Australian Association of Bush Regenerators (NSW) Inc.

c/- Total Environment Centre, Suite 2, 89 Jones Street, Ultimo NSW 2007
phone 0407 002 921 **email** enquiries@aabr.org.au

website www.aabr.org.au

ABN 33 053 528 029

AABR's Guiding Principles for Ecological Restoration and Rehabilitation

DRAFT - Sept 26, 2013

INTRODUCTION

The activities of AABR and its members are motivated by a deep sense of respect and awe for the complexity, intrinsic values and beauty of locally adapted ecosystems, many of which persist and flourish in every region of the globe. Locally adapted species represent aeons of evolutionary input and encompass living components (plants, animals, microorganisms) as well as non-living components (soils, water and climate) and their interactions. This motivation translates as a desire to see such ecosystems conserved in perpetuity – and brought back to health when they are degraded by human impacts.

To a higher degree that other animal species, humans have variously influenced and shaped ecosystems in recent millennia. While some of that influence falls within sustainable boundaries, the relatively recent scale, degree and increasing pace of impact has caused and continues to cause untenably high levels of degradation to most of the world's terrestrial and aquatic ecosystems. This unprecedented situation threatens not only the intrinsic values and sustainability of those ecosystems, but the sustainability of human societies and cultures.

An important response to this is to endorse and actively support the conservation and protection of ecosystems and; in cases where protection from damage has failed, 'ecological restoration' to the highest extent practicable.

Definitions (See also Glossary at the end of this document.)

We define ecological restoration as 'the intentional practice of assisting the recovery of locally occurring ecosystems, taking into account ecosystem change'. This translates as protecting and reinstating the structure and function of historic, locally indigenous ecosystems to the highest extent feasible or practicable. AABR has strong links to our many partner organisations in the promotion and pursuit of restoration globally, including the Society for Ecological Restoration (SER), whose perspectives on restoration are stated in the SER Primer on Ecological Restoration (SER 2004). We endorse the perspectives in the SER Primer but, in this document, bring to the conversation our own clarifications and emphases.

Ecological restoration as a continuum

AABR is primarily concerned with the conservation-based management of natural areas and promotes management that aims to protect, maintain and, where they are impaired, improve the health of ecosystems (indicated by similarity in structure and function to the pre-existing plant and animal communities).

We see ecological restoration as a continuum, with full ecological restoration at one end of the continuum and at least some progress towards full restoration at the other end. Projects that occur at any point along a continuum could be considered an 'ecological restoration' project if (a) the goal of restoration is both stated and feasible (at least in the long term); (b) the activities both aim for the highest standard possible (considering current resource and knowledge limitations); and, (c) if the activities do not create any further negative impacts.

Spectrum of approaches to restoration

Different approaches to restoration will be needed depending on the level of degradation of the site. At the low degradation end, for example, a '*natural regeneration*' approach is likely to be all that is needed, with '*assisted natural regeneration*' interventions being needed for sites of intermediate degradation. High level degradation requires a *reconstruction* approach (if involving restoration practitioners reintroducing and rebuilding the communities from scratch) unless sufficiently long time frames are available for natural recolonization. (See Fig 1 and glossary).

The threshold between restoration and ecological rehabilitation, strictly speaking, falls between Reconstruction and *Type conversion/Fabrication*. (The latter sometimes referred to as 'creation'. See Glossary) However, where the type conversion is to an alternative, locally occurring ecosystem or stable state more suited to the permanently changed conditions for the purpose of restoring integrity to an otherwise restorable larger area, this approach can be considered part of the restoration project[1]

Similarly, where gradual range shifts of genotypes, species, and ecotones are occurring or are anticipated to occur in otherwise healthy reference sites due to environmental changes including anthropogenic climate change - accommodation of those changes are also considered part of the restoration project.

[1] Note: Sacrificing one healthy ecological community to 'offset' another is not defined as restoration by AABR.

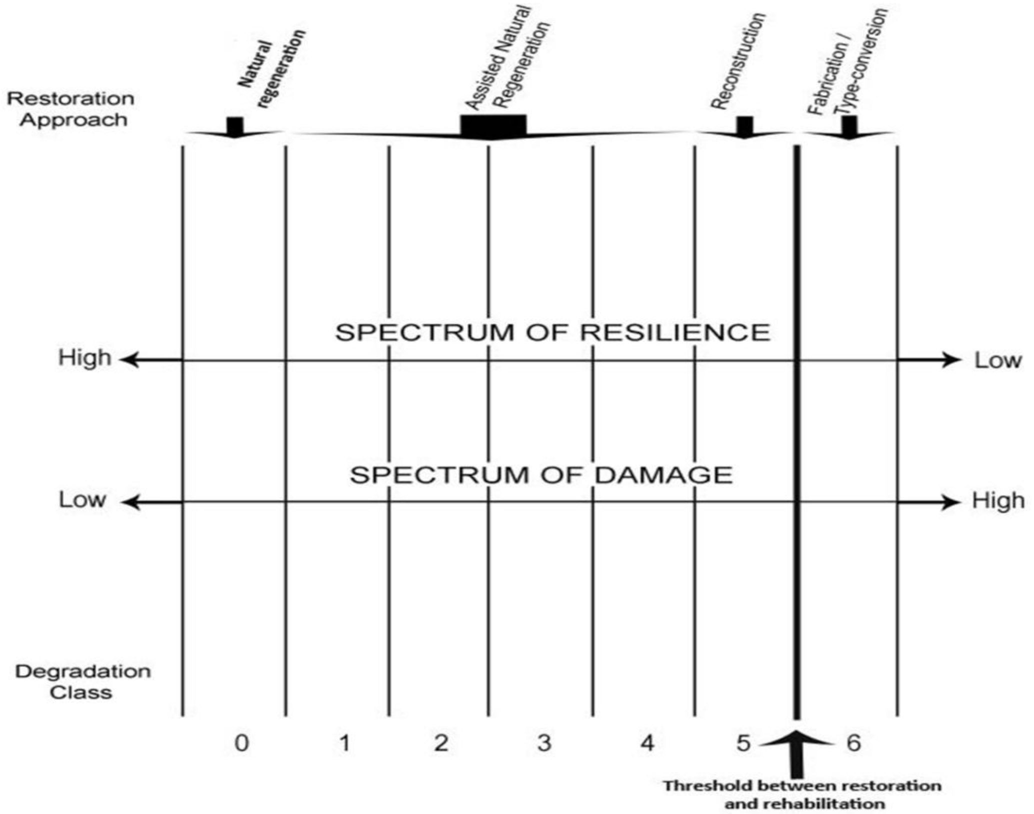

Fig 1. *Conceptual framework showing the spectrum of recovery capacity that can occur across degraded sites, with their corresponding restoration 'approaches'. (The point where restoration cuts off and 'rehabilitation' starts is between 'Reconstruction /Recolonisation' and 'Fabrication/Type-conversion'- although the latter approach can be useful within a restoration site to address irreversible damage to small subsites, thus reintegrating the whole.)*

Where restoration is impossible.

<u>*Ecological rehabilitation.*</u> There are some sites or entire landscapes that are so highly modified that restoration is either impossible (due to extreme level of degradation) or undesirable (due to the value of the modifications to human society).

Judging the impossibility and desirability of restoration is not always intuitive and should be advised by experienced ecological restoration practitioners. However, where restoration is not the appropriate goal, managers are encouraged to still aim for the highest practicable *functional similarity*, if not also *structural similarity*, with the pre-existing ecosystem. This can be termed **ecological rehabilitation** (sometimes referred to as 'restorative management', the restoration of natural capital or 'management of novel ecosystems')**.**

Ecological rehabilitation of the highly modified landscape is considered by AABR to be of equal importance to ecological restoration in potentially intact areas - because ecosystem function within modified landscapes contributes to the function of all ecosystems.

ROLE OF NATURAL REGENERATION

AABR draws specific attention to the pivotal role that natural regeneration plays in ecological restoration and ecological rehabilitation; a role which needs to be taken into account in all restoration projects. This position is based on 25 years of restoration practice by our members and the ecological premise that:

> *Natural regeneration capacity by native taxa is a key attribute of ecosystems, based on the capacity of component species to reproduce and to recover after natural (or similar) disturbances. Reinstating this natural regeneration capacity is therefore a* ***primary goal -*** *and its achievement a* ***measure of success*** *- of restoration. Natural regeneration is also an important* **mechanism** of *recovery, particularly (but not exclusively) likely in lower degradation cases.*

To elaborate:

(i) Natural regeneration as a goal and measure of success. The goals of any restoration project must include the goal of reinstating a functioning ecological community complete with its characteristic structures and functions. While we do not as yet know all the functions of ecosystems, we do consider that a key function of an ecosystem is its capacity to be self-sustaining. All restoration projects must aim to reinstate the ecological community's natural regeneration capacity.

Evidence of the reinstatement of natural regeneration capacity is therefore a key measure of success of the restoration project. It signals that suitable 'regeneration niche' conditions exist on site. These conditions, however, need to be maintained through appropriate disturbance regimes over time.

(ii) Natural regeneration as a mechanism. Recovery capacity can persist on many sites in the form of buried seed banks, persistent rootstocks or proximity to sources of colonisation. The litter layer, debris and

residual native soils also contain many invertebrates and micro-organisms capable of acting as 'starters' for new populations.

Where this regeneration capacity persists, it can function as a primary *mechanism* of restoration.

In low-degradation cases, this can occur simply with the removal of the impact; while in cases of somewhat higher degradation, additional skilled assistance is needed from restoration practitioners. In very high degradation cases, some natural colonisation can be fostered by site manipulation at the early stage, but usually plays a more important role at the stage when reintroduced species start to recruit.

A suite of methods and techniques to trigger recovery and promote recruitment (e.g. natural disturbance simulations in communities adapted to disturbance) are often most important in the early 'recovery response' phase of a restoration project. Proliferation of species with short life cycles can also occur during the early years of a restoration project, assisting with the revegetation. Appropriate further interventions can also be usefully applied at all stages in the restoration process to trigger regeneration as needed.

LESSONS FROM BUSH REGENERATION PRACTICE RELEVANT TO ALL ECOLOGICAL RESTORATION

1. *Address threats and the causes of degradation*

AABR recognizes that ceasing impacts and threats is a first principle of restoration, although this cannot always be achieved, particularly if these (such as industrial development and climate change) arise at a higher scale than the restoration work can influence. However all restoration projects should devote resources to addressing the problems at their sources rather than solely focusing on mitigating symptoms.

AABR recognizes that the momentum of change from human development is rapid and exponentially increasing. One of the most concerning processes is increased fragmentation of habitats, into smaller areas of questionable viability. Unless there is a concerted global effort to decrease these impacts including fragmentation - at the same time as expanding the number and scale of restoration programs throughout the globe - the restoration movement will not make a substantial impression on reducing levels of degradation.

Human-induced global warming is an environmental factor to which taxa and restorationists alike must adapt. As such we encourage restoration practitioners to identify reference communities and goals of restoration that take anticipated unavoidable climate conditions into account. Primarily, however, anthropogenic climate change is a degrading factor to be mitigated. As such AABR supports national and international campaigns to:

- transform from fossil fuels to renewable energy systems (to reduce carbon emissions); and,
- conserve intact natural areas and expand ecologically appropriate native vegetation cover (to store more carbon)

2. Clearly identify project goals.

The second most important step in developing a restoration program is to identify appropriate restoration goals (See also Buchanan 1990, SER 1994, Clewell & Aronson 2013). While restoration is fundamentally the activity of reinstating the health of ecological communities, including all component plants and animals, 'health' needs to be interpreted in more specific terms, with clear and measurable ecological goals identified at the start of any project.

During the late 20th Century, pre-existing structure, species composition and dynamics were considered a reliable guide to the setting of restoration goals. It was generally agreed that restorationists were seeking to reinstate functioning examples of the same plant and animal communities that we believed would have been on site had the degradation not occurred, including their capacity for flux and change. In such scenarios, goal setting would involve the assessment of surrounding ecosystems and indicators remaining on site to identify a pre-existing 'reference' community with capacity to express its historic range of successional states.

Restoration goals for the 21st Century, however, are less straightforward. No longer can we assume that climate conditions will remain suitable for all species within a period as short as 50 years, let alone longer. Researchers advise us that many species will be lost (particularly those with a small current climate envelope and/or where they are already highly threatened by other impacts such as fragmentation and exotic invasives). Other species and genotypes will be subtly moving poleward and/or to higher altitudes if they can, altering assemblages somewhat. Some whole communities (alpine and shoreline) will be lost to colonisation by better-adapted communities (e.g. freshwater communities converted to saltwater communities with sea level rise).The effect of drying, exacerbated by increased fires will reduce the extent and change the configuration of fire sensitive vegetation communities wherever fire is a factor already.

Having said that, the restoration of most pre-existing communities is likely to still be the appropriate goal in most cases. Whether the restoration of pre-existing *species* or genotype may also still be appropriate, however, will need to be determined on a case-by-case basis. Where a species' or genotype's climate envelope is broad and /or there is high connectivity across the landscape, pre-existing species and genotypes may still be viable. But where climate envelopes of key species have moved due to climate change and where habitats are fragmented or tightly circumscribed (making migrations impossible), at least some changes to species composition and genotypes will need to be planned for. Identifying appropriate genetic selection where reintroductions or introductions are necessary for common and less common species therefore requires sound scientific information and collaboration between practitioners and researchers

Care needs to be taken, however, to balance the need for genetic and species diversity (to optimise capacity for adaptation) with the need to retain ecological integrity where that can still be provided by a group of core species that have wider climate envelopes. Too rapid change brought on by radical translocation of species new to an area may end up being a higher risk than the local loss of some species from other areas.

3. Soundly assess sites prior to deciding which restoration approaches to use

Sound site assessment by experienced assessors is needed to ensure that the approach selected matches the resilience level remaining on the particular site or subsection of a site. This effectively means matching the approach to the degree to which natural recovery capacity has been degraded.

If there has been relatively little degradation, a 'natural regeneration' or 'assisted natural regeneration' approach will be the most optimal, whereas where sites have been more highly degraded, 'reconstruction' or 'fabrication' approaches may be needed (Fig 1). Learning to 'read' the indicators of natural regeneration capacity is essential, as applying reconstruction or fabrication approaches where natural regeneration is possible can supress natural recovery and so be counter-productive. (There have been major cases of highly valuable communities almost written off by consultants prior to assessments being corrected by practitioners with more on-ground experience.)

AABR generally does not promote planting within areas of bushland capable of natural recovery and colonisation. Where there is no chance of natural regeneration or there are important ecological reasons (such as known missing species or restricted gene pool), reintroductions of missing plant species and other organisms can be essential to achieve the restoration goals. In addition, where climate-migrating species cannot naturally colonise and colonisation is deemed ecologically necessary, justification may exist for facilitating migration of some species.

4. Consider all components of an ecological community

The functioning of plant communities is usually dependent on the presence of a range of animals (especially invertebrates) for pollination, dispersal, nutrient cycling and decomposition. Site assessment and the design of restoration treatments therefore need to consider all components of the community, including all forms of plants, animals and micro-organisms.

Plants are the most easily observed components and it is often assumed that animals will automatically re-establish if the vegetation is returned. Making special consideration of the habitat and food needs of important animals will improve the chances of faunal recolonisation and this can be particularly important for threatened species. In sites where weeds are being targeted for removal, an important consideration will always be whether such weeds are being used as habitat by native animals. If they are, the weeds should be removed in a mosaic to retain some habitat until native plants can provide the required habitat.

Reintroduction of animals, while a highly specialised task requiring high levels of resources, is recognised as having an important role in ecological restoration.

5. Skillfully apply treatments, ensuring follow up and maintenance.

Successful restoration treatments draw on ecological and practical knowledge and require high levels of **skill**. Reconstruction treatments, for example, require knowledge of site preparation, seeding, planting and maintenance – and assisted regeneration treatments require skill in weed and native plant recognition, recovery ecology and weed control, among other things. (AABR manages an accreditation system to recognise skills in assisted regeneration, and may in the future expand this to include other approaches to restoration.)

A key to converting a site from weed to native dominance is returning to the site multiple times for '**follow up'** treatments. The most demanding period during which successive generations of soil-stored weed will require re-treatment (prior to weed reseeding) is the first 3 years of a project, particularly during the growing seasons and after rain. As native plants recapture the site and weed populations deplete over that period and successive years, the duration of each follow-up treatment lessens. Similar attention to follow up is required in the event of any subsequent disturbances, natural or otherwise.

The requirement for follow up needs to be costed into all projects. In assisted regeneration projects with limited budgets, the extent of primary clearing of weed (i.e. clearing of the parent generation) needs to be limited to that area which can be reasonably subjected to multiple *secondary* treatments (of successive generations of weed) within at least a 3 year period and often longer on more highly weed infested sites.

'**Maintenance'** is the term generally used to describe the lower level of repeat visits required over the long term at a more or less steady level of input. While the aim of restoration is to completely remove causes of degradation and return a site to a self-sustaining state, the reality of many sites is that complete achievement of this goal is not feasible due to extraneous factors beyond the manager's control. Hence the pragmatic long-term aim of managers is often to reach a 'maintenance' stage where the inputs are regular and ongoing, but infrequent and less intensive.

6. *Monitor to see if the treatments are achieving their goals*.

It is generally accepted that regular inspection of the results of treatments is essential for early detection of site responses and any extraneous problems that might arise. Formal monitoring of prior and subsequent condition, however, provides more reliability to this process.

The most basic recording of 'before and after' condition includes photopoint monitoring – with plot sampling providing more information on the actual quality and quantity of changes involved.

Monitoring must be designed into the project from the beginning and the necessary funds costed into a project. The monitoring design needs to be checked with experienced people prior to commencement, to ensure that the data to be collected will help answer the questions you are posing (e.g. are the presumed pre-existing natives increasing in number and cover and weeds reducing?) The first recordings need to be undertaken prior to any works commencing using the same methodology being applied throughout the life of the project.

Monitoring needs to be ecologically meaningful but simple enough to replicate at a range of sites where projects have limited funds. Wherever possible, standard quadrat sizes and sampling methodologies should be used on restoration sites so that small amounts of data collected at each can be compatible when pooled. Data should be stored not only by the collecting group but in a backup repository or ideally with a second organisation. AABR maintains an effort to work with partners to develop simple and low cost sampling strategies for bush regeneration sites and to conduct workshops for practitioners in these methods.

7. Develop sustaining partnerships.

The practice of restoration is not achieved solely by one group in society. Restoration requires active participation by a wide range of stakeholders. While restoration practitioners are at the coalface (and can often be the initiators of projects) partnerships between managers, restoration practitioners, planners, funding bodies, policy makers and restoration ecologists will be critical to the ultimate success of the restoration mission.

Indeed, to a large extent, success is dependent on contributions and support from the whole of society. The more diverse the support, the stronger will be the restoration outcomes.

Role of volunteers and paid restoration practitioners. The task of ecological restoration and rehabilitation is sufficiently immense that there is room for all. However, AABR advocates that restoration practitioners should be skilled, regardless whether they be paid or volunteer workers. AABR bush regeneration accreditation is available equally to paid or volunteer regenerators, with no distinction made between the groups.

Role of land managers, funding bodies and policy makers. Restoration on public land cannot happen without government support and funding and restoration on private land frequently requires not only landholder backing but also government incentives, a legislative and policy framework and facilitation from agencies. As such, the role of agencies and their staff is often overlooked and understated.

Role of researchers. The contribution of ecologists can be of critical importance to the practice of restoration as researchers can provide important information about particular ecosystem functions and species interactions and needs that are otherwise not known. Researchers can also assist with or advise on monitoring protocols to ensure that they are ecologically meaningful.

Role of the public. All stakeholders are important in restoration and rehabilitation including the public. Leaving important constituents out of the process, particularly where some aspects of the project might be controversial, can inadvertently result in the withdrawal of public support for restoration and rehabilitation. Conversely, the support and involvement of the public can improve the long term stewardship and therefore, viability, of a project.

REFERENCE

Society for Ecological Restoration (2004) *SER International Primer on Ecological Restoration.* Society for Ecological Restoration International Science & Policy Working Group (Version 2, October, 2004)

GLOSSARY OF TERMS

Assisted regeneration. The practice of deliberately removing obstacles and reinstating conditions on a restoration site to foster natural regeneration. Interventions may be tailored to improve regeneration niches, trigger resprouting and dormant soil seed banks and foster colonization. While this approach generally is typical of sites of low to intermediate degradation, even some very highly degraded sites have proven capable of natural recovery after assisted natural regeneration interventions.

Bush regeneration. A form of assisted natural regeneration practice which emerged in the Sydney area and is now widespread across Australia. It involves skilled removal of weed and other obstacles to regeneration in a manner that triggers natural regeneration of species that have persisted on or can colonise.

Combined regeneration / reconstruction. A restoration approach that combines assisted natural regeneration with transplanting, planting and/or direct seeding. It is applied in less common cases where some species drop out of a system earlier than others due to sensitivity to a degrading impact such as excessive fire, clearing or shifting bioclimatic zones.

Conservation management. Maintenance of existing and traditionally occurring ecosystems, including their structure, function and dynamics. This is identical to the meaning of the term 'preservation' used elsewhere and recognises intrinsic values of natural systems, not primarily their usefulness to humans.

Creation. See 'Fabrication'.

Degradation. A level of anthropogenic impact that renders an ecosystem dysfunctional in some way.

Ecological restoration. The intentional practice of assisting the recovery of degraded ecosystems to the highest practicable extent, taking into account intrinsic ecosystem change

Ecological rehabilitation. The intentional practice of reinstating ecosystem function to the highest practicable extent in highly modified landscapes where full restoration is not possible or desirable.

Ecosystem. Assemblage of organisms (including plants animals, micro-organisms) interacting with non-living components (including the soil, water, air, fire, climate, topographic relief and aspect) interacting to create complex food webs, nutrient cycles and energy flows.

Ecosystem functions and processes include habitat provision, biotic accumulation, decomposition, pollination, dispersal, nutrient accumulation and cycling, disturbance regimes (fire, flooding and drying), and water cycling.

Ecosystem services are the benefits to humans provided by ecosystems. These include clean air, water , soils, resources and opportunities for recreation.

Ecosystem change. This includes both the naturally occurring flux within ecosystems in response to chance-based triggers such interactions between species and arising from varying natural disturbance regimes and changes to climate. It also includes those changes already caused by humans where that change is long established (e.g. very long term fire management). Some would argue it could include that degree of more recent change caused by humans that is irreversible (e.g. some degree of climate change and conversion of natural areas to agriculture and cities).

Fabrication. (Referred to as 'creation' in some regions). A rehabilitation approach usually based on construction techniques, where the degree of degradation has rendered current conditions no longer suitable for the pre-existing ecosystem and a different, locally occurring ecosystem is the best alternative. (Note: This refers to shifts in whole communities rather than shifts in individual species due to loss of plant-animal interactions or to global warming.) Where this approach is used in small subsites on a restoration site to assist in the reintegration of the whole, it could be considered part of the restoration project, although it is strictly speaking, rehabilitation at the small site level.

Natural regeneration. A restoration approach involving spontaneous recruitment of species on sites left to their own devices after protection from further impact. Examples include minimally degraded sites grazed sites where grazing is removed and natural recovery including colonization occurs over long time frames. Usually occurs in cases of low degradation.

Reconstruction. A restoration approach, applied in sites of extreme degradation, where the pre-existing community is reintroduced. This is required were all or most biotic components of an ecosystem have been removed and where they cannot regenerate or recolonise within feasible timeframes even, after expert assisted regeneration interventions. (Note that this differs from fabrication in that reconstruction is applied where current site conditions will still support the pre-existing ecosystem.)

Reference community. A notional or real ecosystem which acts as a model for restoration at a specific site – although if the site contains a remnant of that ecosystem, the site itself can be said to be 'self-referencing'. A reference ecosystem usually represents a healthy version of the ecosystem that would have existed on the site had degradation not occurred, and includes accommodation of different successional states. Under climate change reference sites would need to accommodate anticipated environmental changes.

Type conversion. A rehabilitation approach (sometimes achieved by natural regeneration) where the degree of degradation has rendered current conditions no longer suitable for the pre-existing ecosystem and a different, locally occurring ecosystem is the best alternative. (Note: This refers to shifts in whole communities rather than shifts in individual species due to loss of plant-animal interactions or to global warming.) Where this approach is used in small subsites on a restoration site to assist in the reintegration of the whole, it could be considered part of the restoration project, although it is strictly speaking, rehabilitation at the small site level.