Your details

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Submission details

I am making this submission as	Other
Submission type	I am making a personal submission
Organisation making the submission (if applicable)	TIG DESIGNS endorsed by A.I.L.D.M., A.I.H. and A.H.M.C.
Your position in the organisation (if applicable)	TIG DESIGNS - PRINCIPLE; AILDM - National Board Member; AIH Member, Registered Horticulturist; AHMC, Member
Consent to make submission public	I give my consent for this submission to be made public

Share your experience or tell your story

Your story	I am making this submission as an initiative to promote natural regenerative management as a highly efficient methodology and practice for mitigation of fire risk and climate extremes. It is an approach that addresses creating conditions that will prevent severe fire events and the effects of climate extremes across the board. It is ecologically, culturally and economically regenerative and predominately about prevention rather than cure. It is strongly focused upon increasing drawdown (sequestration and

photosynthesis) as well as reducing emissions.

I am a landscape designer, registered horticulturist and have been involved in regenerative agriculture/land management for over 25 years. The benefits of sound decision making and regenerative actions are only just beginning to be widely recognised. This knowledge can be efficiently applied to managing landscapes across a broad range of environments on any scale.

This submission is supported by the Australian Institute of Landscape Designers & Managers (AILDM), the Australian Holistic Management Co-op (AHMC) – Land to Market AustraliaTM and the Australian Institute of Horticulture (AIH).

We would like to be actively involved in the planning, establishment and implementation of an ecological land management plan that effectively addresses fire and other natural disasters in New South Wales and broader Australia.

PLEASE NOTE: The attached file has useful reference images and graphs in the content along with an Appendix and Annexure.

Terms of Reference (optional)

The Inquiry welcomes submissions that address the particular matters identified in its Terms of Reference.

1.1 Causes and contributing factors

A REGENERATIVE METHODOLOGY
For Better Landscape Function, Biosecurity,
Public Protection and Climate Stability

SUBMISSION TO THE 2020 NEW SOUTH WALES INDEPENDENT BUSHFIRE INQUIRY
by IAN CROWLEY MAILDM MAIH MAHMC
Dip Landscape Design, Dip Horticulture

22 May 2020

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OVERVIEW
The 2019-2020 fires and natural disasters over the last decade that have such massive economic and social consequences are predominantly biological – ecological. Our restoration, mitigation and prevention management must address these issues biologically and ecologically as well as culturally. It must be

biologically/ecological and culturally regenerative.
The goal of this initiative is the achievement of ever-improving physical environments that regenerate landscape function, provide biosecurity, restore and maintain climate stability. This submission sets out to demonstrate that different concepts and proven management practices are fundamental to the successful deliver of this positive and essential outcome.
The initial focus is protection of people, property and surrounding nature (houses, villages, communities, industry, infrastructure and local landscape spaces and bushland amenity) from fire in fire-prone areas.
The vision for the initial focus is twofold. First, we suggest making better use of existing powerline & telecommunication easements, highways, roads, tracks, lanes, fire trails, railway lines, corridors and the like to create natural 'green' firebreaks. These are areas or strips of land, managed regeneratively to create natural fire free or fire safe zones. Secondly, in collaboration with property owners, local communities, regions and their representatives/decision makers, we advise the creation of new natural firebreaks, assist with planning and management for overall fire prevention/mitigation strategy. This might involve focused, once-off 'strategic' clearing to break continuous canopy in some areas, plus management of the new spaces back to 'High Succession' areas/strips and wildlife refuge. Incorporating advances in architectural design for new dwellings and buildings, re-planning for towns, villages and communities with fire-wise/ecological landscape design.
The longer-term objective is to introduce sound regenerative methodology and management practices into all tracts of public and private land, including parks and gardens, golf courses, sporting and recreation areas, councils, shires, national parks, horticulture, agriculture, forestry, water ways and riparian areas
We contend that climate extremes are the result from many factors, many of which can be addressed by human biological management. It is vital that we transition towards increasing drawdown and invigorating biological ecosystem across a broad range of environments through sound holistic decisions and regenerative actions.
The creation of environments that are resistant to burning will produce healthy, thriving, resilient ecosystem – the most effective remedy for mitigation of climate extremes.

ACKNOWLEDGEMENT
We recognise the efforts of all who have gone beyond the call of duty to help fight the terrible fires of the 2019-2020 summer and assist in recovery efforts. We acknowledge all who have died, lost loved ones and suffered in this enormous social, economic and ecological tragedy. We recognise the physical and psychological damage that many are still battling, the shattering of community routines, the loss of thousands of buildings, the deaths of thousands of livestock animals, the incineration of countless millions of trees, distinct habitats and devastation of innumerable wildlife creatures.
We believe that learning from this experience is not only essential from a practical viewpoint, but also a way to honour those lost.
The fires added to great suffering and loss already caused by a very long drought and severe water shortages. Climate extremes have particularly affected the lives and livelihoods of farmers and rural districts, devastated regional and coastal communities, some of which will tragically never re-emerge, but no Australians have been spared some effects of fire, drought, temperature extremes, dust, wind, soil loss, water shortages, heavy rain, flood, landslip, erosion, and contamination of waterways through to our reefs and oceans. These bio-ecological events have affected our food, water and air quality and security, our health and livelihoods. Last summer, to an unprecedented degree, a great many Australians experienced a dramatically reduced

quality of life.
The long-term effects of the crowning disaster of COVID19, totally unanticipated at the beginning of 2020, are yet to be known. However, there is a general sense that this is a moment for us to rethink what we really want. In isolation, we have achieved surprising connectedness with each other, and the mood that has germinated seems more about giving, sharing and working together than it is about self. We have (mostly) put politics and tribalism aside in a collaborative effort to achieve outcomes that are not only beneficial, but necessary to our collective future quality of life.

SUBMISSION PARTICIPANTS
This submission does not represent any political, religious or industry-based lobby groups.
It is supported by the Australian Institute of Landscape Designers & Managers (AILDM), the Australian Holistic Management Co-op (AHMC) – Land to Market AustraliaTM and the Australian Institute of Horticulture (AIH).
This submission is based on a natural ecosystem regenerative approach for fire prevention, protection and recovery, employing holistic methodology and management practices. Large scale application of natural ecosystem regeneration requires particular tools and focused investment to achieve the desired outcome. In order to achieve true sustainability, we understand that the implementation of any program/s must be financially and socially beneficial as well as culturally enriching
We are well-positioned to provide additional knowledge along with professional skills for landscape design, consultancy, planning, management, mapping and monitoring for efficient ecosystem regeneration.
It is our intention to provide and promote long-term business opportunities and enterprise creating meaningful employment in urban and regional areas of Australia.

1.2 Preparation and planning

IDENTIFYING THE PROBLEM
“El probléma y la solución comparten la misma casa” is a Spanish aphorism meaning “The problem and the solution share the same house”. Applied to holistic regenerative land management it serves as a reminder that we must realise we are a part of the problem in order to be a part of the solution. Holistically, this also applies to cultural regeneration.
Once we understand that most of our ‘natural disasters’ are bio-ecological, we will realise that our recovery, mitigation and prevention management must address such issues biologically and ecologically as well as culturally.
Biological issues and their consequences in New South Wales (and beyond) escalating under our current patterns of decision making, actions and management include:
Fire
Drought (Prolonged – Up To 10 Years in Some Areas)
Great Barrier Reef (Bleaching and Biodiversity Loss)
Temperature Extremes (Extreme Heat and Cold)
River & Ocean Contamination
Fish Deaths (Murray Darling Basin)
Dust Storms
Heavy Rain/Severe Storms/High Winds
Floods
Land Slip Instability
Vegetation Instability
Air, Water & Food Quality Decline
Water Shortages and Food Security
Biosecurity
Contamination, Pollution, Imbalances and Disease
Human Health Degradation
Our decision making, actions and management has had, and

continue to have, a significant negative effect on the biology of the planet. Across many environments, human activity has been mostly detrimental to the biological ecosystem. The rate of degradation has escalated dramatically over the last 50 years.
The Scripps Institute of Oceanography's NOAA Earth System Research Laboratory at Mauna Loa Observatory, Hawaii, measures and graphs atmospheric carbon dioxide in parts per million (ppm). Recording both net emissions and net drawdown of CO2, it reports an increase/decrease of CO2 in part per million (ppm) on an annual and monthly basis over decades.
In 1990, atmospheric CO2 measured 357.5ppm, rising to 372.2ppm in 2000: an increase of 14.7ppm. By 2010, however, the atmospheric CO2 measured 392.9 ppm: an increase of 20.7 ppm. It is this increase of 40.8% from one decade to the next that has sent calls for 'emissions reduction' echoing around the world.
However, looking at the data, we find that from 1990 to 2000 total net emissions measured 79.5ppm, and from 2000 to 2010 total net emissions measured 79.3ppm: a reduction of 0.2ppm. (Zero increase).
As the total net emissions were essentially the same, an increase of 40.8% over this period can only be explained by a decrease in drawdown of CO2 over the second decade. Indeed, from 1990 to 2000 the total net drawdown measured 64.8 ppm, while from 2000 to 2010 the total net drawdown measured 58.6 ppm.
The reduction in drawdown of 6.2 ppm represented a decrease of 9.6% from one decade to the next. It is the 9.6% decrease in drawdown that resulted in a 40.8% increase in ppm levels of atmospheric CO2.
All CO2 drawdown is biological (100%), but the biological ecosystem in many areas of the planet is failing and its ability (as a whole) to draw down (sequester/sink) carbon from the atmosphere is diminishing.
Importantly, terrestrial environments with poor to non-functioning ecosystem will tend to release more organic carbon than they draw down, emitting through bare soil evaporation, evapotranspiration, dust, erosion, oxidisation and fire. These environments have reduced ability to photosynthesise and to sequester and store organic carbon.
For every tonne of organic carbon released into the atmosphere, atmospheric CO2 increases by 3.67 tonnes. and conversely every tonne of organic carbon sequestered, removes 3.67 tonnes of CO2 from the atmosphere.
Climate extremes are caused by many influences, nearly all of which can be addressed by human biological management.
While we must move efficiently towards reducing emissions, it is vital that we transition towards increasing drawdown (sequestration), only achievable by increasing biodiversity, advancing succession and regenerating biological ecosystem across many varied environments.
We must shift toward a regenerative management approach that builds resilience and protects against, combats, enables recovery from and averts natural disasters through proactive biological processes at every step. Biological regeneration is the ultimate prevention.

OUTCOMES
The outcome of this initiative is to accelerate the adoption of regenerative landscape design, planning and management in its many forms. Our goal is a sequence of increasing biodiversity, biomass & groundcover that will boost and increase humus in the soil (organic soil carbon) and photosynthesis. More humus or carbon in the soil will create conditions that enhance water retention, generates greater water holding capacity and allows efficient cycling, accelerating and advancing biological succession to enable biomes that restore nutrient cycling and fertility. Environments will be facilitated that regenerate biological ecosystem functionality, providing microclimate stability which will expand to mitigation of climate extremes.

Regenerative land management principles will ensure positive social and economic impact and regenerative forms of production will provide enduring bio-ecological security. Monitoring and recording ecosystem function, producing reliable scientific data through a process of Ecological Outcomes Verification (EOV), provided by Australian Holistic Management Co-op (AHMC) Land to Market AustraliaTM enables ongoing learning of ecological outcomes and generates ecological literacy and fluency.

This initiative proposes that any strategic plan should entwine with a creative narrative; a 'future landscape description' that describes a vision of Our Environment as we want it to be at a nominated date. Beginning from the proposition that 'the time for reconsideration is always now', a future description is a tool to identify what we, as a community, really want. It is a description, not a prescription. It is intrinsically idealistic.

The narrative that follows describes the Australian landscape as envisaged in 2050:

"It is a cultural and physical landscape that has been achieved through the involvement of diverse communities in frank, enjoyable, respectful and amicable relationships with their neighbours and broader community, government bodies, authorities, organisations, research institutions and education facilities.

In Australia, there is a great variety of natural landscapes that are aesthetically pleasing, healthy, utilised, productive, alive and clean. Our environments have high and ever-increasing level of biodiversity, both above and below the soil surface. We have ongoing advancing succession of species and communities; they are never static. There is an abundance of different varieties of perennial grasses and shrubs, as well as trees for shade, shelter and meaningful amenity.

Our wealth of habitat supports substantial populations of diverse wildlife, birds and insects and affords ready refuge, resulting in an animal community that is self-regulating and self-supporting.

The soil surface is covered with living plants and/or a layer of viable litter and is highly receptive to rain whenever it falls, enabling effective cycling of nutrients and solar energy. Each drop of rain is captured where it lands, and moisture is stored in an ever deepening, carbon rich soil profile. The soil is alive, growing and healthy with high levels of organic matter and humus. Young, fertile and robust soils yield landscapes that are fruitful, efficient and resilient.

Water cycles via transpiration and condensation with very little evaporation, run-off and no erosion. There is no movement of soil across the landscape and any water that runs off drains into underground streams and rivers, emerging as permanent springs or lying in aquifers ensuring continuous supply of filtered water into our waterways. We have a hydrated landscape with abundant water that is clear and does not carry sediment, organic matter, contaminates or residues.

The well-functioning biological ecosystem over much of our landscape mitigates the occurrence and magnitude of floods and drought. We have very few unplanned grass or bushfires in our landscapes because we have managed ecologically to increase biodiversity with ever-advancing successional plant communities. With very little bare soil and diverse vegetative cover, our climate is moderated, insulated from temperature extremes.

We have diverse, integrated agriculture, horticulture, forestry, private and public land management that is productive, profitable and progressively regenerative with multiple income streams and forms of production.

All infrastructure, facilities and resources within our care are treated with respect, are safe, healthy, aesthetically pleasing and welcoming. All is well designed, constructed, installed and/or renovated to be fit for purpose, often multi-functional, modular and movable and always maintained in good condition.

All the people that use or interact with our infrastructure and machinery know how it works, what it is used for and how to

manage resources efficiently. We are financially secure, free of debt and generate wealth from within our values. Any borrowings are short term, beneficial and affordable.
Australians are renowned worldwide as the leading practitioners in natural ecosystem regeneration and ecological landscape management".

1.3 Response to bushfires

WHOLE ECOSYSTEM MANAGEMENT
Terrestrial New South Wales covers an area of over 80 million hectares with many different landscapes, climatic conditions and ecological issues. Management action is required on a widely varying scale with an array of constraints and variation in topography, accessibility and ecological condition. Action in different areas will balance existing practices, if appropriate, with other complementary methodologies. We would expect a transitional period of phasing out or reducing the more degrading practices as regenerative actions are implemented, become more widespread and in time become the norm.
In order to manage for the whole ecosystem, we need to have an understanding of how the biological ecosystem functions and how it functions differently in different environments.
Our biological ecosystem functions as a whole that contains of the same four fundamental processes everywhere on earth. These four ecosystem processes are The Water Cycle, The Mineral/Nutrient Cycle, Energy Flow and Community Dynamics.
The biological ecosystem is a Complex-Inseparable-Physiological-Dynamic and is the essential basis for all life. It is complex in that it consists of an indeterminate variety and number of interconnected parts and symbiotic relationships; it is inseparable in that it does not function in parts, only as a whole; it is physiological in that it involves the behaviours and functions of living organisms; it is dynamic, in that it is in constant change, never static.
Aspects of the biological ecosystem function or respond differently in different geographical environments, landscapes, communities, micro and macro climates and so on.
Humans are part of the biological ecosystem; we do not stand outside it. However, we can manage for direction and velocity of change to ecosystem dynamics, which are always either regenerating or degrading. To achieve this, we must understand the defined social, financial and ecological landscape under management as a whole, and make decisions, plan, test and devise processes to manage complexity (managing complexity is different from managing the complicated, which can be approached in parts).
The interconnected nature of our biological ecosystem means that if one ecosystem process fails or is removed, the whole will fail. The corollary, however, is that if we can manage to enhance or improve only one process, we are inadvertently managing for all four – the whole.
Human creativity, ability to make plans and ability to envisage a 'whole' are our great assets as a species.
An example of an aspect of the biological ecosystem that functions differently in different geographical environments is 'The Water Cycle'. Fundamental to any regenerative landscape plan is a good understanding of the water cycle of the environment, to enable natural actions to be taken to slow water down and store it in the soil. This will have repercussions throughout every element or aspect of the whole biological ecosystem, from solar energy flow and the cycling of nutrients to advancing succession and community dynamics.
Most adult Australians were taught a model of 'The Water Cycle' in school. In this model, continuous atmospheric humidity enables vegetation to recycle naturally without human assistance. However, this story is relevant to only about 40% of the planet's terrestrial land mass. The remaining 60% lacks

continuous atmospheric humidity and consequently behaves and responds differently.
Only about 4% of the land in Australia experiences a ‘Water Cycle’ characterised by continuous atmospheric humidity. This 4% runs in a thin line down the east coast of Australia, most of Tasmania and a patch on the south-west of Western Australia. See Fig. 2. About 90% of our human population resides in it. Despite the self-regenerating characteristics of this water cycle, concentrated population, development, infrastructure, consumption in these areas mean that our environmental resource management is critical and sensitive.
The ecologist Allan Savory uses the terms ‘non-brittle’ and ‘brittle’ environments to distinguish between environments that experience continuous atmospheric humidity – such as the 4% of Australia in which most of the population is concentrated – and those that experience intermittent atmospheric humidity.
In a non-brittle environment, such as our 4%, rainfall patterns are more reliable than in a brittle environment. In a non-brittle environment vegetation will break down, recycle and become incorporated into the soil profile. This natural re-cycling of vegetation feeds the living organisms in the soil which in turn cycle nutrients (minerals) enabling beneficial succession. Importantly, humans can assist the vegetation recycling process manually by composting and enhancing habitats.
A brittle environment experiences irregular, spasmodic, variable atmospheric humidity. (This can be related to ocean temperatures affecting continental rainfall events in different hemispheres.) There are variable periods of rain and extended dry periods that may or may not occur on a seasonal basis. In this type of environment – comprising about 96% of Australia – vegetation does not recycle unassisted and become incorporated into the soil profile. It will oxidise slowly and usually remains standing until acted upon by an external force or a managed action.
This external force or managed action will involve one (or a combination) of the following: fire, whether natural or human-generated, hail, rain, wind, flood or temperature; mechanical intervention such as ploughing, slashing, mowing or rolling; animal impact, such as grazing, trampling, dunging, urinating, controlled rest and so on. (These ‘tools’ for landscape management are discussed below.)
It must be noted that identifying where a particular landscape sits on the ‘brittleness scale’ is only a guide to vegetation breakdown and any planned actions to improve ecosystem function must consider the successional status of existing community dynamics. For example, a sclerophyll forest will experience very slow breakdown, regardless of consistency of atmospheric humidity. Even in non-brittle environments, this slow breakdown means there is a build-up of ‘fuel’ and consequential susceptibility to fire.
In brittle environments, only animals – managed effectively – can recycle vegetation in a natural way that truly enhances ecosystem, increases biodiversity, advances succession and be economically beneficial – improves economy.

SERVICES, PLANNING, COMMUNITY INVOLVEMENT, EMPLOYMENT, EVALUATION AND RESEARCH, ECONOMIC VIABILITY
Our design, consultancy, planning, management and maintenance services include fire and temperature mitigation, weed control, erosion repair, roadside management, vegetation establishment, wildlife habitat and corridor creation, regeneration and vegetation management, infrastructure resource management, as well as Ecological Outcomes Verification (EOV), research and ecological education.
Planning for each project is based on a defined overall outcome and broken down into specific location/s, such as an individual property, a village, town, city or regional community. It may also

include public and private land that impacts these properties and communities.
In our pursuit of regenerating landscape function, we are committed to questioning habit, ossified decision-making processes and pressure from various directions to do things the way they've traditionally been done. At the same time, we value local and indigenous knowledge very highly. We envisage working collaboratively with local communities, traditional owners, public and private landholders, urban and rural fire services, national parks, federal and state governments, local councils and shires, research and educational institutions, industry and mining concerns, landscape architects, designers and managers, land care and bush regeneration groups and urban and regional agriculture and horticulture enterprises.
Our planning consists of evaluating the biological, cultural and financial requirements of the specified area or community and developing a holistic context or desired outcome. In our model, planning is not confined to the initial stage of a project, with a plan 'lying in state' throughout. We find it useful regularly to ask ourselves 'what if we are wrong?' It is invaluable to pre-test all decisions undertaken throughout the duration of the project against the holistic context and re-plan regularly.
Stakeholders and decision makers are identified and a community-specific context is established. Once locally available resources and forms of production are assessed, and materials and infrastructure required to head toward the desired outcome are identified, an initial management plan is proposed and a budget can be prepared.
Initial funding is required for planning, training and establishment of infrastructure. A landscape plan and mapping are required to plot actions and monitor and record outcomes. The intention is to promote and add scale to enterprise in regional and urban agriculture and horticulture as well as create efficiencies for public resources.
Employment is created by installation of infrastructure, ongoing maintenance and day-to-day management. Management of selected sites will be underpinned by new venture and viable enterprises.
Australian farmers/land managers are the first producers in the world to be trained in Ecological Outcome Verification (EOV). Land to Market Australia™ is playing a key role in shaping the implementation of EOV worldwide as a practical and cost-effective approach for farmers/land mangers everywhere.
Land to Market Australia™ works through reliable, clear and transparent measurement. At the farm or site under management, EOV data is gathered, then recorded to show changes in ecological outcomes. Once farmers or land managers join the program, baseline assessment begins. The site is monitored annually, with detailed site evaluation every five years. Data is analysed to provide quality assurance, and the land receives the EOV seal after a positive trend in ecosystem health is confirmed.
Economic viability and income opportunities would be generated through increased scale allowing for greater efficiency of movement, improved performance, greater capacity, greater consistency of supply, higher product quality, branded product conducing to higher price stability, greater equity, lower cost of production, reduced subsistence, carbon credits and so on.

TOOLS AND INSTRUMENTS
Fire not only causes devastating damage to human lives, livelihoods and property, it is also highly detrimental to the environment. It reduces biodiversity, regresses succession and degrades ecosystem. Fire in Australia is a major contributor of methane and carbon dioxide emission into the atmosphere. This goes well beyond the measurement of what is burnt and the subsequent smoke. Fire, renders an environment without green leaf for photosynthesis, depletes soil carbon and consequently,

reduces the environment's sequestration ability. Additionally, and as previously mentioned, any measurement of organic carbon lost into the atmosphere has a multiplying factor of 3.67 in CO2. 1 tonne OC = 3.67 tonnes of CO2

Fire is only one of many symptoms of ecosystem dysfunction. However, when we manage to create environments that are resistant to burning, we effectively address the cause of climate extremes by producing conditions for a healthy, thriving, functioning ecosystem at the same time. We can create strategic natural firebreaks that address whole ecosystem regeneration with many tools and instruments at our disposal.

Australia currently manages its environment for fire prevention and property protection with tools that fit into four categories: fire including 'prescribed burns' and 'cool and Cultural burns'; technology including machinery and chemicals; rest over varying lengths of time; and the actions of living organisms.

Prescribed burns are currently a widespread practice for property protecting and bushland management. They are, and will be for some time, necessary for fuel reduction in urban and industrial areas adjacent to bushland. However, increased prescribed burns will continue to degrade environments, leaving them increasingly fire volatile. Other forms of fuel reduction for property protection need to be investigated and implemented in order to shift away from prescribed burning.

'Cool and Cultural' burns offer a transitional path towards a fire free environment. They are particularly effective for protection from widespread grass and bushfire fire in open and semi-open areas. In areas with continuous sclerophyll canopy, they will reduce the intensity of fire in the understory enabling less damage and faster recovery. Cool burns do, however, have a detrimental effect on the species mix, giving rise to increasingly fire-dependant plant communities and fire-volatile environments. As discussed, the escalation of these fire-dependant sclerophyll dominated plant communities produces increasing volumes of flammable drop. This inevitably exacerbates the fire risk and the consequent frequency of required burns.

Technology and machinery have their places in preparation, establishment and maintenance of many landscapes in Australia. Traditionally, preparation may include once-off spraying of chemical defoliant, select clearing, deep ripping, grading, tillage or rotary hoeing. Planting and establishment can be assisted with planting machinery, fertiliser application and irrigation systems. Maintenance can comprise pest and weed control, pruning and hedging equipment, mowers, slashers, brushcutters, whippersnippers and so on. Technology and machinery can assist in creating natural firebreaks with long-lasting success in many situations, but only if there is efficient ongoing recycling of vegetation. Requiring a step backwards to achieve a step forwards, it is especially applicable for areas that are severely degraded.

The tools of technology, fire and rest have been employed for hundreds of years, yet environments continue to degrade. Existing tools tend to reduce biodiversity and biomass, regress succession of vegetation and degenerate ecosystems. They can be used differently and they are not the only tools available. Expanded forms of management – or tools – that should be considered more seriously, routinely and strategically include manual restoration, that is, the planting of trees and other plants; mulching and composting, including utilisation of food and green waste; planned grazing, properly managed to recycle vegetation; animal impact, to improve conditions; and planned rest, enabling healthy plant recovery and root regrowth.

Each of these management strategies has its place and no practice should be ruled out. The planned action/s should be 'tested' against the context or 'future landscape description' to determine the direction in which proposed action will take us. It is important to realise that this is, by necessity, a transitional process.

Manual restoration, for example, can be effective for creating natural fire breaks in select areas, especially urban and roadside, private properties and the like but it often difficult and expensive to implement and maintain over large areas. Preparation must create conditions for the successful establishment of a diverse plant selection. The soil surface needs to be covered and maintenance must efficiently ensure retaining viable cover. Supplementary ‘pocket’ plant establishment into existing landscape is a low disturbance action that can be implemented efficiently without irrigation. Mulching/composing individual spots will over time create a moisture and nutrient profile suitable for a small higher succession or understory plant. Good planning, preparation and ongoing management are crucial in order to truly regenerate ecosystem.

Animals can be used to great effect to change environments and regenerate ecosystem. They can be managed to create natural firebreaks on any scale and with economic efficiency. A great variety of animals can be employed to achieve specific ends: wildlife, such as kangaroos and emus; domesticated animals, including chickens, turkeys, goats, sheep, alpacas, lamas, pigs, cattle, bison, horses and domestic water buffalo; and even introduced wild animals, such as brumbies, camels and water buffalo.

We can manage animals in a way that regenerates the landscape or mis-manage them so as to degrade it. We can manage regeneratively regardless of the resource and regardless of the forms of production.

It is not so much the tool we use, but the way in which it is used that will lead us towards or away from our desired outcome. “A hammer can be used to build; a hammer can destroy”

Temperature extremes do not cause bare soil, bare soil causes temperature extremes!

Temperature extremes are significantly determined by the condition of the biological ecosystem. Where the soil surface is covered with living plants and/or viable litter, there will be greater moisture retention and improving nutrient cycling, all leading to greater photosynthesis ability, more food for microbes and increased sequestration and storage of organic carbon. These areas have greater temperature stability, cooler on hot summer days and warmer on winter nights and mornings.

There are many examples of properly managed animals creating effective fire breaks and regenerating ecosystem on an array of scales. Goats are being used for fire, erosion, weed control and restoration work in many countries around the world including Australia. When animals are managed properly, the process converts existing vegetation to viable litter, restoring healthy bacteria-to-fungi balance and creating conditions that are no longer suitable for the total dominance of lower-succession fire-susceptible plant communities.

We need to consider the use of each and every tool at our disposal, interrogating the likely beneficial and/or detrimental effects of each upon the total landscape we wish to foster, deliberating in relation to timing and manner of the action and thinking constantly about how each action can be used positively.

TARGET AREAS

Fire security achieved through biological management carries with it the vital benefit of addressing almost all of our ecological issues. Therefore, an initial focus on fire security alone sets us along a path of immeasurable beneficial consequence. Managed regeneration of environments along and around roads, tracks, highways, fire trails, township parameters, powerline, pipeline and telecommunications easements, travelling stock routes, private and public land, retired mining sites, water catchments, lake surrounds, gullies, waterways and so on would address immediate concerns about security from fire, but also introduce the broad public to the science, philosophy, methodology and language of biological regenerative land management.

Initially, it would be ideal to identify sites in different regions of New South Wales and the Australian Capital Territory that have been severely affected and/or face imminent threat. Trials could be conducted in selected sites such as the Garigal National Park, any of the national parks comprising residential/industrial or infrastructure sites such as Ku-ring-gai Chase, Brisbane Water, Marramarra, Lane Cove or the Berowra Valley; the Tallaganda area of the Southern Tablelands; the Wollemi and Yengo National Parks of the Hunter region; the Blue Mountains National Park; and Black Mountain Nature Reserve, Red Hill Nature Reserve and Mount Stromlo in the ACT.
The methodology would expand to other areas of New South Wales/Australian Capital Territory and then to all States and Territories.

ECOLOGICAL AWARENESS
Increasing biodiversity means increasing the diversity within as well as between different species of living things – plants, animals, fungi and microorganisms – including diversity of age, state, longevity, behavioural traits and so on.
Organisms including algae, lichens, annuals, colonisers, sedges are known as 'low succession' entities. 'High succession' plant communities comprise diverse trees, shrubs and understorey. Advancing biological succession means progressing a series of changes in composition and complexity of an ecological community. Human activity plays a significant and necessary role in both the direction and speed of this transition.
'Secondary succession' refers to an instance of biological succession that occurs in an area where primary succession has already taken place and soil is already established. Normally, secondary succession happens when an environment has suffered some catastrophe, such as severe fire or man-made, such as over-clearing, tillage, etc. – anything that renders bare soil.
The table below illustrates characteristics and propensities of low and high succession environments.

LOW SUCCESSION ENVIRONMENTS HIGH SUCCESSION ENVIRONMENTS
HYDROPHOBIC LANDSCAPE HYDRATED LANDSCAPE
Fire No fire
Species loss Abundant habitat/refuge
Temperature extremes Moderate temperature
High evaporation/evapotranspiration Effective transpiration/condensation
Regular drought Occasional dry periods
Wind Wind abatement
Storm damage Habitat stability
Dust No dust
Air contamination Clean air
Run-off Little to no run-off
Flooding Little to no flooding
Erosion No erosion – building soil
Water contamination Clean clear water
Imbalances In balance
Poor nutrient levels Effective nutrient cycling
WATER ACROSS THE LANDSCAPE WATER INTO THE LANDSCAPE
EMITS ORGANIC CARBON SEQUESTERS CARBON
CLIMATE EXTREMES CLIMATE STABILITY
With good planning and management, testing and strategic employment of the 'tools' described above, we can create favourable conditions to blend high succession environments back into our highly combustible sclerophyll/eucalypt and heathland plant communities. The benefits of fostering biological succession within a given region are clear from the table above. We need diversity of (predominately perennial) species covering the ground, understory as well as varying canopy. We can foster

the establishment of plants that help create ‘good conditions’ that stay moist more consistently. Plants with ‘edible drop’ provide food for animals, birds, insects and microbes, improving the nutrient cycle.
Further, however, in seeking to create fire retardant/fire-resistant environments, we can select for fire-retardant species.
Most fire retardant/resistant species are ‘high succession’ plants and share many of the following features: they are both sun and shade tolerant; have advanced xylem (meaning they are more efficient than other plants at pumping water and nutrients); have better photosynthesis ability; have highly advanced, often multi-layered root systems, meaning that they stabilise soil (preventing landslip) and are less likely to fall in storms or high wind; they are edible/forageable/herbaceous, providing food for animals to recycle; their ‘drop’ breaks rapidly and is consumed by the soil, creating humus-sequestering carbon; they are long-lived and/or multiply freely; they create conditions that militate against invasion of ‘lower succession’ plants or weeds; they are highly effective temperature moderators, condensation effect is greater than standard insolation; they are good ‘performers’, with good ‘form’ and are usually true to type.
Mr Neil Marriott has compiled lists of fire resistant and retardant plants for the Australian Plants Society (APS), taking into account the experience of APS Victoria members, many of whom have properties in fire-prone areas or areas which have been affected by bushfires. These can be seen on the Society’s website. An abbreviated list of plants suitable for eastern Australia follows:

SOME FIRE RETARDANT PLANTS
BOTANICAL NAME Common name
Acacia fimbriata FRINGED WATTLE
Acmena smithii LILLY PILLY
Ajuga australis AUSTRAL BUGLE
Alyxia buxifolia SEA BOX
Angophora costata SMOOTH-BARKED APPLE
Brachychiton populneus KURRAJONG
Coprosma hirtella ROUGH COPROSMA
Corymbia maculata SPOTTED GUM
Cyathea australis ROUGH TREE-FERN
Dianella revoluta BLACK-ANTHER FLAX-LILY
Dichondra repens KIDNEY-WEED
Eremophila santalina SANDALWOOD EMU-BUSH
Ficus macrophylla MORETON BAY FIG
Ficus rubiginosa RUSTY FIG
Hymenosporum flavum NATIVE FRANGIPANI
Myoporum acuminatum BOOBIALLA
Solanum laciniatum LARGE KANGAROO APPLE
Solanum simile OONDOROO
Viola hederacea IVY-LEAF VIOLET

SOME FIRE-RESISTANT PLANTS
Atriplex nummularia OLD-MAN SALTBUSH
Atriplex rhagodioides SILVER SALTBUSH
Atriplex semibaccata BERRY SALTBUSH
Carpobrotus glaucescens BLUISH PIGFACE
Carpobrotus modestus INLAND PIGFACE
Einadia nutans ssp nutans NODDING SALTBUSH
Enchylaena tomentosa RUBY SALTBUSH
Eremophila debilis CREEPING EMU-BUSH
Hakea salicifolia WILLOW-LEAVED HAKEA
Melia azedarach WHITE CEDAR
Myoporum parvifolium CREEPING MYOPORUM
Rhagodia candolleana SEABERRY SALTBUSH
Rhagodia crassifolia FLESHY SALTBUSH
Rhagodia parabolica FRAGRANT SALTBUSH
Rhagodia spinescens HEDGE SALTBUSH
Sarcozona praecox SARCOZONA
Scaevola calendulacea DUNE FAN-FLOWER
Scaevola hookeri CREEPING FAN-FLOWER

Sclerolaena diacantha GREY COPPERBURR
Sclerolaena spp ALL COPPERBURRS
Selliera radicans SHINY SWAMP-MAT
Zygophyllum apiculatum POINTED TWIN-LEAF
Zygophyllum billardierei COAST TWIN-LEAF
Zygophyllum spp ALL TWIN-LEAF PLANTS

Other native plants that should be considered when planning a Fire Retardant/Fire-Resistant Environments include: -
SOME OTHERS for CONSIDERATION
Alpinia spp. NATIVE GINGERS
Archontophoenix spp. ALEXANDRIA/BANGALOW PALM
Austromyrtus spp. MIDGENBERRYS
Backhousia citriodora LEMON MYRTLY
Brachychiton acerifolius ILLAWARRA FLAME TREE
Brachychiton discolour LACE KURRAJONG
Brachychiton rupestris QLD BOTTLE TREE
Brachychiton spp. BOTTLE TREES
Buckinghamia cellsissima IVORY CURL TREE
Castanospermum australe BLACKBEAN TREE
Citrus australasica NATIVE LIME BUSH
Cordyline spp. NATIVE CORDYLINES
Cupaniopsis spp. TUCKEROO/TAMERIND
Dendrobium spp. ORCHIDS
Doryanthes excelsa GYMEA LILY
Elaeocarpus reticulatus BLUEBERRY ASH
Eupomatia spp BOLWARRA
Helmholtzia glaberrima CREEK LILY
Ficus spp. FIG TREES & VINES
Lepidozamia spp. BURRAWANGS
Macrozamia spp. NATIVE CYCADS
Microlaena stipoides WEEPING GRASS
Myoporum parvifolium CREEPING BOOBIALLA
Stenacarpus sinuatus FIREWHEEL TREE
Syzygium spp. LILLI PILLIES
Toona ciliata RED CEDAR
Waterhousia spp LILLI PILLIES
Xanthorrhoea spp GRASS TREES

In addition, there are many non-invasive exotic plants well worthy of consideration in many situations. Many deciduous trees, combined with healthy understory, provide effective cooling summer shade, allow beneficial winter sun and have highly valuable leaf drop that provides food for animals and generous bulk of ‘viable litter’ for microbes that is soon integrated into soils.

1.4 Any other matters

SUMMARY
We would like to be actively involved in the planning, establishment and implementation of an ecological land management plan that effectively addresses fire and other natural disasters in New South Wales and broader Australia.
This submission is an overview of what we collectively believe must happen to efficiently manage our environments to generate long term and rewarding social, economic and environmental outcomes.
The goal is the achievement of ever-improving physical environments that regenerate landscape function, provide biosecurity and restore climate stability. If we aim at reducing fire susceptibility through making sound decisions and plans for biological ecosystem regeneration in specified areas, aiming for community dynamics that enhance water retention and carbon sequestration, comprising a healthy mix of plants including fire-retardant species, we will be securing physical, social and economic landscapes against a range of natural disasters – not only fire – into the future.
For us, recognising that the landscape situation we are called

upon to address is always part of the whole ecosystem, not separate from it, is always the first step toward developing a solution. We believe that a holistic way of making decisions is the only way to approach proposed changes to the biological ecosystem – the complex-inseparable-physiological-dynamic whole that it is.
We would be pleased to discuss any points requiring clarification or verification and provide examples of existing actions and outcomes.

Initiative by Tig Designs https://www.tigcrowleydesigns.com.au in association with the Australian Institute of Landscape Designers & Managers (AILDM) https://www.aildm.com.au/ , the Australian Holistic Management Co-operative (AHMC) – Land to Market AustraliaTM https://landtomarket.com.au/ and the Australian Institute of Horticulture (AIH) https://www.aih.org.au/

Supporting documents or images

Attach files	• Ian Crowley_Submission to NSW Indepdent Fire Inquiry.pdf

A REGENERATIVE METHODOLOGY

For Better Landscape Function, Biosecurity,

Public Protection and Climate Stability

SUBMISSION TO THE 2020 NEW SOUTH WALES INDEPENDENT BUSHFIRE INQUIRY

by IAN CROWLEY MAILDM MAIH MAHMC

Email tig@tigdesigns.com.au

22 May 2020

CONTENTS

OVERVIEW

The 2019-2020 fires and natural disasters over the last decade that have such massive economic and social consequences are predominantly biological – ecological. Our restoration, mitigation and prevention management must address these issues biologically and ecologically as well as culturally. It must be biologically/ecological and culturally regenerative.

The goal of this initiative is the achievement of ever-improving physical environments that regenerate landscape function, provide biosecurity, restore and maintain climate stability. This submission sets out to demonstrate that different concepts and proven management practices are fundamental to the successful deliver of this positive and essential outcome.

The initial focus is protection of people, property and surrounding nature (houses, villages, communities, industry, infrastructure and local landscape spaces and bushland amenity) from fire in fire-prone areas.

The vision for the initial focus is twofold. First, we suggest making better use of existing powerline & telecommunication easements, highways, roads, tracks, lanes, fire trails, railway lines, corridors and the like to create natural 'green' firebreaks. These are areas or strips of land, managed regeneratively to create natural fire free or fire safe zones. Secondly, in collaboration with property owners, local communities, regions and their representatives/decision makers, we advise the creation of new natural firebreaks, assist with planning and management for overall fire prevention/mitigation strategy. This might involve focused, once-off 'strategic' clearing to break continuous canopy in some areas, plus management of the new spaces back to 'High Succession' areas/strips and wildlife refuge. Incorporating advances in architectural design for new dwellings and buildings, re-planning for towns, villages and communities with fire-wise/ecological landscape design.

The longer-term objective is to introduce sound regenerative methodology and management practices into all tracts of public and private land, including parks and gardens, golf courses, sporting and recreation areas, councils, shires, national parks, horticulture, agriculture, forestry, water ways and riparian areas

We contend that climate extremes are the result from many factors, many of which can be addressed by human biological management. It is vital that we transition towards increasing drawdown and invigorating biological ecosystem across a broad range of environments through sound holistic decisions and regenerative actions.

The creation of environments that are resistant to burning will produce healthy, thriving, resilient ecosystem – the most effective remedy for mitigation of climate extremes.

ACKNOWLEDGEMENT

We recognise the efforts of all who have gone beyond the call of duty to help fight the terrible fires of the 2019-2020 summer and assist in recovery efforts. We acknowledge all who have died, lost loved ones and suffered in this enormous social, economic and ecological tragedy. We recognise the physical and psychological damage that many are still battling, the shattering of community routines, the loss of thousands of buildings, the deaths of thousands of livestock

animals, the incineration of countless millions of trees, distinct habitats and devastation of innumerable wildlife creatures.

We believe that learning from this experience is not only essential from a practical viewpoint, but also a way to honour those lost.

The fires added to great suffering and loss already caused by a very long drought and severe water shortages. Climate extremes have particularly affected the lives and livelihoods of farmers and rural districts, devastated regional and coastal communities, some of which will tragically never re-emerge, but no Australians have been spared some effects of fire, drought, temperature extremes, dust, wind, soil loss, water shortages, heavy rain, flood, landslip, erosion, and contamination of waterways through to our reefs and oceans. These bio-ecological events have affected our food, water and air quality and security, our health and livelihoods. Last summer, to an unprecedented degree, a great many Australians experienced a dramatically reduced quality of life.

The long-term effects of the crowning disaster of COVID19, totally unanticipated at the beginning of 2020, are yet to be known. However, there is a general sense that this is a moment for us to rethink what we really want. In isolation, we have achieved surprising connectedness with each other, and the mood that has germinated seems more about giving, sharing and working together than it is about self. We have (mostly) put politics and tribalism aside in a collaborative effort to achieve outcomes that are not only beneficial, but necessary to our collective future quality of life.

SUBMISSION PARTICIPANTS

This submission does not represent any political, religious or industry-based lobby groups.

It is supported by the Australian Institute of Landscape Designers & Managers (AILDM), the Australian Holistic Management Co-op (AHMC) – Land to Market Australia™ and the Australian Institute of Horticulture (AIH).

This submission is based on a natural ecosystem regenerative approach for fire prevention, protection and recovery, employing holistic methodology and management practices. Large scale application of natural ecosystem regeneration requires particular tools and focused investment to achieve the desired outcome. In order to achieve true sustainability, we understand that the implementation of any program/s must be financially and socially beneficial as well as culturally enriching

We are well-positioned to provide additional knowledge along with professional skills for landscape design, consultancy, planning, management, mapping and monitoring for efficient ecosystem regeneration.

It is our intention to provide and promote long-term business opportunities and enterprise creating meaningful employment in urban and regional areas of Australia.

IDENTIFYING THE PROBLEM

"El probléma y la solución comparten la misma casa" is a Spanish aphorism meaning "The problem and the solution share the same house". Applied to holistic regenerative land

management it serves as a reminder that we must realise we are a part of the problem in order to be a part of the solution. Holistically, this also applies to cultural regeneration.

Once we understand that most of our 'natural disasters' are bio- ecological, we will realise that our recovery, mitigation and prevention management must address such issues biologically and ecologically as well as culturally.

Biological issues and their consequences in New South Wales (and beyond) escalating under our current patterns of decision making, actions and management include:

Fire
Drought (Prolonged – Up To 10 Years in Some Areas)
Great Barrier Reef (Bleaching and Biodiversity Loss)
Temperature Extremes
River & Ocean Contamination
Fish Deaths (Murray Darling Basin)
Dust Storms
Heavy Rain/Severe Storms/High Winds
Floods
Land Slip Instability
Vegetation Instability
Air, Water & Food Quality Decline
Water Shortages and Food Security
Biosecurity
Contamination, Pollution, Imbalances and Disease
Human Health Degradation

Our decision making, actions and management has had, and continue to have, a significant negative effect on the biology of the planet. Across many environments, human activity has been mostly detrimental to the biological ecosystem. The rate of degradation has escalated dramatically over the last 50 years.

The Scripps Institute of Oceanography's NOAA Earth System Research Laboratory at Mauna Loa Observatory, Hawaii, measures and graphs atmospheric carbon dioxide in parts per million (ppm). Recording both net emissions and net drawdown of CO2, it reports an increase/decrease of CO2 in part per million (ppm) on an annual and monthly basis over decades.

In 1990, atmospheric CO2 measured 357.5ppm, rising to 372.2ppm in 2000: an increase of 14.7ppm. By 2010, however, the atmospheric CO2 measured 392.9 ppm: an increase of 20.7 ppm. It is this increase of 40.8% from one decade to the next that has sent calls for 'emissions reduction' echoing around the world.

However, looking at the data, we find that from 1990 to 2000 total net emissions measured 79.5ppm, and from 2000 to 2010 total net emissions measured 79.3ppm: a reduction of 0.2ppm. (Zero increase). See **Fig. 1.**

As the total net emissions were essentially the same, an increase of 40.8% over this period can only be explained by a decrease in drawdown of CO2 over the second decade. Indeed, from 1990 to 2000 the total net drawdown measured 64.8 ppm, while from 2000 to 2010 the total net drawdown measured 58.6 ppm.

The reduction in drawdown of 6.2 ppm represented a decrease of 9.6% from one decade to the next. It is the 9.6% decrease in drawdown that resulted in a 40.8% increase in ppm levels of atmospheric CO2.

All CO2 drawdown is biological (100%), but the biological ecosystem in many areas of the planet is failing and its ability (as a whole) to draw down (sequester/sink) carbon from the atmosphere is diminishing.

Importantly, terrestrial environments with poor to non-functioning ecosystem will tend to release more organic carbon than they draw down, emitting through bare soil evaporation, evapotranspiration, dust, erosion, oxidisation and fire. These environments have reduced ability to photosynthesise and to sequester and store organic carbon.

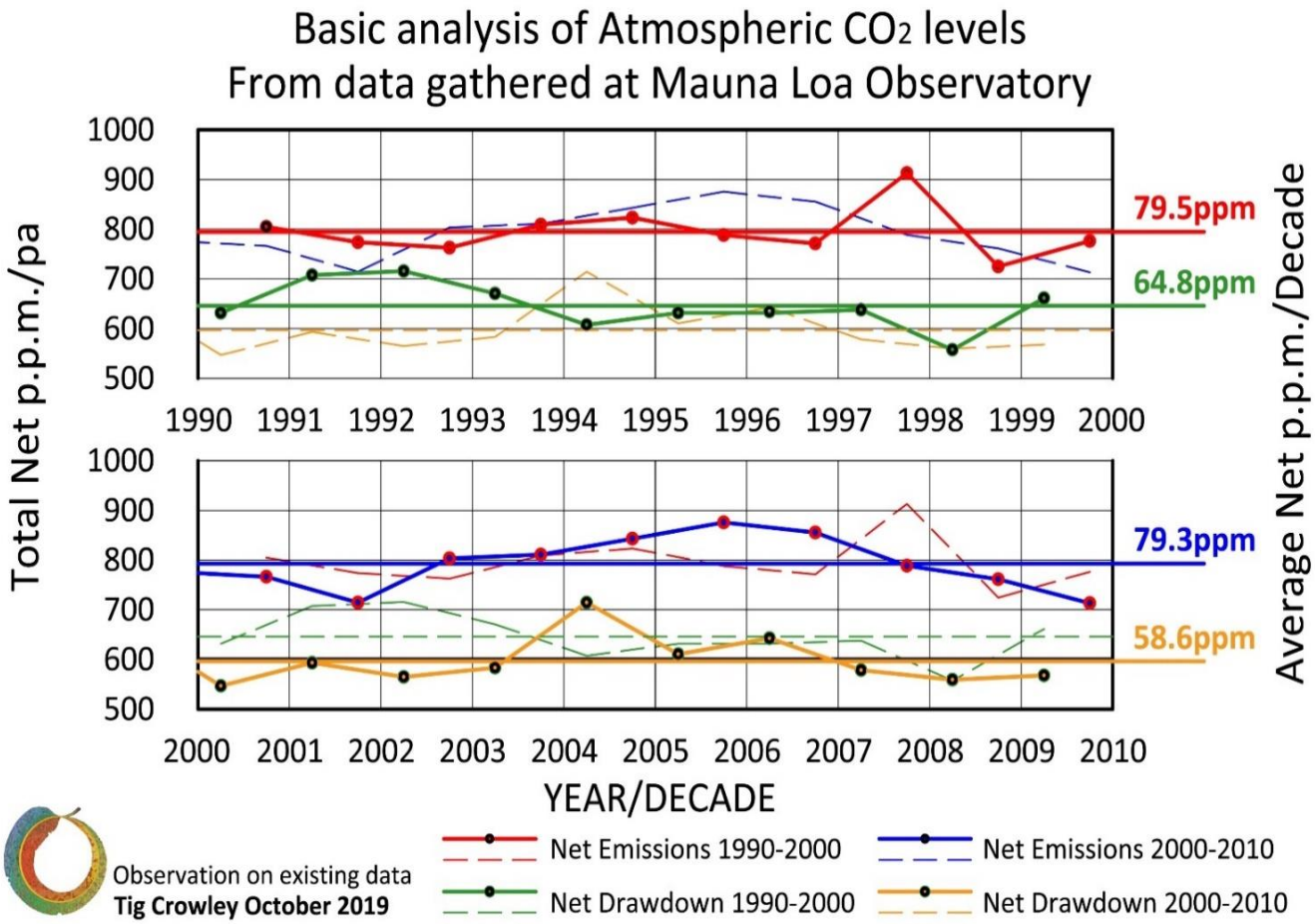


Fig. 1. Graph depicting annual net emissions and net drawdown over two decades 1990-2000 and 2000-2020. Please see further graphs in Annexure.

For every tonne of organic carbon released into the atmosphere, atmospheric CO2 increases by 3.67 tonnes. and conversely every tonne of organic carbon sequestered, removes 3.67 tonnes of CO2 from the atmosphere.

Climate extremes are caused by many influences, nearly all of which can be addressed by human biological management. While we must move efficiently towards reducing emissions, it is vital that we transition towards increasing drawdown (sequestration), only achievable by increasing biodiversity, advancing succession and regenerating biological ecosystem across many varied environments.

We must shift toward a regenerative management approach that builds resilience and protects against, combats, enables recovery from and averts natural disasters through proactive biological processes at every step. Biological regeneration is the ultimate prevention.

OUTCOMES

The outcome of this initiative is to accelerate the adoption of regenerative landscape design, planning and management in its many forms. Our goal is a sequence of increasing biodiversity, biomass & groundcover that will boost and increase humus in the soil (organic soil carbon) and photosynthesis. More humus or carbon in the soil will create conditions that enhance water retention, generates greater water holding capacity and allows efficient cycling, accelerating and advancing biological succession to enable biomes that restore nutrient cycling and fertility. Environments will be facilitated that regenerate biological ecosystem functionality, providing microclimate stability which will expand to mitigation of climate extremes.

Regenerative land management principles will ensure positive social and economic impact and regenerative forms of production will provide enduring bio-ecological security. Monitoring and recording ecosystem function, producing reliable scientific data through a process of Ecological Outcomes Verification (EOV), provided by Australian Holistic Management Co-op (AHMC) Land to Market Australia™ enables ongoing learning of ecological outcomes and generates ecological literacy and fluency.

This initiative proposes that any strategic plan should entwine with a creative narrative; a 'future landscape description' that describes a vision of Our Environment as we want it to be at a nominated date. Beginning from the proposition that 'the time for reconsideration is always now', a future description is a tool to identify what we, as a community, really want. It is a description, not a prescription. It is intrinsically idealistic.

The narrative that follows describes the Australian landscape as envisaged in 2050:

"It is a cultural and physical landscape that has been achieved through the involvement of diverse communities in frank, enjoyable, respectful and amicable relationships with their neighbours and broader community, government bodies, authorities, organisations, research institutions and education facilities.

In Australia, there is a great variety of natural landscapes that are aesthetically pleasing, healthy, utilised, productive, alive and clean. Our environments have high and ever-increasing level of biodiversity, both above and below the soil surface. We have ongoing advancing succession of species and communities; they are never static. There is an abundance of different varieties of perennial grasses and shrubs, as well as trees for shade, shelter and meaningful amenity.

Our wealth of habitat supports substantial populations of diverse wildlife, birds and insects and affords ready refuge, resulting in an animal community that is self-regulating and self-supporting.

The soil surface is covered with living plants and/or a layer of viable litter and is highly receptive to rain whenever it falls, enabling effective cycling of nutrients and solar energy. Each drop of rain is captured where it lands, and moisture is stored in an ever deepening, carbon rich soil profile. The soil is alive, growing and healthy with high levels of organic matter and humus. Young, fertile and robust soils yield landscapes that are fruitful, efficient and resilient.

Water cycles via transpiration and condensation with very little evaporation, run-off and no erosion. There is no movement of soil across the landscape and any water that runs off drains into underground streams and rivers, emerging as permanent springs or lying in aquifers ensuring continuous supply of filtered water into our waterways. We have a hydrated landscape with

abundant water that is clear and does not carry sediment, organic matter, contaminates or residues.

The well-functioning biological ecosystem over much of our landscape mitigates the occurrence and magnitude of floods and drought. We have very few unplanned grass or bushfires in our landscapes because we have managed ecologically to increase biodiversity with ever-advancing successional plant communities. With very little bare soil and diverse vegetative cover, our climate is moderated, insulated from temperature extremes.

We have diverse, integrated agriculture, horticulture, forestry, private and public land management that is productive, profitable and progressively regenerative with multiple income streams and forms of production.

All infrastructure, facilities and resources within our care are treated with respect, are safe, healthy, aesthetically pleasing and welcoming. All is well designed, constructed, installed and/or renovated to be fit for purpose, often multi-functional, modular and movable and always maintained in good condition.

All the people that use or interact with our infrastructure and machinery know how it works, what it is used for and how to manage resources efficiently. We are financially secure, free of debt and generate wealth from within our values. Any borrowings are short term, beneficial and affordable.

Australians are renowned worldwide as the leading practitioners in natural ecosystem regeneration and ecological landscape management".

WHOLE ECOSYSTEM MANAGEMENT

Terrestrial New South Wales covers an area of over 80 million hectares with many different landscapes, climatic conditions and ecological issues. Management action is required on a widely varying scale with an array of constraints and variation in topography, accessibility and ecological condition. Action in different areas will balance existing practices, if appropriate, with other complementary methodologies. We would expect a transitional period of phasing out or reducing the more degrading practices as regenerative actions are implemented, become more widespread and in time become the norm.

In order to manage for the whole ecosystem, we need to have an understanding of how the biological ecosystem functions and how it functions differently in different environments.

Our biological ecosystem functions as a whole that contains of the same four fundamental processes everywhere on earth. These four ecosystem processes are The Water Cycle, The Mineral/Nutrient Cycle, Energy Flow and Community Dynamics. The biological ecosystem is a Complex-Inseparable-Physiological-Dynamic and is the essential basis for all life. It is complex in that it consists of an indeterminate variety and number of interconnected parts and symbiotic relationships; it is inseparable in that it does not function in parts, only as a whole; it is physiological in that it involves the behaviours and functions of living organisms; it is dynamic, in that it is in constant change, never static.

Aspects of the biological ecosystem function or respond differently in different geographical environments, landscapes, communities, micro and macro climates and so on.

Humans are part of the biological ecosystem; we do not stand outside it. However, we can manage for direction and velocity of change to ecosystem dynamics, which are always either regenerating or degrading. To achieve this, we must understand the defined social, financial and ecological landscape under management as a whole, and make decisions, plan, test and devise processes to manage complexity (managing complexity is different from managing the complicated, which can be approached in parts).

The interconnected nature of our biological ecosystem means that if one ecosystem process fails or is removed, the whole will fail. The corollary, however, is that if we can manage to enhance or improve only one process, we are inadvertently managing for all four – the whole.

Human creativity, ability to make plans and ability to envisage a 'whole' are our great assets as a species.

An example of an aspect of the biological ecosystem that functions differently in different geographical environments is 'The Water Cycle'. Fundamental to any regenerative landscape plan is a good understanding of the water cycle of the environment, to enable natural actions to be taken to slow water down and store it in the soil. This will have repercussions throughout every element or aspect of the whole biological ecosystem, from solar energy flow and the cycling of nutrients to advancing succession and community dynamics.

Most adult Australians were taught a model of 'The Water Cycle' in school. In this model, continuous atmospheric humidity enables vegetation to recycle naturally without human assistance. However, this story is relevant to only about 40% of the planet's terrestrial land mass. The remaining 60% lacks continuous atmospheric humidity and consequently behaves and responds differently.

Only about 4% of the land in Australia experiences a 'Water Cycle' characterised by continuous atmospheric humidity. This 4% runs in a thin line down the east coast of Australia, most of Tasmania and a patch on the south-west of Western Australia. See **Fig. 2.** About 90% of our human population resides in it. Despite the self-regenerating characteristics of this water cycle, concentrated population, development, infrastructure, consumption in these areas mean that our environmental resource management is critical and sensitive.

The ecologist Allan Savory uses the terms 'non-brittle' and 'brittle' environments to distinguish between environments that experience continuous atmospheric humidity – such as the 4% of Australia in which most of the population is concentrated – and those that experience intermittent atmospheric humidity.

In a non-brittle environment, such as our 4%, rainfall patterns are more reliable than in a brittle environment. In a non-brittle environment vegetation will break down, recycle and become incorporated into the soil profile. This natural re-cycling of vegetation feeds the living organisms in the soil which in turn cycle nutrients (minerals) enabling beneficial succession. Importantly, humans can assist the vegetation recycling process manually by composting and enhancing habitats.

A brittle environment experiences irregular, spasmodic, variable atmospheric humidity. (This can be related to ocean temperatures affecting continental rainfall events in different hemispheres.) There are variable periods of rain and extended dry periods that may or may not occur on a seasonal basis. In this type of environment – comprising about 96% of Australia –

vegetation does not recycle unassisted and become incorporated into the soil profile. It will oxidise slowly and usually remains standing until acted upon by an external force or a managed action.

This external force or managed action will involve one (or a combination) of the following: fire, whether natural or human-generated, hail, rain, wind, flood or temperature; mechanical intervention such as ploughing, slashing, mowing or rolling; animal impact, such as grazing, trampling, dunging, urinating, controlled rest and so on. (These 'tools' for landscape management are discussed below.)

It must be noted that identifying where a particular landscape sits on the 'brittleness scale' is only a guide to vegetation breakdown and any planned actions to improve ecosystem function must consider the successional status of existing community dynamics. For example, a sclerophyll forest will experience very slow breakdown, regardless of consistency of atmospheric humidity. Even in non-brittle environments, this slow breakdown means there is a build-up of 'fuel' and consequential susceptibility to fire.

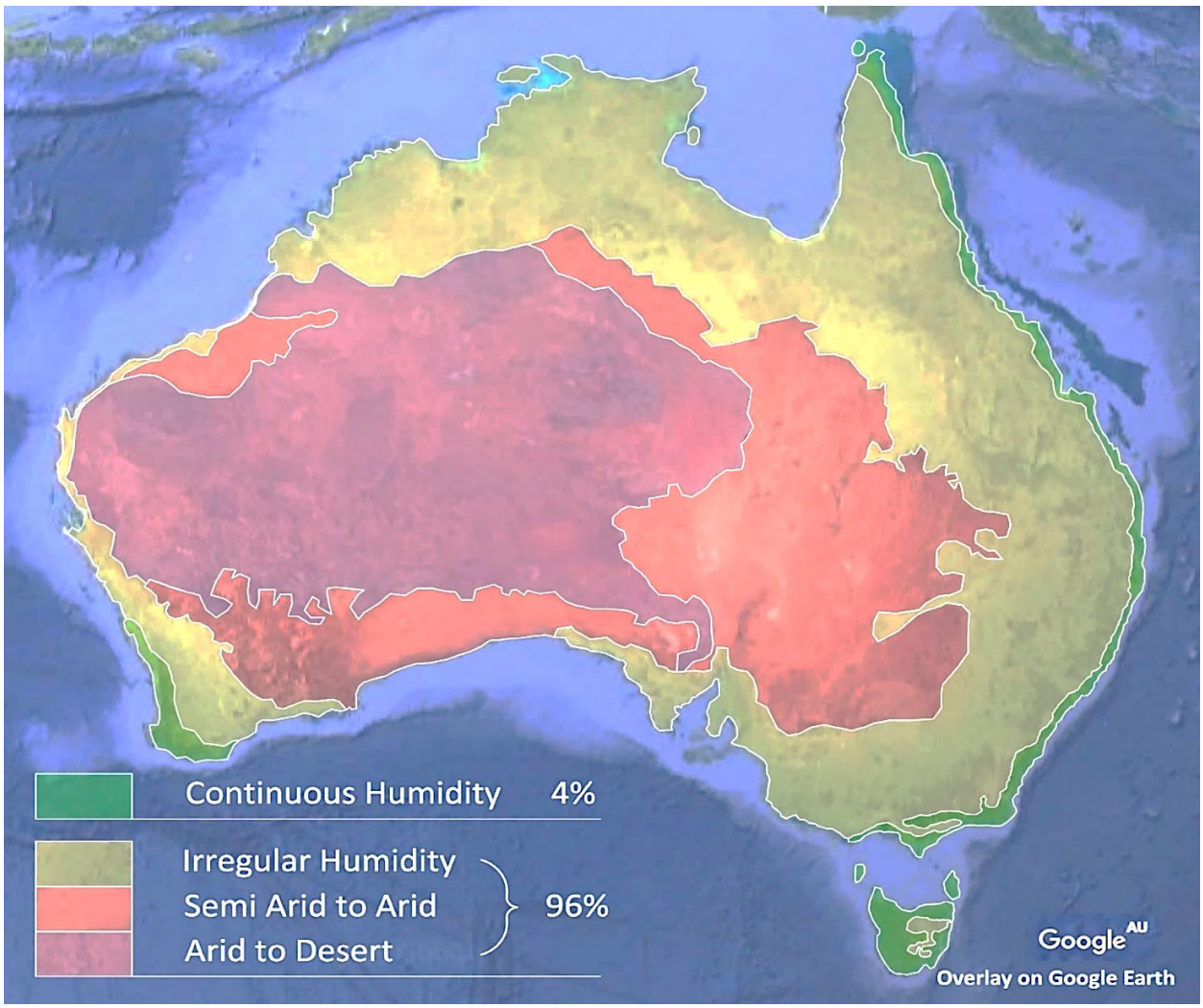


Fig. 2. Map of Australia continent depicting 4% with Continuous Humidity (Non-brittle) and the remainding 96% with Irregular Humidity (Brittle).

The above illustration provides a basic breakdown of brittle and non-brittle land in Australia. Varying methodology and management can increase biodiversity in all areas with the semi-arid, arid and desert proving more challenging in the mid-term.

In brittle environments, only animals – managed effectively – can recycle vegetation in a natural way that truly enhances ecosystem, increases biodiversity, advances succession and be economically beneficial – improves economy.

SERVICES, PLANNING, COMMUNITY INVOLVEMENT, EMPLOYMENT, EVALUATION AND RESEARCH, ECONOMIC VIABILITY

Our design, consultancy, planning, management and maintenance services include fire and temperature mitigation, weed control, erosion repair, roadside management, vegetation establishment, wildlife habitat and corridor creation, regeneration and vegetation management, infrastructure resource management, as well as Ecological Outcomes Verification (EOV), research and ecological education.

Planning for each project is based on a defined overall outcome and broken down into specific location/s, such as an individual property, a village, town, city or regional community. It may also include public and private land that impacts these properties and communities.

In our pursuit of regenerating landscape function, we are committed to questioning habit, ossified decision-making processes and pressure from various directions to do things the way they've traditionally been done. At the same time, we value local and indigenous knowledge very highly. We envisage working collaboratively with local communities, traditional owners, public and private landholders, urban and rural fire services, national parks, federal and state governments, local councils and shires, research and educational institutions, industry and mining concerns, landscape architects, designers and managers, land care and bush regeneration groups and urban and regional agriculture and horticulture enterprises.

Our planning consists of evaluating the biological, cultural and financial requirements of the specified area or community and developing a holistic context or desired outcome. In our model, planning is not confined to the initial stage of a project, with a plan 'lying in state' throughout. We find it useful regularly to ask ourselves 'what if we are wrong?' It is invaluable to pre-test all decisions undertaken throughout the duration of the project against the holistic context and re-plan regularly.

Stakeholders and decision makers are identified and a community-specific context is established. Once locally available resources and forms of production are assessed, and materials and infrastructure required to head toward the desired outcome are identified, an initial management plan is proposed and a budget can be prepared.

Initial funding is required for planning, training and establishment of infrastructure. A landscape plan and mapping are required to plot actions and monitor and record outcomes. The intention is to promote and add scale to enterprise in regional and urban agriculture and horticulture as well as create efficiencies for public resources.

Employment is created by installation of infrastructure, ongoing maintenance and day-to-day management. Management of selected sites will be underpinned by new venture and viable enterprises.

Australian farmers/land managers are the first producers in the world to be trained in Ecological Outcome Verification (EOV). Land to Market Australia™ is playing a key role in shaping the

implementation of EOV worldwide as a practical and cost-effective approach for farmers/land mangers everywhere.

Land to Market Australia™ works through reliable, clear and transparent measurement. At the farm or site under management, EOV data is gathered, then recorded to show changes in ecological outcomes. Once farmers or land managers join the program, baseline assessment begins. The site is monitored annually, with detailed site evaluation every five years. Data is analysed to provide quality assurance, and the land receives the EOV seal after a positive trend in ecosystem health is confirmed.

Economic viability and income opportunities would be generated through increased scale allowing for greater efficiency of movement, improved performance, greater capacity, greater consistency of supply, higher product quality, branded product conducing to higher price stability, greater equity, lower cost of production, reduced subsistence, carbon credits and so on.

TOOLS AND INSTRUMENTS

Fire not only causes devastating damage to human lives, livelihoods and property, it is also highly detrimental to the environment. It reduces biodiversity, regresses succession and degrades ecosystem. Fire in Australia is a major contributor of methane and carbon dioxide emission into the atmosphere. This goes well beyond the measurement of what is burnt and the subsequent smoke. Fire, renders an environment without green leaf for photosynthesis, depletes soil carbon and consequently, reduces the environment's sequestration ability. Additionally, and as previously mentioned, any measurement of organic carbon lost into the atmosphere has a multiplying factor of 3.67 in CO2. 1 tonne OC = 3.67 tonnes of CO2

Fire is only one of many symptoms of ecosystem dysfunction. However, when we manage to create environments that are resistant to burning, we effectively address the cause of climate extremes by producing conditions for a healthy, thriving, functioning ecosystem at the same time. We can create strategic natural firebreaks that address whole ecosystem regeneration with many tools and instruments at our disposal.

Australia currently manages its environment for fire prevention and property protection with tools that fit into four categories: fire including 'prescribed burns' and 'cool and Cultural burns'; technology including machinery and chemicals; rest over varying lengths of time; and the actions of living organisms.

Prescribed burns are currently a widespread practice for property protecting and bushland management. They are, and will be for some time, necessary for fuel reduction in urban and industrial areas adjacent to bushland. However, increased prescribed burns will continue to degrade environments, leaving them increasingly fire volatile. Other forms of fuel reduction for property protection need to be investigated and implemented in order to shift away from prescribed burning.

'Cool and Cultural' burns offer a transitional path towards a fire free environment. They are particularly effective for protection from widespread grass and bushfire fire in open and semi-open areas. In areas with continuous sclerophyll canopy, they will reduce the intensity of fire in the understory enabling less damage and faster recovery. Cool burns do, however, have a detrimental effect on the species mix, giving rise to increasingly fire-dependant plant communities and fire-volatile environments. As discussed, the escalation of these fire-

dependant sclerophyll dominated plant communities produces increasing volumes of flammable drop. This inevitably exacerbates the fire risk and the consequent frequency of required burns.

Technology and machinery have their places in preparation, establishment and maintenance of many landscapes in Australia. Traditionally, preparation may include once-off spraying of chemical defoliant, select clearing, deep ripping, grading, tillage or rotary hoeing. Planting and establishment can be assisted with planting machinery, fertiliser application and irrigation systems. Maintenance can comprise pest and weed control, pruning and hedging equipment, mowers, slashers, brushcutters, whippersnippers and so on. Technology and machinery can assist in creating natural firebreaks with long-lasting success in many situations, but only if there is efficient ongoing recycling of vegetation. Requiring a step backwards to achieve a step forwards, it is especially applicable for areas that are severely degraded.

The tools of technology, fire and rest have been employed for hundreds of years, yet environments continue to degrade. Existing tools tend to reduce biodiversity and biomass, regress succession of vegetation and degenerate ecosystems. They can be used differently and they are not the only tools available.

Expanded forms of management – or tools – that should be considered more seriously, routinely and strategically include manual restoration, that is, the planting of trees and other plants; mulching and composting, including utilisation of food and green waste; planned grazing, properly managed to recycle vegetation; animal impact, to improve conditions; and planned rest, enabling healthy plant recovery and root regrowth.

Each of these management strategies has its place and no practice should be ruled out. The planned action/s should be 'tested' against the context or 'future landscape description' to determine the direction in which proposed action will take us. It is important to realise that this is, by necessity, a transitional process.

Manual restoration, for example, can be effective for creating natural fire breaks in select areas, especially urban and roadside, private properties and the like but it often difficult and expensive to implement and maintain over large areas. Preparation must create conditions for the successful establishment of a diverse plant selection. The soil surface needs to be covered and maintenance must efficiently ensure retaining viable cover. Supplementary 'pocket' plant establishment into existing landscape is a low disturbance action that can be implemented efficiently without irrigation. Mulching/composing individual spots will over time create a moisture and nutrient profile suitable for a small higher succession or understory plant. Good planning, preparation and ongoing management are crucial in order to truly regenerate ecosystem.

Animals can be used to great effect to change environments and regenerate ecosystem. They can be managed to create natural firebreaks on any scale and with economic efficiency. A great variety of animals can be employed to achieve specific ends: wildlife, such as kangaroos and emus; domesticated animals, including chickens, turkeys, goats, sheep, alpacas, lamas, pigs, cattle, bison, horses and domestic water buffalo; and even introduced wild animals, such as brumbies, camels and water buffalo.

We can manage animals in a way that regenerates the landscape or mis-manage them so as to degrade it. We can manage regeneratively regardless of the resource and regardless of the forms of production.

It is not so much the tool we use, but the way in which it is used that will lead us towards or away from our desired outcome. "A hammer can be used to build; a hammer can destroy"

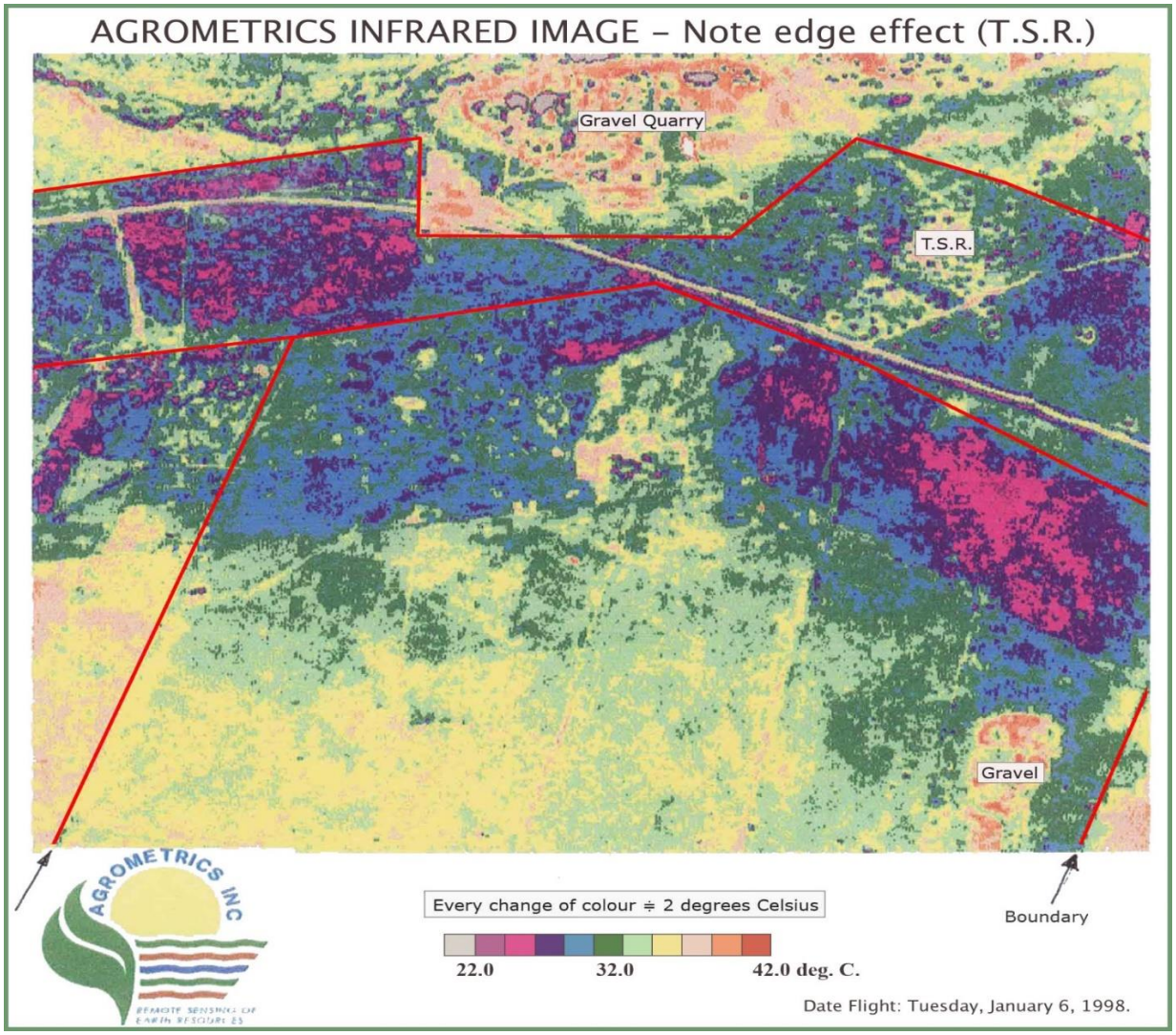


Fig. 3. Infrared imagery is one of many possible instruments for verifying ecological outcome.

The above infrared image was taken in north-western NSW 6 January 1998 by the American company Agrometrics (no longer in Australia). The process measures temperature at soil surface level in 2 deg. C. increments and is not indicative of canopy cover. This image depicts a temperature variation of up to 14-16 deg. C. from one side of a fence to the other within a matter of metres. This difference in temperature is expressed with the same amount of atmospheric CO2, the same wind and under the same Sun. It is important to note that all the land in this image carried livestock including the Traveling Stock Route (TSR) and the only variable is the way the animals are management. The greatest temperature variations on the image are between the TSR and neighbouring land, especially to the northern side.

Temperature extremes do not cause bare soil, bare soil causes temperature extremes!

Temperature extremes are significantly determined by the condition of the biological ecosystem. Where the soil surface is covered with living plants and/or viable litter, there will be greater moisture retention and improving nutrient cycling, all leading to greater photosynthesis ability, more food for microbes and increased sequestration and storage of organic carbon. These areas have greater temperature stability, cooler on hot summer days and warmer on winter nights and mornings.

There are many examples of properly managed animals creating effective fire breaks and regenerating ecosystem on an array of scales. Goats are being used for fire, erosion, weed control and restoration work in many countries around the world including Australia. When animals are managed properly, the process converts existing vegetation to viable litter, restoring healthy bacteria-to-fungi balance and creating conditions that are no longer suitable for the total dominance of lower-succession fire-susceptible plant communities.

We need to consider the use of each and every tool at our disposal, interrogating the likely beneficial and/or detrimental effects of each upon the total landscape we wish to foster, deliberating in relation to timing and manner of the action and thinking constantly about how each action can be used positively.

TARGET AREAS

Fire security achieved through biological management carries with it the vital benefit of addressing almost all of our ecological issues. Therefore, an initial focus on fire security alone sets us along a path of immeasurable beneficial consequence. Managed regeneration of environments along and around roads, tracks, highways, fire trails, township parameters, powerline, pipeline and telecommunications easements, travelling stock routes, private and public land, retired mining sites, water catchments, lake surrounds, gullies, waterways and so on would address immediate concerns about security from fire, but also introduce the broad public to the science, philosophy, methodology and language of biological regenerative land management.

Initially, it would be ideal to identify sites in different regions of New South Wales and the Australian Capital Territory that have been severely affected and/or face imminent threat. Trials could be conducted in selected sites such as the Garigal National Park, any of the national parks comprising residential/industrial or infrastructure sites such as Ku-ring-gai Chase, Brisbane Water, Marramarra, Lane Cove or the Berowra Valley; the Tallaganda area of the Southern Tablelands; the Wollemi and Yengo National Parks of the Hunter region; the Blue Mountains National Park; and Black Mountain Nature Reserve, Red Hill Nature Reserve and Mount Stromlo in the ACT.

The methodology would expand to other areas of New South Wales/Australian Capital Territory and then to all States and Territories.

ECOLOGICAL AWARENESS

Increasing biodiversity means increasing the diversity within as well as between different species of living things – plants, animals, fungi and microorganisms – including diversity of age, state, longevity, behavioural traits and so on.

Organisms including algae, lichens, annuals, colonisers, sedges are known as ‘low succession’ entities. ‘High succession’ plant communities comprise diverse trees, shrubs and understorey. Advancing biological succession means progressing a series of changes in composition and complexity of an ecological community. Human activity plays a significant and necessary role in both the direction and speed of this transition.

‘Secondary succession’ refers to an instance of biological succession that occurs in an area where primary succession has already taken place and soil is already established. Normally,

secondary succession happens when an environment has suffered some catastrophe, such as severe fire or man-made, such as over-clearing, tillage, etc. – anything that renders bare soil.

The table below illustrates characteristics and propensities of low and high succession environments.

LOW SUCCESSION ENVIRONMENTS	**HIGH SUCCESSION ENVIRONMENTS**
HYDROPHOBIC LANDSCAPE	HYDRATED LANDSCAPE
Fire	No fire
Species loss	Abundant habitat/refuge
Temperature extremes	Moderate temperature
High evaporation/evapotranspiration	Effective transpiration/condensation
Regular drought	Occasional dry periods
Wind	Wind abatement
Storm damage	Habitat stability
Dust	No dust
Air contamination	Clean air
Run-off	Little to no run-off
Flooding	Little to no flooding
Erosion	No erosion – building soil
Water contamination	Clean clear water
Imbalances	In balance
Poor nutrient levels	Effective nutrient cycling
WATER ACROSS THE LANDSCAPE	WATER INTO THE LANDSCAPE
EMITS ORGANIC CARBON	SEQUESTERS CARBON
CLIMATE EXTREMES	**CLIMATE STABILITY**

With good planning and management, testing and strategic employment of the 'tools' described above, we can create favourable conditions to blend high succession environments back into our highly combustible sclerophyll/eucalypt and heathland plant communities. The benefits of fostering biological succession within a given region are clear from the table above. We need diversity of (predominately perennial) species covering the ground, understory as well as varying canopy. We can foster the establishment of plants that help create 'good conditions' that stay moist more consistently. Plants with 'edible drop' provide food for animals, birds, insects and microbes, improving the nutrient cycle.

Further, however, in seeking to create fire retardant/fire-resistant environments, we can select for fire-retardant species.

Most fire retardant/resistant species are 'high succession' plants and share many of the following features: they are both sun and shade tolerant; have advanced xylem (meaning they are more efficient than other plants at pumping water and nutrients); have better photosynthesis ability; have highly advanced, often multi-layered root systems, meaning that they stabilise soil (preventing landslip) and are less likely to fall in storms or high wind; they are edible/forageable/herbaceous, providing food for animals to recycle; their 'drop' breaks rapidly and is consumed by the soil, creating humus-sequestering carbon; they are long-lived and/or multiply freely; they create conditions that militate against invasion of 'lower succession' plants

or weeds; they are highly effective temperature moderators, condensation effect is greater than standard insolation; they are good 'performers', with good 'form' and are usually true to type.

Mr Neil Marriott has compiled lists of fire resistant and retardant plants for the Australian Plants Society (APS), taking into account the experience of APS Victoria members, many of whom have properties in fire-prone areas or areas which have been affected by bushfires. These can be seen on the Society's website. An abbreviated list of plants suitable for eastern Australia follows:

SOME FIRE RETARDANT PLANTS

BOTANICAL NAME	Common name
Acacia fimbriata	FRINGED WATTLE
Acmena smithii	LILLY PILLY
Ajuga australis	AUSTRAL BUGLE
Alyxia buxifolia	SEA BOX
Angophora costata	SMOOTH-BARKED APPLE
Brachychiton populneus	KURRAJONG
Coprosma hirtella	ROUGH COPROSMA
Corymbia maculata	SPOTTED GUM
Cyathea australis	ROUGH TREE-FERN
Dianella revoluta	BLACK-ANTHER FLAX-LILY
Dichondra repens	KIDNEY-WEED
Eremophila santalina	SANDALWOOD EMU-BUSH
Ficus macrophylla	MORETON BAY FIG
Ficus rubiginosa	RUSTY FIG
Hymenosporum flavum	NATIVE FRANGIPANI
Myoporum acuminatum	BOOBIALLA
Solanum laciniatum	LARGE KANGAROO APPLE
Solanum simile	OONDOROO
Viola hederacea	IVY-LEAF VIOLET

SOME FIRE-RESISTANT PLANTS

Atriplex nummularia	OLD-MAN SALTBUSH
Atriplex rhagodioides	SILVER SALTBUSH
Atriplex semibaccata	BERRY SALTBUSH
Carpobrotus glaucescens	BLUISH PIGFACE
Carpobrotus modestus	INLAND PIGFACE
Einadia nutans ssp nutans	NODDING SALTBUSH
Enchylaena tomentosa	RUBY SALTBUSH
Eremophila debilis	CREEPING EMU-BUSH
Hakea salicifolia	WILLOW-LEAVED HAKEA
Melia azedarach	WHITE CEDAR
Myoporum parvifolium	CREEPING MYOPORUM
Rhagodia candolleana	SEABERRY SALTBUSH
Rhagodia crassifolia	FLESHY SALTBUSH
Rhagodia parabolica	FRAGRANT SALTBUSH
Rhagodia spinescens	HEDGE SALTBUSH
Sarcozona praecox	SARCOZONA

Scaevola calendulacea	DUNE FAN-FLOWER
Scaevola hookeri	CREEPING FAN-FLOWER
Sclerolaena diacantha	GREY COPPERBURR
Sclerolaena spp	ALL COPPERBURRS
Selliera radicans	SHINY SWAMP-MAT
Zygophyllum apiculatum	POINTED TWIN-LEAF
Zygophyllum billardierei	COAST TWIN-LEAF
Zygophyllum spp	ALL TWIN-LEAF PLANTS

Other native plants that should be considered when planning a Fire Retardant/Fire-Resistant Environments include: -

SOME OTHERS for CONSIDERATION	
Alpinia spp.	NATIVE GINGERS
Archontophoenix spp.	ALEXANDRIA/BANGALOW PALM
Austromyrtus spp.	MIDGENBERRYS
Backhousia citriodora	LEMON MYRTLY
Brachychiton acerifolius	ILLAWARRA FLAME TREE
Brachychiton discolour	LACE KURRAJONG
Brachychiton rupestris	QLD BOTTLE TREE
Brachychiton spp.	BOTTLE TREES
Buckinghamia cellsissima	IVORY CURL TREE
Castanospermum australe	BLACKBEAN TREE
Citrus australasica	NATIVE LIME BUSH
Cordyline spp.	NATIVE CORDYLINES
Cupaniopsis spp.	TUCKEROO/TAMERIND
Dendrobium spp.	ORCHIDS
Doryanthes excelsa	GYMEA LILY
Elaeocarpus reticulatus	BLUEBERRY ASH
Eupomatia spp	BOLWARRA
Helmholtzia glaberrima	CREEK LILY
Ficus spp.	FIG TREES & VINES
Lepidozamia spp.	BURRAWANGS
Macrozamia spp.	NATIVE CYCADS
Microlaena stipoides	WEEPING GRASS
Myoporum parvifolium	CREEPING BOOBIALLA
Stenacarpus sinuatus	FIREWHEEL TREE
Syzygium spp.	LILLI PILLIES
Toona ciliata	RED CEDAR
Waterhousia spp	LILLI PILLIES
Xanthorrhoea spp	GRASS TREES

In addition, there are many non-invasive exotic plants well worthy of consideration in many situations. Many deciduous trees, combined with healthy understory, provide effective cooling summer shade, allow beneficial winter sun and have highly valuable leaf drop that provides food for animals and generous bulk of ‘viable litter’ for microbes that is soon integrated into soils.

SUMMARY

We would like to be actively involved in the planning, establishment and implementation of an ecological land management plan that effectively addresses fire and other natural disasters in New South Wales and broader Australia.

This submission is an overview of what we collectively believe must happen to efficiently manage our environments to generate long term and rewarding social, economic and environmental outcomes.

The goal is the achievement of ever-improving physical environments that regenerate landscape function, provide biosecurity and restore climate stability. If we aim at reducing fire susceptibility through making sound decisions and plans for biological ecosystem regeneration in specified areas, aiming for community dynamics that enhance water retention and carbon sequestration, comprising a healthy mix of plants including fire-retardant species, we will be securing physical, social and economic landscapes against a range of natural disasters – not only fire – into the future.

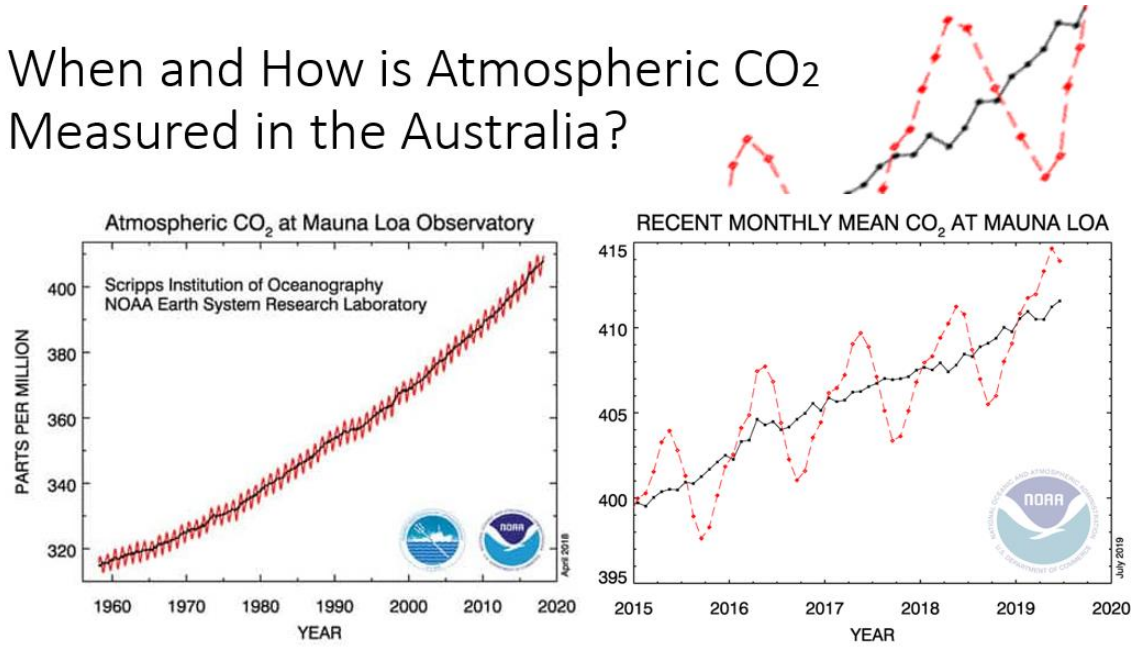
For us, recognising that the landscape situation we are called upon to address is always part of the whole ecosystem, not separate from it, is always the first step toward developing a solution. We believe that a holistic way of making decisions is the only way to approach proposed changes to the biological ecosystem – the complex-inseparable-physiological-dynamic whole that it is.

We would be pleased to discuss any points requiring clarification or verification and provide examples of existing actions and outcomes.

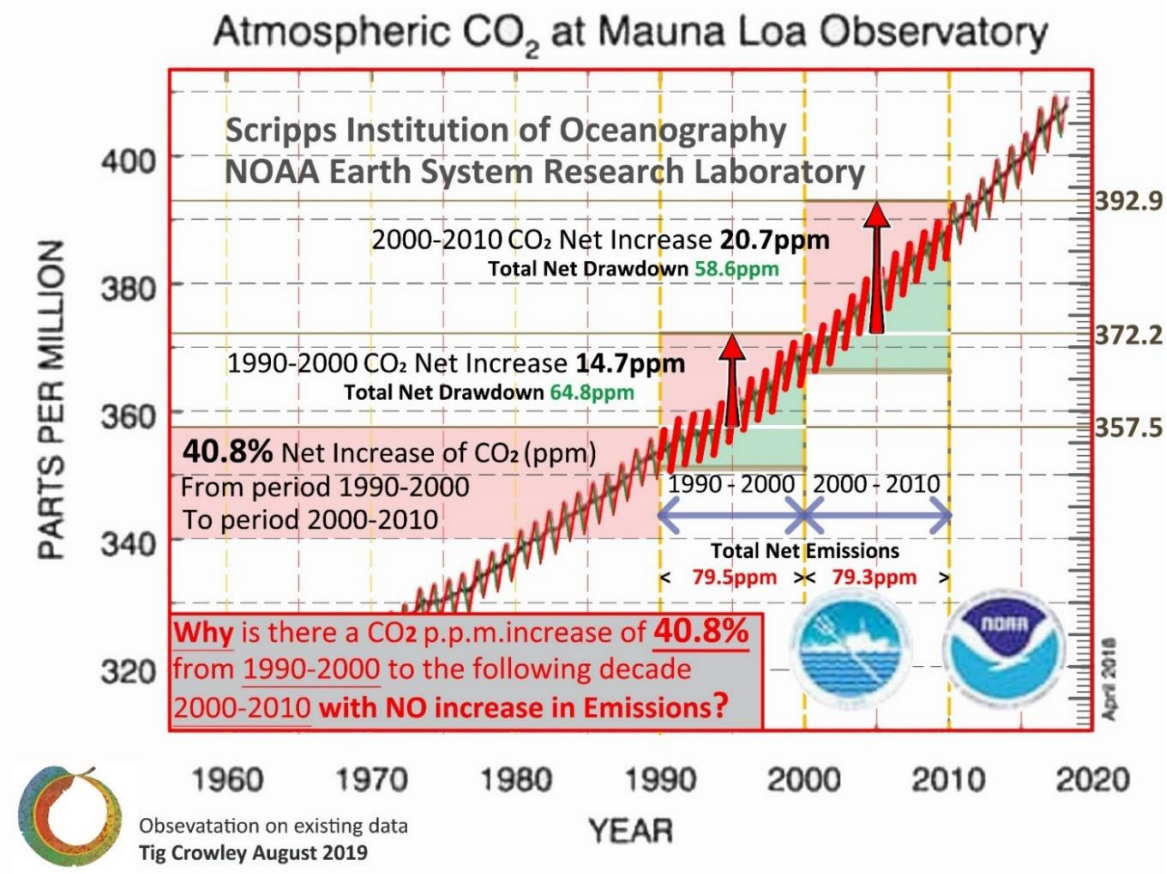
Initiative by Tig Designs https://www.tigcrowleydesigns.com.au in association with the Australian Institute of Landscape Designers & Managers (AILDM) https://www.aildm.com.au/ , the Australian Holistic Management Co-operative (AHMC) – Land to Market Australia™ https://landtomarket.com.au/ and the Australian Institute of Horticulture (AIH) https://www.aih.org.au/

APPENDIX

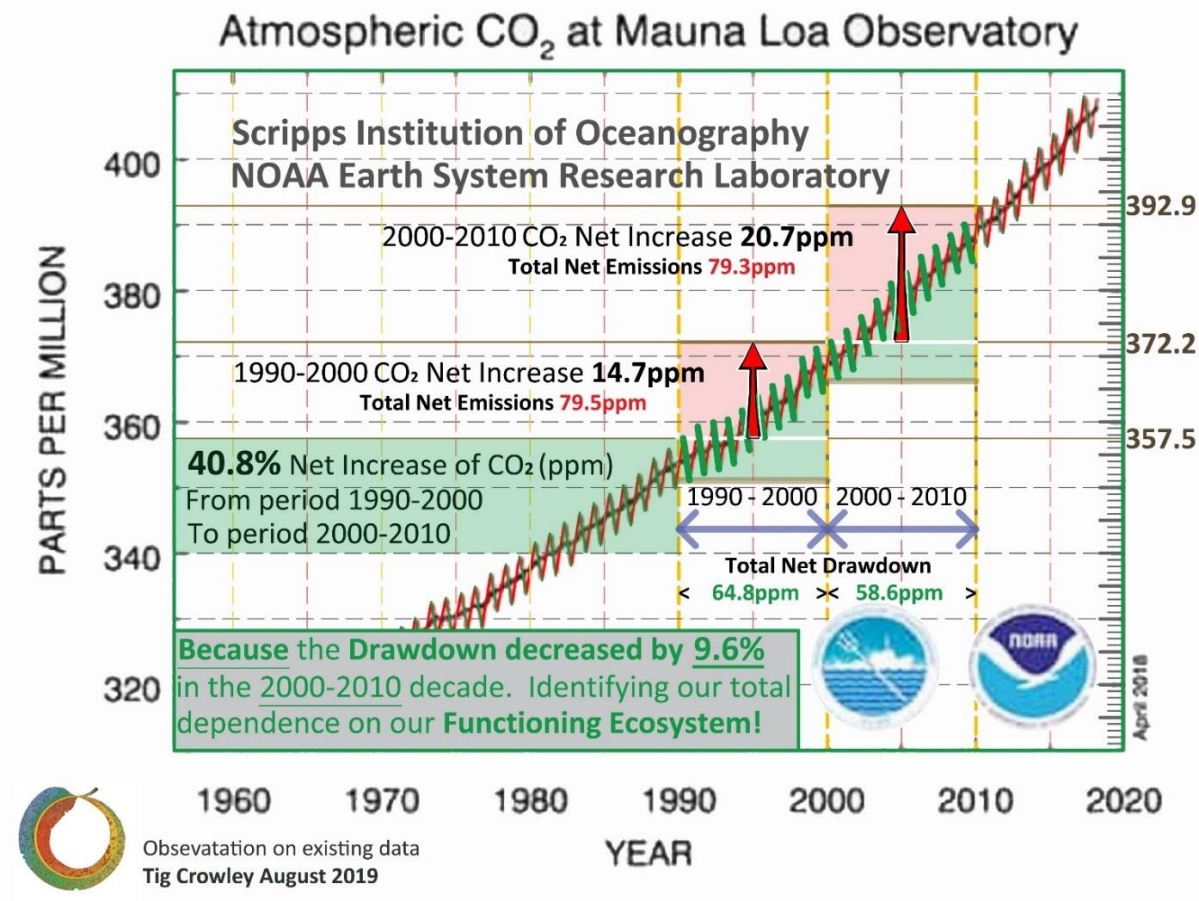
Further supporting material of measurements of graphs from The Scripps Institute of Oceanography's NOAA Earth System Research Laboratory at Mauna Loa Observatory, Hawaii. 2010-2020 to be completed. These measurements are taken in the northern hemisphere!



Observations on net emission and net drawdown for the period 1990-2000 and 2000-2010 indicate net emissions as remaining relatively constant and net drawdown as decreasing



Global net drawdown decrease is a symptom of ecosystem dysfunction on a large scale. The planet's ability to sequester carbon is reducing. Although there is some work done to draw carbon out of the atmosphere with technology, this has not eventuated. Importantly, any technological extraction will have little effect on fire, drought, flood, temperature extremes, etc. as it does not address the fundamentals of ecosystem regeneration. At this stage, and as has historically been the case for 3.8 Billion years, all drawdown is Biological. That's 100% Biological!



Climate extremes are caused by many influences, nearly all of which can be addressed by human biological management. While we must move efficiently towards reducing emissions, it is vital that we transition towards increasing drawdown (sequestration), only achievable by increasing biodiversity, advancing succession and regenerating biological ecosystem across many varied environments.

For every tonne of organic carbon released into the atmosphere, atmospheric CO2 increases by 3.67 tonnes. and conversely every tonne of organic carbon sequestered, removes 3.67 tonnes of CO2 from the atmosphere.

This 3.67 factor can significantly work to our advantage in reducing atmospheric CO2 levels as well as reversing climate extremes.

When we regenerate landscape function, we are increasing drawdown and decreasing emissions simultaneously.

ANNEXURE

This annexure also contains extracts of papers by Dr Christine Jones http://www.amazingcarbon.com

Photo: Christine Jones

Fig. 1. In this paired site comparison, parent material, slope, aspect, rainfall and farming enterprise are the same. Levels of soil carbon in both paddocks were originally the same.

LHS: 0-50cm soil profile from a paddock in which groundcover has been actively managed (cropped and grazed) to enhance photosynthetic capacity.

RHS: 0-50cm soil profile from a conventionally managed neighbouring paddock (10 metres through the fence) that has been set-stocked and has a long history of phosphate application.

NOTES:
i) The carbon levels in the 0-10cm increment are very similar. This surface carbon results from the decomposition of organic matter (leaves, roots, manure etc), forming short-chain **unstable 'labile'** carbon.

ii) The carbon below 30cm in the LHS profile has been sequestered via the liquid carbon pathway and rapidly incorporated into the humic (non-labile) soil fraction. Long-chain, non-labile carbon is highly stable.

Property: 'Winona', operated by Colin and Nick Seis

New England and North West 'Landcare Adventure' 16-17 March 2011

Land management and soil carbon

The **RHS** soil profile in Fig.1 has formed under conventional grazing, intermittent cropping and standard practice fertiliser management. The soil profile on the **LHS** illustrates 50 centimetres of well-structured, fertile, carbon-rich topsoil that have formed as a result of the activation of the 'sequestration pathway' through pasture cropping and grazing management practices designed to maximise photosynthetic capacity. Superphosphate has not been applied to the **LHS** paddock for over thirty years. In the last 10 years the **LHS** soil has sequestered 164 t/ha of CO2 (44.7 tC/ha). The sequestration rate in the last two years (2008-2010) has been 33 tonnes of CO2 per hectare per year (9 tC/ha/yr).

Due to increased levels of soil carbon and the accompanying increases in soil fertility, the **LHS** paddock now carries **twice** the number of livestock as the **RHS** paddock.

Levels of both total and available plant nutrients, minerals and trace elements have dramatically improved in the **LHS** soil, due to solubilisation of the mineral fraction by microbes energised by increased levels of liquid carbon. In this positive feedback loop, sequestration enhances mineralisation which in turn enhances humification

As a result, the rate of polymerisation has also increased, resulting in 78% of the newly sequestered carbon being non-labile. The stable, long-chain, high-molecular weight humic substances formed via the plant-microbe sequestration pathway cannot 'disappear in a drought'. Indeed, the humus now present in the LHS profile was formed against the back-drop of 13 years of below-average rainfall in eastern Australia.

A major cause of soil dysfunction, as illustrated in the **RHS** soil profile in Fig.1, is the removal of perennial groundcover for cropping and/or a reduction in the photosynthetic capacity of pastures due to inappropriate grazing management. In the post-war era, a range of chemical fertilisers have been applied to soils in an attempt to mask reduced soil function, but this approach has merely accelerated the process of soil carbon loss, particularly at depth. The net effect of soil structural decline has been compromised landscape function, particularly with respect to the storage and movement of water, losses of biodiversity, markedly reduced mineral levels in plants and animals and an increase in the incidence of metabolic diseases. This will no longer do.

Australia is not the only country in which subsoils - and hence landscape function - have deteriorated as a result of inappropriate land management and fertiliser practices. In New Zealand, a country blessed with vast tracts of inherently fertile topsoil, carbon losses are occurring at depth under heavily fertilised pastures, due to the inhibition of the sequestration pathway. To date, alternative management practices have been either dismissed or ignored by establishment science in that country.

It is important to note that the rapid improvements to soil fertility and soil function recorded in the **LHS** soil profile in Fig.1 are dependent on the enhanced photosynthetic capacity that accompanies regenerative forms of cropping and grazing management.

Fig. #. Cropping over an old fence-line clearly demonstrates the extent to which soil has been depleted by conventional farming practices. Paddocks on either side of the fence have a history of high nitrogen application (Photo Richard May).