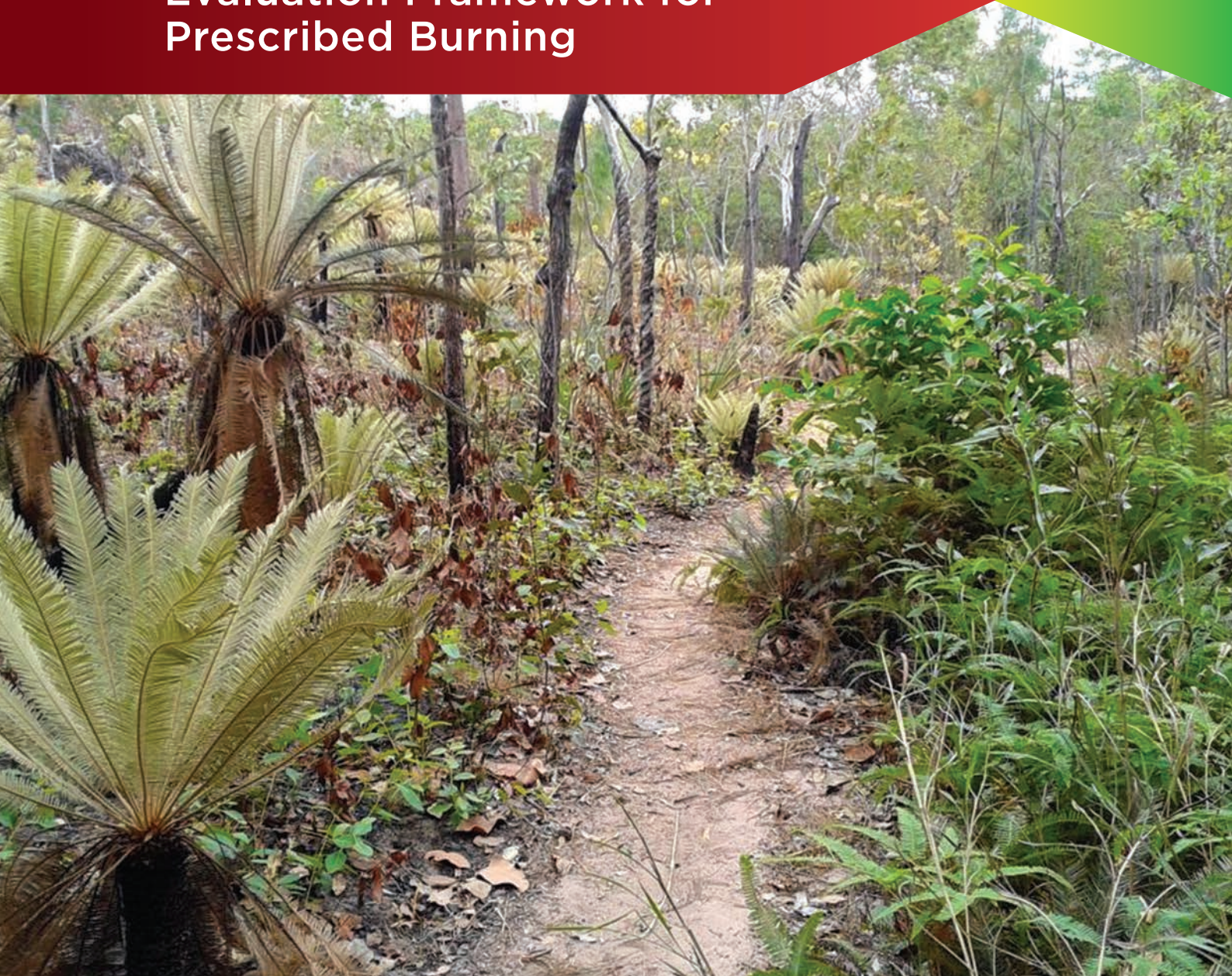


Objectives, Monitoring and Evaluation Framework for Prescribed Burning



PRODUCED BY THE NATIONAL BURNING PROJECT

JUNE 2017



An Australian Government Initiative



— Centre of Excellence —
**PRESCRIBED
BURNING**

INTRODUCTION

The National Burning Project (NBP) has brought together inter-related aspects of prescribed burning across Australasia to design guiding frameworks and principles for a more holistic and consistent approach to prescribed burning. A number of detailed reports have been produced (as shown opposite), each of which stands alone, yet with synergies across reports that have been drawn together into a number of easy to use synopses:

- *Process Map of Prescribed Burning*
- *Best Practice Principles for Prescribed Burning*
- *Risk Management Framework for Prescribed Burning*
- ***Objectives, Monitoring and Evaluation Framework for Prescribed Burning (this document)***
- *Program Logic for Prescribed Burning*

The synopses are designed to facilitate greater utilisation of the prescribed burning principles by land and fire professionals and aim to improve consistency nationally, and provide orientation to users about the NBP products and how they fit together.

The frameworks produced by the NBP identify four phases of planning and implementing prescribed burning. All of these ready-to-utilise synopses are presented across the four phases of prescribed burning as described below.

Figure 1 | The four phases of prescribed burn planning and implementation



This *Objectives, Monitoring and Evaluation Framework* for prescribed burning contains high-level principles and relationships considered relevant for formulation of objectives and monitoring programs, emphasising the relationship among different levels of objectives, and between objectives on the one hand and monitoring and evaluation on the other. This approach reflects and is drawn out of the four risk frameworks prepared by the National Burning Project:

- *Risk Management and Review Framework for Prescribed Burning Risks Associated with Fuel Hazards*
- *A Risk Framework for Ecological Risks Associated with Prescribed Burning*
- *Risk Management Framework – Smoke Hazard and Greenhouse Gas Emissions*
- *A Risk Framework for Operational Risks Associated with Prescribed Burning*

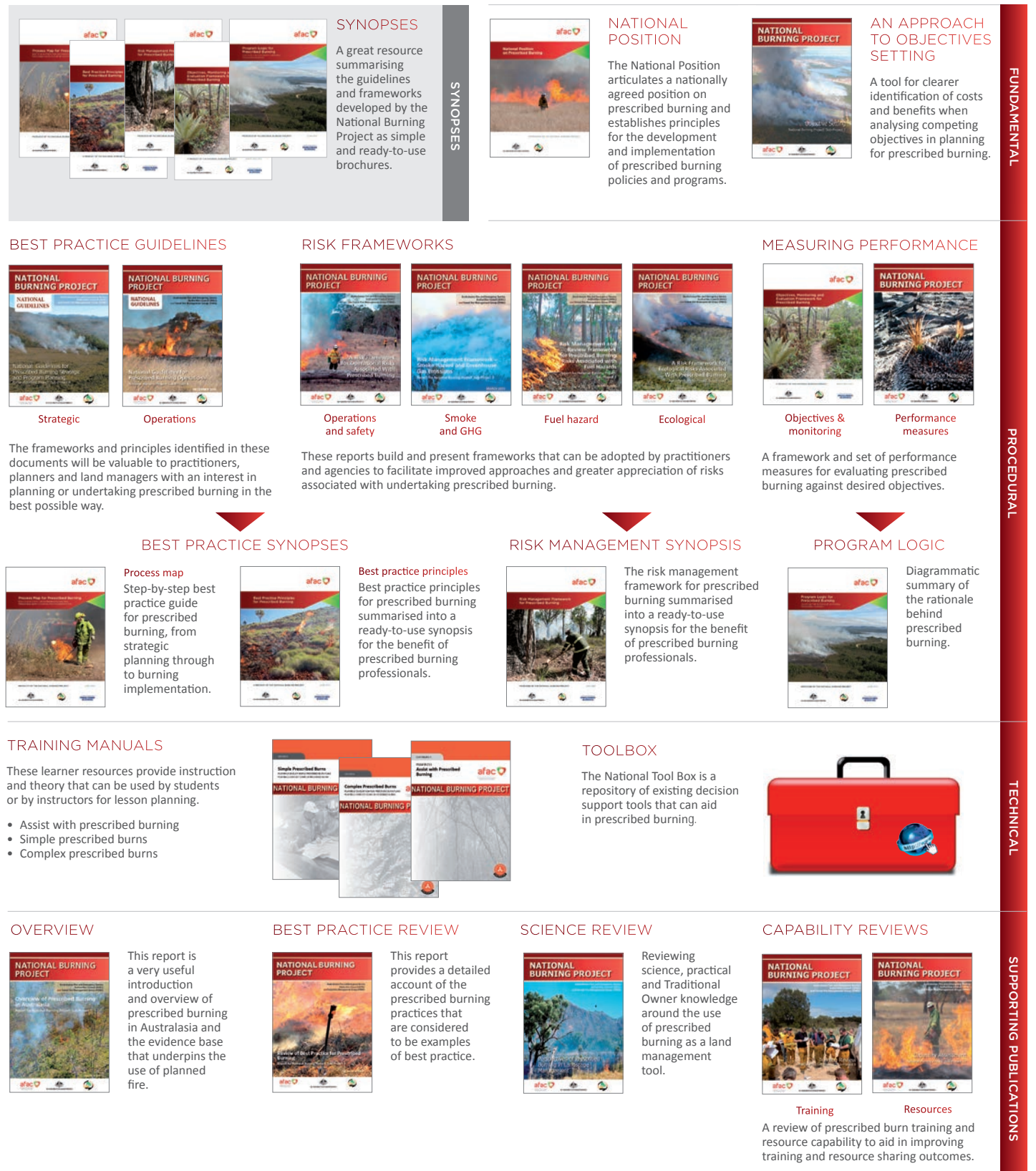
This framework does not contain recommendations for specific objectives or monitoring and evaluation techniques (beyond some examples). For detailed examples on individual objectives and monitoring and evaluation methods, refer to the original risk frameworks listed above.

This framework is offered to assist those involved in developing objectives, monitoring and evaluation policy, systems, procedures and guidelines, as well as to assist practitioners orientate to the guiding principles that underpin objectives and monitoring.

In this document, the term **objectives** is used to encompass goals, aims, purposes, objectives and measurable outcomes. And the phrase **monitoring and evaluation** is used to describe diverse activities aimed at assessing prescribed burn management including informal or one-off post-fire **evaluations**, formal structured long-term **monitoring** programs, as well as **research** activities aimed at assessing prescribed burn management.

NATIONAL BURNING PROJECT

The National Burning Project was jointly commissioned by the Australasian Fire and Emergency Service Authorities Council (AFAC) and the Forest Fire Management Group (FFMG) and has produced a range of products as shown below.



OBJECTIVES, MONITORING AND EVALUATION PRINCIPLES FOR PRESCRIBED BURNING

PRINCIPLE 1

Objectives do not stand alone but **are part of a management system**. Objectives indicate aspirations, however, cannot achieve anything unless linked to supporting strategies, communications, procedures and performance measures.

Objectives are most effective when developed as part of a management framework. For example:

- Strategic objectives should be linked to a strategy or strategies that define the steps of how to get from the current situation, to the desired situation as expressed by the objective;
- There must be a means to communicate the strategic objectives and then associated strategy so that people can contribute to achieving objectives;
- Program planning and operational planning phase objectives should link to and support strategic objectives (see Principle 3); and
- Organisational structures must exist to support the implementation of objectives, such as operating procedures, guidelines, information management systems, training and staff with particular roles and accountabilities.

For example, objectives are often conceived as being part of a risk management framework. The international standard *ISO 31000:2009 Risk Management – Principles and Guidelines* defines risk as ‘the effect of uncertainty on objectives’. And then goes on to recommend that risk management is supported by principles, frameworks and implementation processes. Refer to *A Risk Framework for Operational Risks Associated with Prescribed Burning* page 8 for more information.

PRINCIPLE 2

Objectives should be measurable, or if not directly measurable, explicitly linked to performance measures that allow them to be clearly evaluated with regard to their success.

The *National Position on Prescribed Burning* (AFAC 2016) states:

“Prescribed burning is done in the context of measurable outcomes... Clearly stated objectives facilitate the formation of suitable burn prescriptions, fire implementation tactics and allow evaluation of burn success for adaptive management purposes.”

In the past, objectives for prescribed burning outcomes have not always been expressed in measurable terms, especially for high-level strategic objectives. Where this has been the case, it has been difficult to assess the success of and cost-benefit of prescribed burns, burn plans, burn programs or fire strategies; whether for life and property, ecological or other outcomes. This has sometimes led for demands from the public for more rigour and transparency (see *National Guidelines for Prescribed Burning Strategic and Program Planning* AFAC, 2017)

All levels of prescribed burn planning and implementation ought to be guided by objectives so that activities can be organised, directed and purposeful. At a strategic level, it may be appropriate to state broad or aspirational objectives, such as ‘protection of life and property is of greatest concern’. However, because this is not measurable in itself, it must be linked to performance measures that are measurable, that quantify how this objectives will be evaluated for its success at program planning phase.

Performance measures helps organisations make informed decisions, benchmarks and improves performance and provides for public accountability (see *Prescribed Burning Performance Measurement Framework*, AFAC 2017). In a prescribed burning context, performance measures help organise and orient burn programs toward agreed goals. *The Prescribed Burning Performance Measurement Framework* identifies types of performance measures, the various roles of performance measures and what makes a good performance measure. *The Prescribed Burning Performance Measurement Framework* goes on to recommend a suit of performance measures that can be adopted by agencies, ranging from assessing inputs, activities, outputs, outcomes and economic efficiency.

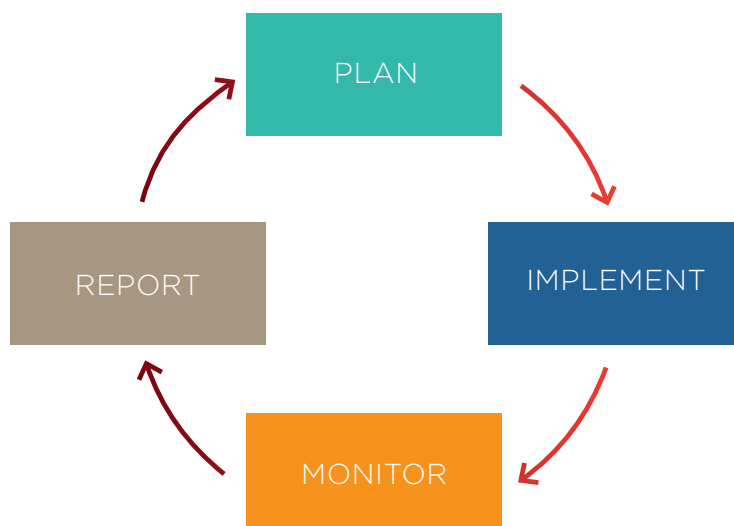
For individual burns, it is common to express one or more objectives that relate to the specifics of the burn area in question. These individual burn objectives also must be measurable, or at least link to measurable outcome statements, so that the success of the prescribed burn can be evaluated. Well stated objectives also help orientate those undertaking burning to appropriate burn conditions, fire behaviour and ignition tactics.

PRINCIPLE 3

Within a land and fire management context, **prescribed burn monitoring and evaluation ought to be part of a management system**. Often monitoring and evaluation has been undertaken as an afterthought to management activities. However, monitoring and evaluation is powerful if integrated into a management framework. In such a framework, monitoring and evaluation would ideally lead decision making, rather than being done as an afterthought to management activities.

The adaptive management cycle is a well-documented and understood approach to management and monitoring that involves planning, implementing actions, monitoring the outcomes of the actions, analysing and then reporting the results and adjusting planning and implementation in relation to the results in a continuous cycle. Figure 2 presents the adaptive management loop in simplified form. However, various additions are possible, including ‘design’, ‘community engagement’, ‘analyse data’ and ‘adjust’. Adaptive management cycles are customisable to the problem at hand.

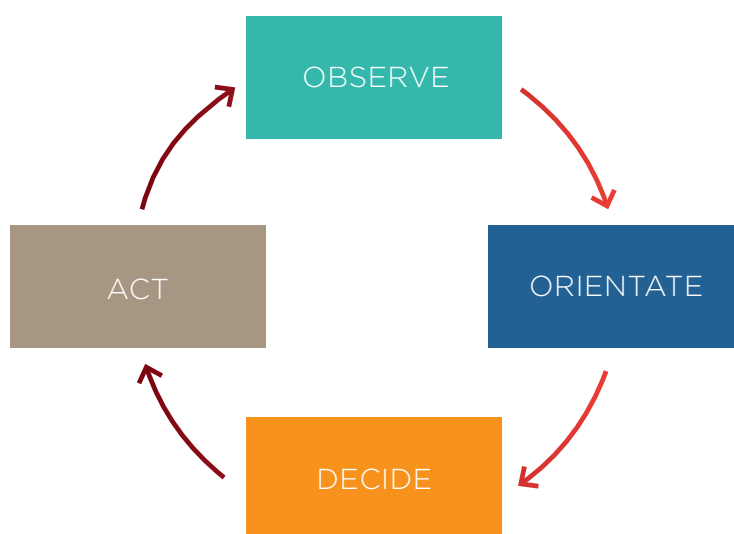
Figure 2 | The Adaptive Management Cycle



Even though well-established, adaptive management cycles are not without their problems. Typical problems include planning that is insufficiently practical, those involved in implementation not properly following plans, insufficient or poorly designed monitoring and data analyses, and insufficient or infrequent reporting. The adaptive management cycle often places monitoring after planning and management activities. This can create an impression that monitoring and evaluation should follow action.

An alternative approach is the OODA (observe, orientate, decide, act) loop (Figure 3). Monitoring and evaluation (the observe step) becomes the first step in the process and orients the practitioner to choosing the most appropriate objectives and management actions. Like the adaptive management cycle the OODA loop can be elaborated to include such activities as community engagement.

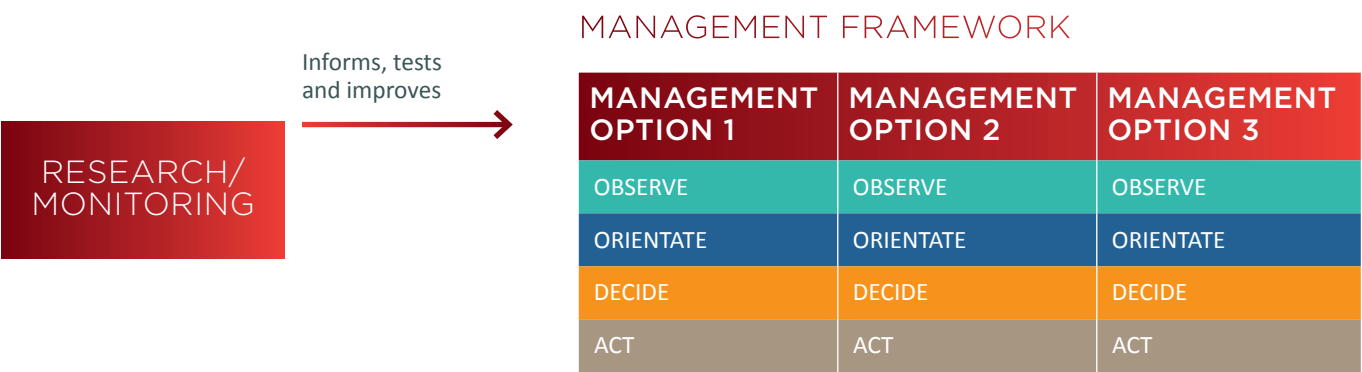
Figure 3 | OODA loop (adaptive from John Boyd)



Also, the role of monitoring and evaluation can be strengthened through integration into a management framework, so that it becomes a decision making tool designed for implementation by practitioners. An example of how the OODA loop can be integrated into a management framework is presented in Figure 4. How this can be applied in a prescribed burning context is discussed below.



Figure 4 | Management Framework



OBSERVE

The practitioner is presented with a range of management options and must determine which management option applies to their current situation. This is achieved in a structure fashion by using some sort of monitoring or evaluation protocol. This may be as simple as observing the environment and then choosing between photographs illustrating different options, written indicators, a decision tree or taking detailed measurements that lead the user to a management option (the level of rigour will vary depending on the situation). By using the results of the monitoring or evaluation protocol, the practitioner can decide which management option is appropriate.

ORIENT

The management framework should include descriptions and discussions sufficient to allow the practitioner to understand the management problem and build a conceptual model. The discussion could be brief or lengthy depending on the complexity of the management issue.

DECIDE

The management framework should include suggested objectives that can be utilised or adapted to suit the current management problem being observed (for example, in an area with high fuel hazard, the objective may be ‘reduce overall fuel hazard to below moderate’). Offering pre-fabricated objectives helps practitioners align their thinking to the management problems at hand. However, an option for the practitioner to adapt the objective or invent a more appropriate one may be required.

ACT

Ideally, a range of suitable specific management actions should be offered that would help resolve the management problem. These management tasks could be quite specific and are aimed at achieving the objective chosen in the previous step.

The practitioner ought to return to the site frequently and reapply the framework, effectively causing them to adaptively manage their landscape.

The management framework should have been initially built with the help of research and monitoring findings, which are also used to test and adjust the framework over time as illustrated in Figure 4.

PRINCIPLE 4

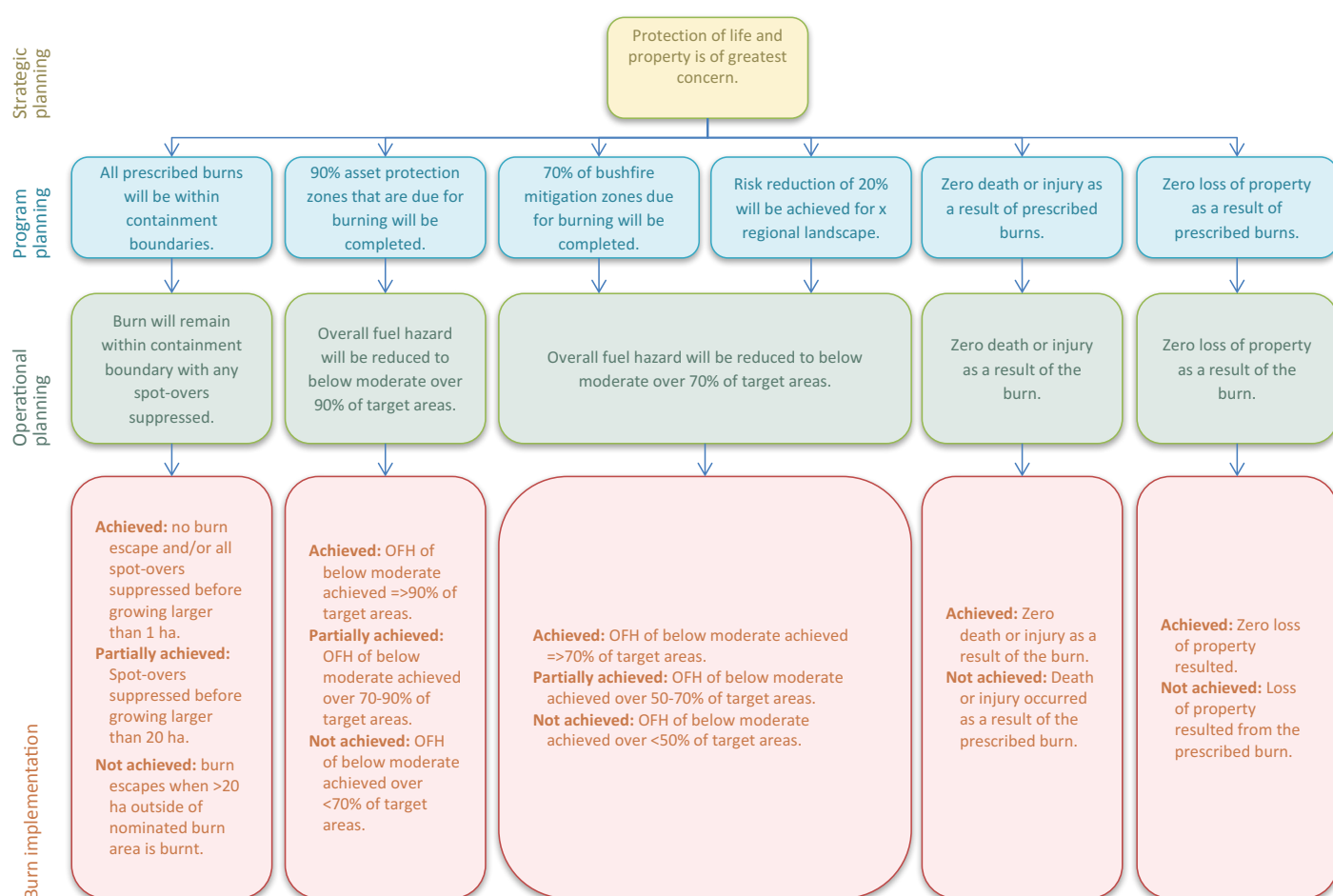
There is a **relationship between strategic planning, program planning and operational planning objectives**, so that objectives of individual burns support an organisation’s strategic direction.

There is a need in prescribed burning to maintain the link between strategic planning and burn implementation, otherwise individual burns may be conducted that do not form part of the strategic intent of an organisation. Maintaining this link is challenging for a variety of reasons which may include insufficient planning, strategic planning that is not sufficiently practical, the complexity involved in carrying strategic concerns through to implementation stage, different staff or different business sections being involved at different phases and insufficient communications.

To better ensure that operational burn implementation is in the service of strategic concerns, an integrated approach to formulation of objectives can be used in which the integrity between strategic planning, program planning and operational planning objectives, and then the monitoring or evaluation of these objectives during implementation phase, is maintained. An example of a structured approach to objectives and assessment that links each phase of prescribed burning is given in Figure 5 (in relation to just one strategic objective, similar diagrams could be drawn for other objectives). Preparing a set of off-the-shelf objectives and assessment procedures is one way to help ensure the relationship between prescribed burn phases is maintained.



Figure 5 | Using objectives to link strategic planning to burn implementation (simplified examples are used for illustration purposes only).



PRINCIPLE 5

Ensure **monitoring and evaluation has a clear purpose**. Maintain a relationship between objectives and assessment so that monitoring and evaluation supports the assessment of objectives. Monitoring and evaluation methods that are designed to test measurable objectives helps ensures the relevance of these activities.

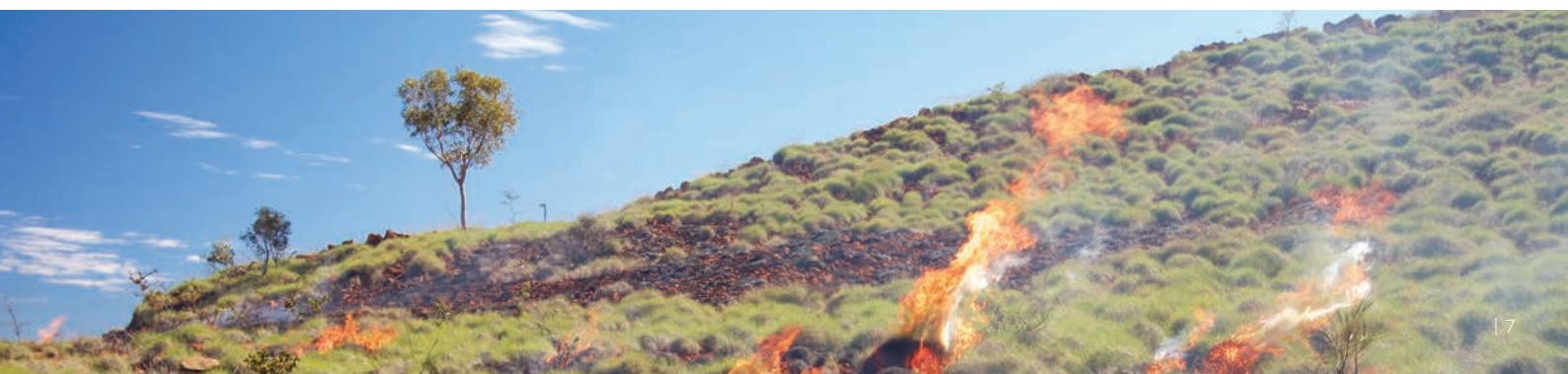
A common challenge for land and fire managers is ensuring monitoring is relevant, funded, resourced and meaningful. One of the ways to address this is to ensure monitoring is designed and implemented to test measurable objectives or performance measures.

Monitoring and objectives should be considered as two sides of the one coin. Objectives that are not evaluated are unlikely to contribute to continuous improvement processes. Monitoring that is not in the service of clear management objectives often lacks operational relevance and may lose support from staff and

Whenever monitoring has a clear purpose (a well stated question or objective), it becomes much easier to determine suitable methods, sub-sampling requirements and data analysis requirements that will properly test the objective or question. On the other hand if monitoring is not led by clear and testable objectives or questions, a number of problems ensue such as:

- Data is collected for many years but it is not useful or does not bear suitable data analysis;
- There is not enough clarity about which environmental/ ecosystem parameters to measure. The choice of parameters (thousands of parameters are possible) very much influence the results, and a good conceptual model (of the ecosystem) and a well cultivated understanding of the problem is required in order to make good choices;
- There is not enough impetus to analyse the data and report on results. And the type of data analyses required is not clear; and
- Monitoring lacks operational relevance and loses the support of staff or managers, and possibly loses funding.

Department of Parks and Wildlife, Western Australia



PRINCIPLE 6

Ensure the **complexity of monitoring and evaluation techniques is suited to requirements**. A lack of alignment between requirements on the one hand, and the complexity of techniques on the other, can contribute to monitoring and evaluation being inefficient or inappropriate, which in turn can cause it to lose funding and support.

Trying to use research orientated or experimental design methodology when more efficient, simple and straightforward

visual techniques could equally answer the same management requirement is a time-consuming and expensive use of resources. On the other hand, using more rapid techniques and coarse assessment approaches where a more rigorous experimental design or fixed plot sampling would have been more appropriate, is also an inefficient use of resources as it is unlikely to have sufficient explanatory power, may not detect underlying trends and may not sufficiently challenge assumptions.

The phase of prescribed burning can be used to guide the complexity of monitoring that is required (refer to Figure 6).

Figure 6 | Styles of monitoring aligned to prescribed burning phases

PHASE	STYLE OF MONITORING	PURPOSE	DESCRIPTION
STRATEGIC PLANNING	Research, validation monitoring, strategic management effectiveness monitoring	Filling knowledge gaps, reviewing strategic outcomes.	Assessment aimed at validating assumptions, testing management models and filling knowledge gaps. This may include formal reviews, research projects and monitoring projects. Rigorous experimental design supported by a strong conceptual model is recommended.
PROGRAM PLANNING	Condition monitoring, program effectiveness monitoring	Reviewing performance measures, KPIs and tracking condition (fuel, ecosystems, species populations etc.).	Monitoring is part of a structured program aimed at detecting trends over time, tracking the condition of ecosystems or species populations, tracking fuel condition or other aspects of prescribed burning and reporting against performance measures. Well-structured, repeatable methods are recommended.
OPERATIONAL PLANNING	Activity evaluation	Reviewing the objectives and outcomes of individual burns.	Focused on evaluating the delivery of individual burn objectives or burning outcomes. Simple, qualitative or visual methods can be utilised. A limited amount of sub-sampling can be used (since the results do not have to be generalised to other locations and statistical analysis is not required). Representative locations or locations that help elucidate particular issues (such as assessing fuel load against an urban settlement) can be used. Simple techniques are suggested so that operational staff are encouraged to evaluate the outcomes of measurable burn objectives and make the link between their burning efforts and the post-fire results. Though simple techniques are suggested, where possible, they should be robust, repeatable and reliable to implement. More rigorous techniques can also be used, where supported by a broader structured monitoring program.
BURN IMPLEMENTATION			



PRINCIPLE 7

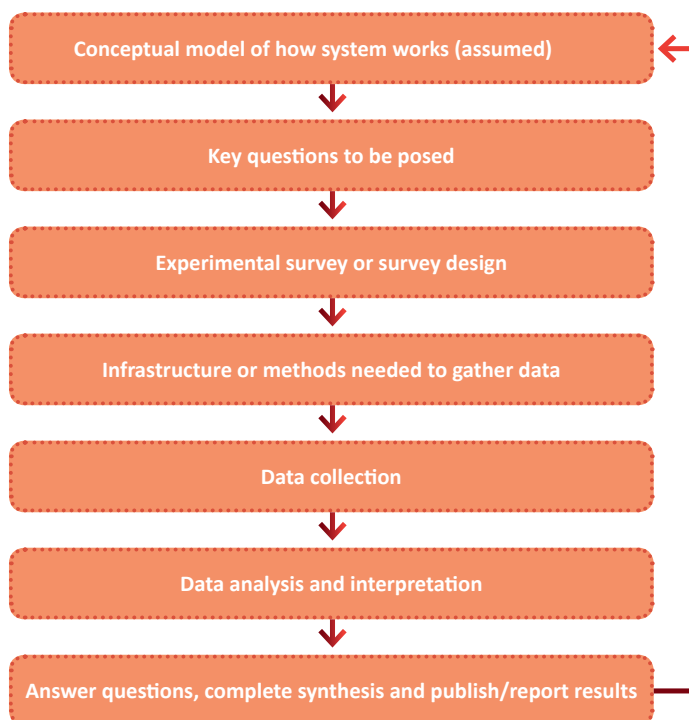
Monitoring and evaluation methods should be well designed. This is especially the case for strategic or program planning phases. However, even where simple methods are employed, such as for the evaluation of individual burn objectives, evaluation methods work best when well considered and designed.

Much has been written about the problems caused by poor monitoring design (Lindenmayan et. al. 2012, Field et al. 2007) and these will not be repeated here. However, a summary of the features of well-designed monitoring is offered below (Lindenmayan et. al. 2012, Field et al. 2007), and the main steps are summarised in Figure 7 below. Some of these also apply to one-off post-fire evaluations.

- The monitoring is testing a clear and measurable objective or question(s);
- The monitoring is guided by a conceptual model developed through cultivating a good understanding of the problem (or ecosystem) on the ground;
- Experiment or survey design is tailored to the problem at hand and tailored to test the objective or question(s);
- Consistency of methods and reporting is important to ensure monitoring is effective over time;
- Quality control is exercised in terms of implementing the monitoring over time;

- Collaboration or consultation with researchers, practitioners, different technical experts and the public helps to ensure robust and accountable monitoring programs can be developed and sustained;
- Careful consideration is given to appropriate parameters to measure, and these relate to the objectives and cultivating a good understanding of the problem and ecosystem (the conceptual model);
- Results are reported and made available in a way that is accessible to planners and those implementing fires;
- There are staff and resources available to support data collection and analysis (where required). There are clearly assigned roles for approving, implementing and reporting monitoring. Ensure monitoring has a good participation model, including managers, implementers and stakeholders;
- Data is analysed or able to be analysed (where required) in a way that is appropriate to address the measurable objective or question(s). How data is to be analysed should be one of the first issues that is resolved as this will influence the design and sampling used;
- The monitoring is well documented (including objectives, methods, data analyses required, roles and responsibilities, approvals and reporting cycles). And the monitoring has a clear business case to ensure it has organisational and funding support;
- Monitoring has appropriate leadership and sponsorship; and
- There is a commitment toward on-going funding, resourcing, data analysis and regular reporting.

Figure 7 | Steps in a well-designed monitoring program (from Lindenmayan and Likens 2010)



OBJECTIVES, MONITORING AND EVALUATION FRAMEWORK FOR PRESCRIBED BURNING

The framework on the following page is a synthesis of the principles and concerns outlined in this document as well as those raised in the National Burning Project risk management frameworks for prescribed burning.

Objectives and monitoring components of these risk management frameworks have been adopted and presented here to highlight the relationships between:

- Objectives, monitoring and evaluation in relation to phases of prescribed burning;
- Objectives in relation to the risk dimensions of prescribed burning;
- Objectives, monitoring and evaluation in relation to strategic planning, program planning, operational planning and burn implementation phases of prescribed burning;
- Objectives on the one hand, and monitoring and evaluation on the other;
- The level of detail typically required for objectives at different phases of prescribed burn planning and implementation;
- The level of rigour typically required for monitoring and evaluation techniques at different phases of prescribed burn planning and implementation;

It is anticipated that this framework will provide assistance to those designing prescribed burn objective setting, monitoring and evaluation policy, processes, procedures and systems and also assist those involved in planning and implementing prescribed burning.

Figure 9 | Objectives and assessment framework for prescribed burning



OPERATIONAL PLANNING

BURN IMPLEMENTATION

IMPLEMENTATION RELATES TO STRATEGY (PRINCIPLE 4)

Measurable objectives for individual burn plans. A set of off-the-shelf (but adjustable) measurable objectives are useful to ensure that they align to performance measures.

- Reduction in fuel distribution (horizontally and/or vertically) or cover of fire
- Reduction in fuel load or overall fuel hazard
- Fire behaviour characteristic goals (e.g. flame height)
- E.g. reduce overall fuel hazard to below moderate in at least 90% of the target area

These could be expressed as formal measurable objectives (e.g. no smoke impacts on residential area during or after the burn) but are commonly express as a smoke risk management strategies (e.g. use an easterly wind to keep smoke away from residential area) within the burn plan.

- Mitigation strategies written into burn plans
- Measurable objectives that, if successful, will contribute to achieving the performance measures.
 - Limiting scorch
 - Retention of grass stubble or hummus
 - Retention of habitat features
 - Fire intensity goals
 - Ecosystem recovery
 - Weed reduction
 - Avoiding weed spread
 - Protecting waterways

Risk management strategies for:

- Crew safety
- Public safety
- Burn containment
- Fire behaviour characteristic goals

Usually individual objectives in burn plans are not required since all burns must adhere to the same objectives of no loss of life, no injury, no loss of property.

Relatively simple techniques for post-fire assessment of individual measurable burn objectives. Well-designed off-the-shelf techniques help to ensure robustness of results.

Post-fire assessment of burn objectives

- E.g. Visual assessment of fuel walking at least 100 metres in at least three representative locations in each target ecosystem using overall fuel hazard guide.

Monitoring atmospheric conditions and smoke during and after a prescribed burn.

Post-fire assessment of burn objectives

- E.g. Visual assessment of burnt vs unburnt areas across 100 metre transects in at least three representative locations in each target ecosystem.
- Formation and evaluation of burn objectives may require specialist, technical or cultural input in some cases.

Appropriate execution of fires by suitably skilled people, under prescribed conditions using an approved burn plan and in accordance with agency procedures. Reporting of incidents in fire reports. Sometimes post fire investigations occur for serious incidents.

VERTICAL ALIGNMENT SO THAT ASSESSMENT RELATES TO OBJECTIVES (PRINCIPLE 5)

DEBRIEFS AND POST-FIRE EVALUATIONS

Simple but robust methods:

- Post-fire evaluations usually using simple to use visual estimation techniques at representative locations
- Debriefs addressing a wide range of matters including meeting objectives, success of mitigation strategies and incidents and near misses.
- Sometimes formal investigations are required for serious incidents.

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Australasian Fire and Emergency Service Authorities Council Limited (ABN 52 060 049 327)

Level 1, 340 Albert Street East Melbourne
Victoria 3002

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**BEST PRACTICE PRESCRIBED
BURNING SYNOPSES:**

- ***Process Map of Prescribed Burning***
- ***Best Practice Principles for Prescribed Burning***
- ***Risk Management Framework for Prescribed Burning***
- ***Objectives, Monitoring and Evaluation Framework for Prescribed Burning (this document)***
- ***Program Logic for Prescribed Burning***

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Northern Territory Fire and Rescue Service



AFAC Limited (ABN 52 060 049 327)
Level 1, 340 Albert Street,
East Melbourne, Victoria, 3002
Phone: 03 9419 2388
Email: afac@afac.com.au
www.afac.com.au



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