

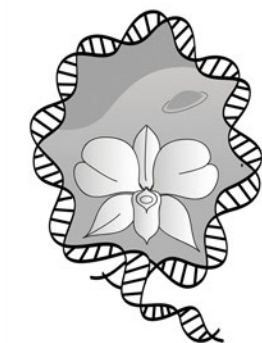
PROCEEDINGS OF THE
ROYAL SOCIETY OF QUEENSLAND

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Special thanks are extended to the anonymous referees who reviewed papers submitted for publication in this volume of the *Proceedings*.

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COVER ILLUSTRATION

Austracantha minax (Australian Christmas Jewel Spider) is a common and much-loved spider throughout Australia, sometimes found in large groups (with overlapping webs) in a range of habitats. Sizes: ♀ 8 mm ♂ 4 mm. Colour photographs of this spider are contained in the book “A Field Guide to Spiders of Australia” by Robert Whyte and Greg Anderson which is reviewed in this volume of the *Proceedings*. The front cover illustration was drawn by Sybil Monteith and is published in Davies, V. Todd. 1988. An illustrated guide to the genera of orb-weaving spiders in Australia. *Mem. Qd Mus.* 25(2): 273-332. Permission of the Queensland Museum to copy this illustration is gratefully acknowledged.

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FEASIBLE PATHS: HOW TO IMPLEMENT SOLUTIONS TO PROBLEMS PRESIDENTIAL ADDRESS

EDWARDS, G.

INTRODUCTION

There is a common theme running through the subject fields in which the Society has organised deliberative forums during the past year or so – mine rehabilitation, public health, the east coast electricity regime and most recently, management of pastoral lands. In all these prominent fields of public policy, dysfunctional conditions have been festering for years. Governments of both major persuasions have seemed incapable of devising or implementing solutions.

Bernard Keane (2018) in the daily newsletter *Crikey* expressed the current paralysis rather theatrically:

“Like a form of cosmic background radiation to our public life, there’s one issue that is always lurking in contemporary political debates: the seeming inability of governments to get things done. Building a national broadband network. Addressing the disadvantage of Indigenous Australians. Delivering effective climate action. Providing sufficient housing supply. Protecting major river systems. Tasks that have proved beyond governments despite, often, huge amounts of money being thrown at the task.”

In this essay I wish to sketch out a model of ‘feasible paths’, being a set of ‘capacities’ which must all be available to the responsible operatives if a policy or project is to be successful in its purpose and is to be implemented successfully.

I’m indebted to my former colleague Russell Holland (pers. comm.) for sensitising me to the term ‘feasible path’ and to the need to identify and satisfy the preconditions if a desired outcome is to be achieved.

CONTEMPORARY EXAMPLE

Governmental incapacity is on plain display in a draft “strategy for nature” published by the Commonwealth’s Department of Environment and Energy (BWG 2017), a 17-page piece

of fluff proposed to replace Australia’s 100-page biodiversity strategy of 2010 (NRMMC 2010). The contemporary version of the strategy commences well enough with a serviceable vision that should appeal as a worthy ideal both to religious conservatives in awe of the Creator’s handiwork and secular humanists concerned about the well-being of humans:

“Australia’s nature, now and into the future, is healthy and resilient to threats, and valued both in its own right and for its essential contribution to our health, well-being, prosperity and quality of life.”

There follow 12 Objectives which are summarised in “Our approach”:

“Caring for nature is the shared responsibility of all Australians. The aspirations described in this strategy will only be achieved through the joint efforts of governments, communities and individuals.”

One would not have guessed! But there is no inventory of the legislative, economic, policy or tools available to “governments, communities and individuals” to progress nature conservation nor an action plan on how to apply them. The nearest the paper approaches to an action plan is to airily opine that “Australia’s governments could partner to develop an action inventory to showcase how each government is delivering on ground action against the goals and objectives.” In the words of the International Union for Conservation of Nature in a scathing critique (IUCN – Hasham 2018) despite the “fine aspirations”, “there is no mention of investments of any kind in the strategy”.

The paper also includes no assessment of the dire straits of our natural inheritance to match the eloquence of the “World Scientists’ Warning to Humanity: A Second Notice” co-authored by Society member Professor Bill Laurance of James Cook University in 2017 (Ripple et al 2017).

If this is the best response to the past seven years and more of scientific research into biodiversity that the Commonwealth can muster, then our nation's policy capability is in dire straits.

NO FEASIBLE PATH

The core feature that I wish to highlight in this essay is the commonly observed absence of any **feasible path** to connect a high-minded ideal with the instruments available to achieve it. Government reports, federal and state, all too often articulate lofty ideals without assigning personnel or allocating funds to give them effect or to reconcile objectives that are in tension with each other – for example, promises to achieve economic growth while protecting the environment, delivering better services and reducing taxes.

Keane continued:

“This is the product of decades of neoliberal policy in action, aimed at curbing the role of government. Much of this has been delivered by taking away the tools of governments to accomplish things. We can't build an NBN, for example, because we privatised the government business we traditionally used to roll out telecommunications infrastructure, and, worse, privatised it as a vertically integrated anti-competitive monster. So to build an NBN we had to build a new government business to do it from the ground up. Or we've allowed powerful interests to dictate policy, as in climate policy (well, we don't have a climate policy currently) or the Murray-Darling.” (2018).

Neoliberalism – approximating what in Australia is called economic rationalism – is a political philosophy in which an anti-government, pro-business, anti-environmental world view is grafted onto roots in neoclassical economics. It is however a soft target. Yes, neoliberalism's enthusiasm for an idealised model of self-contained individuals managing their well-being through markets, and its antipathy towards solutions mediated by governments, blinds its adherents within the economics profession, business and senior levels of government to the existence of non-market public goods, including many or most elements of the natural environment. Yes, pursuit of its idealised model of competitive markets has led policy woefully astray in fields such as electricity where nationally there is yet no serious economic incentive to reduce carbon emissions or avoid waste.

However, there must be some more fundamental reason why neoliberalism's solutions have appealed to our political and policy leaders; and why they keep being attempted, despite repeated evidence of failure. Scapegoating neoliberalism can be self-affirming for non-economists like myself but doesn't carry analysis very far and can blind analysts to the genuine insights that can come from economics, some sub-disciplines more than others.

Did our nation have such difficulty in solving systemic problems in the past? A nostalgic view is that until the neoliberal era of the Hawke government of 1983 onwards, there was a high level of public confidence in Australia as a prosperous, peaceful, knowledge-rich, self-sufficient society, optimistic of human progress and with the ability to adjust policy to continually improve those conditions. It would be possible to advance a counter-argument. Take Medicare, for example. Jamieson (2014) traced “the tortuous introduction of Medibank” in 1975 from earlier initiatives in the 1940s, its abolition by the Coalition, then its replacement by national health insurance in the form of Medicare when the Hawke government came to power. Medicare survives today. One could highlight the previous 35 years of instability in health policy, or the post-1983 period of 35 years of Medicare, creaking but still operating according to its designed structure.

Sidestepping nostalgic assessment of past capacity, in this article I examine what I consider to be a more fundamental weakness in public affairs – fragmentation – than simple pursuit of an inadequate theory of economics. Before articulating this view, I briefly recapitulate a couple of thoughts expressed in previous presidential addresses.

PREVIOUS COMMENTARY

In 2014 (pages 103-106) I referred to the privileged access that representatives of business enjoy to inner policy circles, the undue influence of media proprietors, the ascendancy of the neoliberal prism in national policy and the decline of scientific literacy.

“The main reason why our leaders in business and government keep making decisions that undermine the life support systems of the planet is that the prevailing world view of the leadership class does not have room for knowledge about those systems – their complexity, their vulnerability to disturbance and their vital importance to the economy. The remedy does not

lie in more scientific research, as facts alone do not change an opinion-leader's world view. Scientific knowledge about the natural environment has already far surpassed the capacity of our political systems to accommodate it."

I concluded by observing that if environmental thinking is to be mainstreamed into the corridors of power, governments must recruit people sensitive to natural sciences in positions of influence; and to build at least a passing knowledge of natural science into the curriculum of those being trained for leadership.

In 2017 (pages 12-14), I referred to the absence of independent forums to bring scientific information to ministers in a form that can be built into policy, and to the "broader, international culture war waged against climate science [that] won't be reconciled by more science". I argued "for establishing (or re-establishing) a capability in Queensland to translate scientific knowledge into policy and decision-making and to build knowledge of scientific method throughout the ranks of parliamentarians and the public service."

In this address I would like to elaborate on the vital role that scientific method should play across all levels of decision-making in our society, across all subject sectors. Scientific method skills its practitioners in tracing cause and consequence, anticipating the effects of acting or not acting in optional directions, evaluating alternatives and mapping the preconditions necessary to achieve desired results.

Scientific method is not the unique preserve of qualified scientists, but education in a scientific discipline helps. Scientific method is more than simply reporting on experiments, although the assemblage of empirical information lies at its heart. Scientific method is more than just reasoning, for reason alone doesn't elevate knowledge above philosophical speculation. Scientific method is more than just avoidance of logical fallacies, although rational analysis is an essential ingredient.

When I was in secondary school, in English classes we studied "Précis writing", a practice that encouraged us to seek to understand a writer's meaning and to identify false logic in written materials. Scientific method is analogous.

Scientific method and an understanding of the preconditions of a successful outcome – an understanding of causation – can be applied to any

step in the policy process, from early detection of a problem through to achievement of a preferred solution. When this works effectively, we can say that there is a 'theory of cause and consequence' and a 'feasible path' to apply it.

SOLUTIONS REQUIRE A STRATEGY

To achieve a desired purpose, one can rely on serendipity or strategy. Without denying the power of serendipity or exaggerating the importance of rationalism in public affairs (Saul 1992 reminded us of the vital importance of practical judgement in public affairs), governments need strategies to guide purposeful action, if they are to rise above chaos and the influence of self-interested pressure groups.

An effective strategy will:

1. Set out a realistic vision, an aspiration, a sense of purpose.
2. Be based upon a foundation of coherent theory linking causes and effects and explaining the forces at work, by drawing insights from many disciplines and sources of expertise.
3. Map effective feasible paths for achieving the vision and for overcoming fragmentation of accountability and of knowledge.

Visions are important, for they crystallise the insights of opinion leaders and the strategy's authors. They are rarely the ingredient limiting progress. Time and again visions aren't implemented not because of a deficiency in the vision, but because of the institutional separation of those with the knowledge of the subject field from those with command over the capacities to apply the relevant knowledge. Vision-setting is a decidedly political activity, requiring human judgement and insight beyond scientific knowledge and isn't considered further in this essay.

Formulating the second element of an effective strategy, a coherent theory of cause and effect, requires the application of scientific method, even if the subject lies within the domain of the humanities. Science is the most powerful system yet invented to formulate explanations of causes and effects.

The third element of an effective strategy, the tracing of feasible paths, also benefits from an understanding of cause and effect, even though most scientists would consider it as a decidedly operational function lying outside the domain of scientific investigation. The

reflexive role for scientists is to cast their research into the ether via a refereed publication, and to surrender implementation to others, or to nobody. Implementation is a discipline that rests more comfortably within public administration or organisational management, the seminal text being Pressman & Wildavsky (1973), *Implementation: How Great Expectations in Washington Are Dashed in Oakland; Or, Why It's Amazing that Federal Programs Work at All*.

THE NEED FOR THEORY

Theory is required during policy analysis to sort important from incidental issues and to distinguish fixtures in the institutional arrangements from variables. Some features such as the Australian Constitution are fundamental fixtures: they shape the long-term policy settings and are changed only slowly or with difficulty. Other issues are proximate variables: they are questions of contemporary policy and practice that can be altered by routine process should leaders wish to do so.

Without robust theory to link previous experience, technical information and insights from a range of disciplines, governments can stumble badly, driven by every wind of public opinion or the enthusiasms of lobbyists with a sectoral interest to promote. Large sums of public money can be squandered pursuing inappropriate remedies, such as building prisons to incarcerate young miscreants suffering from medical conditions.

Systemic issues require thoughtful conceptualisation, otherwise solutions become simply patches that may work at a time and place but require continual revision. Without an adequate theory, solutions may or may not work but those involved wouldn't know why, so preconceived ideological positions are conjured up. Put in pithy terms: if the foundational assumptions are invalid, the regime built on them is fragile.

Of all the issues prominent on the Society's agenda in the past year, none illustrates how faulty theory can derail policy more than preventative health. One example can demonstrate the point. For four decades, overweight people have struggled with officially endorsed low-fat, managed-carbohydrate diets that simply don't work. They don't work because they are underpinned by a faulty, overly simplistic theory of carbohydrate metabolism that doesn't adequately account for insulin resistance (Fung 2016).

No social phenomenon is mono-causal. To trace causation through intertwined biophysical and socio-cultural influences, a serviceable theory must draw upon a range of academic disciplines. Reliance upon a single discipline, such as clinical medicine, accountancy or law, to resolve a multifaceted societal problem is a trap for managers in public bureaux with a narrow educational composition.

Theories are derived from observations (evidence), scholarly research and logical analysis. Scanning the contemporary policy landscape, it is possible to identify numerous fields which have been under-theorised, with the result that policy is fractured, unstable, vulnerable to reversal after a change of government and, above all, ineffective. Examples other than preventative health are:

1. Sustainability. This is now just a slogan, with no clear pathway to offset continual conversion of natural capital into manufactured capital; with little official recognition that the very notion of sustainable DEVELOPMENT is an oxymoron; and with little progress in theorising the concept since the *National Strategy for Ecologically Sustainable Development* of 1992.
2. Pastoral land management. Queensland pastoralists manage their properties to produce marketable commodities and are expected to manage the natural capital, including the land, soil, water and atmosphere that form part of the global fabric of life support systems, using the surplus between the prices they receive from markets and their costs. Rising farm debt hints that the 'surplus' is low and decreasing. The markets for commodities follow their own erratic dynamics and are disconnected from the condition of the natural assets upon which production depends. The capacity and willingness of the producer to divert some of the surplus (if any) to regeneration of non-marketable environmental public goods is circumstantial and personal.
3. Centralisation/decentralisation. The distribution of powers between the Commonwealth, the States and local government remains a source of overlap, inefficiency and mismatched funding. When the Commonwealth in 2008 wanted to spend money on insulating houses, it administered the program directly and bypassed the 563 local governments who exercise building control and are staffed with

building inspectors who know the credentials of the contractors in their areas.

A set of theories about how the world functions constitute a person's 'world view'. Leadership factions can share a world view and these tend to frame the set of possible solutions to issues on their agenda. For example, drug addiction can be conceptualised as a personal moral shortcoming (addicts are sinful); or as a sociological shortcoming (addicts' family upbringing was deficient); or as a biomedical shortcoming (addicts' diet or their mothers' diet was deficient). Widely different remedies – incarceration, education, school breakfasts respectively – derive from the different theories of causation.

The neoliberal world view (set of theories) is the prevailing one shared by the governing party in all Australian states and the Commonwealth. I have written of its systemic weaknesses in previous addresses and won't labour that point here.

ELEMENTS OF A FEASIBLE PATH

Governance of Australia's natural resources and environment is un-coordinated. Those who manage the outdoors lack the funds to make sustainability happen. Scientists, design professionals, planners and sociologists who understand how to manage places and communities tend to shy away from involvement in politics. Those who hold the power and the budgetary levers don't understand ecology and in any case are busy promoting economic growth. In looking around, one is impressed by the number and earnestness of capable people labouring to manage our landscapes and environment, but one commonly looks in vain to find any entity which is properly resourced with command over the several required capacities within its area of jurisdiction.

Though committed functionaries will always try to make the best of their circumstances, the absence of any one or more of several essential capacities renders much other capacity impotent. The irreplaceable ingredient is the mandate of a respected coordinator or coordinating body because it can muster the other capacities if any are missing. It can identify the best tools and persuade their administrators to bring them into service of the strategy. It is not essential that it hold all the powers. Yearning for a single benevolent authority is futile as control over the tools will always reside in different bodies; institutional boundaries are required somewhere.

Within the Australian federation, separation of the guardians of the public purse from the operatives who really know and care about the problems requiring remedy and are charged with delivery is endemic. According to the phone book and their website (Treasury 2018), the all-powerful federal Treasury does not even have a public office in Brisbane.

The feasible path model applies to all fields of public policy, but for simplicity the explanation below focuses on natural resources and the environment, the province of natural scientists. For any strategy to be implemented effectively, five capacities are necessary, within the one locus of activity or jurisdiction – say, one study area.

A COORDINATOR

The coordinator motivates the other stakeholders and assembles whatever ingredients are necessary to make progress. The coordinator legitimises the enterprise and accepts responsibility for implementing the strategy.

A crucial task of the coordinator is to scope the exercise or set the geographical and administrative boundaries. A great deal of energy is wasted through mismatch of boundaries. An effective coordinating person or body will encourage existing stakeholders to align their own planning and budget processes to serve the shared task of implementing the vision. For strategic planning exercises, this will often mean aligning spatial boundaries, even if as a subset or superset.

A common reason for the disempowerment of a potential coordinator within a State's administrative apparatus is the involvement of the Commonwealth in implementing strategies that are primarily within the State's operational province. For numerous fields, such as natural resource management, electricity supply and the preventative functions in health, only the State can establish or legitimise a workable regime, but the involvement of the Commonwealth as funder or putative coordinator greatly complicates and potentially weakens the capacity of the State to implement. The prospect of tapping or retaining a pipeline into Commonwealth funding is a powerful disincentive for any State to exercise its responsibilities in those fields where it is sovereign.

Any Commonwealth involvement in a State function reduces the States' accountability, invites cost shifting

and adds exponentially to the transaction costs. State Treasuries can declare that the function is funded by the feds, so they prune the budgets of their local departments further. When the Commonwealth later tightens the fiscal screws or alters the funding criteria, good projects are jettisoned and good people leave, as the States may not make good the shortfall, because their departments would then each have to beg their own Treasuries for brand new initiative funds. The involvement of the Commonwealth in funding natural resource management from about 1997 allowed State Treasuries to progressively reduce their contribution.

The role of coordinator in this typology embraces that of a champion who can command respect from decision-makers and can protect the enterprise from destabilisation by others with different interests to advance. Where the operation has a high public profile, the champion might be separate and remain just a high-profile figurehead without involvement in the practicalities.

The role of coordinator in this typology also embraces that of line command. A person or organisation with acknowledged organisational authority, and, preferably, 'can-do' operational experience, is essential to instruct staff and engage contractors effectively.

The absence of any entity in charge of the east coast electricity regime has afflicted electricity policy ever since the first wave of privatisations. Coordination by a national market regulator with no line command over the generators that are owned or regulated by the states, is hamstrung from the outset.

Where real property or capital assets are to be managed, there is no substitute for ownership, which normally conveys line command. Perhaps the most egregious example of the importance of line command is the saga of fibre-based telecommunications after the privatisation of Telstra dating from 1997. The inability of governments to impose their will on a pugnacious Telstra via third-party regulation induced it to establish its own corporation (NBN) to build a national broadband fibre network, allowing it then to exercise line command. Tens of billions of dollars have arguably been squandered through the disaggregation of Telstra's capacities and erection of various regulatory and advisory bodies endeavouring to exercise some kind of coordination without authority to make things happen.

LEGAL AUTHORITY

In a nation under the rule of law, every operative needs legal authority to conduct works, perform maintenance, tread on land or expend public money. "Legal authority" does not necessarily mean statutory power: most departments operate their administration under royal prerogative without specific statutory origin but administer a range of statutes that both convey and limit their powers to act. Statutory power is however always necessary for coercive actions by the state. To conduct works, the critical legal authority is permission of the landholder. Landholders are sovereign on their properties, enjoying rights to manage and to exclude trespassers that derive from common law (freehold land) or their title (leasehold).

There are some gaps in the suite of statutes available to protect natural resources and environment, but by far the bigger weakness is the unwillingness of governments to adequately fund enforcement of the existing statutes.

CAPABLE PERSONNEL

An instrumental approach to personnel management regards staff as economic units that can be recruited or dismissed according to workflow. By this economic approach, there is no merit in retaining skilled staff in-house: an authority or firm can always outsource a function to wherever the skills are held, even overseas.

The shortcomings of this clinical, commercial approach to human resource management are well known to any officer who has been a victim of organisational restructure, enforced redundancy, budget cuts or temporary employment, or has participated in a project with stop-start funding. Organisations, public or private are organic systems, not machines. Culture, corporate memory, passion for the work or the work team, dedication to serving the public interest and accumulated years of experience within a field all matter. All this intelligence can be swept aside whenever, say, a government entity applies the 'yellow pages' test: if a private firm can be found to deliver a service, there is no need for the government to retain the capacity.

This is not just a plea from a scientist at the end of his career that agencies should retain mature aged professionals in employment, for any organisation needs a continuous infusion of young talent. It is a plea for stability in staff structures to strengthen

governance, to train a pool of officers ready for the future, to reduce the risk of capture by parochial or sectoral interest groups and to minimise the cruelty that organisational restructures visit upon professional staff who simply want to fulfil their vocation.

Nor is this a plea to build large bureaucracies without recourse to contractors or consultants, as any nimble organisation will be capable of supplementing their own expertise with additional workload capacity or skill sets as required. But there is no substitute for in-house expertise that is on tap without contract overheads, conflict of interest or start-up hiatus. Nor can any contractor match employees on secure tenure for retaining corporate memory or offering disinterested advice.

INFORMATION

Portfolios in government and academe are divided along functional and disciplinary lines. This allows disciplinary technical expertise to flourish and like-skilled people to reinforce each other's skills. Then within organisations, roles are commonly separated along science-policy-operations lines. However, these demarcations – the 'silo effect' – have a significant defect. Natural resources inevitably are managed locally as places, so information from disciplinary specialists must be continually translated into place-based format.

How complicated is this? Fairly complicated, but more to the point, it requires a long-term commitment to embrace that as a mission. This is one activity that is not amenable to delivery through short-term projects. A translator must:

- bridge disciplines and coordinate and meld disparate information from various sources;
- change scale, zooming in from a broader scale to the property scale, or zooming out to feed intelligence back to the centre; and
- interpret information, tracing cause and effect, articulating a theory to explain what is happening, identifying remedies for the problems uncovered and explaining the implications.

FUNDS

While the conventional wisdom that throwing money at a problem doesn't necessarily solve it may well be valid, in a market economy, NOT directing sufficient public money to a problem where collective action is required will nearly always guarantee failure. 'Sufficient money' means

budgetary provision or the capacity to secure it easily, for the lifetime of the program.

A budget or revenue-raising capacity is not just one element of a feasible path. It also enables the coordinator or the line commander to procure some of the other necessary elements, notably the skilled personnel (with provisos, see above) and knowledge.

The quantum of money needed to nourish sustainable natural resource management and environmental protection is vanishingly small in comparison with the amount of money that governments spend on the big-ticket construction items such as defence hardware, transport infrastructure and built construction projects. Yet the obstacles that confront a keen scientist in endeavouring to secure funding to implement a new insight arising from their research are immense. Unless the amount required is modest enough to fit into their employer's or sponsor's current budget without supplementation, there may be only one or two opportunities per year to seek funds: the annual budget deliberations and possibly a mid-year review. Within the public service, it is normal practice for Treasury to invite all departments to submit budget proposals twice per year, but with a qualifier to the effect that 'As Treasury will be seeking cuts in your annual appropriation, no new initiatives that have not already been endorsed as a promise of the Government will be entertained'. This exhortation snuffs out the rhetoric of 'innovation', 'smart state' and many of the other high-minded ideals that governments proclaim but without a feasible path to make them happen.

Another obstacle, faced by public servants and non-government entities alike, is the pernicious practice of requiring co-funding from other participating organisations. The time and energies of scientists and others who want to get on with their work are spent in coaxing others to contribute. But other stakeholders have other priorities and their budgetary timelines may be quite mismatched. The case of fire ants exemplifies this corrosive practice.

FIRE ANT CASE STUDY

It is difficult to fathom why governments, having sound scientific advice of the havoc that exotic fire ants are likely to wreak upon economic production and lifestyle in Queensland, would dither over cost-sharing with the other states and the Commonwealth who were not immediately

threatened. Yes, fire ants could colonise virtually all of mainland Australia, rendering it a national threat, but control of pest plants and animals is clearly a state responsibility and fire ants made their landfall in Queensland, several times from 2001. The Queensland Government stepped in quickly in 2001 to commence an eradication program, but once a national program was conceived, urgency faded.

In November 2014, the Commonwealth, apparently not trusting the evidence of Queensland's scientists, commissioned an 'independent' review of the eradication program (IRP 2016). This was on top of 13, repeat 13, previous external reviews of the Queensland program. The report was furnished to ministers in May 2016 but not released until November 2016, and then only after the Senate passed a motion to force the executive to do so. The report found that there was only a small window of opportunity left to eradicate the pest, that a benefit cost ratio of 25 to 1 could be demonstrated and that the failure to achieve eradication to date was "not due to the science, but rather to missed opportunities: the limitations of short-term funding, and a reallocation of funding from eradication to delimitation...". The lack of funds for eradication allowed the ant to re-infest localities from which they had been destroyed.

All nine governments were required to come to a unanimous decision to boost funding by the requested amount deemed adequate to achieve eradication within 10 years, a derisory \$20 million per year (Invasive Species Council 2017). The funding plan was finally signed in 2017. Canegrowers (2017) reported that prior to that budget injection, cane farmers in the Rocky Point District south of Brisbane were waiting up to 60 days for an inspector to visit reported nests. Western Australia ceased their contribution for three years prior to 2017 because they thought they could keep the ants from reaching their state. A refreshed commitment from Western Australia was delayed by their March 2017 election.

It is incomprehensible that our society allows its natural resource management to be subjected to such inefficient and ineffective budgetary procedures, in this case especially given that Queensland scientists recognised the economic and environmental threat immediately upon discovery of the first incursion in 2001. It is incomprehensible that the conclusions of an authoritative report dated May 2016 advocating that there was only a narrow window of opportunity

to prevail over this pest were not implemented as a matter of national emergency.

The 'national coordination' in this case study seemed to have been an obstacle to speedy and effective action. In biosecurity, this weakness may be systemic. In a news report on the interception of Varroa Mite in the Victorian docks (Rooth 2018), there is an implication that the Commonwealth coordinating entity could not coordinate any sense of urgency between the States on a matter of paramount importance to the apiary and horticulture industries.

Testing our model of feasible paths through the fire ant case study, it can be seen that a number of elements were missing. Vision? A vision of eradication was easy to develop. Theory? Science was equal to the task: there was a scientific theory to underpin eradication efforts, strengthened through research into treatment methods as the program unfolded. Arguably, however, the economic theory underpinning national biosecurity programs has been deficient, firstly based as it seems on risk management (IRP 2016) and not ecology; and secondly based as it seems on minimising the cost to the Queensland budget by prevailing upon the other states. Champion? There was no obvious champion willing to prosecute the case for adequate funding according to the national model. The national model fragments accountability and is only as strong as its most recalcitrant link. The Commonwealth agency could have been a champion but lacked either legal authority or knowledge or both. Line command? No operator with line command over personnel and resources is visible. Legislation, skilled personnel and knowledge? These have not been limiting factors amongst scientists, but knowledge at the level of decision-makers seem to be lacking. Funds? Funding was the critical shortfall but need not have been if there had been a vigorous state-based champion. The case study demonstrates that it is insufficient to have in-depth scientific knowledge at the periphery if there is no champion at the centre with passion for the task at hand and with the authority to secure the necessary resources for the actions known by experts to be necessary.

The interpretation that most fits these circumstances is not the economic cost of environmental protection measures, as a 25:1 ratio of economic benefits puts most construction projects in the shade. The lack of an empowered, ecologically literate coordinator is the

most plausible explanation. This can be remedied and must be, if our society is to protect the life-support systems of the planet from collapse.

CONCLUSIONS

This essay presents a diagnosis of the reasons why scientists' knowledge of natural resources and the environment is so often not applied or ineffectively applied to protective action. There is a strategic reason: absence of robust theory; and there is an eminently operational reason: absence of one of five critical elements of a feasible path. The lack of an empowered champion or can-do commander or dispersed legal powers can be summarised as fragmented accountability. The lack of skilled personnel or information can be summarised as fragmented knowledge. The lack of funding can be summarised as starvation of public goods.

It is not sufficient to have two or three of these elements in abundance if at a specific locus of activity one of them is lacking. The absence of one or more of these capacities renders so much other capacity impotent. Within the public service, the central agencies of government are best placed to assemble the necessary ingredients and empower champions. Within business, directors exercise this function. It is a matter of vital importance that our society improve the scientific and environmental literacy of those occupying these roles and make them aware of feasible path analysis, so that those with knowledge of the distress that our planet's life-support systems are suffering are empowered to apply remedies.

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