ACT Government

CONSERVATOR GUIDELINES FOR THE TRANSLOCATION OF NATIVE FLORA AND FAUNA IN THE ACT

Supporting Information

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Front Cover
Ginninderra Peppercres (ACT Government), Grassland Earless Dragon (E. Cook, ACT Government).

Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT

Supporting Information

Conservator of Flora and Fauna
Environment Division
Environment, Planning and Sustainable Development Directorate
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1. Translocation purpose: the conservation problem

Principle 6:
A translocation should have a primary focus on biodiversity, ecological, and/or species conservation, and should contribute to ecosystem functioning and restoration.

The purpose for translocating should be very clear in a proposal.

Translocation should be considered as an option when the intended conservation outcomes outweigh any environmental, social and economic risks, and alternative conservation options are insufficient or unfeasible. A translocation is most likely the best option when populations are declining and would benefit from strategic addition of individuals (and their genetics), or where the absence of a species has left a gap in ecological function.

Given the risks associated with translocations, the *IUCN Guidelines for Reintroduction and Other Conservation Translocation 2013* (IUCN/SSC Guidelines) recommend the use of a structured decision-making process that is logical, justified and transparent, to determine whether or not a translocation is worth any associated risks.

A number of reasons exist to rationalise a translocation including:

1.1. Conservation

Habitat loss, fragmentation, and exotic pests are key threats to many populations. Conservation of a species that is declining or vulnerable to extinction is typically the primary cause for a translocation. Translocation is generally considered a last resort conservation option to assist species and population persistence and ecological restoration (IUCN/SSC 2013).

1.2. Restoration of ecosystem function

Introduction or reintroduction of a species/taxon to a location may intend to restore an important ecosystem function that is important to other species and the local ecology that may have been lost.

For example, the Eastern Bettong (*Bettongia gaimardi*) was reintroduced to the ACT from Tasmania to assist with ecological restoration. The translocation aimed to restore the ACT's woodlands to a condition more reflective of the pre-European settlement natural ecosystem. The Eastern Bettong is an ecosystem engineer, and its foraging activities will assist in improving soil condition, water capture and storage, nutrient cycling and fungi dispersal (Batson *et al*. 2016).

1.3. Assisted colonisation

Under increasing threats from climate change and other causes that impact habitat suitability, the intentional and strategic movement of species through assisted colonisation, including outside of their natural range, is becoming an important adaptation strategy. In addition to the prevention of extinction, assisted colonisation may be important in maintaining ecosystem services where they are declining or are predicted to decline (Burbidge *et al.* 2011). Species will most likely benefit from assisted colonisation where they are incapable of adapting rapidly enough within their distribution or have limited dispersal abilities or opportunities (Gallagher *et al*. 2015). Species that are unable to adapt or migrate are candidates for assisted colonisation, and might benefit in the long-term from translocation to areas that will be better suited (McLachlan *et al*. 2007; Richardson *et al*. 2009; Schwartz *et al*. 2012).

1.4. Mitigation and salvage

Under certain circumstances translocations can mitigate (to some extent) the loss of individuals or loss of habitat (IUCN/SSC 2013). However, such circumstances are rare and would typically require the establishment of a new population from translocated individuals in suitable habitat that is not currently occupied by the species. Where such circumstances exist, the translocation would usually form part of an offset strategy for a development proposal. Such translocations require detailed assessment and planning to ensure conservation outcomes are achieved at the release location.

In circumstances where a translocation is not used to assist in mitigating the loss of habitat or individuals, 'doomed' individuals might still be translocated for use in public display or research studies. Because such salvage translocations do not compensate for the loss of habitat, populations or individuals, they are not part of an offset strategy.

The translocation of the Striped Legless Lizard (*Delma impar*) (listed as vulnerable under Commonwealth and Territory legislation) from two source populations into a reserve with apparently unoccupied habitat is an example of a translocation that has occurred subsequent to an approved development. While not part of an official offsets strategy, the relocation of the Striped Legless Lizard assists in preserving existing populations of the species and increase its distribution, overcoming its limited dispersal capabilities (Howland *et al*. 2016).

1.5. Rescue or emergency

The need for a rescue or emergency translocation might arise where a serious or unavoidable threat to a vulnerable population emerges that is likely to cause the extinction of that population, such as development, bushfire, drought or de-watering of water bodies during development or maintenance. These translocations may be permanent, or they may be temporary where the individuals and/or their progeny are returned once the threat is ameliorated. Unless undertaken by a Conservation Officer, these types of interventions will require a Nature Conservation Licence, however, a full translocation proposal may not be required to allow for quick decision-making and actions.

1.6. Trials and experiments

Principle 6.1:
Translocations may be trial or experimental in nature, but should have a primary focus to improve species, population, and/or ecological understandings, or to improve translocations methods and techniques, to inform decision making and future, larger-scale translocations.

Translocations carried out as trials or experiments play a role in generating improved understandings around the likelihood of population establishment and persistence (Kemp *et al*. 2015). If undertaken within an adaptive management approach, well-planned experiments can help fill knowledge gaps and support the success of translocations in the future by improving understandings around behaviours, ecology, and suitable habitat characteristics and requirements, translocation methods and designs, etc

2. Types of translocation

Translocation is the term widely accepted to refer to "the human-mediated movement of living organisms from one area, with release in another" (IUCN/SSC, 2013). Movement includes between wild locations and populations, from a captive facility or *ex situ* population to a wild location, and/or from the wild to a captive facility for cultivation/population growth (with an intention to release the individuals or progeny to the wild). The primary objectives of conservation translocations are to improve the status of threatened species or to restore natural ecosystem functions or processes. Translocation can occur within the species known current or historical distribution (population restoration) or outside of it (conservation introduction) (IUCN/SSC, 2013).

Plants and animals may be salvaged from development sites and moved to secure areas. However, translocations typically have low rates of success and there are risks (such as the spread of disease). Thus, salvage translocations will only be considered as a last resort after all efforts have been made to protect wildlife and their habitat.

The following definitions come from the *IUCN/SSC Guidelines for Reintroductions and Other Conservation Translocations*:

Population restoration is the translocation of living organisms to an area within its known current or historical indigenous range. Population restoration can be categorised as either reinforcement or reintroduction.

- **Reinforcement** is the addition of living organisms to a population of the same species. Reinforcements often require deliberate and strategic manipulation of the population, and its genetic pool, to improve the population's viability and persistence.
  [Synonyms: re-stocking, enrichment, supplementation and augmentation, and enhancement (plants)]
- **Reintroduction** refers to the movement of living organisms to an area within its indigenous range from which it has disappeared to re-establish a population.

Conservation introduction is the translocation of living organisms outside of their known current and historical indigenous range to an area of appropriate habitat. The nature of an introduction might involve assisted colonisation or ecological replacement.

- **Assisted colonisation** is the relocation of organisms to an area outside of its known current and historic distribution, with the intention to establish a viable population and in doing so, avoid extinction. Assisted colonisation is recognised as a threat mitigation strategy for climate change, agricultural expansion and urbanisation (Seddon, 2010) (Hoegh-Guldberg, et al., 2008) (Gallagher, et al., 2014).
  [Synonyms: benign introduction; managed relocation; assisted migration]
- **Ecological replacement** is the movement of living organisms to a location where the species will provide a critical ecological function.
  [Synonyms: taxon substitution; ecological substitutes/proxies/surrogates; subspecific substitution; analogue species]

3. Goals, objectives & actions

Principle 7:
Translocations should aim to establish naturally self-sustaining populations in the wild with minimal or no human intervention.

Translocations should always support an overarching conservation goal to establish or restore a self-sustaining population, with a view to increasing the species abundance and/or resilience. Translocations should also support broader goals for ecosystem restoration that seek to increase biodiversity, increase the presence of native species, improve landscape connectivity, and support resilience to current and potential threats, including the changing climate and environmental conditions.

To achieve this, the planning phase of a translocation should establish clearly defined objectives and actions (IUCN/SSC 2013). Depending on the phase of the translocation and the status of the translocated individuals, goals and objectives should be specific to the various milestones of the translocation program.

Principle 8 and 8.1:
In meeting conservation outcomes a translocation proposal should clearly identify its goals, which may be at a species, community, or ecosystem level.
To meet these goals, a translocation proposal should demonstrate how the program will be guided by clearly defined objectives and actions.

4. Suitability and Feasibility

4.1. Species information

A translocation must be well-planned prior to implementation to ensure that the translocation is both suitable and feasible.

Principle 12: A translocation proposal should demonstrate the collation of sufficient information and research on the biological and ecological requirements of the target species.

Knowledge of the biological and ecological requirements of the target species is essential in increasing the likelihood of translocation success. This information can be collected through research, scientific literature, reports, lessons learnt from past translocations, and expert knowledge. Research specific to the source population can provide important information regarding the needs, behaviours and roles of individuals within the population. As a guide, some of the biological and ecological information that might be required is listed in Table 1.

Table 1. Biological and ecological information requirements to inform translocation planning.

Animals (IUCN/SSC 2013; NSW National Parks and Wildlife Service 2001)	**Plants** (Vallee *et al*. 2004)
• life history • population size • life cycle stages • reproductive biology • mating behaviour • breeding requirements • parental care • population demographics and dynamics • social structure and behaviour • adaptations to native environment • food and water requirements • refuge and shelter requirements • intraspecific variation • climate sensitivities • adaptations to local ecological conditions • dispersal • feeding and foraging behaviour • predation • pests • disease • commensalisms • symbiosis • mutualisms • home range requirements	• longevity • primary mode of regeneration (vegetative or seed) • population age structure • population size • breeding system (self-compatible or self-incompatible) • pollination mechanisms • phosphorus tolerance • flowers and fruit production • seed dispersal mechanisms • seed viability and germination rates • seed bank size, distribution and longevity • abiotic requirements: soil type, water quality, water table depth, drainage, slope, landform, elevation, aspect, precipitation and climatic conditions, sensitivities and projections • biotic interactions with commensalistic and mutualistic taxa, including soil microbiotia (e.g. mycorrhizae, rhizobia) and key pollinator species.

	• habitat characteristics (e.g. preferred amount of canopy cover, shade, light, exposure to wind) • life history (if the plant is short or long-lived) • susceptibility to disease • resilience to weeds • resilience to herbicides • fire sensitivity and regime requirements • fire requirements (e.g for germination) • resilience to grazing and other disturbances or land management practices

4.2. Habitat suitability

Principle 13: A habitat assessment (that includes biotic and abiotic conditions) of the release location should be provided to demonstrate its suitability for the proposed translocation.

A habitat assessment is an important component of translocation planning to ensure that the release location is suitable to accommodate the new individuals.

Though reinforcements and reintroductions are more likely to provide for a successful translocation than introductions, the proponent should carefully consider that the area where a species has become extinct may no longer be appropriate. If environmental conditions and ecological composition and dynamics have continued to change in the species absence, or if threats cannot be removed or mitigated, then the habitat is unlikely to be suitable for reintroduction. When assessing habitat suitability for reintroductions, the current range of a species is not always a reliable indicator if a remnant population has been pushed into areas of suboptimal habitat (IUCN/SSC 2013) or if climate change has changed the suitability of the habitat (Gallagher *et al*. 2015).

The proponent should consider the extent of habitat change and fragmentation at present and in the future associated with human development and climate change. For translocation to habitats and landscapes that have become degraded, modified or reconstructed, site preparation and post-release habitat management may be required and should be specified by the proponent. Surrogate habitats, sanctuaries, and captive habitats may be a useful strategy for translocation before release into the wild, as these for individuals to adapt to the local conditions and breed.

Some translocations may take advantage of the creation of new habitats from degraded land, surrogate or artificial habitats, captive habitats and sanctuaries, or created as a result of climate change. A risk assessment for these types of habitats should be undertaken, and the proponent should outline how these habitats will be supportive of self-sustaining populations in the future.

The extent of the habitat assessment will depend on the species. Immobile species might require a localised habitat assessment and consideration of how suitability may change in that locality. Larger, mobile species may rely on a greater geographical range and therefore require a greater habitat size and may be exposed to greater environmental variation.

Relevant information to the habitat assessment might include:

- Key biotic and abiotic components of the habitat, and whether or not the candidate individuals are suited to these now and into the future as they change.
- How the release area accommodates the species biological and ecological requirements - consider the lifespan of the species, life cycles, migratory patterns and other inferred requirements (food, water, shelter, drought, flood, fire, refuge, etc).
- Habitat size and carrying capacity to accommodate the intended population size - consider isolated patches if the habitat is fragmented. A population viability analysis can assist with determining this.
- Potential impacts of changing seasons and environmental variation, including impacts from unpredicted events that are extreme or severe, both now and into the future.
- Any known or potential threats to the species, and how these will be mitigated or managed. Proponents should ensure the pressures and threats that have caused original population decline are not present at the new release site, and consider that where a species has become extinct from the area and is being reintroduced, the habitat may no longer be suitable and new threats may have emerged.
- Whether the species will fulfil an ecological role at the release area.
- Past land use management practices, and how these have disturbed the habitat, including weeds, erosion or impacts from grazing or cropping.
- How secure the habitat is from potential damage and destruction post-translocation
- Adjacent land tenures that may affect persistence.

4.3. Climate suitability

Climate conditions at the release location should be suitable for the candidate species; this includes seasonality and climatic variation, mindful that habitat selection for translocation should aim to support the observed trend of most species to move poleward and/or upward in altitude in response to climate change. Particularly in the context of climate change, as the severity and frequency of severe weather events continues to increase, the success of a translocation might be impacted by the inability of vulnerable, un-established individuals and populations to acclimate in the short-term without management intervention. Increasing genetic diversity may be one strategy to overcome certain climate-change scenarios by providing the population with greater ability to adapt to conditions through greater variation in genetics and traits.

Current species distribution and climate models can be used to infer the climatic requirements and likely impacts, and also provide predictions for future climate scenarios and for areas that may become more or less suitable over. Long-term climate suitability is required to support a successful translocation. Long-lived species, such as trees, that are unable to move at the rate that the climate is changing may be assisted to move towards more suitable habitat through translocation of seedlings into habitat anticipated to become more suitable as the climate changes.

4.4. Pressures & threats

Principle 11:

Proponents should demonstrate how any threats responsible for causing the decline or local extinction of the target species should be managed to provide the best opportunity for successful translocation. A translocation proposal should outline how these threats are to be managed or mitigated so that they do not impact on the translocation's success.

A translocation proposal must demonstrate careful consideration of potential pressures and threats that might impact on the translocated species and the overall success of the translocation (IUCN/SSC 2013). Reintroductions should consider that the cause for local extinction may still exist. Pressures and threats might include presence of exotic predators, competition, habitat fragmentation, climate change, disease and low genetic diversity. A translocation that does not consider and plan the management, removal or mitigation of these threats is unlikely to be approved.

4.5. Animal welfare

Principle 4:
All translocations involving animals should adhere to the *Australian code for the care and use of animals for scientific purposes 8th Edition (2013)*.

All fauna translocations that involve health checks, genetic assessment, capture from a source population, handling and transportation, release, and post-release monitoring must have approval from their relevant animal ethics committee (AEC). Proponents should consider obtaining this prior submitting a translocation proposal to the Conservator. This is to ensure the welfare of the animals involved.

Proponents must ensure that the welfare of animals is foremost at all times, and must comply with any Commonwealth and Territory licensing requirements for the duration of the translocation. Proponents should also consider any other jurisdiction requirements. Translocation proposals that involve research must be approved by the institution's AEC under the *Animal Welfare Act 1992*.

Stress can be expected as part of any translocation, as the process involves many stressful events including capture, captivity, transport, release and establishment in a new environment (Dickens *et al*. 2010). Physiological and behavioural outcomes associated with chronic stress can inhibit the success of a translocation in the establishment phase. Animals involved in a soft-release strategy may experience prolonged stress from extended holding times, especially when sourced from wild populations, as can those subject to a hard release that suddenly find themselves in unfamiliar territory. Stress may also be experienced within the source population after individuals are removed (IUCN/SSC 2013).

Translocations often observe higher mortality rates in the initial weeks following release due to predation, starvation, disease, interception with roads, cardiac pathology, reduced reproduction and dispersal from release site. Chronic stress does not directly cause a translocation to fail, however it increases the vulnerability of individual animals to these factors that contribute to translocation failure. Therefore, animal stress should be accommodated within translocation planning and procedures (Dickens *et al*. 2010).

When preparing risk management strategies and actions, proponents should consider animal welfare (for example, where pest control is required).

4.6. Source population & selection of individuals

A translocation should aim to relocate enough individuals, of the appropriate age/sex mix, to withstand demographic and environmental stochasticity and also to maintain genetic variation so that the population can withstand longer-term environmental change.

Individuals can be sourced from captive or wild populations. Those relocated from a captive facility may have been bred there prior to release as part of a soft release strategy. An example of this is the propagation of Tuggeranong Lignum, Button Wrinklewort, Small Purple Pea and Ginninderra Peppercress at the Australian National Botanic Gardens, which allows numbers to build up prior to the reinforcement or augmentation of wild populations. If individuals are sourced from a wild population, the aim should be that there be no impact on the persistence, health or climate change resilience of the source population, and no effect on its ecological role in that environment. In a dire emergency situation where only one source population remains, it may be decided that the need to improve chances of the species survival through establishment of a second population may warrant exposing the source population to a slightly higher level of risk.

The environment of the intended release location should not be vastly different from that experienced by the source population as this will reduce the likelihood of success if individuals are not capable of adapting to their new environment. When assessing the appropriateness of a source population, applicants should consider the adaptive potential of individuals to future climatic and environmental situations.

Population viability analysis

In determining the number and type of individuals to be translocated, a population viability analysis (PVA) is a method for using demographic data from the source population to determine the number of individuals to translocation. It also helps to assess the long-term risk of extinction (considering environmental stochasticity or other scenarios) and obtain future projections of population growth.

Genetic considerations

Genetic considerations are not commonly straightforward or easily identified, though it is important to consider when establishing or reinforcing a population. To assist in establishing a healthy, self-sustaining population in the long term, sufficient genetic variation should be included when translocating plants or animals (IUCN/SSC 2013). Therefore understanding the genetic diversity of the founding population/s, and the population's history, is important to reduce the risk of inbreeding depression and maximise evolutionary potential (without risking outbreeding depression).

For translocations that aim to support the establishment or persistence of a population in a new environmental context or in the face of environmental change, the strategic mixing of individuals from multiple source populations to increase genetic diversity is a means of establishing and augmenting the population in the long term. This would provide the necessary basis for improved adaptability to environmental change (Weeks *et al*. 2011). Increased genetic diversity allows a population to adapt and evolve, as beneficial traits increase population fitness and survivability. The population would also avoid the consequences associated with small or fragmented populations (such as genetic load and inbreeding depression) (Weeks *et al*. 2011). Care must be taken however, as population fitness can be impacted if the genetic variation added is not well adapted to the conditions of the new location (for example, inability to tolerate winter temperatures), thus potentially adversely affecting population growth.

For translocations that aim to support the persistence of a severely reduced population in a continuing context, individuals from nearby populations may be able to provide well-suited genetic traits. Individuals that exist in similar climatic and ecological conditions might be considered so that genes that are already pre-adapted to particular conditions will not be diluted.

In order to avoid the consequences of genetic drift, population size over time needs to be strictly monitored. If population growth is slow, the risk of genetic drift is greater than if the population is growing fast. For slowly growing populations, larger and more diverse source populations are required, and may need to be supported by consequent translocations over generations to maintain or improve genetic diversity.

4.7. Release location

In considering a release location, a translocation proposal should consider the appropriateness of the following:

- habitat and landscape suitability (now and future)
- need for site preparation or creation of artificial/surrogate habitats or sanctuaries
- estimated carrying capacity
- availability of refuge, food, and water
- climate and weather suitability
- threats (exotic predators, disease, climate change, anthropogenic impacts)
- the current and historical distribution of the species
- the genetics of the receiving population (for population restoration)
- threats to the receiving ecosystem (risk of invasion, genetic risks, disease risk, climate change)
- dispersal and connectivity potential
- access to and from the site (by the proponent and by other humans)
- neighbouring land uses
- current and future land tenure.

5. Risk analysis & management

Principle 10:
A translocation proposal should: • identify risks and threats associated with the translocation • assess the risks, and prioritise them by likelihood and consequence • outline strategies and actions that will manage, control or mitigate the key risks • balance the benefits of the translocation, and likelihood of success, with the overall risks and impacts.

A translocation proposal is unlikely to be approved without an assessment of the risks involved. A comprehensive risk assessment must be included as part of a translocation proposal to assist its long-term success. A full collection/sourcing to planting/release approach is preferred.

The risk assessment should:

1. identify and define the risks/threats (mention whether that are inferred, observed, measured, and if they are direct, or indirect).
2. assess the risk level for each risk by determining the likelihood of it occurring and the consequence of it occurring (risk = likelihood x consequence).
3. outline any mitigation strategy or control measures.
4. balance the benefits of the translocation, and likelihood of success, with the overall risks and impacts.

The Department of the Prime Minister and Cabinet's *Guide to Preparing Implementation Plans* provides a framework for risk assessment that may be useful as part of a proposal: http://pandora.nla.gov.au/tep/53572 (Licensed from the Commonwealth of Australia under Creative Commons Attribution 3.0 Australia Licence).

Some key threats likely to be associated with a translocation are outlined in Table 2 and should be considered as part of a proposal.

Table 2. Risks that may be associated with a translocation.

Impacts to animal welfare	A clear and thorough understanding of the overall animal welfare risks will assist the Conservator in deciding whether to approve a translocation proposal. A translocation involving or affecting native fauna must include an analysis of animal welfare risks. These might include: • suitability of captive-bred fauna for release into wild location • presence of native or introduced predators • competition with other native species • resource availability • nutrient status of new habitat. A proponent should also consider how works and mitigation measures may also create animal welfare risks, such as culling or exclusion of predators.

Disease, pathogens and parasites	Individual candidates for translocation should be selected on the basis that they are free of any disease, pathogen or parasite that could cause harm at the release location (Cunningham 1996). Translocations can have negative impacts if disease or parasites (infection agents, such as viruses and bacteria) are unintentionally transferred to new locations with individual animals/propagules. Particularly when source populations are geographically distant from the intended release location, a more rigorous assessment of existing pathogens and disease might be warranted before screening and selecting individuals to translocate. It is important to consider the role of parasitic communities for any translocation since it affects parasites at the source and destination. Introduction of parasites at release locations can bring disease to existing populations and impact on other species or the ecosystem more broadly. Alternatively, some parasites can assist in reducing disease outbreaks. Some parasites play an important role in ensuring other populations do not grow to excessive numbers. Therefore, if those types of parasites are not translocated with the individuals, the species may become more successful within its new location than in its source location (Sainsbury & Vaughan-Higgins 2012). A risk assessment might also consider the following infection sources: • stress-induced disease throughout and following translocation implementation • infection through contact with humans, domestic animals or other aspects of translocation implementation • feeding stations that allow unhealthy mixing of species • interaction with wild and domestic plants - or disease vectors (plant translocations). A thorough risk assessment is needed for any translocation that attempts to translocate a required parasite with the individuals.

Invasion Risk	Invasive or feral populations can be established as a result of excessive population growth or escape of the translocated species or any secondary organism translocated with the species (associated invasion) (IUCN/SSC 2013; Ministerial Council on Forestry, Fisheries and Aquaculture 1999). As assisted colonisation becomes carried out more frequently as a climate change adaptation strategy, consideration of invasion risk is required on a case-by-case basis since there is some possibility that an introduced species may become uncontrollable and proliferate to the extent that it becomes invasive and harmful. In the context of a changing climate, there is a greater likelihood that more invasive species will establish in the future, and this should be taken into account in any risk assessment (Mueller & Hellmann 2008). While robust indicators for a species potential invasiveness is difficult to ascertain (Muller & Hellmann 2008), a proponent might consider aspects of the species to be translocated and the recipient environment that are likely to contribute to the species invisibility, such as: • species richness/diversity at the recipient environment (Byers & Noonburg 2003) • community structure • growth rate • fecundity • maturity rate • resource availability & competition for resources • dispersal ability • predator presence/absence • habitat characteristics • traits and ability to tolerate/adapt to disturbed or changing environments (e.g. plasticity in phenology, morphology, physiology) (Barney, Tommaso & Weston 2005) • type of translocation (introduction vs reintroduction)

<table>
<tr><td>Ecological Risks</td><td>Environmental conditions cannot be exactly the same in any two locations, and it may be largely unknown how a translocated species will react, particularly where translocations occur outside of the species’ known range. A translocation should not displace or negatively impact any of the native endemic species at the release location, this should therefore be addressed as part of any risk assessment.

Ecosystem risks that might arise following translocation could involve changes to hydrology, nutrient regimes, food webs, natural benthic communities, habitat loss, physical disturbance, fire regimes, successional patterns and soil attributes (IUCN/SSC 2013).

Translocation activities (accessing a site, setting up cameras and fences, habitat preparation, planting, soil preparation, and increased pedestrian activity) can potentially affect the release location by disrupting ecological processes and causing direct damage by trampling and destruction (Vallee et al. 2004).</td></tr>
<tr><td>Genetic Risks</td><td>Understanding a population’s genetics can be important in determining the number of individuals to translocate (and which individuals to translocate), and how many subsequent translocations are required. These decisions ultimately inform the long-term success of a translocation by ensuring that enough individuals with enough genetic variation lay the foundations for a successful translocation by providing greater evolutionary potential (Groombridge et al. 2012).

A number of genetic risks are associated with a translocation at the release location, and should be considered carefully when selecting founder individuals to translocate, including (Vallee et al. 2004; Weeks et al. 2011):
<u>Intraspecific hybridisation:</u> occurs where the genetics from the translocated individuals dominate the genetic pool of the original population.
<u>Inbreeding depression:</u> occurs when the translocated individuals have low genetic diversity and are not representative of the range of genetics available, resulting in the founder effect. This can cause reduced population fitness where undesirable genes occur more often, breeding is inhibited (where self-incompatibility mechanisms exist), and the ability for the population to adapt is reduced.
<u>Outbreeding depression</u>: occurs where breeding between genetically distinct populations, that may not have otherwise occurred, causes reduced fitness due to dilution of locally important adaptations. Methods that assist in predicting outbreeding depression exist, though concerns surrounding outbreeding depression are often over-emphasised (Frankham et al. 2011).</td></tr>
</table>

Socio-Economic Risks	Socio-economic risks can occur where the translocation negatively impacts on human interests or livelihoods. Other risks can come about if there are perceived threats associated with the translocation. Other indirect effects may arise where the translocation affects food supplies or disrupts natural ecosystem functioning (IUCN/SSC 2013).
Financial Risks	Costs associated with remediation if a translocation causes significant, unintended consequences have the potential to be quite high (IUCN/SSC 2013). Therefore, a sound risk assessment should demonstrate that financial risk will be avoided by planning and proactively ensuring that funding is available for all aspects of a translocation.
Risks associated with no action	In weighing up the risks of translocation, consideration might be given to the risk to the source species/population and/or the recipient environment if no action is taken, particularly where extinction is imminent or the predicted impact of a changing climate is negative and inevitable (Burbidge *et al*. 2011).
Risk of failure	Translocations are inherently risky and subject to failure. A risk assessment should attempt to assess, analyse and mitigate the risk of a translocation failing. This may be greater for some types of translocations, such as introductions and salvage digs.

6. Implementation

It is recommended that a multidisciplinary team is involved in the implementation of a translocation, and that experts are consulted for relevant aspects, in the planning and implementation of a translocation. A proposal should outline the details of the required personnel with certain technical skills in their proposal.

6.1. Capture, Transport and Release Methods

A translocation proposal must outline the plan and methods for the capture, transport and release for any single, multiple, simultaneous and sequential translocations. Throughout, precautions should be taken to minimise stress. The release site should be carefully chosen, and should consider human access (in consideration of trampling and other damage, or interference) and immediate refuge availability for animals. If media is involved, this should be included as part of the release method. The proponent should consider the timing, weather and life stage of the individuals.

7. Project management

7.1. Measuring success

A successful translocation may broadly be considered when "it results in a self-sustaining population" (Griffith *et al*. 1989). However, success criteria unique to the individual translocation and its various milestones and timeframe should be clearly outlined in the proposal. The IUCN Guidelines set out three observed phases which can be useful in assessing the success of a translocation from the short term through to the long term (IUCN/SSC 2013).

- *The Establishment phase* describes the time from the first release until the post-release effects no longer impact the founding population. During this time, success might be based on short-term indicators such as initial survival, germination, plant or body size and condition.
- *The Growth phase* describes positive rates of population growth well above the extinction threshold, or until estimated growth rate/population size is reached (this may be calculated by a PVA). Indicators for success during this time might include medium-term survival rates, abundance, dispersal, reproduction rates, offspring survival rates and recruitment.
- *The Regulation phase* refers to a reduction in population growth and recruitment as the result of high population density. Longer-term indicators of success might be based on population growth stabilisation, population establishment, resilience and persistence, development of age structure and sex ratio comparable to other wild populations.

7.2. Monitoring and evaluation in an adaptive management framework

Principle 14:
To demonstrate how conservation goals, objectives and actions are progressing, a translocation program should provide details of a forward plan for active monitoring, evaluation and adaptive adjustment of practices.

A long-term monitoring program should be provided in the translocation proposal and may have a number of components depending on the phase of the translocation. Monitoring, evaluation and adjustments are essential for learning and improving (IUCN/SSC 2013) and allows for early detection of unintended outcomes, new or emerging threats.

An effective monitoring program will provide opportunity for feedback to inform future management in an adaptive management process to meet the translocation's goals and objectives. Within an adaptive management framework, additional or alternative data may be identified as important as new questions and observations arise (Harding and Williams 2010).

A monitoring program should:

- specify what will be monitored, what data will be collected, and at what time intervals. The *IUCN Guidelines for Reintroductions and other Conservation Translocations* suggest monitoring demographics, behaviour, ecology, genetics, health and mortality.
- have clearly defined questions or problems to be answered. These may change as more information is obtained, understandings are improved, and key research questions change.
- seek to measure clearly defined indicators of success. These may also change under an adaptive management approach to monitoring.

- outline the methods that will be used to collect data
- have a specified duration
- specify how often data will be collected and how it will be reported.

Monitoring and evaluation should occur for both the translocated species and the recipient environment. By obtaining baseline data prior to translocation of the recipient environment, changes can be detected (both positive and negative) by taking the same monitoring measurements at regular intervals post-translocation.

A monitoring and evaluation plan should also consider the how the recipient environment and habitat is impacted. The Department of Environment and Energy's *EPBC Act Policy Statement for Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC ACT* (Department of Sustainability, Environment, Water, Population and Communities 2013) lists a number of potential impacts at the translocation site, such as:

- competition with other individuals (e.g. species with similar attributes to the translocated species, and abundance of potential prey or predator species)
- effects on other species, communities and ecological processes through cascading interactions
- establishment pest populations (where populations become too successful)
- introduced pathogens
- impacts from genetic diversity and mixing of individuals.

Note that these should also be considered as part of the risk assessment.

7.3. Reporting

Principle 15:
Periodic reporting, or a report on exit, should communicate the successes, failures, and reasons identified for success or failure.

To communicate the success or failures of a translocation at any given point, and the reasons behind these outcomes, reporting of monitoring and evaluation is important. The ACT's *Conservator Guidelines for the Translocation of Native Flora and Flora* provide that a proponent, as part of their proposal and translocation plan, must outline how they intend to report back their findings to the Conservator. This may include regular reporting intervals.

Reporting can also outline how plans and management options may have changed under an adaptive management framework where monitoring and evaluation outcomes have brought to light new questions and matters to address.

7.4. Long-term Management

A translocation program is often a long-term commitment, and ongoing care, maintenance and management of the translocation must be committed to as demonstrated by the proposal. Post-translocation activities might include:

- threat abatement
- habitat management
- pest and weed control

- fencing or other structural maintenance
- protection measures
- management of fire and hydrological events
- management of the translocated population, as needed, e.g. by further introductions
- monitoring of climatic and environmental change
- further ecological restoration and conservation efforts.

A translocation program that continues for many years might anticipate potential changes to management, monitoring, and resource requirements and how goals and objectives will evolve under an adaptive management approach to translocation management.

Additionally, a proponent may consider pre-empting potential management responses at particular phases or milestones of a translocation (though would need to remain flexible). Ideally these would be included or linked to the risk assessment and management plan, where it is outlined how specific, immediate management responses would be implemented if specific criteria or circumstances are met from the monitoring data.

7.5. Contingency Plan and Exit Strategy

The monitoring program will inform decisions surrounding how a translocation should proceed. A pre-planned contingency plan and exit strategy is important so that the translocation can accommodate for any failures that may occur and terminate the translocation to prevent any further harm or damage. A translocation should not go ahead until all risks are addressed and control measures put in place (for example, a plan to end the program and control the target species if necessary).

7.6. Stakeholder Engagement

Surrounding landowners and local communities may have some interest in the translocation, and their support is important to the translocation's success. Views and attitudes can be diverse and extreme; a translocation should plan engagement with relevant stakeholders and communities.

Support from surrounding landowners can be important in ensuring that no accidental or intentional damage is caused to the translocation. Boundaries not to be disturbed, fences, artificial or natural habitats should to be communicated.

Engagement with the local community, including Aboriginal communities, particularly with those directly affected, can be an effective way of not only gaining support, but also securing help in managing the translocation (especially in budget constrained environments).

Procedures around how conflict resolution procedures will be implemented is important in demonstrating how a translocation intends to maximise compliance and minimise conflict.

7.7. Communications

Translocation programs may benefit from a communications strategy, particularly those that are likely to attract high levels of community interest or are somewhat controversial. A communications strategy can assist in effectively disseminating information through mediums specific to target audiences. It can also be useful in maintaining local community support through both awareness and through understanding boundaries and how actions might affect a translocation.

8. Funding & resources

Principle 16:
A forward plan outlining any investment and resources required initially and into the future should be provided to demonstrate the feasibility of the program in achieving a sustainable conservation outcome.

Given the long-term nature of translocations, proponents should demonstrate through their translocation proposal that sufficient resources (human, physical and financial) are available for the entirety of the translocation program.

9. Legislative framework, licensing and permits

Provided here is a summary of some of the policy and legislation that may be relevant to a translocation program; this list may not be exhaustive and the proponent should ensure they have consulted all the relevant legislation to their translocation program. A brief summary of some the licences and approvals that may be required is outlined in ***Table 3***.

Table 3. A summary of licences, permits and approvals that may be required as part of a translocation in the ACT.

Legislation	Application for:	Apply to:	Purpose:
Nature Conservation Act 2014	Nature Conservation Licence	Conservator of Flora and Fauna	To carry out an activity as part of the translocation program that would otherwise be considered an offence.
Animal Welfare Act 1992	Licence to research, breed or teach	Animal Welfare Authority	To use or breed animals for research or teaching, or for both research and teaching, at stated premises.
	Authorisation	Animal Ethics Committee	To conduct a program of research or teaching in relation to the use or breeding of animals.
	Trapping Permit	Animal Welfare Authority	Trapping.
Fisheries Act 2000	Scientific Licence	Conservator of Flora and Fauna	Scientific purposes, teaching purposes, or museum and aquarium purposes.
	Import and Export Licence	Conservator of Flora and Fauna	To import live fish into or export live fish from the ACT.
The Australian Code for the Care and Use of Animals for a Scientific Purpose	Approval	Animal Ethics Committee	For the use and care of animals for scientific purpose.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Policy Statement – Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC Act

The *EPBC Act Policy Statement for Translocation of Listed Threatened Species* (Department of Sustainability, Environment, Water, Population and Communities 2013) is relevant to translocations that are part of proposals referred under the EPBC Act for assessment and approval (s 133) and, in more unlikely scenarios, as actions in their own right if they impact on protected matters under the EPBC Act. Translocations may be proposed as mitigation or compensation for the impacts of a proposed action, or to offset any residual impacts on a protected matter. Note that even with Commonwealth approval, a person intending to translocate native animals, plants or fish in the ACT will also need approval from the Conservator of Flora and Fauna through a Nature Conservation Licence.

National Policy for the Translocation of Live Aquatic Organisms – Issues, Principles and Guidelines 1999

Translocations involving aquatic organisms should be consistent with the *National Policy for the Translocation of Live Aquatic Organisms – Issues, Principles and Guidelines for Implementation 1999* (Ministerial Council on Forestry, Fisheries and Aquaculture 1999) (National Policy). The National Policy provides a policy framework that sets out translocation principles and emphasises the importance of a comprehensive risk-assessment to inform the development of a translocation program for approval, and provides a national and international context so that translocations are consistent within broader legislative and environmental objectives.

The Nature Conservation Act 2014

<u>Protection and management of Native Species</u>

There are many aspects of a translocation program that are likely to be offences relating to the protection and management of native species under the *Nature Conservation Act 2014* (NC Act). For example, it is an offence to:

- interfere with the nest of a native animal (s 128)
- injure or endanger a native animal (s 130)
- take a native animal (s 132)
- keep a non-exempt animal (s 133)
- import or export a non-exempt animal (s 136 & 137)
- release an animal from captivity (s 138)
- take a native plant growing on unleased land (s 140)
- take a plant that is a protected native species or native plant of special protections status (s 142 & 143), or
- import or export a native plant (protected or special protection status) (s 150 & 151).

Exemption to these offences is provided for in the NC Act if, for example, the person is a Conservation Officer, holds a Nature Conservation Licence, or if the activity is undertaken in accordance with a management agreement or is authorised under a Controlled Native Species Management Plan.

<u>Reserves</u>

For translocation into or out of reserves, the proponent should understand that it is an offence to:

- feed a native animal in a reserve (s 214)
- possess or use weapons or traps in a reserve (s 217)
- damage a native plant in a reserve (s 218)
- take a plant or reproductive material into a reserve (s 219)
- plant a plant in a reserve (s 220)
- remove soil or stone from a reserve (s 221), or
- damage, destroy or remove things in a reserve (s 222).

Exemption to these offences is provided for in the Act if, for example, or if the person is a conservation officer, holds a nature conservation licence or if the activity is , undertaken in accordance with a management agreement or is authorised under a controlled native species management plan.

<u>Nature Conservation Licence</u>

A person undertaking a translocation that involves an activity that will be considered an offence should apply for a Nature Conservation Licence, unless otherwise exempted. The Conservator may only issue a nature conservation licence if reasonably satisfied that an applicant is a suitable person carrying out a "suitable activity" (s 273).

The Fisheries Act 2000

A person carrying out a translocation that involves movement of fish or other aquatic species, such as crayfish, may need to apply to the Conservator for a Scientific Licence or an Import and/or Export Licence under the *Fisheries Act 2000* (s 19). A number of offences may apply if a licence is not held or the person does not have written approval from the Conservator, such as importing and exporting live fish (s 76) and releasing fish into public waters (s 79).

The *Fish Stocking Plan for the Australian Capital Territory 2015-2020* (ACT Government Environment and Planning Directorate 2015) provides for the stocking of fish in the ACT's water bodies for the purposes of recreation, conservation and research. Proponents should refer to this plan for guidance on fish stocking activities.

The Animal Welfare Act 1992

Animal welfare is an important component of translocations involving animals. Relevant provisions exist under the *Animal Welfare Act 1992* (Animal Welfare Act). A person in charge of an animal has a duty to care for the animal (s 6B) and, as a result, must provide the animal with appropriate food, water, shelter, exercise and space to behave normally. For animals that will be subject to confinement during the translocation program, the person in charge of the animal will need to ensure that the animal is provided with adequate opportunity to exercise (s 9). Additionally, a person must not transport or contain an animal under conditions that cause unnecessary injury, pain or suffering (s 15).

Subsidiary codes of practice under the Animal Welfare Act also apply to the management of animals. This includes the *Australian Code for the Care and Use of Animals for Scientific Research* (the Code). Any person involved in the care and use of animals for scientific purposes must apply the governing principles and ethical framework to their specific circumstances provided in section 1 of the Code

Licences, Authorisation and Permits

A person who uses or breeds an animal for research or teaching must apply to the Animal Welfare Authority for a licence (unless they are an authorisation holder or someone assisting an authorisation holder) (s 26).

A person employed by a licensee must apply to an Animal Ethics Committee (AEC) for authorisation to conduct a program of research or teaching in relation to the use or breeding of animals at the licensed premises (s 37).

If trapping is involved in the translocation, the person must apply to the Animal Welfare Authority for a trapping permit (s 63).

Animal Diseases Act 2005

Spread of animal[1] disease may be a significant risk in translocations.

Under the *Animal Diseases Act 2005* there may be import restrictions from areas outside the ACT that may be infected with an exotic disease (s 15). The movement of animals into or out of areas that are declared as quarantined areas within the ACT is not permitted without the permission of the Director-General or the Chief Veterinary Officer (s 24). When translocating animals, the proponent should understand that it is an offence to do something that communicates a disease or disease agent to an animal (s 32).

With regards to animal vaccination, it is an offence to use a virus, vaccine or other biological product containing living organisms for the treatment or prevention of an exotic or endemic disease, or a biological product containing something derived from a living organism for diagnosis of an exotic or endemic disease (s 33), although this does not apply if the person acts with the written approval of the Chief Veterinary Officer.

Plant Diseases Act 2002

A person considering translocating plants should be aware of any restrictions on the introduction into, or transport within, the ACT of plants, insects, diseases or pests (s 8). Additionally, there may be declared quarantine stations for the entry of plants, insects, soil or goods into the ACT (s 9). Before importing a plant, the proponent should be aware of any areas that are subject to import restrictions (s 12).

[1] The definition of an animal differs between Acts.

10. Glossary

Assisted colonisation is the relocation of organisms to an area outside of its known current and historic distribution with the intention to establish a viable population and in doing so, avoid extinction. Assisted colonisation is recognised as a threat mitigation strategy for climate change, agricultural expansion and urbanisation (Burbidge *et al*. 2011; Gallagher *et al*. 2015; Hoegh-Guldberg *et al*. 2008; Seddon 2010). [*Synonyms: benign introduction; managed relocation; assisted migration]*

Candidate or **target individuals/species** refers to the focal species for which the translocation is occurring.

Capture refers to the attainment of individuals, propagules or seeds either from a wild or captive population.

Captive source population refers to a population that has been propagated, bred or rehabilitated within a captive facility.

Conservation introduction is the translocation of living organisms outside of its known current and historical indigenous range to an area of appropriate habitat. The nature of an introduction might involve assisted colonisation or ecological replacement (IUCN/SSC 2013).

Ecological replacement is the movement of living organisms to a location where the species will provide a critical ecological function (IUCN/SSC 2013). *[Synonyms: taxon substitution; niche substitution; ecological substitutes/proxies/surrogates; sub specific substitution; analogue species]*

Goal refers to a statement of the intended result of the conservation translocation that articulates conservation benefit (IUCN/SSC 2013).

Hard release is a translocation strategy that involves releasing animals directly to their designated release location following transport from their original habitat.

Objective refers to a clear and specific statement that details how goals will be realised, and addresses identified and presumed threats (IUCN/SSC 2013).

Parasite refers to any an animal, virus, bacteria, fungi, protozoa or metazoan which lives on or in an organism of another species (the host), from the body of which it obtains nutriment (Cunningham 1996; Macquarie Dictionary Publishers 2017).

Population restoration is the translocation of living organisms to an area within its known current or historical indigenous range. Population restoration can be categorised as either reinforcement or reintroduction (IUCN/SSC 2013).

Reinforcement is the addition of living organisms to a population of the same species. Reinforcements often require deliberate and strategic manipulation of the population, and its genetic pool, to improve the population's viability and persistence (IUCN/SSC 2013). *[Synonyms: re-stocking, enrichment, supplementation and augmentation, and enhancement (plants)]*

Reintroduction is the movement of living organisms to an area within its indigenous range from which it has disappeared to re-establish a population (IUCN/SSC 2013).

Release refers to the release of animals into their wild or captive destination, or the planting of seeds, seedlings or mature plants at their wild or captive destination.

Release location refers to the geographic range that the translocated individuals and population is expected to navigate and inhabit post-release. Dispersal may be controlled by natural geographic boundaries or by deliberate management actions, such as fencing (IUCN/SSC 2013).

Release site refers to the point of release of an animal or planting of seeds and seedlings. The relocation site should offer immediate refuge and resources and should factor in the number of people involved in the release and whether a media event will take place (IUCN/SSC 2013).

Research refers to applying scientific methods to investigate clearly defined questions which address conservation objectives of the ACT's biodiversity research and monitoring program, including evaluation of data collected.

Soft release is a translocation strategy that involves translocating individuals to a controlled, captive facility for a period of time, sometimes to breed, before being released to their designated wild release location.

Source population throughout these guidelines refers to the original, native population from which a number of individuals will be removed as part of a translocation program. This population might be wild or captive.

Translocation is the human-mediated movement of living organisms from one area, with release in another (IUCN/SSC 2013).

Wild population refers to a population that exists solely in the wild.

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