrevocably altered rain wind and soil microbic life. 300yrs of scrubbing vegetation especially C4 species has removed all of life supporting activities. Science not boardroom chair advisors to the PM and cabinet is urgently needed. What is needed in a plan applied in other nations reversing deserts to grow food fodder forestry flora fauna and microbes and by de-fault sequester essential CO2e.
(d) Subject to detailed master planning the planting out of the small array of CO2e sequestering vegetation meeting UNFCCC 100yr carbon storage rule then under the recently decreed UNSG and EU agreement $20,00 tonne CO_2 reparation of the river catchment is self funded.
(e) 1995 as elector branch secretary to the Hon John Howard he sought my advice on a series of matters. Doubting Liberals would get elected I advised him on a sure protocol to wind green groups. I presented me with an environment department written environment plan. I handed him a series of correction he incorporated.
(f) 2-4% of Earth's vegetation sequester CO_2e 96% of Earth's plants take biomass carbon from the soil not the atmosphere hence deserts.
(g) With the serious anthropogenic damage to the baseline assets of man and all living matter soil water vegetation atmosphere most critical planning of reparation protocol is demanded. Trees rice cotton most grain vegetables take biomass carbon from the soil. It is as though life sustaining production line is stalling

As invited foreign expert guest of PRC I lecture to Agriculture Forestry Science Law Universities advise 7 ministers and lead Farmers in reparation
During my tenure on UN assemblies I was consultant to KPMG Deutsche Bank Chairman
While-ever board room chairs advise on a millennium of science to cabinet and well meaning folk assemble to each decade to discuss declining assets recover escapes. God help the historian of tomorrow! Their future is in your hands.

Robert Vincin
Chairman Emission Trading Association Australia Ltd
Est. 1999

See Google and web
Senate Direct Action submission 3/99
See W E Australian 8/9 Feb 2014 pp22
Productivity Commission Natural disaster submission#2 May2014
ANREU Account Representative # 1312

Since 2005, Robert Vincin has been living in China as an invited foreign expert advising the Chinese government and industry in lowering mass volumes of CO2e, halting and reversing desertification, and reparation of water resources. With a background in engineering and agriculture, Robert is a globally published writer of articles on climate change, carbon emissions, sustainable development, and business economics. Far from being a greenie, Robert preaches sustainable development with an inter-mix between business economics and climate awareness. Robert was the Secretary of the electoral branch for the former Prime Minister the Hon John Howard from 1996. Helped Hon Tony Abbott publish Direct Action Green Corp 1995! He was appointed by UN USG to served on various UN bodies since 1996, including the UNCTAD, UNCCD, UNFCCC (helping set up IPCC) and has addressed many different government bodies, national and international committees, and corporations on carbon trading, emission reductions, climate change, carbon trading and environmental issues.
Previously, Robert was an advisor to KPMG and Deutsche Bank! He was also the Chairman of the Yass River Valley Green Australia Committee Program funded by Major Australian Industry. He addressed UNNY 1985 and detailed to 65 nations' delegates community based environmental reparation management. He addressed USA senate inquires 1998 on methane capture management garbage and effluent for profit and clean environment /environs. The Paper the Missing Sink (Condon Vincin) tabled at UNFCCC COP6 is credited now as the Australian clause preserving c4 vegetation as the only CO_2e sink. Since 2005, Robert as invited foreign expert guest to 7 Ministers CBEX NDRC lecturing to Science Law Forestry Agriculture Universities! He leads Farmers Herders in desert reversal growing food fodder and in time forestry in a wide array of deserts. Recently Robert toured Mongolia advising Government desert reversal and UNEP Nairobi 1st Food Security Assembly detailing growing soil in deserts.

Attached (1) There was no river system, including sketches illustrating the damage in 150 year!
(2) A photo of a wharf chasing the falling water flow
(3) The missing sink (Condon Vincin) written to save UNFCCC article 3.4 the only article to cover the critical 2-4% of vegetation that Sequesters CO2e! Tabled at COP 6 by the Hon Robert Hill! 3.4 is now known as the Australian clause!
(4) A private copy of the letter from PM Abbott
(5) Some of the ministerial appointment in PRC
(6) The recent Australian Article selected by the Australian as the best of 106 "Direct Action" "committee"
(7) Submission to the "productivity Commission
(8) The UNFCC the body meeting for 20 yrs seeking a solution to lowering CO2 sought and is seeking my input for a plan see attached

WHAT IF THERE WAS NO RIVER SYSTEM

A Millennium Project

Robert Vincin (1)

"What if there was no River System (1)" is based on 22 years of study of the first Explorers original journals and surveyors reports. Explorers Oxley, Sturt, Mitchell, Hume, Leichhardt, and botanists John and Allan Cunningham (brothers) all repeatedly reported that watercourses ceased in reed barrier ponds (billabongs). (Rare books Mitchell Library Collection FM4/3578 FM 4/3089 CY815 CY5452).

The Darling, Macquarie, Gwydir, Namoi, Lachlan, Murrumbidgee, Goulburn, Murray died in the plains (2) Watercourses were surface flush between trees and reed ponds. They reported the watercourses – "unlike any other" (River of UK Europe) "with a total absence of water worn banks". The collapsible boats taking 2 days to assemble were launched onto the pond/lake vainly seeking flow. (Mitchell Library rare books TL Mitchell DGA6, DXPD719)

The Aborigines showed how and where to dig for water 60 miles from the billabong or known watercourse. The billabongs, lakes, watercourse and soils were charged once a year from the north (monsoon) and the alps (snow) with occasional regional downpour. (See Fig. 1 & 2) (Sketches by TL Mitchell, Mitchell Library rare books CY560, DGA6, DXPD719).

Abundance of tall oatgrasses on rich soil plains were "unable to accommodate the wagon wheels or beast (oxen horses)" (Mitchell). In greater abundance was *Atriplex* (3) in such density often around salt pond and stream regions it took on occasion's days to bypass. The animals relished the *Atriplex nummularia* but were peculiarly selective in their choice of plant disregarding 10 or more before devouring one and perhaps returning again the following day to the same bush. (Mitchell Library rare books TL Mitchell three expeditions into the interior eg page 53 and 54, the first naming of salt-bush). (Also see 1998 the Producers Gazette and Settlers Record Perth V5 part 1 January 1898, NSW Royal Society Vol XIV 1880, NSW Gazette April 1900 630.5/6 Gov. Botanist). Cod and other species of fish lived in the cool reed barrier ponds and were observed moving up the catchment in times of flood.

It was disturbing to the Surveyor's Generals returning after some years to their original routes to find settlers squatters had burnt reeds for their cattle and sheep and cleared areas adjacent to watercoarses and rapid flowing "in deep trenches" cutting new courses, often miles from the original path. (See Mitchell Library rare books and original sketches John Oxley A1191 CY 815 TL Mitchell The Macquarie River 3 ft wide in thick bush DG A6 DX, PD719, DGA7, PXA3, CY1560, CY1099, 981-6A1 Maps: MT4/805, 1827 50/1, ZM2, 806 1 847/1, 98/6A1, CY695, CY419, CY811). The prior streams and billabongs were draining to the new lowered rivers.

Captain Light reported to Governor Hindmarsh after viewing the storm-tidal entrance to Lake Alexandrina and the deep trench behind the western headland (now an island) that no water flowed from the lake. (Ref. Mitchell Library rare books A381).

Captain Cadell won the S.A Governor, Sir Henry Young, prize of 20,000 pound in 1853 for reaching Albury and returning with wool and grain. He stated that with a man up the mast arriving at Swan Hill and "upon his instructions we cut a path from billabong to billabong often travelling 6 miles to achieve one mile up the direction of flow". (Ref. Mitchell Library rare books CY877 and Sydney Morning Herald various 1853 records)! This voyage was during the annual flow.

The Clearing of Watercourses and Creating Flow!

Cadell after a presentation to the NSW Government was granted 80,000 pounds to clear a "river up" the Murray. He developed a steam powered saw machine for cutting trees below the waterline. Evidence still exists (in back waters today) of his damage. He went on to clear (under contract) the Goulburn, Darling and other rivers. (Ref NSW Gazette 1856 to 1863 various)! When floods occurred new river courses were cut into the soft soil and clays miles from the prior watercourses, under cutting and dropping large stretches down several feet. He then returned to clear the river of these further obstructions.

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A TASK.
At this most important assembly you represent Australia's very best water, land, vegetation scientists and are charged with the responsibility to fix degradation. For over 150 years Premiers, Governments, Scientists have written "someone had better do something soon". (Mitchell Library rare books photo No 47684 Deniliquin 1902 showing the Mayor of Deniliquin and Councilors viewing the new deep river and loss of homes).

The World is a bank, a bank of resources! Man has, from time immemorial, withdrawn from that bank, never depositing, not even rolling over, those resources. Now, the management of those resources, Nature, is calling for the account to be addressed, failure to do so will see the receivers brought in.

For too long this nation has attended to the symptom and reacted to effects of the cause. Surveyor General John Oxley, witnessing the man made denigration, lobbied the government for years to have the watercourse and for miles either side declared "a common". (Ref. Mitchell Library rare books A1191 CY 815, CY542, CY1488).

Successive governments federal and states have extended engineering "bypass surgery" on the lifeblood arteries and flesh of the body of the nations. The same governments report that at least 20% of farms are unsustainable and should leave the land (no doubt supporting Oxley). (Ref. NSW Government publication soil conservation 1988)!

The Official Receivers
If you were the official receivers to the failed production company Australia Food bowl Inc (AFI) and today was the decision makers meeting to salvage or let it collapse, I suggest you would look at the original company books and ask; (a) if it was No 1 what went wrong? (b) What changed? (c) Can it be salvaged? (d) Where to begin? (e) What will it cost (f) should we shut it down like the manufacturing division and nett import (g) is there a potential growing world market for AFI to recapitalising back to sustainability are there any other "new products" that can be added to AFI range, (I) who are the stakeholders who want in and who will take cents in the dollar and get out?

The data process salvage or liquidate?
(a) What went wrong?

The changes that ran the AFI into unsustainability were mostly governments catering to the loudest lobby of the day as well recorded, ignoring the future results of their decisions.

(b) What changed?
The success of 1958-62 was actually a rally due principally to new chemical stimulants. Unsustainability of AFI can be traced back to the later 1800's.

Therefore hard evidence from historical records can establish; how the land successfully self irrigated; how some regions were best suited to oat/wheat grass and others so marginal even then they should be left to reed pond, *Atriplex*, vegetation and trees as the natural nutrient generators.

Addressing **(c) Can it be salvaged**? The decision has to be made that we must restore the business AFI as there is no other business opportunities. If we fail there are others who will take it over as their food production process is overloaded. (**d) Where to begin?** Assuming capital beyond the Telstra "downpayment" is available.

Flood water gains speed and depth when it runs off hills and slopes taking with it the remaining fertile soils and nutrients. Begin in a series of locations plant out eroded hillslopes. Evaluate location for some billabongs recharge areas. Determine flow paths for watercourses and flood effected zones. Decide which land and landholders are unsustainable in the short term/long term and are returned to "common". Such landholders offered land/sharefarms elsewhere or role in supervision of Work for the Dole (W.F.D) reparation workers.
Engineering firms that formally built canals, elevated rail, road and drainage routes, report on affects of such construction and natural catchment flow and offer alternate proposals to re-establish flow. Also to report on the best sustainable solution such as dam walls or forestry around towns on the flood plains waste effluent and waste water purification processes and costs.
(e) What will it cost? and **(f) Should we shut it down**?
Cost of do nothing – continue engineering short fixes- each unstainable leading to total bankruptcy or, utilise all resources such as Work for the Dole (as so ably achieved by Roosevelt's T.V.A – Peace Corp and Israel Kabutz initiatives). By offering recognition for diligence, effort, leadership etc to be first to return to the business workforce, their worthiness like those so well documented in each of the above programmes will also be a lifetime achievement.
(g) is there a potential growing world market for AFI to recapitalising back to sustainability and are there any other "new products" that can be added to AFI range. Who are the stakeholders who want in and who will take cents in the dollar and get out?
Rapid population growth to the north of Australia and their exhausted soils, water and pollution could mean that they also look elsewhere for food production lands. Such nations either become customers or, by necessity stakeholders in AFI in one form or another.

A SOLUTION
As a member of various United Nations committees on global climate change/emission trading I am acutely aware that Australia stands poised to offer, technology transfer to the World via C.D.M., Clean Development Mechanism, T.T., Technology Transfer. J.I., Joint Implementation and sequestration of CO_2! The above references are

part of the United Nations Conference of the Parties (COP) known as the COP3 Kyoto Protocol. A further Conference COP4 in Buenos Aires Argentina expanded upon these subjects. This Conference needs to seriously consider much of the conclusions of these United Nations global agreements (Australia is a signature). Vegetation can be either a sequester of CO2 which is a greenhouse gas or together with soil disturbance an emitter of CO2. Australian Greenhouse Office on behalf of Australia as claimed a target of 8% above Australia's 1990 Greenhouse Gas Emission. The rest of the World has agreed to 5.2% below their 1990 levels. This target is to be achieved by 2012. Land management including the effects of erosion, revegetation, deforestation form part of Australia's 1990 baseline. If this Conference sets a path of stream reparation and forms a master plan including planting of native vegetation and trees in definable auditable areas then the following financial benefits will flow to the State, the Shire, the stakeholders of the repaired region. This acquired knowledge could then be transferable to developing countries through the above-mentioned T.T., C.D.M., and J.I., UNITED NATIONS Initiatives.

Assume the following model; say a region of 1,000,000 Hectares of Watercourses gully erosion drained former grazing land and original forested land 1860's. The land and watercourses can sustain large scale planting if the funds were available. The planting will not happen through normal funding channels.

Global Corporations, World Governments whose industries and citizens are dependant upon fossil fuels and have no technology or land to sequester CO2 through vegetation planting! They are seeking emission-trading companies to find emission reduction opportunities. Say a corporation needed to find 10 million tonne of CO2, P.A. as offsets for their assigned U.N. target reduction. If they don't find offsets for their emission between 1990 and 2012 a heavy fine penalty is proposed.

Say the collective 2nd stream Management Committee marked out the land selected, the vegetation that collectively sequester 20 tonne of CO2 per hectare per annum, say the N.P.V. of a tonne of CO2 is worth $10 tonne, the value to the landholder is $200.00 p.a, per hectare, until at least 2012. At present value a Hectare of revegetated land at $200.00 per annum over next say only 10 years, will yield a return of $2000.00! It would be necessary to deduct the cost of planting, annual audit to verify the "CO_2 sequestration vegetation remained in-situ".

One does not have to be an accountant to realise that, by coordinating the goals of the 2nd stream Management Conference with the business and scientific sectors efforts to reduce global climate change through vegetation sequestration all sectors will contribute to stream-soil vegetation reparation.

Through this man developed atmospheric denigration lies the opportunity for Australia to repatriate land, water, vegetation, unemployment and, global debt.

Under strict scientific guideline coupled with, UN/COP (United Nations Conference Trade and Development) 4, UNCTAD Emission Trading rules and regulations! Australia, known as reliable responsible suppliers of commodities and services can assist the World's Nations and Corporations to reduce their Greenhouse Gas Emissions (GHG).

By offering appropriate Australian technologies and equipment, some global GHG emissions can be reduced. The most significant reduction will come from non-pollutant energies. If such technologies were introduced today it would be 12 to 25 years before such initiatives were in widespread use.

OPPORTUNITY

Therefore a brief window (perhaps doorway) of opportunity exists for Australia to aid Northern Hemisphere and Asian Countries to meet their Kyoto commitments through sequestration of CO_2.

In each of the above headings (**a)** through to (**g)** it would be of significant importance that this Conference consider and put forward as a finding that; Reparation of streams, flora, fauna and fertility can be achieved and funded through Australia being the sequester of Global CO_2; provided it moves cohesively as a single minded unit; taking the best scientists, administrators, marketers and planners working as one.

For 150 years we have sought to find the monies and the will to repair the widespread cancerous decay. Failure to heed the receivers warning at this Conference with its collective influence and the offer of the funds is not an option and a direct failure of judicial duty knowing the facts present and past.

As Brazil was once the lungs of the World, Australia through vegetation (and trees) can take up part of that role.

A significant underwriting in surgery of stream reparation of AFI is needed concurrently with such plantings.

There are hundreds of leadership roles in performing "total environment reparation".

It will be years again before such a collection of scientific and engineering skills can be assembled.

CONCLUSION

I am currently working with developed and developing nations to reduce their Greenhouse Gas Emissions through both technical means and planting out of vegetation to soak-up CO_2 through carbon sequestration into biomass roots and soil including plantings in deserts and high salt regions.

Nations and their fossil fuel dependant corporations under the U.N. Protocol must invest in these offsets.

Sequestration of Global CO_2 emissions is big serious business. Australia is the last to recognise this.

This responsible Assembly has the power to bring to Australia multi billions of dollars of investment into vegetation.

Simply Australia is respected as a responsible supplier of services and commodities. Aiding the world to absorb its CO_2 emissions is servicing a need. Planting vegetation as part of a long term stream soil reparation is the means to meet the global CO_2 reduction and the goal of this Conference.

Australian States and Federal Governments will never find the monies to address $1/1000^{th}$ of the denigration.

Serving the world through sequestration of CO_2 is the doorway of opportunity that is open soon to be a window then a crack. Few nations are so well placed as Australia and it's great photosynthesis blessing. Delay is not an option.

Form an Executive Board, set out regions of reparation that will also act as a signified CO_2 sink. As a member of various global bodies working in this area I can assist. If this great gathering could agree on a total environmental reparation initiative (a Millennium Project); set a Management Committee; sub groups; master target and benchmark critical path before leaving; major stream rehabilitation along with, vegetation and fertility, employing 100,000 plus people, ongoing funded by a Corporate World interested in atmospheric rehabilitation then you could achieve all that our pre-decessors have failed to do.

You have the knowledge, the tools and the will. The significant funds are available for a very short time frame, delaying the decision is not an option.

Incorporation between historical sustained conditions and meeting practical sustainable reparation of land, water, vegetation and atmospheric is, the necessity of a Millennium Project and Australia's future. God Bless You.

REFERENCES

1. Robert Vincin's paper to AGSO Conference on the Murray Darling 1995.There was no River System

2. "died in the plain" an aboriginal expression on the disappearance of watercourses. (Mitchell Library rare books Surveyors General John Oxley CY542, CY1488, Captain Charles Sturt Q346-911/N, Major (Sir) TL Mitchell DGA6 PXA3, Allan Cunningham Colony Botanist FM4/3578, FM4 3089, CY815).

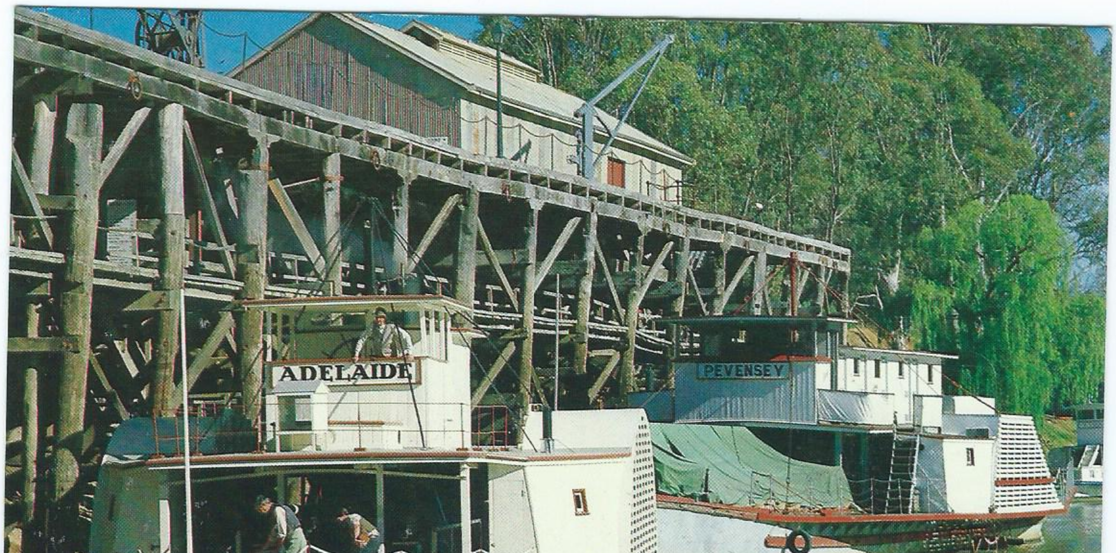
3. *Atriplex* Saltbush all but eliminated through clearing and repetitive reduction as part of "the long paddock" drought grazing. A high carbon and salt take-up plant. (Mitchell Library rare books Oxley CY542 Mitchell Three Expeditions into the Interior pages 53, 54).

4. Vincin, (1 of only 2 Australian members) of UNCTAD (Geneva) Emission Trading Forum, CDM Committee, International Emission Trading Association.

5. UN Conference of the Parties COP4 Buenos Aires November 98. COP3 was Kyoto.

Fig 1. Mitchell crossing Darling in Flood Junction of Murray 1845

Fig.2 Macquqarie in flood 8pm 1844
Both figures are copies of Major TL Mitchell's own sketches (Ref: Tropical Australia DG A6 DX PD 719). (CY 1560)


ADELAIDE
PEVENSEY
ADELAIDE

THE MISSING SINK ?

-- ITS IN THE SOIL !

Robert Vincin, Emission Traders International, and
R.W. Condon, OAM Rangeland and Environmental Consultant

A SUMMARY

Researchers in climate change have long recognised that there is a 'missing sink' -- derived from a recognition that, there should be more carbon around the planet than can be accounted for -- in the oceans, in the atmosphere, and as terrestrial carbon in the biosphere. Several research groups consider that the missing sink is in the deep subsoil, having been put there by C4 plants in past periods of high atmospheric carbon (CO_2) -- sometimes as long as 20,000 years ago, and on occasions since. The research also indicates that much of the carbon which has been lost to the atmosphere over the last 150 years or so, come from the soil. The researchers stress a need to select soil management (land use) options that decrease the loss of carbon from the soil to the atmosphere as well as those that will sequester the total soil organic carbon pool to balance the atmospheric carbon pool.

The research also reveals that, there have been shifts over the past 20.000 years from C3 vegetation (trees, cotton, rice, crops) to C4 vegetation, the latter coinciding with past periods of lowered atmospheric CO_2 shifts. These aspects have led to a consideration of what is happening in the soil, looking in turn at carbon uptake by European forests, carbon loss and sequestration, in plantation forests (in Australia) carbon sequestration in dryland soils, carbon decomposition rates , organic matter storage in agricultural soils and the management of carbon sequestration in soil, considerations in respect of livestock grazing, and understanding the role of dung in respect of soil carbon.

In view of the earlier references from C3 to C4 vegetation and back again, there is also consideration of studies on C3 and C4 plants, looking particularly at the ability of C4 plants to tolerate salinity, and the fact that they may also have an advantage over C3 plants in response to increasing atmospheric CO_2, and the expectation of more frequent and severe droughts with climate change. The other consideration in respect of C4 plants is their ability to sequester and sustain carbon deep in the subsoil by reason of deep root systems, this being seen in both C4 grasses and the C4 *Atriplex*.

The "Missing Sink" (3, 12)

Many of the research papers discuss the role of plants with a C4 photosynthetic metabolism in earlier glacial periods (also arid periods) in sequestering large amounts of atmospheric CO_2 and storing it deep in the soil in plant roots. Many of these research papers refer to this C4 soil carbon as the missing sink that has long been a puzzlement to researchers in this field and at "UN conferences on climate change". The so-called 'missing sinks' have derived from a recognition that, there should be more carbon than what researchers have been able to account for, in the oceans, in the atmosphere, and as terrestrial carbon in the biosphere.

Fisher *et al* (1994)[1a] report that estimates of the global carbon dioxide balance have identified a substantial 'missing sink' of 0.4-4.3 Gt per year, it having been suggested that much of this may reside in the terrestrial biosphere. Lal, Kimble and Follett (1997)[1b] have also investigated the amount of carbon that might be in the "missing sink". They report that atmospheric carbon concentration was about 250 ppmv From 900 to 1200 AD, and about 280 ppmv from 1300 to 1800 AD. In 1994, the concentration was 358 ppmv. These values have been shown in graph form by IPCC (1995)[1c] -- copy attached along with a depiction of the carbon cycle.

The major increase in atmospheric CO_2 (about 80 ppmv has occurred since the 1850s. This increase is attributed to two principal human activities - land use changes (1.6 +/- 1.0 Pg C p.a.) and fossil fuel combustion (5.5 +/- 0,5 Pg C p.a.). Annual increase from these two activities is estimated at 1.5 ppmv or 3.3 Pg C p.a.

With oceanic uptake of 2.0 +/- 0.8 Pg C p.a. and forest regrowth in the northern hemisphere estimated to account for 0.5 +/- 0.5 Pg C p.a. the unknown, or missing, terrestrial sink is estimated at 1.3 +/- 1.5 Pg C p.a., Since the unknown sink is not ocean, and is likely within the terrestrial ecosystems, the question about the role of soil in C sequestration is very relevant.
Another debatable issue is how much of the 80 ppmv of the increase in atmospheric concentration since 1850 came from the soil, and what is the potential of the world's soils to sequester carbon **?** Lal *et al*'s chapter goes on to discuss the various pedospheric processes and mechanisms and potential for C sequestration in the atmosphere. Lal *et al* also discuss the linkages between the five predominant spheres -- the hydrosphere, lithosphere, biosphere. pedosphere and atmosphere. Photosynthesis and respiration are predominant processes linking the atmosphere and the biosphere.

The important and strategic need is to select soil management options that decrease the efflux of CO_2 from soil to atmosphere, and to increase the total soil organic carbon pool at the expense of the atmosphere carbon pool.

[1a] FISHER, M.J, Rao and several others (1994). *Carbon storage by introduced deep-rooted grasses in the South American Savannas.* Nature 371 (6794) 236-8. Sept. 1994.

[1b] LAL, KIMBLE AND FOLLETT (1997). *Pedospheric processes and the carbon cycle.* IN : R. Lal *et al* (Eds.) Management of Carbon Sequestration inj the Soil. CRC Press. New York.

[1c] IPCC (1995) Technical Summary. Inter-Government Panel on Climate Change. WMO, Switzerland.

Research papers from a wide area (Europe, North America and South America) make reference to the 'missing sink' reporting that the missing sink of carbon is in the deep subsoil, and that that this has come from the carbon left by deep-rooting C4 plants in past periods of high atmosphere CO_2, sometimes as long as 20,000 years ago. [There are current concerns that forest plantations are using up some of the carbon from this deep subsoil in getting established -- before they begin briefly using some carbon from the atmosphere]. The then felling and timber use discounts gains!

This is relevant to the role of plantation old man saltbush in that it is a C4 species with a deep-ranging root system in which a large proportion of the root system dies off and is left in the deep subsoil after each defoliative grazing. The other relevant consideration is that the C4 carbon is apparently less susceptible to decomposition and, being deep in the sub-soil, is much less exposed to the oxidising proceese that lead to decomposition.

Shifts from vegetation dominated by C4 species to vegetation dominated by C3 species (1, 2)

Connin *et al* (1998)[2] studied patterns of climate and C4 plant abundance in southwestern United Sates during the last glaciation. They proposed that the interactions of seasonal moisture, temperature and lowered atmospheric CO_2 determined glacial-age C4 abundance patterns. Cole and Monger (1994)[3] report that palaeosol carbon isotope ratios reveal a shift from from C4-dominated grasses to C3-dominated shrubs about 7000-9000 years ago on an alluvial fan in the Chihuahuan desert in new Mexico. This move to C3 dominant plants coincides with a rapid increase in atmospheric CO_2 concentration recorded in Antarctic ice cores, and increased aridity.

[2] CONNIN.S.L. BETANCOURT, J, and QUADE, J. (1998) *Late Pleistocene C4 plant dominance and summer rainfall in the south-western United States from isotopic study of herbivore teeth.* Quaternary Research 50 : 2 : (179-193) Sept. 1998.

[3] COLE, D.R. and MONGER, H.C. (1994) *Influence of atmospheric CO_2 on the decline of C4 plants in the last glaciation.* Nature 368 (6471) 533-536. Apr. 7 1994.

Shifts during the last 40 - 120 years (4)

Boutton *et al* (1999)[4] report that use of delta(13) C values in soil organic carbon records changes in the vegetation of sub-tropical savannas in North America from C4 grassland to C3 woodlands in the last 40-120 years this co incident with the intensivication of livestock grazing and reduced fire frequency. These researchers found evidence also of changes in ecosystem hydrology that accompanied the grassland-to-woodland transition. In this study it was found that **50-90% of the soil carbon beneath the present C3 woodlands was derived from the earlier C4 grass vegetation**.

Pertinent to the question of groundwater recharge as the primary cause of the inceasing salinity problem in Australia, Boutton *et al* also report that tree and shrub species are rooted more deeply and have significantly greater root biomass and density than grasslands. Studies with isotopic H and O in plant and soil water confirm that grassland species acquire water primarily from the upper 0.5 m of the soil profile. In contrast, trees and shrubs utilise soil water from throughout the upper 4 m of the soil profile. They consider that soil water that formerly may have infiltrated beyond the reach of grassland roots may now be captured and transpired by the recently formed woodland plant communities. They report that stable isotopes provide direct spatially explicit evidence of dramatic changes in ecosystem physiognomy and demonstrate some functional consequences for the hydrologic cycle.

[4] BOUTTON, T.W., ARCHER, S.R. AND MIDWOOD, J. (1999). *Stable isotopes in ecosystem science : Structure, function and dynamics of subtropical Savanna.* Rapid Communications in Mass Spectrometry 13 : 13: (1263-77

Carbon Uptake in European Forests (5)

Valentini *et al* (2000)[5a] report that studies of data collected between 1996 and 1998 on 15 European forests state that many European forests act as carbon sinks. The annual carbon uptake ranged for 6.6-6.7 tC pha pa to a release of nearly 1 tC pha pa, with a large variability between forests.

[5a] VALENTINI and a host of others (2000) *Respiration as the main determinant of carbon balance in European forests.* Nature 404 (6780 : (861-65)

Carbon loss and sequestration in plantation forests (6)

Turner and Lambert (2000)[5b] working in forests in south-east Australia report that there was a large loss of carbon from the deeper horizons (to 50 cms) within two years after planting, soil carbon then continuing to decline. Soil disturbances involved in establishment of plantations results in decomposition of soil carbon. Such losses will be offset by accumulation of this carbon in vegetation, but the period when net effect is zero varies with different plantations being of the order of decades. This means that it may take 20 years after establishment before the carbon in the plantation balances the carbon which has been taken from the soil in the earlier growth of the plantation. These results have significant implications for fast-growing short rotation plantations for biomass fuels, and soil carbon decline can be expected to continue
over subsequent rotations. The net being losses by C3 tree forestry.

[5b] TURNER J, and LAMBERT, M. (2000) *Change in organic carbon in forest plant-ation soils in eastern Australia.* Forest Ecology and Management 133 : 3 : (231-247) Aug. 2000

Carbon sequestration in dryland soils (7)

Lal (2000)[6] reports that, drylands occupy 40 % of the earth's surface and are prone to land degradation by different processes. Desertification (implying degradation of soil and vegetation due to anthropogenic activity) reportedly affects 3.6 billion hectares of the drylands. Although most severe in sub-Saharan Africa, it is also prevalent in arid regions of North America, , Australia and parts of Europe. Degradation of soil and vegetation leads to loss, greenhouse gases to the atmosphere. In contrast, improvement of soil quality through adoption of restorative measures can lead to increase in soil organic carbon content, improvement in biomass productivity and mitigation of greenhouse effect.

Restorative technologies include introducing appropriate plant species adapted to harsh environments [for which old man saltbush is well suited], controlling erosion [for which old man saltbush is likewise well suited] and reclaiming salt-affected soils [for which old man saltbush is also well suited], adopting water harvesting schemes [such as water spreading as used in some parts of rangeland Australia] and efficient irrigation schemes [old man saltbush being highly productive with primitive forms of irrigation under desert conditions].

While the potential of C sequestration in drylands may be high (0.9-1.9 Pg (10^{15}) p.a., realisation of even a fraction of this potential requires a coordinated effort at national and international levels. Development of a policy that involves participation of farmers and land managers is crucial in this endeavour.

[6] Lal, R. (2000) *Carbon sequestration in drylands.* Annals of Arid Zone 39 : 1 : (1-10) Mar. 2000

Carbon decomposition rates (8)

It has been suggested that, increases in temperature can accelerate the decomposition of organic carbon contained in forest mineral soil and, therefore, that global warming should increase the release of organic carbon to the atmosphere. Giardina and Ryan (2000) [7] found that soil carbon decomposition rates were remarkably constant across a global-scale gradient in mean annual temperature. The data suggest that soil carbon decomposition rates for forest soil are not controlled by temperature limitations to microbial activity, and that increased temperature alone will not stimulate the decomposition of forest-derived carbon in mineral soils.

> A consideration in respect of old man saltbush is that the high temperatures which apply to most places in which old man saltbush plantations will be established will have no effect in releasing more CO_2 from soil carbon under the plantations

[7] GIARDINA, C.P. and RYAN, M.G. (2000) *Evidence that decomposition rates of organic carbon in mineral soil do not vary with temperature* Nature 404 (6780) 858-61. Apr. 2000

Conservation strategies for soil organic matter (9)

Karlen and Cambardella (1996?) [8] review strategies for improving soil quality and organic matter storage in agriculture soils, looking at a range of conservation farming practices. Schlesinger (1990)[9] reports that agricultural soils act as both sources and sinks. Their role is dynamic, often fluctuating between the two processes as a result of how they are being managed [or mismanaged]. The soil carbon pool is about 3 times larger than that in the vegetation. Changes in land use over the last two centuries have caused a large release of CO_2 to the atmosphere from the terrestrial biota and soils. Some indication of the importance of the adverse land use can be guaged by *recognising that prior to approximately 1960 the annual release .associated with changes in land use exceeded that from fossil fuels.*

Houghton *et al* (1983) [10] estimated that the total release of carbon since 1860 is between 135-228 Pg (10^{15}). Since 1958, this is estimated at 38-76 Pg. The large amount primarily due to forest clearing since that time. Source and sink relationships vary within different climatic zones and hemispheres. Houghton (1987)[11] concluded that the northern hemisphere was more important because it has almost twice as much land area and, presumably, twice as much terrestrial metabolism than the southern hemisphere. Houghton also reports that the carbon loss in the northern hemisphere is 3 to 4 times greater than in the southern hemisphere.

Houghton also makes the point that atmospheric CO_2 concentration is the dominant factor controlling carbon sequestration. Concentrations of CO_2 in the atmosphere have increased by 15-25 % over the last 100 years.

Evidence is growing that, land use changes have contributed more CO_2 to the atmosphere than originally estimated. The North Americans are subscribing to no-till farming practices as a claim for retarding CO_2 emissions. *The evidence is that individual farmers cannot* *carry the cost of new equipment or the responsibility to maintain the practices.* **The practice will not secure deep carbon storage and unfortunately will not meet UNFCCC additionality criteria.**

8 KARLEN, D.I. and CAMBARDELLA, C.A. (1996?) *Conservation strategies for improving suil quality and organic matter storage.* IN : M.R. Carter and B.A. Stewart "Structure and Organic Matter Storage in Agricultural Soils." CRC Press, New York.

9 SCHLESINGER, W.H. (1990) *Evidence from chronosequence studies for a low carbon-storage potential of soils*. Nature 348 (232-234).

10 HOUGHTON, R.A. and several others (1983) *Changes in the carbon content of terrestrial biota and soil between 1860 and 1980. A net release of carbon to the atmosphere* Ecological monographs 53 : (235-62)

11 HOUGHTON, R.A. (1987) *Terrestrial metabolisms and atmosphere* CO_2. Bioscience 37 : (672-78)

<u>Organic matter storage in agricultural soils.</u> (10)

Carter (1997)[12] reports that soil organic matter is a temporary sink for plant nutrients in agroecosystems. Soil organic matter is important in maintaining soil tilth, aiding the diffusion of air, the retention and infiltration of water and reducing soil erosion.

Soil organic matter is the major terrestrial pool of carbon. It is a labile component of the soil, but also a renewable resource. Changes in the soil environment leading to a decrease in plant productivity can cause a rapid decline in soil organic matter levels, while an increase in crop residue inputs or organic amendments [e.g. manure from heavy short-term grazings of plantation old man saltbush] can lead to a synthesis of new soil organic matter (Swift *et al*, 1991)

Dalal and Bridge (1991)[12b] report that soil (and crop) management practices which leave plant residues on the soil surface [as on the floor of an old man saltbush plantation] not only reduce aggregate breakdown from the disruptive energy of raindrop impact but also are likely to enhance the soil organic matter at the soil surface by spatially and environmentally (e.g. moisture and temperature) isolating organic substrates from many decomposers and degradative enzymes. Soil aggregates and the soil organic matter are optimum when the soil is disturbed minimally, the soil surface is covered with plant residues or litter and, above all, optimum conditions exist for maximum plant biomass production commensurate with the environment.

Increased carbon input from manures can cause a gradual accumulation of soil carbon. Input of manures in drylands offers more stable storage of sequestered carbon. Different constituents of organic matter will have relative stability, ranging from labile to stable forms (Theng *et al*, 1989) [13] The rate of turnover of organic matter in soil will depend on both quality and kind of organic matter, and its location within the soil (Stevenson and Elliott, 1989).[14] Carter has provided a table showing the proportion of various types of organic matter stored in agricultural soils and their turnover times, with 40-60 % as physically or chemically sequestered organic matter having turnover times ranging from 50 to 3000 years. Physically or chemically sequestered organic matter is protected from rapid decomposition in micro-aggregates. Generally, sequestered organic matter increases with increasing clay content. [Most soils on which plantation old man saltbush is established will have heavy clay at the surface or in

a close to the surface B horizon]. Studies with stable carbon isotopes have confirmed that organic matter sequestered in fine clay microstructures is a relatively long-term pool of stored carbon
(Balesdent *et al* 1988) [15]

[11] CARTER, M.R. (1997). *Analysis of organic matter storage in Agroecosystems.* IN : M. R. Carter and B.A. Stewart. "Structure and Organic Matter Storage in Agricultural Soils". CRC -- LEWIS PBLXRS. NEW YORK, LONDON.

[12a] SWIFT M.J., KANG, B.T., MULONGOY, K. AND WOOMER, P.(1991) *Organic matter management for for sustainable soil fertility in tropical cropping systems.* IN : C.R. Elliott *et al* (Eds). "Evaluation for Sustainable Management in the Developing World." Vol. 2 Tech. papers. IBSRAM Proc. No. 12, Bangkok, Thailand.

[12b] DALAL , R.C.AND BRIDGE, B.J. (1991) *Aggregation and organic matter storage in sub-humid and semi-arid soils*. IN : M. R. Carter and B.A. Stewart. "Structure and Organic Matter Storage in Agricultural Soils". CRC -- LEWIS PBLXRS. N.Y., LONDON.

[13] THENG, B.K.G., TATE. K.R. and SOLLINS, P. (1989) *Constituents of organic matter in temperate and tropical soils*. in : D.C. Coleman *et al* (Eds.) "Dynamics of soil organic matter in tropical ecosystems." Univ. Hawaii Press. Honolulu.

[14] STEVENSON, F.J, and ELLIOTT E.T., 1989). M Methods of assessing the quality and quantity of soil organic matter. IN : D.C. Coleman *et al* (Eds.) "Dynamics of soil organic matter in tropical ecosystems." Univ. Hawaii Press. Honolulu.

[15] BALESDENT,J. WAGNER, G.H. and MARRIOTTI A.. (1988) *Soil organic matter turnover in longtern field experiments as revealed by C-13 natural abundance.* Soil Sci. Soc. Am. Journ. 52 : 118-21.

Management of carbon sequestration in soil (11, 13)

Lal *et al* (1999)[16a] stress the need for research and the need for action. It is now widely recognised that world soils play a major role in the global carbon cycle. Since a considerable part of the world atmospheric C pool came from the soil, there is a potential to reverse the trend and sequester carbon into the pedosphere through appropriate land use, farming systems and management practices.

Lal *et al* (1999) have summarised the recent push by USDA for the world to accept no-till farming will result in significant reductions in CO_2 and other gases emissions. It is argued that the pedosphere, the thin layer of surface soil (10-15 cms) will permanently store carbon

[16b] LAL, R., KIMBLE, J. and FOLLETT. R. (1997) *Need for Research and Need for Action.*

IN : R. Lal *et al* (Eds.) “Management of Carbon Sequestration in Soil.” CRC Press, New York

[16b] LAL, R., KIMBLE, J.M., FOLLETT, R.F. and COLE, C.V. (1999) *The potential of US cropland to sequester carbon and mitigate the geenhouse effect.*

<u>A rational approach to livestock grazing</u> (14)

From his experience in alpine regions of south-east Australia and the Western Division of NSW and other arid regions of Australia (Condon, 1969[17a] 1991 [17b]), the junior author has long known that the best way to encourage a decline in the biodiversity is to remove livestock grazing from a pastoral ecosystem. Oba *et al* (2000)[17C] have confirmed this in a wide-ranging review (citing over 100 references worldwide) dealing with grazing management in the arid zones of sub-Saharan Africa. They propose a new perspective on interactions between climate, plants and grazing animals that rangelands influenced by highly variable weather and grazing disturbances are degraded, not by continuous grazing, but by the long-term absence of grazing.

In contrast to the prevailing equilibrium view of rangelands, developed in humid environments, an extended lack of grazing may result in the accumulation of “old” vegetation, a decline in plant cover, the loss of species diversity, and reduced plant production. The other aspect that Oba *et al* have apparently not recognised is that, in an ungrazed pastoral ecosystem, the dominant species take over to the almost total exclusion of the lesser species and a consequent serious loss of biodiversity -- and biomass productivity.

The model developed by Oba *et al* also suggests that some plant species require regular grazing. Arid rangeland plants that are grazed continuously may have lower residual biomass and ground cover, but they may also have greater production and better survival than ungrazed plants. Consequently, grazing, often regarded as destructive can be a requirement for proper management of arid zone pastures, and can improve carbon sequestration levels.

Grazing by wild ungulates is based on moving through a landscape in large numbers, dunging heavily and trampling down much of the ground cover, coarse grazers (large ungulates) using such areas first and making it easier for fine grazers (small ungulates) to access the feed. The heavily grazed, but not degraded, areas are then left to recover as the herds move on to repeat the process in an adjoining or nearby landscape, coming back some months later (and in that case of the North Americam bison, perhaps a year or two later) to repeat the grazing cycle.

The grazing management practice known as cell-grazing, or time-control-grazing, provides a similar approach -- a combination of short-term heavy stocking (and consequent heavy dunging and urination of the pastures to the point where there is plenty of ground cover left but the livestock want to get out of their fouled feed resource) and medium-term rest (for weeks or months, depending on current growth conditions). This combination of short-term heavy grazing and medium-term rest, allows the pastures revitalised by the previous heavy dunging and urination to encourage rapid pasture growth, the urine in the mix serving to make the nutrients in the dung more readily available to the plants.

This is also the system used in the grazing of plantation old man saltbush, resulting in a continuing turnover of carbon (and other nutrients) through the plant, the grazing animal and back to the plantation floor as dung and urine. Following each grazing cycle there is a gradual build-up of organic carbon in the plantation floor through the microflora, plants. This process is repeated ever 8-12 at the next animals grazing cycle.

17a CONDON, R.W., NEWMAN, J.C. and CUNNINGHAM, G.M. (1969) *Soil Erosion and Pasture Degeneration in Cenetral Australia.* Jnl. Soil Cons. NSW. 25 : (1), 125 : (2), 25 : (3) ND 25 : (4).

17B CONDON, R.W. (19991). *A role for ratinal grazing in Australian rangelands.* IN : IVth Internationa Rangelands Congress. Montpellier, France. Apl. 1991

17b OBA, G., STENTSETH, N.C. and LUSIGI, W.J. (2000) *New perspectives on sustainable grazing management in arid zones of Sub-Saharan Africa*. Bioscience 50 : 1 : (35-51).

Understanding the role of dung (18)

In reading through several papers dealing with dung, the evidence was that dung with urine was more effective in encouraging enhanced growth of plants (Powell, 1998)[18], when dung and urine are applied together, as it is in heavy grazing, the carbon, and other nutrients, in the root systems of the associated plants increases. Sheep dung contributes more to soil carbon than cattle dung . The papers, generally, report improved plant growth and increased soil carbon when dung is plentiful.

Bol et al (2000)[19] traced the movement of carbon from applied dung, finding that only 17 % of the amount applied was later found in the 5 cms of surface soil. But in this case their was an absence of urine from the equation. Powell *et al* (1999)[20] improved N uptake efficiency in plants.

It would appear that, in respect of carbon, some disappears into the atmosphere by respiration processes, some is taken up into the plants, with some proportion of that finding its way into plant roots where it would be retained in the soil. Above ground, parts being consumed by the animal again are left on the ground as dung to be recycled through the same processes, accordingly each recycling adds to the amount being sequestered in the soil.

18 POWELL, J.M. AND SEVERAL OTHERS (1998) *Urine effects of soil chemical properties, and the impact of dung on pearl millet*. Exptl Agriculture 34 : 3 : (259)

19 Bol, R and several others (2000). *Tracing dung-derived carbon in temperate grassland using C13 natural abundance measurements.* Soil Biology and Biochemistry 32 : 10 : 1337-43)

20 POWELL, , J.M., IKPE, F.N. and SONDA Z.C. (1998) *Crop yields and fate of N and P following application of plant material and faeces to soil.* Nutrient Cycling and Agroecosystems. 54 : 3: (215-26)

C4 plants and deep root systems. (1, 15)

Fisher *et al* (1994)[1a] present an analysis of carbon stored by deep-rooted grasses introduced in the South American savannas, finding that they also sequester significant amounts of organic carbon deep in the sub-soil. They suggest that this process could account for the sequestration of 100-507 Mt carbon per year -- a substantial part of the “missing sink.” Their research showed sequestration of about 30 tonnes of carbon pha over 3.5 years, this C being stored well below the plough layer of 10-15 cm, suggesting also that this deep-stored carbon should be less prone to oxidation, and hence loss , during any cropping phase that might be undertaken in integrated crop and pasture systems. [Although Fisher *et al* make no reference to C4 species , the generic name *Andropogon*, a close relative of sorghum, suggests that there could have been some C4 influence]

Osmond *et al* (1980)[6a] have advised that the proportion of living roots in the fragments isolated from the soil is never easy to estimate. Studies by Hodgkinson (1978)[6b] suggest that less than 10 % of the root mass in the Great Basin (USA) communities may be alive. Osmond *et al* suggest that, in this context, it may be that the bulk of the root mass in these communities should be considered as **below ground litter.**

Atriplex confertifolia, a medium-sized shrub somewhat smaller than old man saltbush, is also a C4 plant, and apparently like the C4 grasses discussed above, able to sequester a lot of carbon to the deeper subsoil [as is expected from old man saltbush plantations subjected to a regular defoliatory grazing].

> Osmond *et al* also make the point that the warm deserts in Australia are among the least productive (worldwide?) and those of the cool deserts of the Great Basin in Nth America are among the most productive of arid ecosystems. Perhaps the North American ranchers, with a need to make the most of the available feed before the winter freeze makes it inaccessible, manage their saltbush in much the same way as is done for plantation old man saltbush, with a large proportion of the root system being shed each year. Or, more likely, the closing down of the plant's metabolism during the cold snow-fed winters causes the roots to be shed -- and to grow again in the moistness of the following spring.

Jones and Hodgkinson (1970)[6d] have studied the root system of *Atriplex nummularia*, finding a three-tiered system -- fine ephemeral roots beneath the plant to about 30 cms -- a series of large horizontal roots radiating out to about 20m from the centre of the plant -- and a series of large vertical roots branching branching down from the horizontals and extending to a depth of 3-7 m. In one example of a ten-year-old bush in a natural stand, the main root was 20 cm in diameter at the top, tapering to 5 cm at 90 cms depth. Below this level it would have branched out to the series of horizontal and vertical roots described above.

> It can be expected that the larger horizontal and vertical roots in the deep sub-soil would send out branchlets of fine roots as required to to utilise deep-seated moisture when it is available, taking advantage of the plant's superior capacity for root extension (Jones and Hodgkinson *op. cit*.) to explore for moisture (and plant nutrients) at depth. It could also be expected that, as soil moisture was dried out, most of the fine root material would die off, with new roots being established when deep-seated moisture was again available. This may explain the statement above in respect of Hodgkinson (1978) that less than 10 % of the root mass of the *Atriplex* in the Great basin communities may be alive and that the bulk of the root mass in these communities should be considered as below-ground litter.

Kuzyakov and Domanski (2000)[6e] investigated the differences in below-ground C translocation pattern between plant species (cereals, grasses and trees), the pasture plants having been found in recent years to be a significant sink. Pasture plants (grasses) translocated about 30-50 % of assimilates below-ground (nearly twice as much as cereals), about half of this being found in roots, with about 1/3rd lost in CO_2 respiration and the remainder translocated into the soil microorganisms and soil organic matter. Total C translocated below ground amounted to about 1.5 tonnes of C pha p.a.). The main carbon sink in trees is the stem.. In contrast to grasses, most nutrients in trees are stored in the stem.

1a FISHER, M.J, Rao and several others (1994). *Carbon storage by introduced deep-rooted grasses in the South American Savannas.* Nature 371 (6794) 236-8. Sept. 1994.

6a OSMOND, C.B., BJORKMANN, O and ANDERSON D.J. (1980). "Plant Phsioology and Ecological Processes -- towards a synthesis with *Atriplex*" Springer-Vorlag, Berlin, New York. 1980.

6b HODGKINSON, K. C. (1978). *Influence of summer rainfall on root and shoot growth in a cold-winter desert shrub.* Oecologia 34 : (353-62)

6d Jones, R.M. and Hodgkinson, K. C. (1970) *Root growth of rangeland phenopods- morphology and production*
Jones, R.M. <u>*Atriplex nummularia A vericiri*</u> *Simposium Deniliquin NSW Oct 1969 Publication CSIRO Div Plant Industry 1970*

6e KUZYAKOV, Y. and DOMANSKI, G. (2000) *Carbon input by plants into soil.Review* Journal of Plant Nutrition and Soils Science. 163 :4 : 421-31)

C3 and C4 Vegetation (15)

In a number of pps from China, India and from several countries. in Europe, the indications were that C4 plants are able to tolerate high salinity conditions, being able to regulate differently the amount of sodium in the plant tissues. That certainly happens in *Atriplex and specifically nummalaria (old man Sat Bush).*

Boscherini *et al* (1999)[21] compared the characteristics of C3 and C4 lines of a tomato species and found that the C4 plants showed an ability to tolerate high salinity condition, being able to regulate differently the amount of sodium in tissues.

Ward *et al* (1999)[22] in comparing the responses of model C3 and C4 plants to drought under low and elevated CO_2 levels, found indications that CO_2 enrichment may alleviate drought effects in C4 plants. C4 plants showed higher recovery from drought than C3 plants at current and elevated levels of CO_2. They concluded that C4 species may have an advantage over C3 plants in response to increasing atmospheric CO_2 and more frequent and severe drought.

21 BOSCHERINI, G. and several others (1999) *Characterisation of salt tolerant plants cloned from a <u>Lycopersicon esculentum</u> somaclone.* Journal of Plant Physiology. 155 : 4-5 : (613-19)

22 Ward, , J.K. and several others (1999) *Comparative responses of model C3 and*

C4 plants to drought in low and elevated CO_2.
Global Change Biology 3 : 8 : (857-67)

SOME CONCLUSIONS

The above review of literature has been undertaken in order to throw more light on the role of plantation old man saltbush in sequestering soil carbon. The principal consideration is that old man saltbush, and many other perennial bush species in the same Family Chenopodiaceae, have a C4 photosynthetic pathway. This enables them to make greater use of CO_2 per unit of water use than C3 plants, in the process using up more CO_2. By reason of their deep root system down to 3 – 7+ metres, and the management practice of defoliation grazing at intervals of 8 - 12 months, plantation old man saltbush is able to leave much carbon deep in the subsoil, as well as tying carbon up in the woody stems for the life of a plantation, estimated at 80-100 years. In the deep sub-soil the organic carbon is well removed from the respiration processes which serve to transfer some of the carbon from the near surface horizons of the soil profile to the atmosphere in the process of decomposition of organic matter.

There has been acknowledgment that lack of grazing may not be beneficial and could be harmful to biodiversity and carbon sequestration in arid environments. There is no doubt that grazing in excess of the environment's capacity is harmful, but grazing can be managed to ensure improved productivity and improved carbon sequestration. Plantation old man saltbush has a special place for livestock grazing -- as a means of developing a significant improvement in productivity as a forage crop, making it a profitable crop for saltland rehabilitation, or as an alternative form of land use to the increasing emphasis on cropping -- which continues to cause soil carbon loss to the atmosphere.

That same high productivity, requiring repeated defoliation and refoliation, ensures an incremental production of sequestered carbon -- in the soil, in the dung and plant litter on the plantation floor, in the below-ground litter in dead root material, and in live root material and in above ground woody stems which will be incrementing in mass as the individual bushes in the plantation continue to make growth.

In the early part of this review, reference was made to the loss of carbon from the soil by the clearing of forests and woodlands and the cultivation of the soil for agriculture. It is only since about 1960 that the rate of loss from the burning of fossil fuels has exceeded the loss rate from clearing and cultivation. Australia has made its contribution to the loss of soil carbon in this way, in the process destroying many of the C4 plants which were effective in sequestering carbon in the deep soil. All in the name of agriculture progress. Australia suffers more regularly from droughts and sustained rainfalls from vegetation/transpiration was cleared. The water / Carbon Cycles have stalled.

Plantation old man saltbush offers a means of redressing these losses, to help Australia meet its commitments under the Kyoto Protocol, and to provide a profitable alternate form of land use to cultivation and cropping which continues to allow soil carbon to be lost to the atmosphere. It also offers a profitable approach to saltland desert rehabilitation with its capacity to earn carbon credits in this situation helping to meet the cost of planting.

A companion review to this one considers the research on the special characteristics of old man saltbush and considers evidence confirming the productivity of plantation old man saltbush. Critical today is the need to sustainably lower CO2 while addressing the World Bank and UN concerns that 35nations are food import dependant due to lack of sustainable soil to grow food. With the potential to sequester 25-70tonne of CO2 per hectare per annum and live for more than 75-150years C4 Atriplex nummalaria (Old Man SaltBush) is the precurser to have C3 Crops and indeed tree forest to follow combined exciting bees flora and fauna to follow with trained sustainable farming and the capacity to balance the Carbon Cycle under “Business as Ussual”.

February 15 2001

Note:- A visual Page 2 follows with the hard copy and attachments available.

01/Oct 2007RV4 grammar check (for Chinese version where mass plantation have commenced)
Update 31/Oct 2008

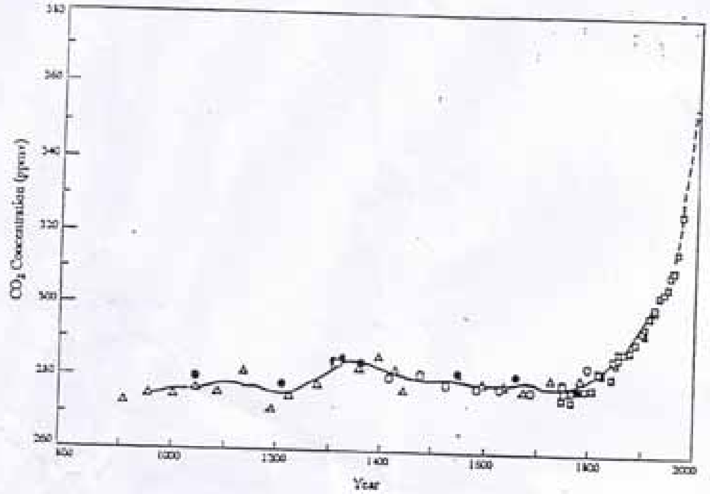


Figure 1. Changes in atmospheric CO_2 concentration. (Adapted from IPCC, 1995.)

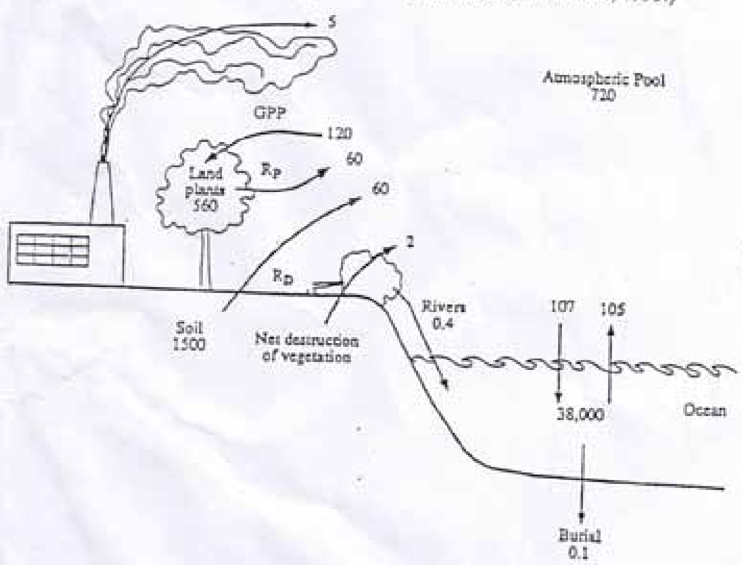


Figure 2. The global carbon cycle, showing the major annual transfers between land, sea, and atmosphere, expressed as 10^{15} g C/yr. (Modified from Schlesinger, 1991.)

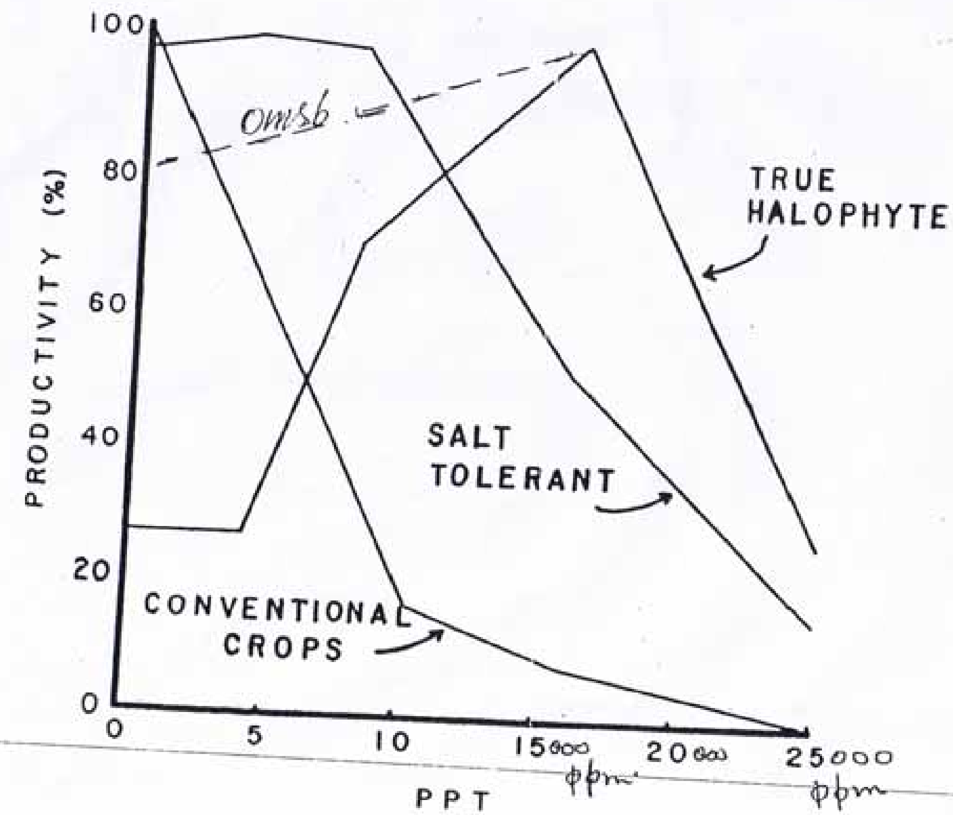


Figure 1. Productivity (percent of maximum dry weight) on salinity (parts per thousand NaCl) of a) a conventional crop, i.e., a tomato, Walters cultivar (15), b) a salt-tolerant plant, i.e., a variety of *Distichlis spicata* (this paper) and c) a true halophyte or euhalophyte, i.e., a particular "cultivar" of *D. palmeri* (this paper).

PRIME MINISTER

2 8 OCT 2013

Reference: C13/66061

Mr Robert Vincin
Project Director
Emission Traders International Pty Ltd

Dear ~~Mr Vincin~~ Rob

Thank you for your letter of congratulations.

Only seven times in sixty years have Australians voted to change the government – so I am very mindful of the responsibility entrusted to the Coalition.

The new Coalition Government will strive to govern for all Australians, including those who didn't vote for us.

I have always believed that no one person is the font of all wisdom and that no political party has a monopoly on common sense. If you ever believe that the Government can do better, please let me know.

Though your work and my work are different, the aspiration we share for our country is the same: to build a stronger Australia and a better future for everyone.

I look forward to working with you in the years ahead.

Yours sincerely

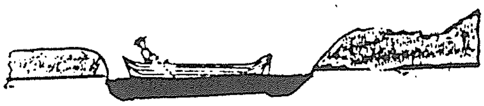
TONY ABBOTT

I have asked Greg Hunt to make contact with a view to an early meeting

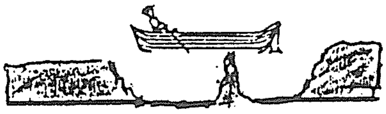
Parliament House CANBERRA ACT 2600

SUMMARY OF SIR THOMAS L. MITCHELL

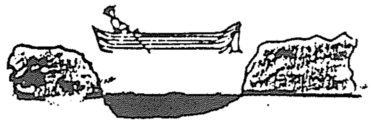
CROSS SECTIONS OF WATERCOURSES, LAGOONS



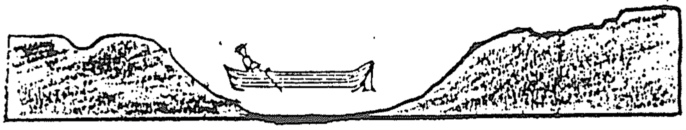
THE KARAULA - 23 JUNE 1832
NO FLOW
• NOW BARWON AT THE POINT IT JOINTED
THE DRY WATER COURSE OF DARLING



G'WYDIR - 9 JUNE 1832
NO FLOW
JOINED THE DARLING
AT KARAULA

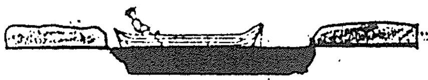


NAMMOY - 1 DECEMBER 1831
VELOCITY ½ MILE PER HOUR
NAMMOY FLOWED INTO AND DIES IN
REED PLAINS

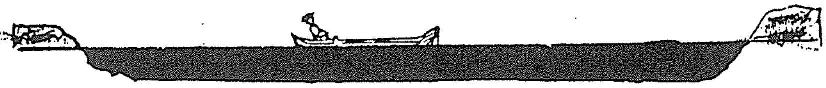


DARLING AT FORT BOURKE - 10 August 1835
NO FLOW
N.B. DARLING SOURCE 148°.50 EAST 29°.30 SOUTH
NOW CALLED BARWON

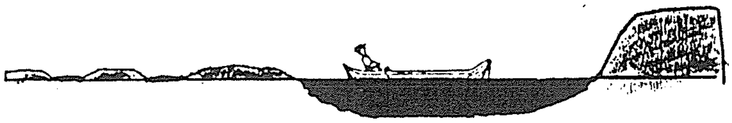
LACHLAN at WAAGAN - 24 MARCH 1836
NO FLOW
TODAY'S FORBES



MURRUMBIDGEE at WEYEBA - 16 MAY 1836
NO MEASURE OF FLOW
REED LAGOON (BILLABONG)
TODAY 28 MILES N.E. BALRANALD



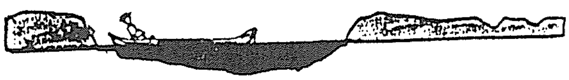
MURRAY - 9 JUNE 1936
IN LONG 143°E
NO FLOW
AT TODAY'S ROBINVALE
CROSS SECTION
REED BOUND THROUGH BENANEE



MILLEWA (MURRAY) - 20 OCTOBER 1836
IN LONG 146° 40 EAST
VELOCITY 2½ MILES PER HOUR
AT TODAY'S MULWALA CROSS SECTION
THROUGH REEDED LAGOONS

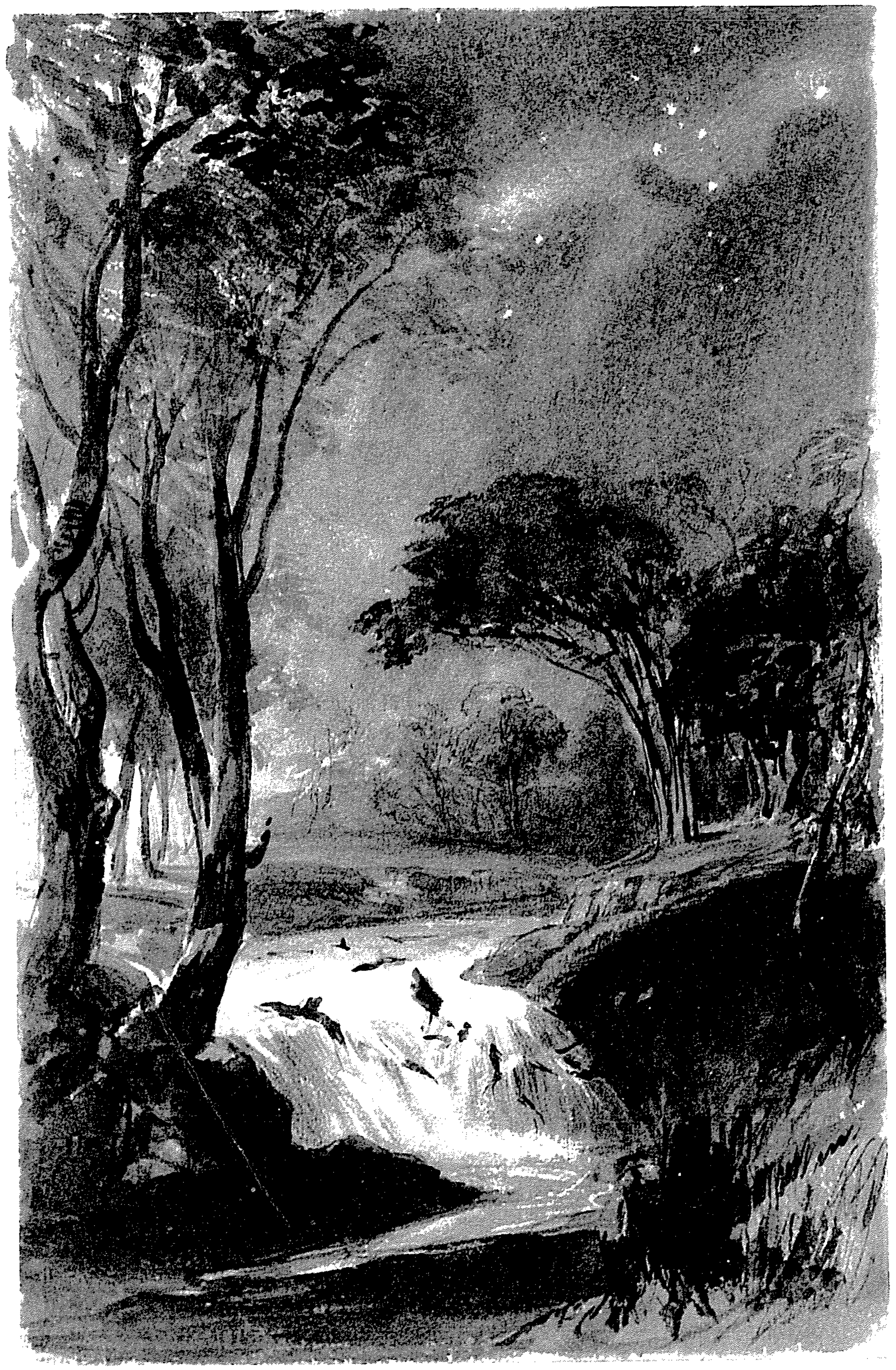
OWEN or BURWANG - 16 OCTOBER 1836
VELOCITY 1¼ MILES PER HOUR
NOW NAMED KING
REED LAGOONS AT WANGARATTA

GLENELG - 14 AUGUST 1836
VELOCITY 1863 YARD PER HOUR
NEAR TODAY'S ROCKLANDS RESERVOIR



BAYUNGUN or GOULBURN (VIC) - 9 OCTOBER 1836
VELOCITY 1¼ MILES PER HOUR
REEDED LAGOON NEAR TODAY'S EUCHUCA

MACQUARIE RIVER, N S W, c. 1846 - 1848.



PLEASE DO NOT TAKE OUT OF ENVELOPE

MITCHELL, Sir THOMAS LIVINGSTONE

Flood Coming Down The Macquarie. 13th Feb^y 1846.

c.1846-1848. Grey wash heightened with white. 17.2cm. x 11cm.

Unsigned. Attribution from note in ink in unknown hand on verso. Dated from year of expedition and date of publication of his Journal of an Expedition Into The Interior of Tropical Australia .... London, Longman, Brown, Green, and Longmans, 1848. Appears to be the original of the Journal's frontispiece, from which it has

S.L.
Macquarie, river, N.S.W., c.1840-1848

see also card 2.

MITCHELL, Sir THOMAS LIVINGSTONE card 2 & last

[Flood Coming Down The Macquarie.]

been titled. Ink note on verso reads 'Original Sketch Frontispiece to Tropical Australia drawn by Sir T. L. Mitchell Given to Emily Tenchet [?] by the sole surviving son N.B.Mitchell on 3rd January 1892 on the conditions that it will always continue an Heirloom to some of the Descendants of his talented Father'.