## Appendix A - Workshop participants

# Invited speakers and participants

| Name | Affiliation | Email |
|---|---|---|
| Gregory Andrews | Threatened Species Commissioner, Dept. Environment and Energy | ThreatenedSpeciesCommissioner@environment.gov.au |
| Lauren Ashman | Student, Research School of Biology, ANU | lauren.ashman@anu.edu.au |
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| Gaynor Dolman | Manager and Research Scientist, Western Australian Museum | gaynor.dolman@museum.wa.gov.au |
| Rachel England | Assistant Facilitator, Fenner School of Environment & Society, ANU | rachel.england@anu.edu.au |
| Tariq Ezaz | Associate Professor, University of Canberra | Tariq.Ezaz@canberra.edu.au |
| Simon Ferrier | Senior Principal Research Scientist, CSIRO Land and Water | Simon.Ferrier@csiro.au |
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| Elise Furlan | Research Fellow, Institute of Applied Ecology, University of Canberra | Elise.Furlan@canberra.edu.au |
| Sue Fyfe | Director, Biodiversity Science, Parks Australia, Department of the | Sue.Fyfe@environment.gov.au |

| Name | Affiliation | Email |
|---|---|---|
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| Andrew Young | Director, National Research Collections Australia, CSIRO | andrew.young@csiro.au |

## Appendix B - Draft discussion paper

# The interface of evolutionary biology and policy impact

*A two-way engagement and dialogue workshop for research providers (scientists) and research users (policy makers and managers)*

Innovative capabilities in biodiversity science are rapidly emerging at the boundaries of evolutionary biology, genomics and spatial ecology. These concepts and tools have been heralded as having considerable potential to assist with many of the complex issues confronting current, and future, biodiversity policy and management (*1,2,3,4*). However there is a substantial 'implementation gap' between academic research, where the majority of this new biodiversity data is being generated, analysed and interpreted as fundamental research; and the ongoing needs of practical policy development and real-world management (Figure 1).

This meeting aims to transfer knowledge, perspectives and challenges amongst scientists and policy makers and find ways to effectively engage into the future. It will endeavour to address the 'science push' and 'demand pull' knowledge agenda setting that often shapes the relationship between researchers and policy makers (*5*). The disconnect is well recognised between the cultures and constraints of policymaking and management (e.g. political agendas; stakeholder values; decision making; tradeoffs) and academia (e.g. grant funding cycles; 'publish or perish'), and various efforts have been made to address it (*6,a,b*).

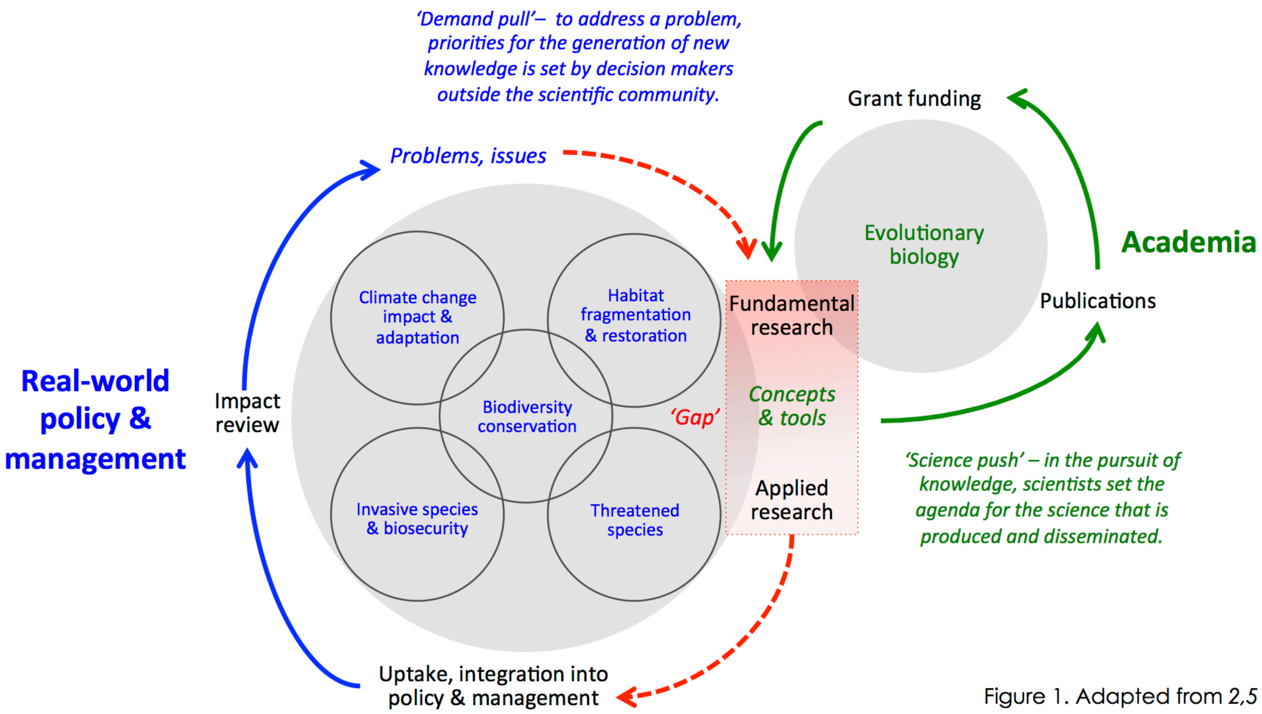


Figure 1. Adapted from *2,5*

The following text is a starting point for the workshop's discussions - where we think evolutionary biology as a science, and its place in policy and management, is currently placed. However, this workshop is about two-way communication and the document will be further shaped by input of the participants, particularly those from policy and management.

***a*** *APS200 Project: The Place of Science in Policy Development in the Public Service*
***b*** *Science & Technology Australia's annual Science meets Parliament*

# The interface of evolutionary biology and policy impact

## Biodiversity conservation and evolutionary biology

As a science ecology aims to understand how organisms interact with their biological and physical environment, and hence the structure and functioning of ecosystems. Accordingly it is, and has long been, a natural fit with biodiversity conservation. Indeed, ecological principles and scales (e.g. species interactions, life-histories, short-term population, and community change) are the scientific framework for most biodiversity-related policies and management plans. Ecological research can identify solutions to current threatening processes, such as habitat fragmentation, fire regimes and invasive species (Box 1). This also makes it relevant, and attractive, to decision-making (and political) timescales.

**Box 1** The main threats to Australia's biodiversity are:

- Loss, fragmentation and degradation of habitat.
- The spread of invasive species.
- Unsustainable use of natural resources.
- Climate change.
- Inappropriate fire regimes.
- Changes to the aquatic environment and water flows.

https://www.environment.gov.au/biodiversity/conservation

Evolution is responsible for all of the world's biological diversity, both extinct, and extant. Evolutionary biology offers the fundamental context for understanding modern patterns of biodiversity (*7*). It can provide knowledge on which species occur where and why, uniqueness, relatedness and ancientness - all information relevant to species conservation planning and prioritisation.

The importance and value of conserving biological diversity at the genetic level (as well as species and ecosystem) is widely understood and is acknowledged by numerous international and national frameworks and legislations (*c,d,e,f,g*). In general, they all include various statements and aims regarding the maintenance of maximum genetic diversity and evolutionary potential. For example, Australia's Biodiversity Conservation Strategy 2010-2030 states that "Biodiversity is not static; it is constantly changing. It can be increased by genetic change and evolutionary processes".

In practice however, diversity of species and communities (good, valid measurements of biodiversity) are often used as a surrogate for the conservation of the other third of the biodiversity hierarchy, genetic diversity. Evolutionary principles, although long incorporated into practical applications for agriculture and medicine (e.g. heredity, selective breeding, pest and pathogen resistance) and conservation genetics (e.g. inbreeding depression), are infrequently used for other applied biodiversity-related problems (*7,8,9*).

The problems and threats to biodiversity are (for the most part) well recognised (Box 1) and have considerable government and academic attention (*h,i*). Evolutionary biologists have long discussed and articulated ways of using evolutionary concepts and knowledge to improve the effectiveness of biodiversity policy and practice (*4,7,10,11,j*). But possibly the most important role evolutionary biology can play in modern biodiversity conservation is in the understanding of how species and populations will respond to accelerating environmental change. Although climate change is listed as a threat itself (Box 1), all of the well-documented threats to biodiversity, and in particular, habitat fragmentation, are now compounded by the effects of human-induced global warming. Current patterns of biodiversity have been shaped by evolution in response to past environmental change and should be viewed as dynamic. Understanding how various drivers (such as climate change) have influenced biodiversity in the past can assist with predictions of future changes and assist with management strategies to ensure the ongoing evolution of biodiversity (*4,12*).

***c*** *Convention on Biological Diversity (CBD)*
***d*** *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*
***e*** *Australia's Biodiversity Conservation Strategy 2010-2030*
***f*** *Australia's Native Vegetation Framework*
***g*** *Strategy for Australia's National Reserve System 2009-2030*
***h*** *NESP Threatened Species Recovery Hub*
***i*** *ARC Centre of Excellence for Environmental Decisions*
***j*** *CERF National Taxonomy Research Hub's 2010 summit on Conserving Australia's Genetic Diversity*

## Four "Game Changers" at the interface of evolutionary biology and biodiversity conservation

### *1. Evolutionary response to environmental change can be fast*

In contrast to Darwin's view of evolution as a gradual process, extending over millennia, numerous studies have now documented evolutionary change of species' DNA and traits in response to rapid environmental change, both natural and human-induced (e.g. pollution, urbanisation, climate change). For example:

- Beak size of Darwin's finches evolves over a few generations in response to food type availability due to the oscillation of La Niña and El Niño climatic conditions (*13,14*).
- Field mustard has evolved earlier flowering times in response to drought-induced shortened growing seasons (*15*).
- In response to late 20th century climate warming, pitcher-plant mosquitoes have evolved to remain active for longer into the autumn (*16*) and geographic gradients of fitness-related polymorphisms in fruit flies have moved towards the poles (*17*).

While such cases typically involve species with short generation times and large populations, they serve to demonstrate that evolutionary, as well as ecological, processes are relevant to how species respond to environmental change at short to moderate timescales.

### *2. Most species have geographically structured genetic variation*

Far from the early view that species are homogenous, it is now clear that genetic variation within taxonomic species can be strongly structured geographically, and across environments. This has two consequences for species' management:

i. For low dispersal or habitat specialist species, loss of geographic range can result in irretrievable loss of genetically divergent populations that have evolved independently over millions of years (*18,19*); and

ii. Populations across the species range can be adapted to local environmental conditions, providing options for genetic management to increase resilience of species that are vulnerable to rapid climate change (*20,21,22*).

### *3. Distinct species often share their genes*

Zoologists in particular have long considered hybridization and genetic exchange among species to be an aberration. Evolutionary analyses of genomes are now revealing that genetic exchange during and after speciation is rather common, including across distantly related species. In several cases (e.g. mimicry patterning of butterfly wings, *23*), this enables transfer of adaptive variants that arose by mutation in one species, yet which promote evolutionary change in others (*24*).

Evidence of genetic exchange across species during past evolution calls into question our 'purist' views that hybrids are anathema, and that mixing divergent species or subspecies should be avoided at all costs. Introducing genetic material from closely related species or subspecies has been shown to be a valuable management strategy for some endangered taxa, resulting in hybrid populations but saving the species from (or at least delaying) extinction (e.g. Florida panther (*25*); Norfolk Island boobook owl (*26*)).

### *4. New tools are revolutionising biodiversity science and access to biodiversity knowledge*

The tools of evolutionary genomics, once restricted to a few 'model' species of the lab, can now be applied across the tree of life, enabling us to solve previously intractable problems. Applications include:

- High resolution detection of taxonomically cryptic diversity and mapping of biodiversity hotspots (*27*);
- Metagenomic methods to facilitate the sampling of highly diverse, ecologically significant, but taxonomically challenging systems, e.g. invertebrate communities, soil microbes (*28*).
- Using genome-scale analyses of historical samples from museum or herbaria to detect evolutionary response to environmental change and to inform captive breeding and translocation strategies (*29*).

- Identifying types of genetic variation that predict responses to climate change (*4,22*) or novel diseases (e.g. genes for immunity to Tasmanian Devil Facial Tumor Disease (*30*)).

In parallel to rapid advances in genomics, enormous strides have been made in biodiversity informatics and modelling (*31*). These enable both research into biodiversity and the processes that sustain it, and knowledge transfer. It could be argued that evolutionary biologists have been rather poor at the latter! Examples include:

- Combining data on species' distributions, their genetic diversity and environments to understand responses to past and future environmental change;
- Visualising patterns of (phylo)genetic as well as species diversity across landscapes and bioregions, and how these could change under different management and policy scenarios.

Policymakers and managers are well aware of the need to find ways of responding and adapting to the impacts of environmental change on biological systems (e.g. *g,k*). Now the challenge is for scientists, policymakers and managers to co-produce a scientific knowledge agenda that exploits the concepts and tools of evolutionary biology and genomics to conserve biodiversity now, and into the future.

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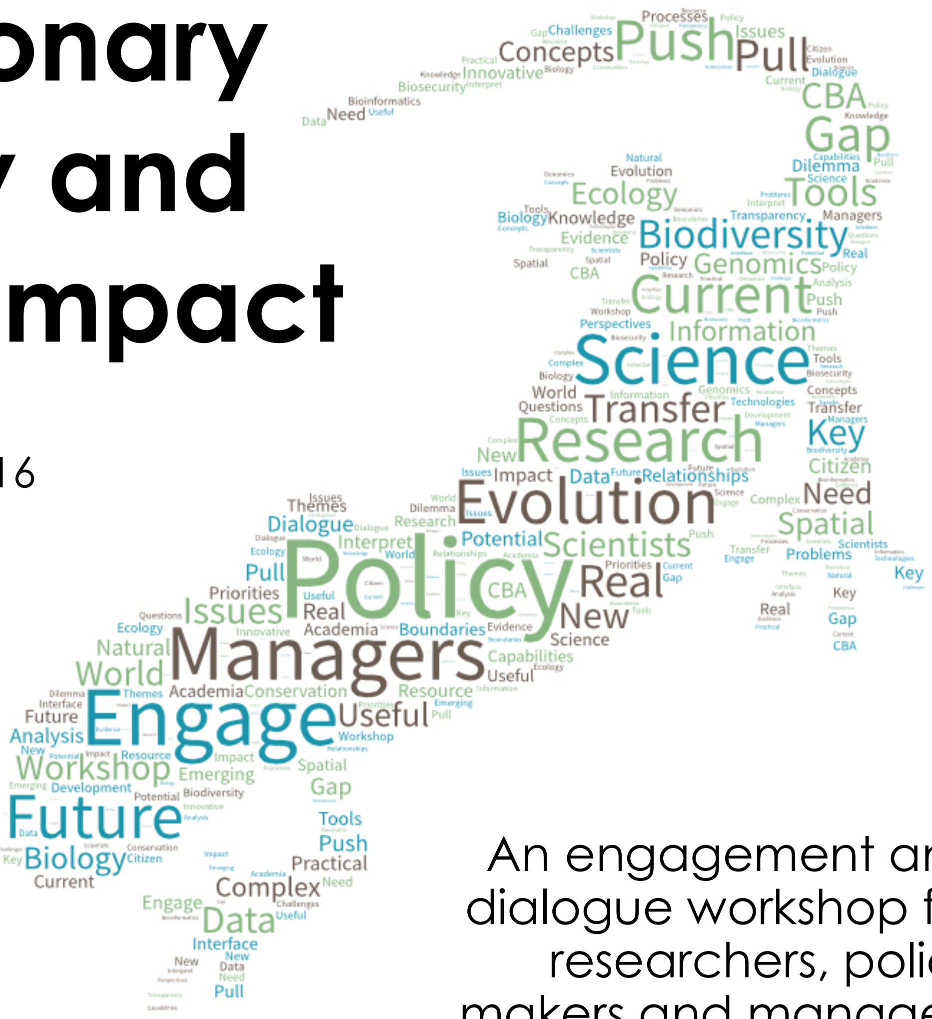
***g*** *Strategy for Australia's National Reserve System 2009-2030*
***k*** *The National Climate Resilience and Adaptation Strategy*

Appendix C - Workshop program

# The interface of evolutionary biology and policy impact

6-7 September 2016
ANU Commons
Canberra




An engagement and dialogue workshop for researchers, policy makers and managers

CSIRO

Australian National University

Centre for Biodiversity Analysis

cba.anu.edu.au

# Workshop schedule

6-7 September 2016

***Speakers: please put your slides on the laptop in the workshop room in the break prior to the session you are speaking in.***

| Tuesday 6 September | ANU Commons, cnr Barry Drive and Marcus Clarke Street, Acton (ANU) |
|---|---|
| **DAY 1 – Understanding 'the problem'** | |
| 8:30 | Registration, Tea & Coffee |
| 9:00 | **Welcome and Acknowledgement of Country**<br>Craig Moritz<br>Professor, Research School of Biology, ANU; Director, Centre for Biodiversity Analysis<br>**What can we expect from the workshop?**<br>Wendy Russell<br>Workshop facilitator; Director, Double Arrow Consulting |
| 9:15 | **What is this 'gap' and what signals that it is a problem?**<br>Craig Moritz<br>Professor, Research School of Biology, ANU; Director, CBA<br>**What is the changing context in which scientists, policy-makers and managers interact and exchange information (or fail to)?**<br>Linda Broadhurst<br>Director, Centre for Australian National Biodiversity Research/Australian National Herbarium, NRCA, CSIRO<br>Gregory Andrews<br>Threatened Species Commissioner, Department of the Environment and Energy<br>Kate Wilson<br>Executive Director, Science Division, NSW Office of Environment and Heritage |
| 10:15 | **What is your experience of making or using data for policy?**<br>*Speed dating* |
| 10:45 | Morning tea |
| 11:15 | **How does it look when things aren't working well (when the gap is wide)?**<br>*Case studies*<br>Carla Sgro<br>Associate Professor, School of Biological Sciences, Monash University<br>Sue Fyfe<br>Director, Biodiversity Science, Parks Australia, Department of the Environment and Energy<br>John Kanowski<br>National Science and Conservation Manager, Australian Wildlife Conservancy<br>Andrea Taylor<br>Adjunct Senior Research Fellow, School of Biological Sciences, Monash University |
| 12:30 | Lunch |
| 2:00 | **What causes the problem? What is missing? What's in the way?**<br>*Small group discussion* |
| 3:00 | Afternoon tea |
| 3:15 | **What opportunities are lost when the gap is wide? How could things be better if we solved this problem?**<br>*Panel discussion*<br>Margaret Byrne<br>Director, Science and Conservation Division, WA Department of Parks and Wildlife<br>Emma Campbell<br>Assistant Secretary, Landcare and Biodiversity Policy Branch, Department of the Environment and Energy<br>David Salt<br>Editor 'Decision Point', Fenner School of Environment and Society, ANU<br>Cameron Slatyer<br>Head of Natural Science Collections, Australian Museum |

| | |
|---|---|
| 4:15 | **Contributed 'Lightning talks'**<br>**1. Landscape genomics for seed sourcing decisions in Eucalyptus reforestation**<br>Megan Supple<br>Research Fellow, Research School of Biology, ANU<br>**2. Genetic adaptation alters our understanding of outcomes for biodiversity under climate change**<br>Karel Mokany<br>Senior Research Scientist, CSIRO Land and Water<br>**3. Overcoming admixture-phobia: using genomic data to evaluate the risk of outbreeding depression**<br>Alexandra Pavlova<br>Senior Research Officer, School of Biological Sciences, Monash University<br>**4. Dung, dorpers & diets: dietary analysis of sheep in rangelands through DNA metabarcoding**<br>Andrew Mitchell<br>Senior Research Scientist, Australian Museum<br>**5. Do we need species for conservation? A phylogenetic approach to mapping and conserving biodiversity in Northern Australia**<br>Dan Rosauer<br>Research Fellow, Research School of Biology, ANU |
| 5:00 | Drinks and canapés |
| 6:30<br>*Dinner will be served from 7pm* | Workshop dinner — The Common Room, University House, 1 Balmain Cres, Acton (ANU)<br>**Guest speaker: The evolution of antievolution policies**<br>Nick Matzke<br>Research Fellow, Research School of Biology, ANU |
| **Wednesday 7 September** | ANU Commons, cnr Barry Drive and Marcus Clarke Street, Acton (ANU) |
| **DAY 2 – Finding enduring solutions** | |
| 8:30 | Tea & Coffee |
| 9:00 | **How does it look when things work well?**<br>*Case studies*<br>Adrian Manning and Sam Banks<br>Professor & Research Fellow, Fenner School of Environment & Society, ANU<br>Dave Coates<br>Program Leader, Flora Conservation and Herbarium Program, WA Department of Parks and Wildlife<br>Stephanie von Gavel<br>Business Development Manager, Atlas of Living Australia, CSIRO<br>Peter Latch<br>Terrestrial Threatened Species Section, Department of the Environment and Energy<br>Andrew Weeks<br>Senior Research Fellow, School of BioSciences, University of Melbourne; Director, cesar Pty Ltd |
| 10:00 | **In the best possible world, what would things look like? Where would we like to be?**<br>*Small group visioning* |
| 10:45 | Morning tea |
| 11:15 | **What helps us to get there? What stops us getting there? Where should we put our energies?**<br>*Forcefield Analysis* |
| 12:30 | Lunch |
| 1:30 | **What concrete steps should be taken? What strategies will help us move in the right direction?**<br>*Open Space* |
| 3:00 | Afternoon tea |
| 3:15 | **What strategies have we come up with? What are we going to do next?**<br>*Strategies report back* |
| 4:00 | **Close** |

# Appendix D – Workshop notes

## Context factors

- Need to understand role of genetic diversity in restoration
- Mismatch of timescales
- Talking to ourselves – publish or perish
- Lack on international standards
- New scientific insights
- Climate change
- Complex policy environment and competing interests
- Who is not in the conversation?
- Decisions use best evidence
- Publicly available scientific evidence
- Community equipped to contribute
- Enabling factors:
    - relationships
    - the right questions
    - different ways to source and use
    - products on time, accessible
- Co-design of knowledge needs
- Culture shift – more pervasive use of science
- Knowledge-sharing as policy objective
- Translating into "punter" language
- Overlap, intersections <->
- 1st threatened species strategy – policy principles, targets
- Physical, social, political challenges
- Marketing (Kardashians), preciousness (Gollem)
- Policy needs suggestions not one solution
- Need social licence to act

### Causes and characteristics

- Poor understanding of evolutionary concepts
- Lack of practical tools
- Uncertainty about outcomes of management
- Science-policy interface
- Lack of resources
- Short-term vs long-term
- Lack of education
- Failure to demonstrate benefit of evolutionary biology data
- Conservation not a priority
- Misconceptions re evolutionary biology
- Definitions missing
- Lack of alignment of policy and science
- Scientific info not contextualised
- Disconnects – science-policy-practice
- Management – multiple challenges & demands
- Lack of time & resources
- Failure of knowledge transfer
- Need for many communication channels
- Simple questions, complex answers
- Managers get the blame
- Need for honest brokers
- Lack on consensus, contestation
- Lack of credit for policy input
- Mismatch of incentives & performance indicators

- Managers need general info *and* specific answers
- Competition for science results, rewards
- Need for good collaborative practice
- Bad press setting research back
- Poor attitudes to evolutionary biology science
- Lack of expertise, capacity in agencies
- 2 gaps: science-policy and genetics-ecology
- Genetics/evolutionary biology not part of conservation toolkit
- Academic vs 'service' research
- Policy patchiness (eg across States)
- Poor data interpretation/understanding
- Patchy data sets

## What's missing? What's in the way?

**Table notes**

Where groups were pretending to be 'other' groups (imagining their perspectives on the problem), this is indicated with "". Comments in italics are the 'other' groups correcting their perceptions of them.

**Policy & land management group**

- Communication within Dept
- Knowledge loss within Dept and increasingly less external networks
- Timeframes – not conducive to consultation and advice
- Change is hard/time-consuming, takes effort and buy-in across whole govt hierarchy
- Contestability of information (publicly and politically palatable)
- Not possible to keep up with/be across scientific literature across all areas relevant to policy and management

**"Researchers"**

- Who to talk to?
- Level of knowledge contacts have -> comms
- Recognition for input
- *not built into performance metrics*
- *most willing to engage (but would they fill metrics required?)*
- Issues with "expert consultation"

**Researchers (Pavlova, Taylor, Banks, Manning)**

- Different perceptions of risks and benefits of intervening between groups
- Need to assess risk of doing nothing -> Most common decision
- Lack of consensus between scientists on conservation goals
- Risk aversion is a barrier to experimentation
- We need to learn through experimentation
- Low adaptive potential cannot be demonstrated for most systems
- Lack of case studies that show possible solutions: Need strategic selection of case studies
- No rewards from being engaged in policy making

**"Managers"**

- Research is too general, not specific enough to solve the problem without talking to scientists
  *…specific, not broad enough to deal with… (depending on the problem)*
- *need to write abstracts with particular management recommendations*
- No access to literature, *no library, no access to databases*
- No *adequate* time to do own research and synthesis
- Difficult to derive a solution based on available information
  *access to sufficient uncontested info leading to defensible decision*
- No definite answers, always caveats
  *Not a problem. Expert opinion could be an issue – rarely backed up by data*
- Research driven by questions not directly related to management
  *Ok, but if you take something from government -> give something useful back to management*

- Data takes too long to collect – decisions have to be made now

**Policy**

- Issue – ‘opportunity’ not ‘gap’
- Reframe language
- Open access/open data
- MOU – set expectations
- Transparency for scientists -> how they contribute

**“Researchers”**

- Limited clarity on requirements/needs
- Not strategic/long term
  *time frames short term*
- Priorities not clear
- Compromising on technical detail
- Not up to date with science/technology
- Values as a cop out

**“Managers”**

- Scientists do what they want to do, not what is needed
- Scientists don’t explain terms in ways that are accessible and easily interpreted
- Spend too much time focussing on contested ideas/advice, rather than broad generalities and accepted knowledge
- Don’t provide clear and definitive advice and guidelines

**Researchers**

- Knowing/finding out what govt/users need (who wants what)
- Knowing who to talk to/what is going on we could contribute to?
- Many contexts
- Matching generic vs specific knowledge
- Discovering <u>who cares</u> and why?
- Knowing what of our work is in the policy/research overlap zone
- Knowing when knowledge gaps matter beyond our curiosity

**“Research users”**

- TMI (too much info)
- Tell us what to do and concisely tell us why
- Answer the question we need answered
- Why are you so slow?
- Why do you always want $? (we don’t have it)
- Published papers incomprehensible
- How do we know that your research is important?
- We don’t get to plan long term/strategically
- You don’t understand how decisions are made

**Managers**

- Different motivations
- Different Values-rules-knowledge
- Complexity

**“Researchers”**

- A belief that knowledge is enough to prompt implementation
- ‘Ignorant’ managers – don’t list, don’t understand
- Want to complicate the issue
- Managers do have access to current research

**Research users**

The problem (the gap)

- The metrics/rewards of science vs policy
- Different time scales
- Lack of money

**"Researchers"**

- Too much turnover of policy people (and each new crop dumber)
- The question keeps changing
- They don't give us enough time
- They don't know what their long term goal is
- They twist our science

**Research**

Causes

- Different 'key performance indicators'
- Identify combined goals/overlap
- Communication – best way?

Missing

- Channels of communication
- Education of how to communicate science to policy makers and public
- Resources -> time and money

In the way

- Need to publish and get grants
- Timescale differences
- Way to communicate

**"Research users"**

Cause

- Attitude – focus on non-applied goals
- Communication and transfer of information
- Don't understand our resources constraints

Missing

- Don't appreciate complexity
- Decision making – understand complexity and transparency

In the way

- Accessibility – people, science resources
- Resources – time and money
- Short term vs long term

**Policy**

- Translation of science language -> policy -> community
- Building personal relationships
- Structural separation
- Lack of accessibility to information

**"Researchers"**

- Not being listened to
- Science not being directly translated to decision making
- Tension between inherent uncertainty of science and desire for a black/white answer
- No reward/encouragement to engage outside of academia

**Research**

- Academic incentive – pubs, grants
- Relevance/terminology!?

- Data restrictions
- Data sharing & IP (both ways)
- Who do I talk to?
- Users: How do they know I exist?
- How do I know what problems you have?
- How do users get information with no library to use? Eg journals

**"Research users"**

Researchers are:

- Too slow
- Go off on tangents
- The basics
- Want money -> no usable outputs
- Want good news story
- Not interested in communicating and advising on results
- JARGON!
- Not aligned to decisions we need to make

**Summary cards (causes/what's missing/what's in the way)**

- Short term needs of policy vs long term needs of science
- Long term/short term disconnect
- Academic incentive structure not conducive to applied research
- Different metrics of rewards/success
- Managing expectations
- Conservative nature of policy vs drive for novelty in science
- Contestability vs risk aversion in govt/politics
- Strategic research to anticipate future needs
- Lack of empathy
- Knowledge brokering
- Transparency of process - access
- Communication – simplify language and concepts
- Jargon
- Summary and synthesis (plain English)
- Positive case studies – to demonstrate outcomes
- Science communication to steer public and political opinion
- NRMs not having access to scientific literature
- Lack of data sharing/IP restrictions
- NRMs not knowing the scientists out there
- Scientists not knowing the NRMs and their problems
- Networking
- Opportunity not gap/problem

## Success Factors

- Bravery ( incl government)
- Outdoor laboratory
- Visions of a better world
- Recalibrating expectations
- Tactics, key comparisons
- Flexible infrastructure (research management)
- Experimental management
- Meeting different goals and constraints
- Adaptive management and collaboration
- Catalyst for change
- Animal ambassadors eg Bettong
- Science highlighted in policy

- Science influences policy and management toward conservation outcomes
- Decision trees, prioritisation, strategic application of science
- Integration, communication
- Ownership
- Personal contacts
- Science backgrounds
- ALA enabler, data aggregator, information supply chain
- Engaging data visualisation
- Data – science – policy – impact
- Adding value
- Engage Enable Embed
- "it's not a one night stand, or monogamous"
- Understand the political economy
- Keep a Babel fish in your ear, translation
- Making data influential – timeliness
- Strategic alignment
- Engage with key policy drivers
- Federal – State collaboration
- Stakeholder teams
- Coordination policy eg recovery plans; constrain actions, guide investment
- Keeping up to speed on developments
- Big (wicked) challenges eg fragmentation, climate change
- Knowledge brokering and translation
- Integration of science – key policy principles
- Taking risks
- Genetic rescue, restoration, gene-pool mixing/widening
- Choice of words
- Attitudinal change – animal ambassadors (eg mountain pygmy possum)
- Engage policy or ground level (latter can influence the former)

## Main features of an effective system

- Effective integration across research, management and policy
- Robust support and buy-in from institutions
    - Culture
    - Reward system, not disincentives
- Components of knowledge system available on web – open information including spatial component
- Efficient – short-form information sheets and/or webcasts
- Scalable and national
- Embedded science knowledge in government and policy in research institutions
- Engagement at both strategic and tactical levels
- Reveal 'ecosystem of research'

- Early & ongoing engagement between research and management
- Effective communication & understanding among different cultures
- Acceptance of risky research

- More proactive instead of reactive (crisis) management
- More systems based/integrated management (rather than management of individual threatened species)
- Good information flow and networking
- Everybody knows what the others are doing and what they need -> avoid duplication of efforts, specialise/play to one's strengths, find right partner…
- Good scientific communities of practice -> clear positions to government and politics
- (from researcher perspective) Studies can be designed in a way that they offer not only very specific but also wider applicability (and thus publishability)

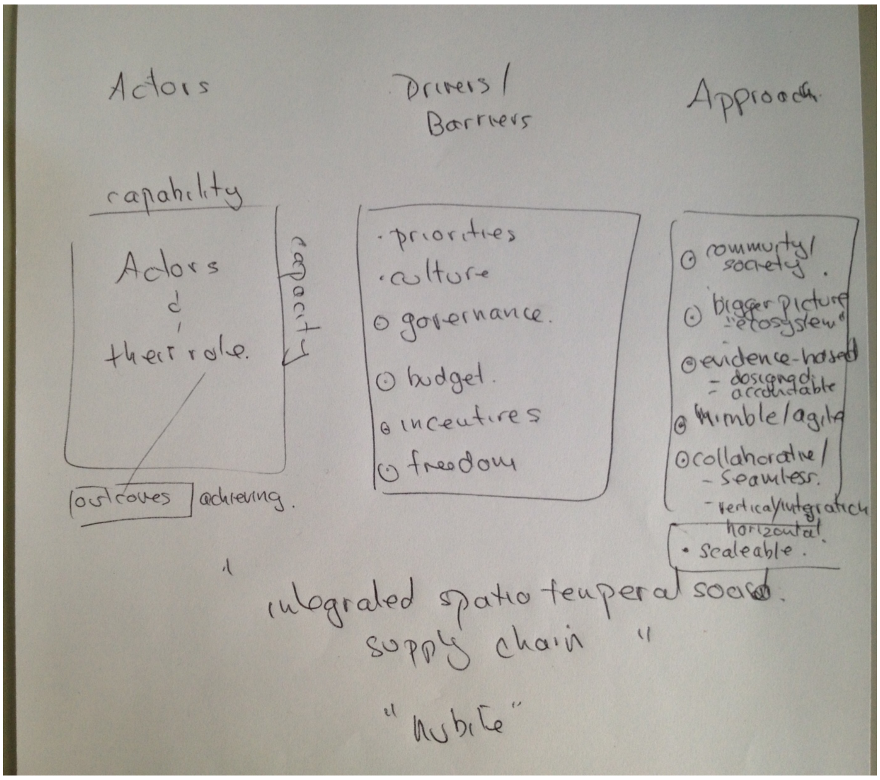
- Better integration of aims and approaches
- Embed adaptive management organisationally
    - specifically tailored to on ground operations & management
    - ultimately practical and affordable
    - guides management actions for efficient management of multiple problems

- Federated data exchange system
- Information exchange (network?) – who to speak to about specific topics both within government and research sectors
- Two-way career pathways – change performance measures
- Ability for researchers and government employees to have opportunity to work in either sector without implications for research careers
- Strategic alignment of research & policy
    - reflection of this in grant programs -> including academics and decision-makers as reviewers
    - applied research contributing to performance indicators
- <u>Missing</u>: clear and communicated vision of what it should be like (beyond threatened species) with all players (policy-science-management)
- Integration between scientists and management and the respect to listen to and follow advice (practically)

- Good balance between in-house and 'out-house' scientists
- Scientists well-supported in-house by their organisation and valued by the scientific community
- Data/publications freely available to all users
- Good feedback from policy-makers to scientists
- Evolutionary biology represented among the in-house scientists

- Integrated science & policy/management
- Open communication structure -> clear pathway
- Ongoing consciousness/awareness of needing each other
- Understand underlying questions in policy
- Focus on feedback mechanisms (the loop -> to improve)
- Strategic planning for getting long term investment -> involving evolutionary biology
- At all policy levels, 'long-term' meant the involvement of an evolutionary biologist.

- Actors:
    - Capacity and capability for evol. biol within organisations ($, labs, understanding, ability to outsource, quality control)
    - Clear roles linked to conservation outcomes
- Drivers/barriers:
    - Priorities
    - Culture
    - Governance
    - Budget
    - Incentives
    - Freedom
- Approach:
    - Community/society
    - Bigger picture "ecosystem"
    - Evidence-based – designed, accountable
    - Nimble/agile
    - Collaborative/ seamless – vertical & horizontal integration
    - Scaleable
- An "integrated spatio-temporal-socio supply chain", "nubile"




## Force Field Analysis

**Templates**

**Main forces (driving)**

Openness

- Open collaboration
- BUT different stages, different model & structures, different ways of capturing value
- Strong force, medium ability to change (negotiated)

Technology

- Creating and opening possibilities
- Limited by capacity to understand & use to best
- Strong force, easy to change

Desire for engagement

Both sides want effective policy based on science

Collaboration and development of common ground

Secondments and postgrad research exchange

Forums for knowledge exchange

Open data, creative commons

Change regulations etc, to include evolution

Public outreach & social media

Success stories – exemplars

Open access to data

Genetic info – access easier and cheaper

**Main forces (restraining)**

Language barrier and communication

Risk tolerance – be more transparent

Reward incentive change

Politics

- Can undermine everything
- But not easy to change
- Undermining confidence
- Very strong, very hard to change

Lack of interaction

Lack of networking structures

Lack of policy makers access to science

Risk aversion (both sides)

Fear of failure

## Strategies session

**Strategy proposals**

1. Expertise directory
2. Develop high level policy 1 pagers on key issues such as getting DEE to discuss including recovery plans in block grant requirements
3. We propose an information system to communicate who are the evolutionary biologists who have expertise in a certain area.
    - Use an existing social media debate
      LinkedIn – used more by policy?
      ResearchGate – used more by researchers

**Strategies**

**Title**: gALA

**Description**: Genetic/evolutionary biology data aggregation into ALA

**How will this help? What will this achieve?**

Bring all the bits together that already exist and understand them/standardize them in accordance with international/national informatics communities relevant to biological and genomic and spatial data

**Steps required to be taken and by whom:**

| **Action** | **Timeframe** | **Who?** |
|---|---|---|
| Bring actors all together | 4 months | Stephanie |
| Relevant information models | 12 months | All? |
| Use cases, commons | | Stephanie |
| Data standards/Vocabs & informatics communities and applications<br>ID -> existing | 4 months | Justin & Megan |
| What are the gaps? Data, data collaboration tools, data analysis & visualization & discovery applications | 4 months | Justin & Megan |

**Who will sign up to this strategy and what will you do?**

Sue, Tania, Megan, Justin, Randal, Stephanie

**Title:** "The Evolution Solution"/Consensus Statement and Success Stories

**Description:**

Clearly written statement as to what evolutionary biologists agree are the principles of best practice for conservation planning and management.

**How will this help? What will this achieve?**

Accessible, common ground narrative to start discussions – entry point & examples of success cases – and of the emerging tools available.

Key messages:

a) There's a lot of common ground
b) Success stories are out there for a range of systems, scales, applications
c) Genetics can make your life easier, not harder, and can even be economical
d) There's a lot of information out there already – so it's not a big empty space any more

Aim to give "research-users" a crib sheet to help link them to more detail or experts if needed. Or, maybe to simple answer their questions!

Case studies – 4 to start with (pygmy possum, yellow box, soil metagenomics, Dan's PE)

**Steps required to be taken and by whom:**

| **Action** | **Timeframe** | **Who?** |
|---|---|---|
| Circulate idea around workshop participants & get buy-in from researchers, policy makers, practitioners, nominate case studies | End of Sept | Adrienne via Claire |
| Approach David Salt about Decision Point as a venue | Next Week | Sam B. |
| Set aside a couple of days and have a workshop to write this | After discussions with David S, possibly seek CBA support | |

**Who will sign up to this strategy and what will you do?**

Simon F., Andrew W & Y, Carla S, Ian C, Sam B, Adrienne N, Margaret B, Randall S, Cate McElroy, Andrea T, Tanya L.

**Title**: Evolution and conservation Information Commons

**Description**:

Policy/management <-> research network for finding and connecting people/expertise

**How will this help? What will this achieve?**

Broaden networks and enable 2-way communication

**Steps required to be taken and by whom:**

| **Action** | **Timeframe** | **Who?** |
|---|---|---|
| 1. Scope goals and participants | 1 month | Craig Moritz |
| 2. Key words, glossary relevant | 1 month | Dave Coates & Jennifer |

| | | |
|---|---|---|
| to EB <-> Policy | | |
| 3. Get info on govt agency & NGOs structure/roles/generic contact info (Directory) | 2 months | Claire -> Sarah Hearn, Dave Coates etc |
| 4. Research gate experiment – policy/management keywords | 3 months | Sasha Pavlova |
| 5. talk to IT/network/social media experts | 2 months | Karel Mokany |

**Title:** Better incentives for academics to do applied research

**Description:** A one-page letter to Aidan Byrne also broader audience – attach further an applied impact of evolutionary biology -> cost neutral funding system suggestions

**How will this help? What will this achieve?**

Change incentives for researchers, raise profile of discipline

**Steps required to be taken and by whom**:

| **Action** | **Timeframe** | **Who?** |
|---|---|---|
| 1. Outline of points which summaries intent of doc | 1 week | Dan Rosauer |
| 2. Finesse info to 1 page document with cover letter | | |
| 3. Circulate for comment | | |
| 4. Collect signatures | | |