IUCN

Guidelines for Species Conservation Planning

IUCN Species Survival Commission's Species Conservation Planning Sub-Committee

Version 1.0









SSC Species Survival Commission

Species Conservation Planning Sub-Committee

Synchronicity Earth

هيئة البيئة - أبوظبي Environment Agency - ABU DHABI

Guidelines for Species Conservation Planning

SPECIES SURVIVAL COMMISSION
CAT SPECIALIST GROUP

CONSERVATION PLANNING
SPECIALIST GROUP
Changing the Future for Wildlife

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Snapper, Seabream, Grunt
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Contents

Drafting process and Acknowledgements

These Guidelines were developed by members of the International Union for Conservation of Nature (IUCN) Species Survival Commission's Species Conservation Planning Sub-Committee (SCPSC) through the years 2015–2017.

The objective was to build on and revise the 2008 Strategic Planning for Species Conservation: A Handbook,[1] using the diverse experiences of SCPSC members and others in planning for species over the intervening years. The Guidelines describe the rationale in greater detail.

The SCPSC members are listed below. The Guidelines were developed through the iterative involvement of all members, starting with consultation and agreement on the scope and nature, including the desired 'look and feel', and detail such as the language to be used, the role of case histories and the desired brevity. The next stage was to agree on the shape and terminology of the Species Conservation Planning Cycle, reflecting the many other versions of the standard planning cycle, yet adapting it for this purpose.

At that point SCPSC members were asked to submit short text or bullet points on those areas of their technical strength relating to planning. Those who contributed original text were: Robin Abell, Christine and Urs Breitenmoser, Amielle De Wan, Axel Hochkirch, Caroline Lees, Ken Lindeman, David Mallon, Nigel Maxted, Philip McGowan, and Lee Pagni.

A small number of people outside the SCPSC originated text in their areas of expertise: Resit Akçakaya, Wendy Foden, Tara Martin, David Minter, Pritpal Soorae, Bruce Stein, Kathy Traylor-Holzer, and they are most gratefully recognised.

Mark Stanley Price collated and edited these contributions, and inserted them into his basic text.

In a parallel activity, the SCPSC Chairman created a working group (comprising Mark Stanley Price, Amielle De Wan, Ken Lindeman, Philip McGowan) with the Climate Change Specialist Group (CCSG) for development of material on climate change in the context of species conservation planning. Our needs complemented the activity of this Specialist Group as it prepared its own Guidelines on Assessing Species' Vulnerability to Climate Change. We are indebted to the following from the Climate Change Specialist Group who collaborated on this: Wendy Foden (Chair, CCSG), Resit Akçakaya, James Watson, Tara Martin, Bruce Stein. Wendy Foden is thanked especially for her input to these Guidelines.

The draft text, prepared by Mark Stanley Price, went through several rounds of development with review by the whole SCPSC, with members contributing further text, references or case histories.

The final draft was sent out widely across the Species Survival Commission for review. All comments received were considered and changes made to the text where judged appropriate. These reviewers are listed below, and their contributions are warmly recognised.

The members of the SCPSC thank their host institutions for allowing them to contribute to this work for IUCN-SSC.

The Chair offers thanks to two organisations for their support to him over these years: first, to Synchronicity Earth which took a keen interest in the development and promotion of species conservation planning; second, to the Environment Agency of Abu Dhabi, through its core support to the SSC Chair's Office, for it has both funded development of these Guidelines and enabled critical financial support for species planning activities across many Specialist Groups.

1 http://cmsdata.iucn.org/downloads/scshandbook_2_12_08_compressed.pdf

It is a pleasure also to recognise the support and encouragement of both Simon Stuart, immediate past Chair of SSC, and the current Chair, Jon Paul Rodriguez.

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Guidelines reviewers

The following reviewed a complete draft of the Guidelines and made many helpful comments. They are all thanked for their contributions which improved the product immensely. They are:

Sustainable Use and Livelihoods Specialist Group: Rosie Cooney, Marina Rosales, Stefan Michel, Neil Maddison, Frank Vorhies and others.
Conservation Planning Specialist Group: Robert Lacy, Kathy Traylor-Holzer.
Medicinal Plant Specialist Group: Danna Leaman.
Wildlife Health Specialist Group: several anonymous.
Durrell Wildlife Conservation Trust: Jamie Copsey.
North of England Zoological Society/Chester Zoo: Mike Jordan.

Preface

The IUCN Species Survival Commission (SSC) released its *Strategic Planning for Species: A Handbook*,[1] with a companion *Strategic Planning for Species Conservation: An Overview*[2] in 2008. In 2010 its Species Conservation Planning Sub-Committee, answering to the SSC Steering Committee, was established to promote planning for species conservation primarily within the family of SSC Specialist Groups. The aim was to encourage and catalyse planning work that would be explicitly strategic for conservation action, following the Red List assessment work that many Specialist Groups were engaged in.

In the years since 2008, the Handbook has been a resource and source of guidance to many planners around the world, both within and outside IUCN. Hence, much experience has accumulated of species conservation planning under a wide range of needs and conditions.

The 2008 Handbook remains a valuable source for the principles of species conservation planning, with many real world examples. Therefore, these Guidelines are very much an evolution based on experience, rather than a fundamental replacement. Drawing from the experiences of the last few years, there are several basic reasons as to why this new guidance is needed.

First, early species planning efforts were largely focused on terrestrial large mammals, and more recently there has been a great increase in attention on other taxa, whether plant, animal or fungal. Many species had been overlooked in the past either because of lack of information on them, or ignorance of their conservation status or needs, or because they occupy environments which are more challenging to work in.

Therefore, while there are trade-offs and implications, these Guidelines aim to be equally relevant for any taxon on Earth. Recent experience has shown that no two planning situations are the same. So while the principles of planning may be constant, the purpose of the planning and the circumstances, the information available and its accuracy, and other factors, all combine to make every situation unique. This then demands a planning process that is both rigorous in analysis but flexible in its application.

Second, these Guidelines, however, do not cover the setting of priorities for species planning. This is because they are a resource for planning; how bodies responsible for species conservation prioritise their efforts to some species and not others is their responsibility.

Third, a single planning workshop can include local conservationists and experts, technical advisers or academics, local community members and indigenous communities, possessing between them a huge array of expertise, experiences, values and cultural perspectives. The Guidelines are designed and written to be helpful to any and all of such users.

This has shaped the design of the Guidelines. For its first publication, they are designed as a conventional document with a short main text and multiple Annexes. The main text and Annexes can be downloaded and printed. In due course, this design will allow relatively easy transfer to other media such as web-based guidance. The main body of the Guidelines covers the absolute essentials of planning. It refers to Annexes that explain in more detail, or cover complexities or uncertainties, describe methods or tools, or present examples. The use of references to published works is kept to a minimum.

One benefit of this design is that these Guidelines are not seen as a final, polished product that will stand as a model for a period of years. Rather, as experience accumulates and the tools available for species planning evolve, it is expected that the Guidelines will have regular or annual updates

1 http://cmsdata.iucn.org/downloads/scshandbook_2_12_08_compressed.pdf

2 http://cmsdata.iucn.org/downloads/scsoverview_1_12_2008_2.pdf

through the next few years, and the web-based version is likely to become more commonly used.

Conserving species covers many different activities, and here ‘conservation’ follows the definition of the World Conservation Strategy (IUCN et al., 1980):

> Conservation is defined here as: the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration, and enhancement of the natural environment.

These Guidelines in context

These Guidelines will join several other initiatives within and outside IUCN that will all contribute to meeting global targets for biodiversity conservation, such as the Convention on Biological Diversity’s Aichi Target 12: “By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained”.[3]

These Guidelines are a further contribution to the growing family of SSC Guidelines which collectively comprise a wealth of information and advice on species conservation.[4, 5, 6, 7]

Complementarily, the SSC is committed to a vast expansion of species conservation planning within its Specialist Groups. The shape of the organisation needed to carry this out will be formulated in 2017, and it is hoped that these Guidelines will foster the expansion of planning to all species that need conservation support.

This enhanced level of planning activity will feed directly into the SSC and IUCN’s Species Strategic Plan for 2017–20 which contains multiple Key Species Results that require species planning. Further, the newly operational global standard for Key Biodiversity Areas[8] will assist identification of where conservation interventions at site level can be addressed optimally, based on objective assessment. This will be a primary resource to inform prioritisation of efforts for species conservation planning and actions.

Through contributing to the Species Strategic Plan the Guidelines will support IUCN’s contribution to the Aichi Target 12. In turn, these objectives will ultimately contribute to the United Nations’ Sustainable Development Goals 2030 through its Goal 15’s proposed targets: “15.5 Take urgent and significant action to reduce degradation of natural habitat, halt the loss of biodiversity, and by 2020 protect and prevent the extinction of threatened species.”[9]

Mark R. Stanley Price
Chair, SSC Species Conservation Planning
Sub-Committee

3 www.cbd.int/sp/targets/
4 Guidelines for Wildlife Disease Risk Analysis.
5 Guidelines for Reintroductions and Other Conservation Translocations.
6 Guidelines on the Use of *Ex Situ* Management for Species Conservation.
7 Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species.

8 https://portals.iucn.org/library/node/46259
9 http://una-gp.org/the-sustainable-development-goals-2015-2030/

Introduction

Introduction overview

1 Why new IUCN Guidelines on species conservation planning are needed.
2 What is strategic planning for species?
3 Creating effective species conservation plans.
4 The Species Conservation Planning Cycle.
5 Structure of the Guidelines:
Section 1: The nine stages of the planning cycle.
Section 2: How is planning done? The processes and tools.
6 How to use the Guidelines
7 The names used in the planning cycle.

Background

Users of the 2008 Handbook will recognise the similarity to these new Guidelines. This is deliberate, in recognition of the quality of its approach and examples, and the benefits of avoiding unnecessary change. However, conservation and the world in which it operates have changed significantly between 2008 and 2017. This is reflected in the tone and content of these Guidelines.

First as indicated above, it is intended and hoped that these Guidelines can be used for planning for any taxon; accordingly, the number of stages in the planning process have been kept as few as possible, and the terminology simple. This is to emphasise that sound planning is the first and essential stage in supporting species conservation; but it is merely a process and not an end in itself. Further, the tone of language aims to be plain and simple English. The text is supported by illustrative examples of all the stages.

Second, there is now much greater awareness of both the present and predicted future impacts of climate change and the increasing realities of life in the Anthropocene era. Accordingly, this is treated in these Guidelines in a way that is intended to encourage planners to engage with it from the start of the planning process. The position is taken that even if climate change is not currently the most pressing issue for the planned species, it may have synergistic effects with other threats that are operational at the time of planning. The key resource for bringing climate change into the planning process is the Guidelines for Assessing Species' Vulnerability to Climate Change,[1] of the IUCN-SSC Climate Change Specialist Group.

These Guidelines also emphasise the fact that we do not know everything about species, and this should be acknowledged in planning for their conservation. Climate change science accepts great uncertainties in many aspects, but shows how it can be handled. Similarly, these Guidelines take the view that no species strategy or plan is likely to be completely correct in its diagnosis of the threats to the species, or in cause and effect and in the choice of conservation interventions on behalf of the species. They show how uncertainty can be addressed.

One reality is that conservation is usually limited by funds for action, often because of lack of a business case for allocating funding, whether through philanthropy, investment or as subsidy. But, much planning proceeds and comes to conclusions as if money were not a consideration. So, these Guidelines offers advice on making decisions when the level of resources is known and limiting, through the concept of return on investment.

This is important for a further reason: the test of any plan is whether the conservation interventions that it leads to are effective. In the past, much conservation action has been based on erroneous or inadequate information. Within IUCN, and the conservation world in general, there is a drive to make conservation more conventionally

1 https://www.iucn.org/content/iucn-ssc-guidelines-assessing-species-vulnerability-climate-change

'evidence-based'. Good decision-making is grounded by planning for species conservation that is rigorous in its thinking, while also acknowledging where there is critical uncertainty, which should be remedied or accommodated. In the context of decision-making, critical uncertainty covers doubts and imperfect knowledge that, if remedied, would lead to a different management action. The Guidelines aim to reflect this.

Hence, the Guidelines emphasise the assessment of options and alternatives, techniques for exploring the outcomes of different actions, and how to deal with unintended outcomes through adaptive management.

Finally, the test for species conservation planning is that it results in improved conservation status for the planned species. It should be appreciated that while species may face immediate problems of biological origin, their effective conservation needs solutions that will require responses by society, and may therefore require changes in behaviour at the level of individuals, communities or local and central governments. There are two obvious ways to increase the chance of successful conservation interventions. The first is to ensure the correct range of people and organisations is involved in the planning process. The second is to include individuals with the right skills in the social sciences and psychology who can appreciate the complexities and potential for encouraging the necessary behaviour changes.

What is strategic planning for species?

To be strategic, any Plan or Strategy should be characterised thus:

- It should start with a high-level question such as 'What do we want for this species within so many years?' and then progressively work down in terms of time horizons and detailed answers to the question, ending up with the tactics required to implement the strategy.
- It must involve the full range of organisations and individuals that have interests in the species and its habitat.
- A strategic approach should include the social, political and cultural environments in which conservation actions will be taken, acknowledging that the most effective interventions for species may depend on the activities and behaviours of local people.
- A strategic approach explicitly acknowledges the dynamic cycle of learning by doing and then adapting in pursuit of the longer-term ambition, in contrast to a one-off set of responses or actions.
- A strategic approach includes consideration of the resources, risks, priorities and other aspects of implementation.

Creating effective species conservation strategies

As the test of a species conservation plan is improved conservation status, planning must provide the basis for this. It is generally true that the primary threats to biodiversity are due to human activities. These include land use changes affecting habitats and ecosystems, hunting for food or for cultural reasons; or larger factors such as pollution, climate change and pressures from expanding human populations and their needs. Hence, it is essential to engage the right people in planning from the start. These will include the communities closest to the species on the ground (or in the water) who may provide critical information about the species, the pressures these species face, and who will inevitably be stakeholders in conservation actions.

Establishing the 'value' of a species to humans is intrinsic to its conservation. Finding 'win-wins' for people and wild species has been the goal of many conservation strategies, but both finding and then delivering them is recognised to be often very challenging. This will often require creating incentives for changes in human behaviours which will be truly supportive of conservation aims and be sustainable.

Ensuring that a conservation strategy is effective will also depend on the nature and quality of leadership in the responsible organisations. On evidence that the commonly found 'command-and-control' approach cannot yield desired conservation outcomes, there is a case for an alternative 'Systems Thinking' approach. This requires (a) an understanding of natural systems; (b) a sense of how human behaviour is influenced; (c) an understanding of how knowledge should inform decision-making and problem solving; and (d) an understanding of variation in natural systems (Black and Copsey, 2014).

The SSC Species Conservation Planning Cycle

The heart of the planning process is the SSC Species Conservation Planning Cycle (*see* Introduction Figure 1). This is an adaptation of the conventional project planning cycle, though there are innumerable ways of depicting the component stages. The key aspect is that, although the emphasis in the Guidelines is on *planning* rather than *implementation*, together these must comprise a cyclical process that runs throughout the time from the initial decision to intervene for a species through to its successful and sustainable conservation.

The process falls naturally into two phases, corresponding to stages in the planning cycle (see Figure 1):

Planning (Stages 1–5)

- Why do you want to plan for one or several species? What is the need?
- What is the scale and scope of your planning?
- Where are you starting from?
- Where do you wish to get to?
- How will you get there?

Implementing, Learning, Adapting, Communicating (Stages 6–9)

- Implementing your strategy
- Monitoring, learning, adjusting
- Communicating
- Planning again as necessary.

As these Guidelines are primarily about planning, they focus on the questions in the Planning section above. The activities of Implement, Monitor and Learn, Communicate and Plan again will span many years, and certainly be longer than the initial planning phase. However, the weight of information and detail in these Guidelines is firmly on the planning stages. But it must be emphasised that the value from planning is only obtained from implementation and follow-up.

The structure of these Guidelines

The Guidelines comprise two sections:

Section 1 comprises the Species Planning Cycle and its stages, with one chapter for each stage. Each chapter is kept as short as possible to describe the principles behind the stage; this is the content and step sequence of planning. Further detail and references to sources are then contained in a related Annex where necessary. Each chapter has a very brief starting overview, which summarises the key elements of the chapter.

Section 2 describes the process of planning: how it can be done to greatest effect, through careful selection of participants, the design of any workshop, the selection and roles of facilitators and how they and participants conduct themselves.

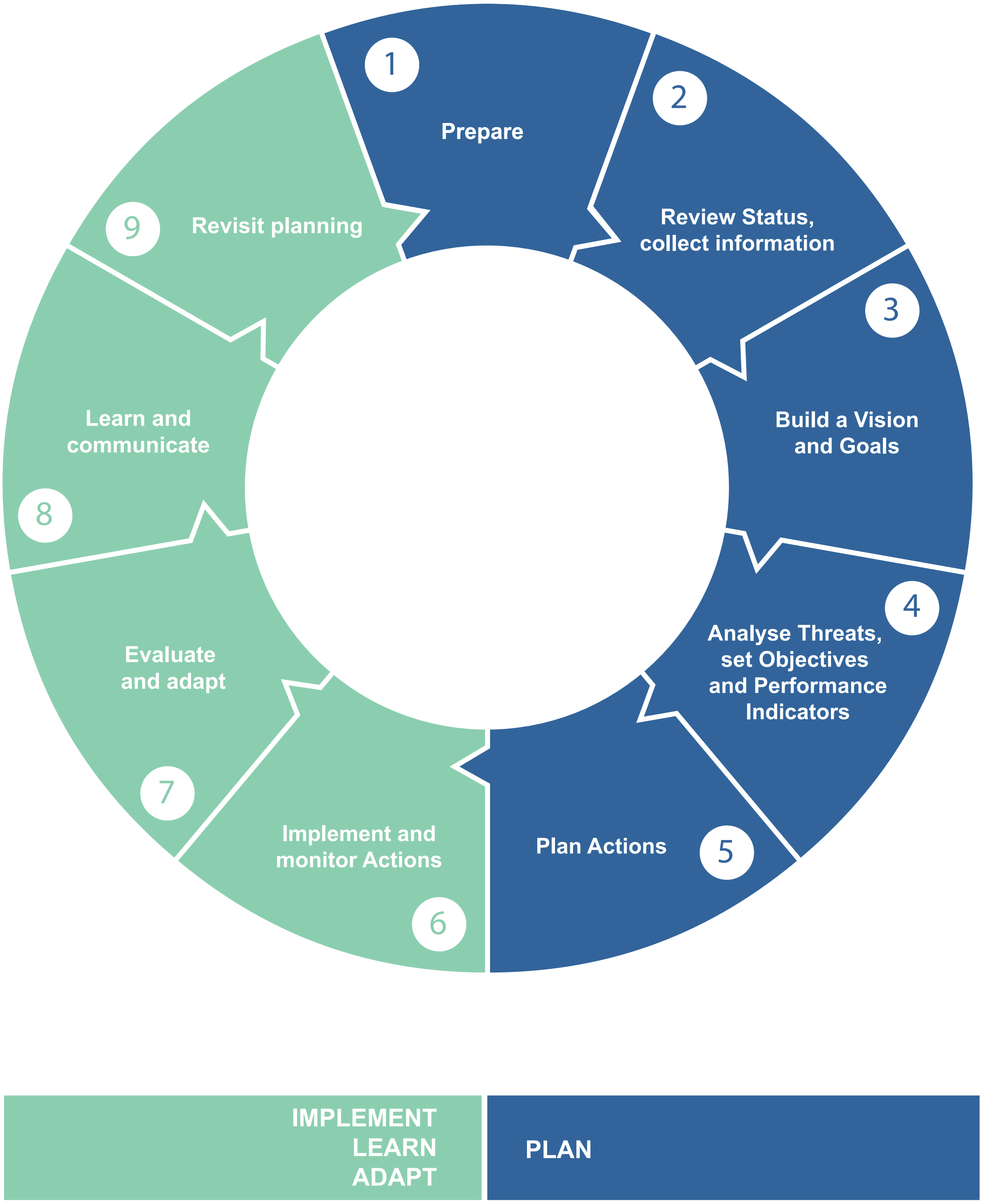
How to use the Guidelines

It is hoped that the Guidelines will help planners of every degree of experience and confidence. Consequently, some users will not need to start at the beginning and follow every stage. Rather, it is intended that the Guidelines are a flexible resource for guidance that users may consult over specific aspects. This is consistent with the view that planning should be adapted to each and every situation, while adhering to the highest standards in thought processes and intellectual challenge.

Key concepts and sources

The sources of greatest help and closest comparability in developing these Guidelines have been SSC's 2008 *Strategic Planning for*

The SSC Species Planning Conservation Cycle



Species: A Handbook,[2] the Cat Specialist Group's *Cat Conservation Compendium: A Practical Guideline for Strategic and Project Planning in Cat Conservation*,[3] and the Conservation Measures Partnership's *Open Standards for the Practice of Conservation*.[4]

The One Plan Approach

The One Plan Approach, conceived by the SSC Conservation Planning Specialist Group, encourages planners to expand their horizons and place species conservation planning in the widest possible context. While Annex 1 describes this further, the key element is acknowledging that all populations of a species may have potential value for its conservation, irrespective of where they are located or how they are managed; they should therefore be included when planning.

Terminology

The stages of the planning cycle do not fit a standard format: between sources and users, definition of its stages and their labels vary, but the underlying principles remain constant.

The terminology used in the planning products of different organisations or processes vary, although equivalents are usually evident. These Guidelines most closely follow the 2008 Handbook's terminology, but there is no attempt to standardise terms or harmonise them with other planning processes; that is deemed less important than consistent promotion of the concept of the planning cycle.

While such inconsistency may be immaterial, some distinctions between a strategy and a plan, the two most common planning products, are offered.

A strategy tends to address a higher-level and overall aim, addressing a situation such as a suite of threats challenging a species, and it will relate to the longer term.

A plan connects what has to be done to improve a species' status with the means to do it. Hence, it will contain the implementation detail necessary to achieve the required conservation outcomes for the species in terms of who will do what, when, requiring what resources, and for what outcomes.

There may be a hierarchical relationship, in that a Range-wide or Regional ('multinational') Conservation Strategy setting out the long-term Goals for a species across its range will often be followed by development of National Action Plans to achieve it (IUCN-SSC, 2008; Breitenmoser et al., 2015). But, the diversity of planning situations means there is no absolute distinction between a strategy and a plan.

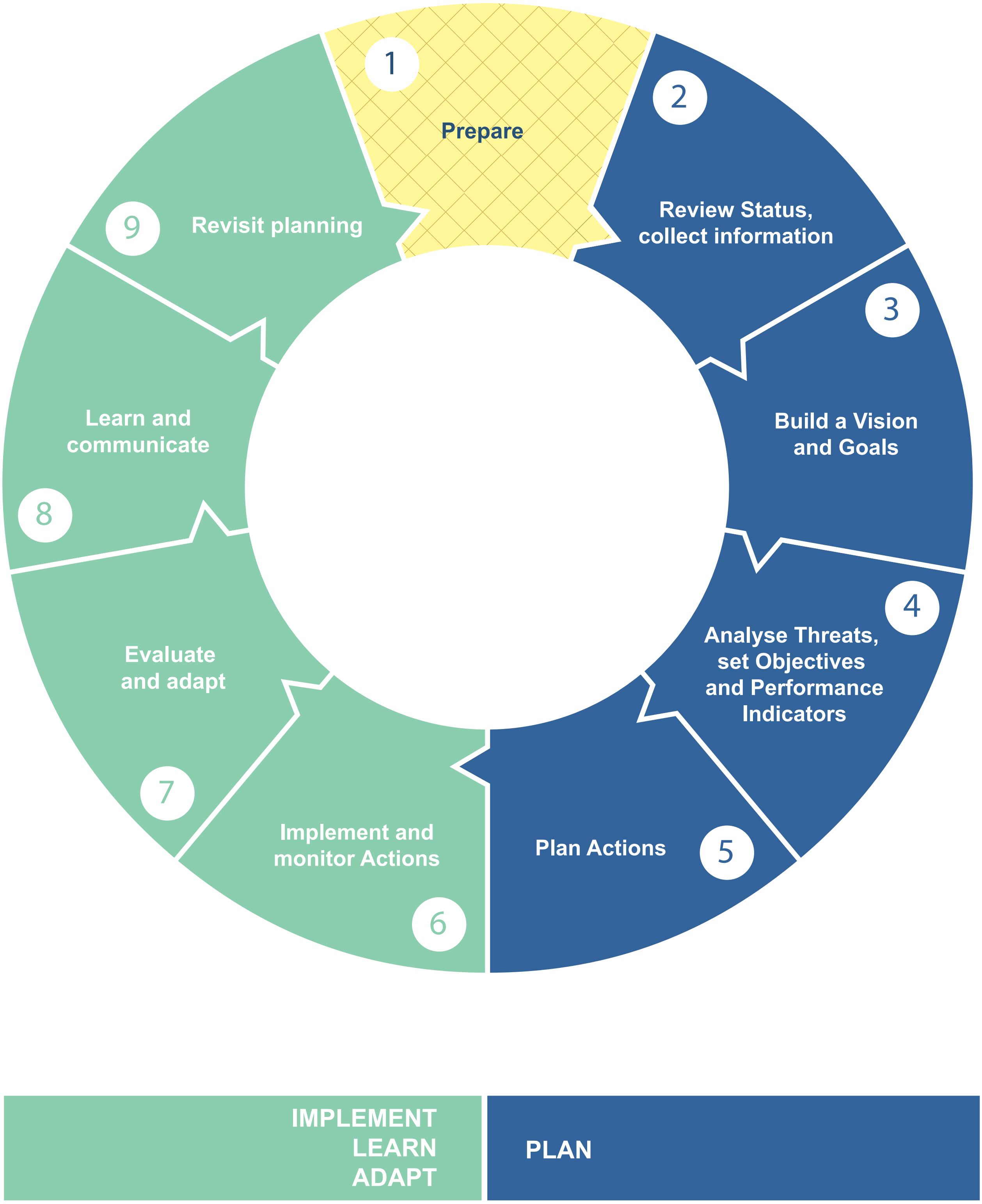
Thus, with strategies, especially if there is a multinational aspect, government participants in planning will often be senior officers, protected area managers and possibly national-level politicians. There will normally be an emphasis on global Goals and Objectives for the species, and the resulting Actions will often be relatively general and few.

In contrast, as the planning relates to progressively smaller geographical scale, the Goals and Objectives will be more specific while still contributing to the global-level Goals and Objectives. Again, the Actions will be more detailed and greater in number, for it is at this level that conservation interventions are made and measured. Correspondingly, the stakeholders in a plan will be suitably local-level government officers and politicians, protected area wardens but also senior park rangers, local community representatives, and others with specific interests in the species and their ecosystems such as the array of potential resource users, often including non-governmental organisations (NGOs).

2 http://cmsdata.iucn.org/downloads/scshandbook_2_12_08_compressed.pdf
3 www.catsg.org/index.php?id=625
4 http://cmp-openstandards.org/

SECTION 1

1. Prepare


1
Prepare
2
Review Status, collect information
3
Build a Vision and Goals
4
Analyse Threats, set Objectives and Performance Indicators
5
Plan Actions
6
Implement and monitor Actions
7
Evaluate and adapt
8
Learn and communicate
9
Revisit planning
IMPLEMENT
LEARN
ADAPT
PLAN

Chapter 1

Preparing: purpose and diversity in species conservation planning

Planning cycle stage 1

Chapter overview

1. What is the purpose of the planning?
2. When is strategic planning needed for species?
3. Are you planning for a single or multiple species?
4. What should be the timescale of a plan?
5. How important is climate change?
6. Flexibility in the planning process to adapt to all situations.

1.1 Purpose

The purpose of a planning exercise will be the headline reasons why a group of individuals or organisation(s) have determined that a single species or group of species needs conservation support, for which planning is a necessary first stage. This determination will usually be the result of a systematic process of prioritisation, which is outside the scope of these Guidelines. Box 1.1 shows the purpose for two planning exercises.

Box 1.1 Examples of purpose

1 Purpose of the 2015 planning initiative for Greater Bilbies (Bradley et al., 2015)

Background: the Greater Bilby, *Macrotis lagotis*, is an iconic Australian species which has suffered an ongoing decline in range and abundance since the introduction of exotic mammals to Australia. The species is now listed as Vulnerable at national level and as Endangered in the State of Queensland, where as few as 300 individuals remain.

The purpose of the 2015 Bilby Summit:

- To assemble a community of stake-holders from across Australia who are ready and able to take action for Greater Bilby conservation.
- To bring this community to a common understanding of the threats to and prognosis for the Greater Bilby across Australia.
- To develop a shared vision for the future of the Greater Bilby across Australia and a plan to guide its realisation.
- To agree, within this wider context, a plan of priority actions for the Greater Bilby in Queensland.
- To build a commitment to immediate action for this species and an enabling framework through which action can be sustained.

2 Planning for Bellinger River Snapping Turtles, Myuchelys georgesi (Jakob-Hoff et al., 2017)

Edited background: The Bellinger River Snapping Turtle (BRST) (*Myuchelys georgesi*) is a freshwater turtle endemic to a 60 km stretch of the Bellinger River, and possibly a portion of the nearby Kalang River in coastal north-eastern New South Wales (NSW).

In mid-February, 2015 a significant mortality event was observed in BRSTs. Prior to the 2015 mortality event, the BRST was described as locally abundant, with a population estimate of between 1,600 and 4,500 individuals. The current BRST population is estimated to be between 200 and 300 individuals, predominantly juveniles, and is currently listed as Critically Endangered under the NSW *Threatened Species Conservation Act 1995*.

Since the mortality event a disease investigation has identified a virus (Bellinger River Virus or BRV), previously not known to science, as the agent most likely to be responsible for the mortality event.

Before the disease event, potential threats to BRSTs were considered to be their limited distribution and habitat requirements, predation, water quality, and hybridisation and competition with Murray River Turtles (*Emydura macquarii*). Although much is unknown about the role and impact of these factors on BRST viability, it is considered possible that some or all played a role in increasing the susceptibility of the species to the disease, or could prejudice its recovery from it.

The purpose of the 2016 planning initiative was to:

- Review the information available on the species and its reaction to the recent disease event;
- Review the information available on the disease itself;
- Review the information available on other existing or potential threats to the species;
- Build a consensus interpretation of this information among the experts present;
- Use this interpretation as the basis for recommending a plan of action for BRST recovery.

The IUCN Red ListTM[1] is the globally accepted standard for assessing extinction risk and documenting the status of species. It can be a useful resource at the initial scoping stage for assessing species in need of planning for their conservation.

When is strategic planning needed for species?

These Guidelines can be used in a range of situations to plan for conservation interventions for species, which include:

- Analyses of a species' numbers indicate it is currently vulnerable to decline or even extinction;
- An observed, significant decline in occupied area;
- The appearance of new threats or intensification or accumulation of existing threats, or all these;
- Significant habitat loss or fragmentation;
- Where a set of species in a community or ecosystem needs specific conservation support either as a standalone project or as part of a wider ecosystem plan;
- Where a translocation with conservation benefit is intended, which can include:
    - an introduction beyond indigenous range;
    - a reintroduction into previously occupied range;
    - a translocation between two current range areas, often for the purpose of restocking and/or sustainable use.
- When a population is threatened by major disruption of its habitat or ability to carry on an undisturbed existence through a proposed major land use change, such as through infrastructure development; species planning in these circumstances could be part of a wider environmental impact assessment;
- When species or populations face an imminent major threat in the form of the predicted arrival of devastating disease or alien invasive species;
- When a population is subject to significant harvesting, whether legal or illegal;

1 http://www.iucnredlist.org

- Ecosystem change is seen or anticipated through, for example, climate change, or processes such as major landscape or land use planning in which biodiversity conservation is not the main focus;
- When a species or assemblage is either relatively neglected or unnoticed, or is under threat from actions which are not covered by existing conservation interventions;
- When stakeholders have widely different interests or priorities, and strategic planning can bring them together for consensus solutions.

Such situations would result in prioritising for planning those species which:

- Are naturally rare, and/or are declining in number;
- Have the high conservation, utilisation or other values;
- Have very specific ecological needs;
- Are key species in ecosystem functions or processes;
- Are under threat from planning processes whose primary focus is not biodiversity.

1.2 What are you planning for?

Is it one species, several species, a community or ecosystem? Planning for multiple species presents economies of scale but with a trade-off against the level of detail than can be achieved. Examples of multi-species planning and their situations are shown in Box 1.2.

Box 1.2 Situations for planning for multiple species, with examples.

- A species guild in a single ecosystem where it is not easy to separate the needs of individual species: the freshwater fish of the Paraiba Basin, Brazil (Polaz et al., 2011).
- A suite of species falling within the remit of a single SSC Specialist Group: e.g. seven species of Asian wild cattle (IUCN-SSC Asian Wild Cattle Specialist Group, 2010).
- Integrated planning for a whole group at different spatial scales: crop wild relative species planned at global (FAO, 2013), regional (Maxted et al., 2015) and national (Maxted et al., 2014) scales.
- Groups of species falling within a Multilateral Environmental Agreement: 13 ungulate species across 14 countries in the Convention on Migratory Species' Central Asian Mammals Initiative.[2]
- Closely related species within a single country: for example, four equid species in Ethiopia (IUCN-SSC Equid Specialist Group, in preparation).
- A taxonomically closely related group facing common threats: for example, the desert truffles of north Africa and south-west Asia all face common threats from habitat destruction, exploitation and war (Minter, 2013).

Planning for multiple species occupying defined areas is becoming increasingly common because of the observed pressures on whole ecosystems, and because of the resulting greater cost-effective use of resources (e.g. Parks Canada Agency, 2016). As a general rule, consideration of cost-effectiveness might dictate that as many species as possible are planned jointly unless this reduces the likelihood of meeting the conservation goals for any single one of them.

One potential hazard from the production of individual strategies/action plans for several species within the same ecosystem, region or country, is consequent duplication – or even inconsistencies – between plans. This can result in competition for resources and, at worst, the possibility of competing or contradictory objectives for two species that require different types of habitat management.

Irrespective of these aspects, planning will be much influenced by the basic attributes of the taxa being planned for. Characteristics such as environment (aquatic or terrestrial), fecundity and mortality, generation time and breeding system, mobility and dispersal system, and the level of knowledge of the species will all influence its

2 www.cms.int/cami/en/page/programme-work

development. Factors in the non-biological environment will also have influence (Chapter 2).

Annexes 2.1 to 2.7 outline some key characteristics and considerations when planning for plants, fungi, invertebrate animals, amphibians and reptiles, for marine fishes and invertebrates, and in freshwater ecosystems. Similar attention is not afforded to birds because of the existence of BirdLife International's Methodology for Bird Species Recovery Planning in the European Union.[3] The same is true for most mammals as there has been extensive planning for this group (for examples, see IUCN-SSC, 2008). However, examples of planning for bird and mammal species are used in these Guidelines.

1.3 What is the timescale of planning?

Every strategy or plan must relate to a defined time span. The main determinants of the lifespan of strategy or plan will depend on:

- The generation time of the species;
- Its/their conservation status, trends, threats and opportunities;
- Implementation and evaluation aspects.

In general, most plans will have a life span of 3-5-10 years before significant review and revision. However, the African Elephant Action Plan (AEAP, 2010) is designed for 100 years, with National Action Plans effective for 10 years (Hedges, 2014). Range-wide planning for the orangutan considers a 500-year timeframe (Utami-Atmoko et al., 2017)

Despite uncertainty over the precise pattern and impacts of climate change for many species and locations, species planning should take account of climate change scenarios for the next 100 years.

In addition to the factors above, the timing of evaluation or revision of a plan may depend on the funding cycle and donors' requirements, as well as further time lines such as national development plans, or international targets such as the Aichi Target for 2020.

The Goals in a Species Conservation Strategy are likely to refer to longer timescales than those in a National Action Plan, reflecting the need for more short-term actions in the latter.

1.4 Planning and climate change

Climate changes to date have already had observed negative impacts on natural systems, at scales from genes to populations, species, communities and ecosystems. Further change is predicted for the foreseeable future, often with likely amplifications of existing trends (e.g. loss of Arctic sea ice, increased rates of sea level rise etc. (IPCC, 2014)). In light of rapid and pervasive changes, it is now essential to incorporate climate considerations into species conservation planning.

However, taking the next logical step of asking 'How is climate change affecting the planned species now and over the coming years and decades?' may cause various reactions. These can include reluctance to see climate change as urgent or currently significant as a threat, or not knowing where to seek specialist advice, or a general feeling of being overwhelmed by the associated complexity and uncertainty.

Consequently, these Guidelines offer assistance in the two key areas of (1) assessing the extent to which the planned species will be exposed to climate change and whether and how they will be vulnerable within planning timeframes; and (2) ensuring that planning specifically takes climate change into account in anticipation of focal species' degrees of vulnerability, even if they seem unaffected by climate change at the time of planning. The key point is to ensure planning is climate-smart from the outset (Stein et al., 2014).

Climate change is considered further in Chapter 2 'Collecting information', and the accompanying Annex 6 provides more detail on the critical questions to be asked concerning climate change and the planned species, and how to follow up.

3 http://ec.europa.eu/environment/nature/conservation/wildbirds/action_plans/docs/final_report

1.5 Moving from the intention to plan to actual planning

Moving from 'Why plan?' to 'How to plan?' brings in many aspects such as the planning process, participation, facilitation, organisation and the application of a range of tools. The critically important component of the 'how' is covered in detail in Section 2.

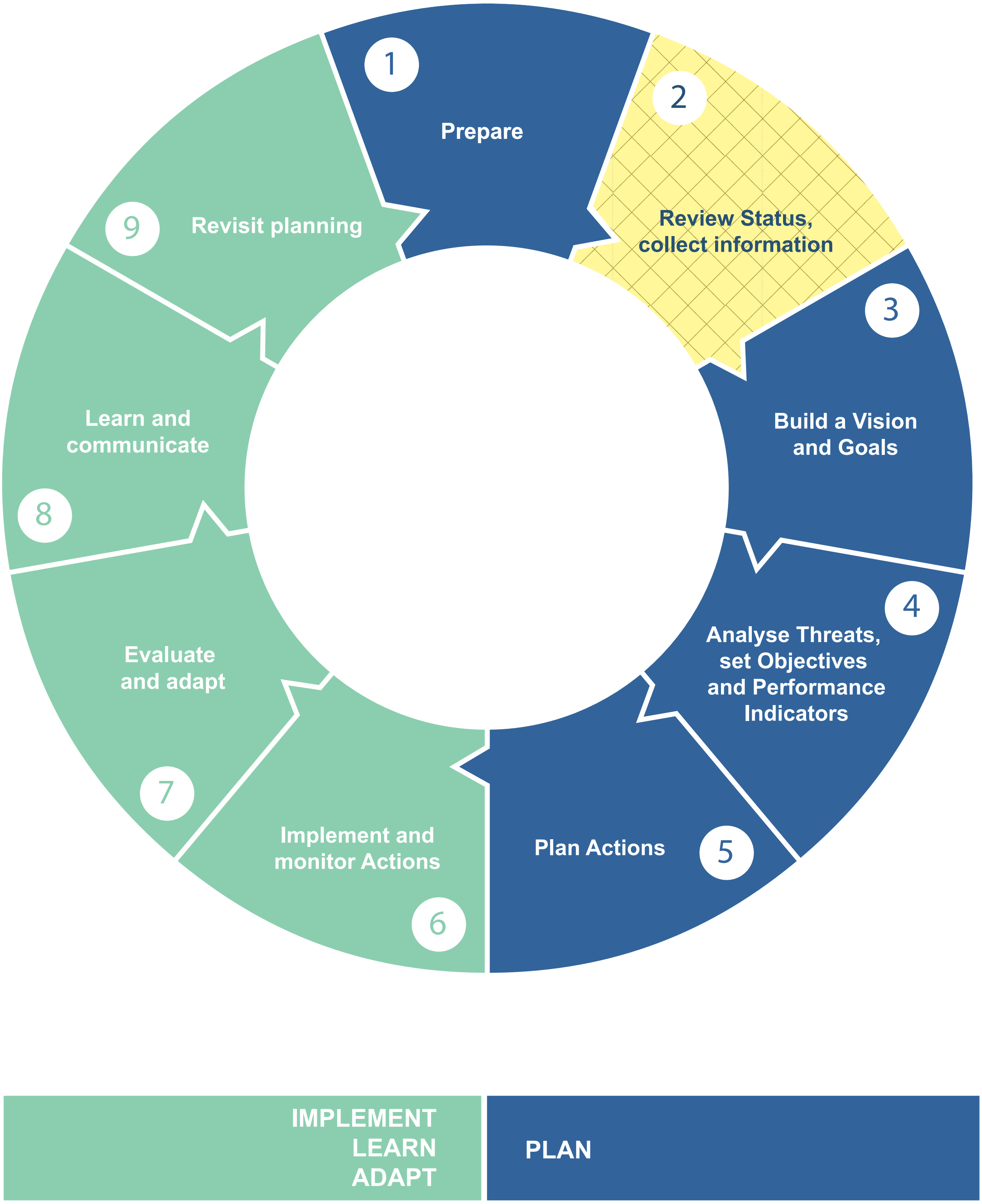
1.6 Conclusions

Effective planning for species conservation must reflect and address a wide range of situations and needs. Further, the distinctive characteristics or peculiarities of individual taxa can all influence and shape the planning process. Such factors are evident from the issues around planning for major taxa or in freshwater and marine ecosystems as in Annexes 2.1 to 2.7.

Consequently, this means that there is no single planning formula for all situations. The planning cycle is the *template*, but it is an adaptable template for application. At the same time, planning will only be as good as the information used in the process, and it must be acknowledged that perfect knowledge or understanding of biological systems (and accompanying non-biological systems such as culture) may never exist in practice. This does not prevent development of good conservation strategies (Chapter 5), but it is essential that the thinking behind planning challenges facts, and recognises assumptions and areas of uncertainty. Such aspects are covered in these Guidelines.

In summary, species conservation planning should be flexible in its form and application, but it must always be based on sound information and critical thinking. 'Rigorous flexibility' could be the guiding principle.

2. Review Status, collect information



Chapter 2

Collecting information

Planning cycle stage 2

Chapter overview

1 A Status Review as an essential first step.
2 Essential information for a Status Review (expanded in detail in Annex 3):
   - a Historic account
   - b Present distribution
   - c Taxonomy and management units
   - d Species biology:
     - i Current numbers
     - ii Population dynamics
     - iii Life history, ecological role
     - iv Habitat selection
     - v Mobility
     - vi Dispersal
     - vii Diet and nutrition
     - viii Social behaviour
     - ix Reproductive behaviour
     - x Disease
     - xi Genetics
   - e Values
   - f Climate change
   - g Conservation context
   - h Active parties
   - i Threats, Drivers of Threats and Constraints.

The first step after Preparing (Chapter 1) is to gather all available information about the planned species. This is the purpose of the Status Review. Conventionally, it includes everything that is known about the species, its conservation status and the pressures that are acting on it (or them). This is the basis of fact whose analysis will lead to the main planning elements of Vision, Goals, Objectives and Actions.

The factual basis for species conservation planning should include every aspect of the planned species that might shape its conservation plan. It should include everything that is relevant under prevailing ecological conditions and should also anticipate changing conditions within the time span that is being planned for, so that the plan is adequately future-ready. The human social, economic and political environments are often the most important factors for designing a plan. While human cultural aspects in the species range should be a major consideration, more distant cultures can be very relevant to planning where species are subject to high levels of offtake and trade and/or yield high-value products.

Species information can be found in many sources: the main ones being published works, the grey literature, and through the elicitation of knowledge from experts (Martin et al., 2012). Each has its merits, but the type of source should be specified.

IUCN Red List assessments may be a useful starting point, and new information in a Status Review can lead to an updated assessment. Further, if a species has never been assessed, a sound Status Review can stimulate the gathering of further information on the species for its first assessment on the Red List.

The factual basis may not be comprehensive or totally accurate, for a variety of reasons. Thus, recommended Actions (Chapters 5 and 7) may not be perfect or the most appropriate solutions and there should be willingness to adjust them. An adequate plan can be developed despite missing or less than accurate information; a key point is that planning is an iterative process (Chapter 9), so that it can be repeated and a plan updated as information becomes available.

The following suggested contents of a Status Review closely mirror those suggested by Breitenmoser et al. (2015) for cat conservation planning, while the 2008 Handbook (IUCN-SSC, 2008) contains detailed recommendations for identifying populations and assessing their size, densities and other vital measures.

Each of the following sections contains only key information needs. Annex 3 expands on each of these headings with further detail on information needs, sources of information and tools.

2.1 Historic account, across all known or inferred ranges

The distribution and numbers of the planned species in the past is information of obvious relevance in assessing what causes the present distribution and numbers, and may provide insights into effective conservation solutions.

The sources of information can be many and diverse, and of variable reliability. Further, as direct evidence of a species' former presence may be found at very few sites, it is acceptable to use judgement on what may be inferred as having been indigenous range (IUCN-SSC, 2013) in the past.

2.2 Present distribution

A fundamental for planning is to know where the species occurs today, within the scope covered by the One Plan Approach (Annex 1). Irrespective of the scope of the planning interest (below), a map of all living representatives of the planned species should be constructed at suitable scale.

In general, there will be greater confidence in the most recent location data, which should be spatially explicit. Historic information on the locations of fungi, plants and animals may all be equally inaccurate.

2.3 Taxonomy and management units

In general, the IUCN Red List and/or the relevant SSC Specialist Groups should be considered authoritative on the taxonomy of species.

When the known current range of a species is split between many sub-populations, and the extent of historic range is not clear, the issue may arise whether these sub-populations comprise more than one species – or sub-species. If the latter, there may be a case for combining the sub-populations with common traits into separate sub-specific management units.

The decision to recognise different management units within closely related populations increases the work of planning and conservation considerably and should not be taken without good evidence. Even when there is taxonomic uncertainty over whether populations are members of a metapopulation or populations of more than one species, planning can proceed; one resulting Action in a strategy may be to clarify their exact taxonomic status and relationships.

Populations under captive management can be significant resources for species conservation; these should be itemised by location, demographics, their inclusion in regional breeding programmes and extent of studbook recording, their ownership and availability for species conservation *in situ*.

2.4 Species biology

Given the diversity of species that may be planned, the following sections only provide indicators to what might be important for their planning; it is illustrative but not exhaustive. Annex 3 provides further information.

In many situations it is most unlikely that adequate information is available on all the topics. For example, for multi-species assemblages of harvested reef fish species, it is impossible to collect all the information. In these cases (Annex 2.6), planning can proceed based on (1) the use of proxy, possibly co-occurring species; or (2) best judgement on biological parameters.

Current numbers

Much conservation planning will be for species that meet any of the Red List criteria as 'Threatened with extinction'. This implies that there is at least basic information on the numbers of such species. Where population estimates may not be possible, for example with many fungi, plants or invertebrates, proxy measures may be necessary, such as the number of populations or the size of the occupied area.

The One Plan Approach (Annex 1) ensures that the following are all resources for species conservation planning:

- All wild populations in indigenous range (truly *in situ*);
- Wild populations that are out of indigenous range, but remain in a range state;
- Wild populations that are out of indigenous range, including where the species may be alien, and may or not be invasive;
- Individuals or populations held in a range of managed or confined situations, such as in zoos, aquariums, botanic gardens, ranches or private collections (*ex situ*);
- Preserved, living materials held in biological banks, such as seeds, propagules, semen, tissues;
- Comprehensive information on such populations includes their locations, the number of individuals and their demographic structure and performance, the nature and competence of any management, and their potential as contributors to species conservation strategies.

Population dynamics

Two measures here are especially important in planning:

- *Fecundity*: this is a measure of the number of offspring (in animals) or propagules (in fungi and plants) that are produced by an individual. Given the difference between a blue whale producing one calf every two to three years and a fish releasing tens of thousands of eggs every year from which a small percentage might survive, such information is necessary in planning.
- *Mortality rates and causes*: including age class-specific survival rates, the prevalence and impacts of stochastic environmental effects such as disease pandemics or extreme weather events; and the mortality rates from harvesting (legal and illegal) require specific ecological.

High-quality data on sex and age structures, and survival rates, allow population modelling and simulations that can provide very valuable insights for species planning. These issues are further explored in Annex 3.

Life history and ecological role

The life history characteristics of the individuals of a species cover the full range of requirements (such as habitat, diet) and activities (such as reproduction, movements) through different seasons, and at different life stages. This latter information may be critically important for development of an effective conservation plan in groups such as invertebrates and marine fish (Annexes 2.3, 2.6).

Such information also helps define the ecological role of any species, which may be as a keystone species or as an essential ecological engineer. The reduction in numbers or loss of such species may have profound ecological impacts.

While it may be difficult to determine critical ecological benefits from the presence of some species, each, nonetheless, has intrinsic value for biodiversity and ecosystem services that may not be well defined. Effort should be made to assess the ecological and socio-economic roles of any planned species and the diverse values (below) of maintaining them in viable numbers.

Habitat selection, including at different stages of life history

Habitat here includes all the living and non-living elements with which a species interacts during the lifetime of its individuals.

Species occurrence or distribution data can be used to develop species distribution models, based on a carefully selected array of environmental parameters; these models are then used to map species' habitat (*see* 'Habitat models' in Annex 9). Traditional ecological knowledge may be most useful in supporting modelling of habitat selection.

Two cautions are necessary around compiling information on habitat selection:

1 Some species require very different habitats at different stages of their life cycles: this is often the case with terrestrial invertebrates and for many aquatic species.

2 Some species, such as many insects, have very specific and small-scale habitat requirements at specific life stages: hence, effective planning will require detailed and accurate knowledge of these.

Mobility

The extent and nature of movements that members of a planned species make are of obvious importance to their planning. Some of the key questions around mobility that should be answered in a Status Review are shown in Annex 3.

Dispersal

The young individuals of many fungi, plants and animals move away from their home or breeding site, either actively or passively, as on the wind or by water. The mechanisms are multiple, and in animals there is variation in which gender moves away from the site or area of birth, and at what age. The Status Review should attempt to include a description of the species' dispersal process and pattern.

Diet and nutrition

As food supply is a common determinant of animal population distribution, the numbers of a species or the fitness of individuals, the diet of any planned species should be stated as fully as possible. Assessing nutritional quality is more difficult but can yield significant information.

Social behaviour

Essential information will comprise description of the normal social systems and behaviour of the planned species with their variability depending on circumstances. The latter might include the species' responses under adverse situations of reduced numbers or when forced into suboptimal habitat. Individuals of many species will exhibit radically changing social behaviour at different developmental stages.

Reproductive biology

The species of the fungal, plant and animal kingdoms exhibit a wide array of reproductive systems. Where these require specific ecological, physical or social conditions, this information will be essential for planning efforts given the importance of reproductive success and its processes in population dynamics. Annex 3 illustrates some factors associated with reproduction that may contribute to sound planning.

Disease

Disease has long been regarded as a rare and unwelcome disruption for wild populations and efforts to conserve them. In addition to accepting that disease may be one in a suite of natural factors that regulate population, its full role is now captured in the One Health principle, namely that the health of people, of animals (both wild and domestic) and of the wider environment are all interlinked.

Thus, the interplay between these groups results in many implications not just on their health but also for biodiversity broadly, on politics, economics and society.

Disease should therefore be considered in any species conservation planning, and the IUCN Guidelines for Wildlife Disease Risk Assessment provides help. Its Disease Risk Assessment is described further in Annex 4.

Genetics

An understanding of the genetic population structure of planned species may be very relevant and helpful. Reduced populations may have suffered loss of genetic diversity with implications for long-term viability. This can become more serious when previous populations are reduced and become sub-populations in small and fragmented habitat patches. Genetic analyses may in some instances be necessary to identify suitable management units.

Annex 3 describes further the techniques and opportunities in genetics that can provide greater understanding of species or populations, and hence be incorporated into planning for species persistence.

2.5 Values

While priorities for conservation planning may usually be based on scientific criteria such as rarity, endemism or reduced abundance, different groups in human society may attach quite different values to particular species; these may be the driving reasons for conserving a species, and may significantly influence conservation strategies.

For this reason, it is essential that local communities, containing experts (in the sense of Annex 3.3) in indigenous local knowledge, are engaged from the start in compiling their values.

2.6 Climate change

Responsible species conservation planning cannot ignore the current impacts of climate change, with possible increases in future. Hence, a Status Review should consider the impact of climate change on the planned species and the consequent influence it should have on the planning process (Foden et al., 2016b).

The topic is highly complex, dependent on the species and landscape, and the approaches to understand and confront climate change are still developing. Key issues include (1) the extent to which the planned species will be exposed to climate change; (2) the extent to which they can themselves respond adaptively; and (3) how adaptation planning will be conducted and implemented.

Annex 6 deals with these issues in terms of:

- Why should climate change be considered in species conservation planning?
- What are the key questions for planners to ask?
- How do planners embark on handling climate change issues?
- Where are the necessary information sources and short cuts to help?
- Where can further technical guidance be found?

2.7 Conservation context

Preparation for planning for any species should include determination of its legal status in each range country (and/or subsidiary legislative unit where there is a hierarchical system of government with devolved conservation legislation) within the geographic scope of the plan.

If a species is subject to a planning effort for its conservation, then it is likely to have been a priority in terms of its rarity, or endangerment, or of immediate use value. If so, then it is probably subject already to inclusion in conservation conventions or listings, such as those listed in Annex 3.

2.8 Active parties

The organisations and individuals engaged in conservation management or research on the planned species should be listed in the Status Review. These experts and their agency documentation can often be sound sources of conservation status information at population and sub-population levels. They may in due course be identified as stakeholders in the planning process (Section 2).

Similarly, all projects that relate to the planned species should be itemised.

2.9 Threats, Drivers of Threats and Constraints

A Threat to a species is any factor that causes a detrimental impact on population abundance. Hence, a compiling of known Threats is a first step for planning. It is common that more Threats will be identified during the analysis stage (Chapter 4) and also during conservation interventions; if so, they can be incorporated in subsequent revisits to the planning stage (Chapter 9).

The Status Review encourages identification of all known Threats. When a Strategy's Objectives are to be defined, often when stakeholders are gathered in a workshop context, the Threats are subjected to analysis, ordering and are often prioritised for conservation attention according to scope, severity of impact and other aspects such as urgency and reversibility (Chapter 4).

There are many alternative terms used around Threats. Here the most straightforward ones are

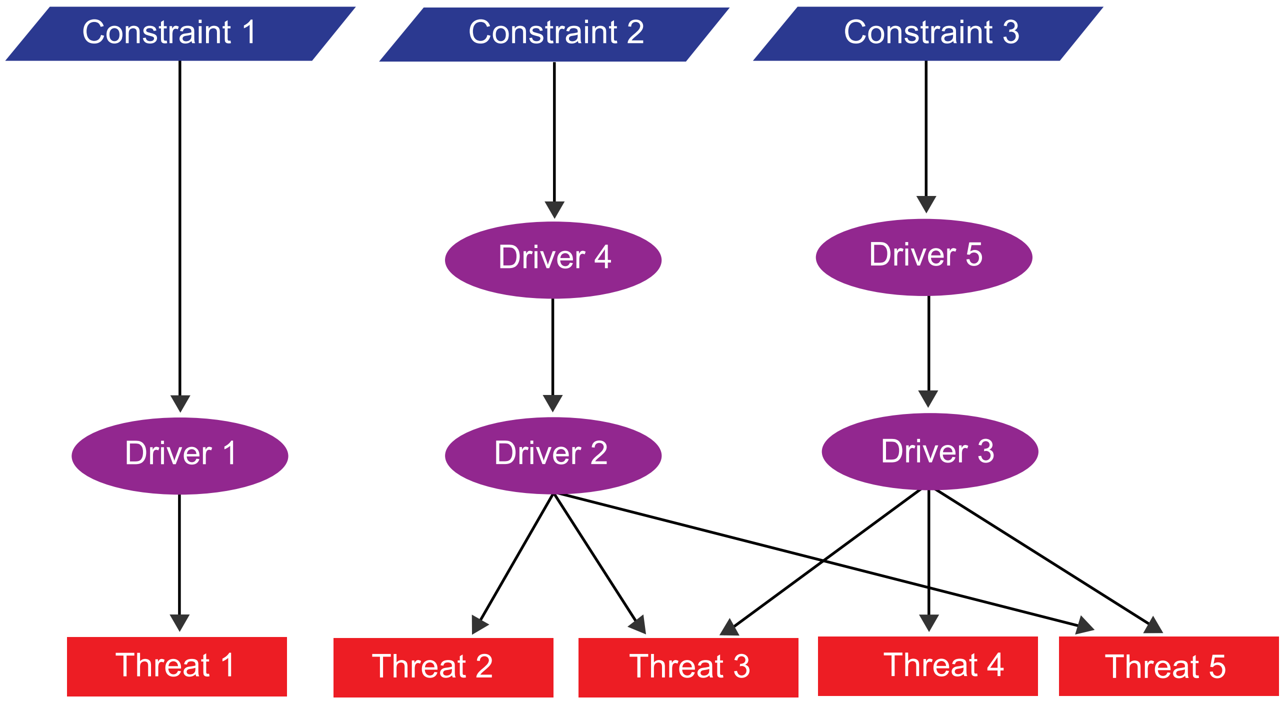


Figure 2.1: A model Problem Tree with Threats, Drivers and Constraints

used, but others are presented in IUCN-SSC (2008),[1] and defined in Annex 1 of Open Standards.[2]

Threats comprise the most fundamental impacts on species, and form the base of a hierarchy of further factors impacting any species (*see* Figure 2.1).

1 Direct Threats

These threats represent the immediate causes of detrimental impacts on a population. Most direct threats may be the result of human activity (e.g. road building, urbanisation and dam creation, direct harvesting, as well as changes in a management regime or introduction and competition from invasive species and other factors). However, direct threats can also arise from major disruptions to community structure (for example, see Cameron et al., (2011) on the role of bumble bees) and the consequent imbalance between species, leading to greater levels of predation or parasitism, for example.

Standardised classification schemes for threats are available from both the Red List[3] and the IUCN/ Conservation Measures Partnership (Salafsky et al., 2008). While comprehensive in scope, species planning may require identification of threats at finer scale and in more case-specific detail. Business tools for situational analysis of political, economic, social and technological macro-factors may help identify Threats, provided the social element includes adequate consideration of cultural aspects.

Planning for very small populations may have to focus on their recovery from possible extinction. Their main immediate threats may be stochastic or chance events; addressing these will be a priority, such as demographic support to increase numbers quickly or genetic reinforcement to reduce inbreeding, before the other primary threats to the population can be addressed.

1 http://cmsdata.iucn.org/downloads/scshandbook_2_12_08_compressed.pdf
2 http://cmp-openstandards.org/
3 http://www.iucnredlist.org/technical-documents/classification-schemes/threats-classification-scheme

2 Drivers of Threats

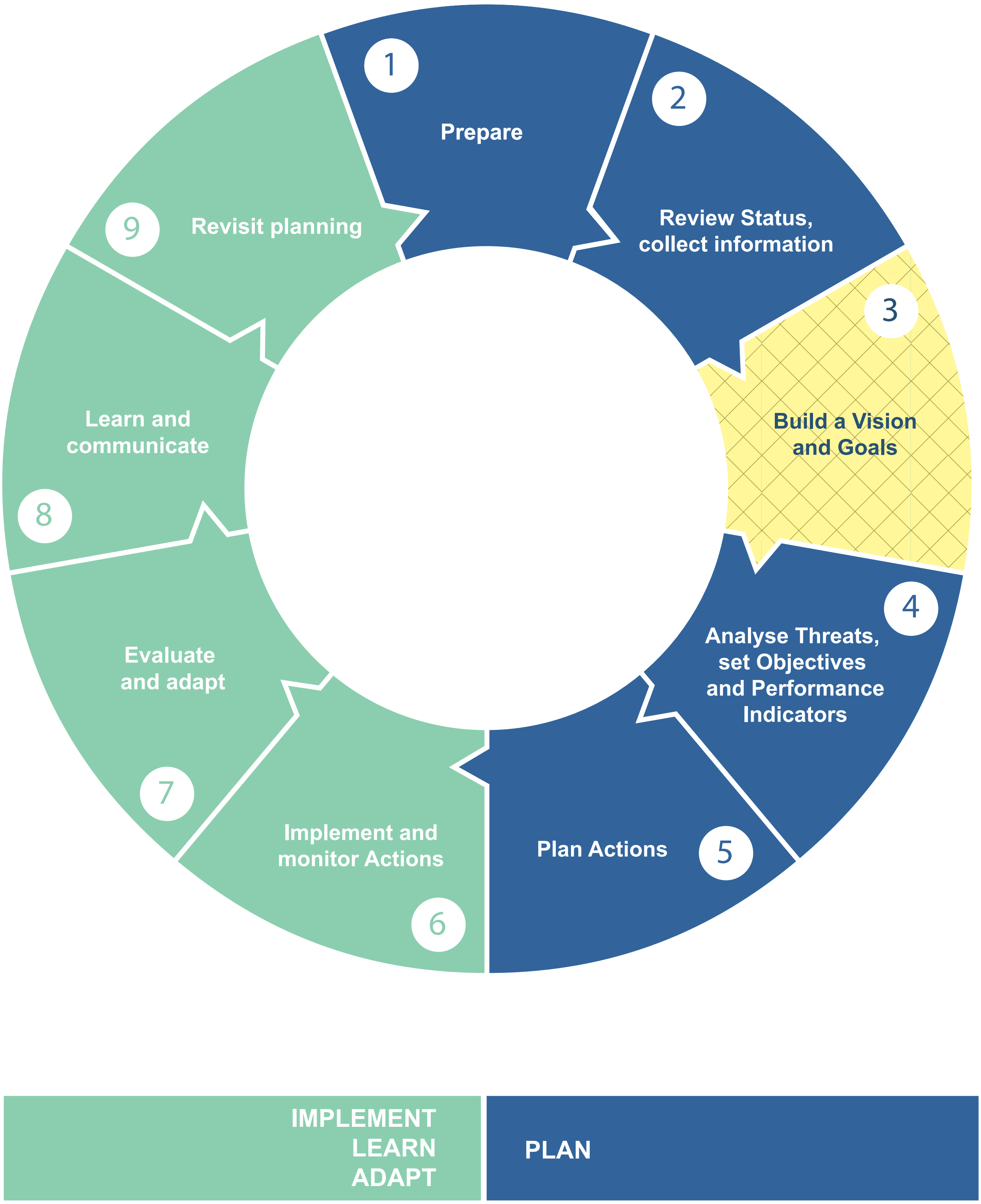
Drivers of Threats are the causes that sit behind direct Threats, and can be regarded as the root cause of a direct Threat to a population. Drivers can be identified by asking, 'What causes this Threat?' For example, agricultural subsidies may be a Driver of land use changes on the local scale, and these land use changes are a direct Threat to a species.

The same question applied to the Driver allows creation of a hierarchy of Drivers, originating from the direct Threat. Climate change can often be a Driver exerting influence through a long chain of other Drivers, as well as being a direct Threat.

3 Constraints

A Driver may have a further Driver which can potentially be reversed. By establishing a chain of Drivers after asking 'Why does this Driver exist?' for up to five times from the original direct Threat, a factor can usually be identified that does not itself impact negatively on the planned species but allows the Threats to have such impacts. This is called a Constraint. A Constraint is a major factor such as human demography, poor governance or armed conflict. While conservation planning often cannot reverse such Constraints directly or mitigate their impacts, planning can respond by adapting to them. A process for identifying Constraints through a Problem Tree is described in Chapter 4.

3. Build a Vision and Goals



Chapter 3

Building a Vision and setting Goals

Planning cycle stage 3

Chapter overview

1 The value of visioning.
2 How to make a good Vision.
3 The value of Goals deriving from the Vision.
4 How to build Goals.
5 Tools to help build Goals.

3.1 Vision

An overarching Vision outlines, in an inspirational and relatively short statement, the desired future state for the species. Hence, the Vision describes, in broad terms, the desired range and abundance for the species, its ecological roles, and it relationship with humans (IUCN-SSC, 2008).

For a short-lived and highly threatened invertebrate, the time horizon might be five years; in contrast, the Vision for a large mammal might be 30 or 50 years; a five to ten year Vision for an annual plant species might be appropriate, with 50 or 100 years for a longer-lived plant species. Fungal leaf parasites with several cycles of spore production each year might merit a five-year Vision, whereas a 50- to 100-year Vision might be more appropriate for long-lived wood-rotting polypores.

Box 3.1 contains some examples of Visions.

Box 3.1 Examples of Visions

1 Madagascar pochard, *Aythya* innotata, Madagascar

Populations of Madagascar pochard are increasing and restored and thrive in healthy, well-managed ecosystems, involving local communities and other stakeholders, contributing to sustainable development and being a source of pride as a flagship species for Madagascar (Woolaver et al., 2015).

2 Greater Bilby, Macrotis lagotis, Australia

In 2040, the Greater Bilby and its cultural and spiritual significance to Traditional Owners is valued and embraced by all Australians and by the global community. Together we engage through effective partnerships providing legislative, management and stewardship framework that support a secure, viable and self-sustaining population of bilbies in the wild, across and extended range (Bradley et al., 2015).

3 Adriatic marbled bush-cricket, ***Zeuneriana marmorata***, Italy

The Italian North Adriatic coastal area will maintain a well-connected network of open wetland habitats, including reeds, marshes and wet meadows, which will be under sustainable conservation management, sustaining large viable populations of *Zeuneriana marmorata* and other associated threatened wetland species (Hochkirch et al., 2017 b).

4 White-bellied Heron, ***Ardea insignis***

By 2020 we will achieve the effective conservation of White-bellied Heron across its range countries. White-bellied Heron conservation will inspire and challenge people to maintain and create healthy riverine eco-systems and their dependent human communities (Stanley Price and Goodman, 2015).

A good Vision statement should be inspirational, capturing the conservation ambition that is desired for the species in simple and general wording. The level of detail should be appropriate for the situation. A very comprehensive Vision might include:

- Ensuring the ecological diversity of habitats used, and genetic diversity across any sub-populations;
- Aiming to have replicates of populations in similar ecological conditions, so that any local extinction would not be the total loss of possibly a unique range area or genetic material;
- Ensuring the species' numbers and the sizes and locations of areas used are large enough for self-supporting populations to play their full ecological roles, and sustain genetic diversity;
- Ensuring inclusion of human social, economic and cultural needs and values, especially where there is sustainable use by local communities;
- Including resilience in the species' prospects for persistence in the face of ecological change and challenge over the planned period;
- Ensuring appropriate backup *ex situ* actions are taken to underpin *in situ* actions, which if required can act as a reintroduction source;
- Specifying a time period for the Vision.

Developing the Vision is an important part of the planning process because it summarises the values attached to the species by the stakeholders. These values are best drawn out through a facilitated group discussion in a workshop setting.

3.2 Goals

While the Vision is a statement of the ideal situation for the long term, the Goals are practical, concrete steps that contribute directly to achieving the Vision. The Goals may be seen as 'the Vision redefined in operational terms' (IUCN-SSC, 2008). If the Goals are met, then it can be claimed that the Strategy and Plan has been successful.

The Goals are important in specifying how the Vision is to be interpreted; as they lie between the Vision and the more specific Objectives, it is important to understand the characteristics of Goals. In general:

If the Vision includes reference to maintaining a viable population, then the Goals should translate this in terms of how many sub-populations of how many individuals,

A Goal should have a timeframe; for most species it is likely to be difficult to develop Goals for more than five to ten years ahead.

The Goals may include ambitions such as improving the species' IUCN Red List status or achieving an improved conservation state, as will be defined by IUCN-SSC's Task Force on Assessing Conservation Success.

If the Vision is adequately refined, there should not need to be more than five Goals; any more will make the resulting Strategy hard to manage.

The set of Goals may refer to a range of timeframes such as short, medium or long term, all consistent with the time stated in the Vision.

Box 3.2 contains some examples of Goals with their associated Visions.

Box 3.2 Examples of Visions with their Goals

1 Adriatic marbled bush-cricket. *Zeuneriana marmorata*, Italy

Vision

The Ljubljansko barje, a unique marshland with outstanding value regarding its natural and cultural heritage, will maintain large areas of well-connected wetland habitats, under sustainable meadow management, supporting a large viable population of the Adriatic marbled bush-cricket, *Zeuneriana marmorata*, and other associated threatened wetland species. It will become a major pillar of a network of wetlands ranging from northern Italy to Slovenia that maintain populations of *Zeuneriana marmorata*.

Goals

Goal 1: Habitat management
To increase the area of high-quality wet grassland habitat in concordance with other relevant plans and strategies, facilitating population growth and spread of *Zeuneriana marmorata* and other threatened species in the area.

Goal 2: Species support
To increase the population size and area of occupancy of *Zeuneriana marmorata* in the Ljubljansko *barje*, obtain full protection under national law and develop approaches to protect the species from potentially detrimental effects of climate change.

Goal 3: Research
To obtain the information necessary to understand the distribution, specific requirements of the species, the best practice of habitat management and restoration as well as the identification of conservation units.

Goal 4: Public awareness
To build public awareness of the values of the unique wetland ecosystem, the rarity of and responsibility for the unique bush-cricket species as well as the associated threatened flora and fauna (Hochkirch et al., 2017a).

2. Raffles' banded langur, ***Presbytis femoralis femoralis***, Malaysia and Singapore

Our 50-year Vision

The Raffles' banded langur thrives in intact rainforest, ranging freely in viable, connected populations, widely appreciated and well understood. As a valued part of the natural heritage in both Malaysia and Singapore, it exemplifies synergistic conservation collaboration across its range.

Goal 1: To recover and protect Raffles' banded langur in the wild, ensuring that:

- The rainforest habitat of the taxon is intact, where necessary restored, and safeguarded.
- Wild populations are connected where needed.
- Genetic and demographic viability are ensured.

Goal 2: To gather key data through ongoing studies, ensuring that:

- Its taxonomy and systematics are clarified, and the biology and ecology of the taxon are well understood.
- Long-term monitoring and conservation research are in place.

Goal 3: To secure the necessary resources and commitments for long-term conservation of Raffles' banded langur, ensuring that:

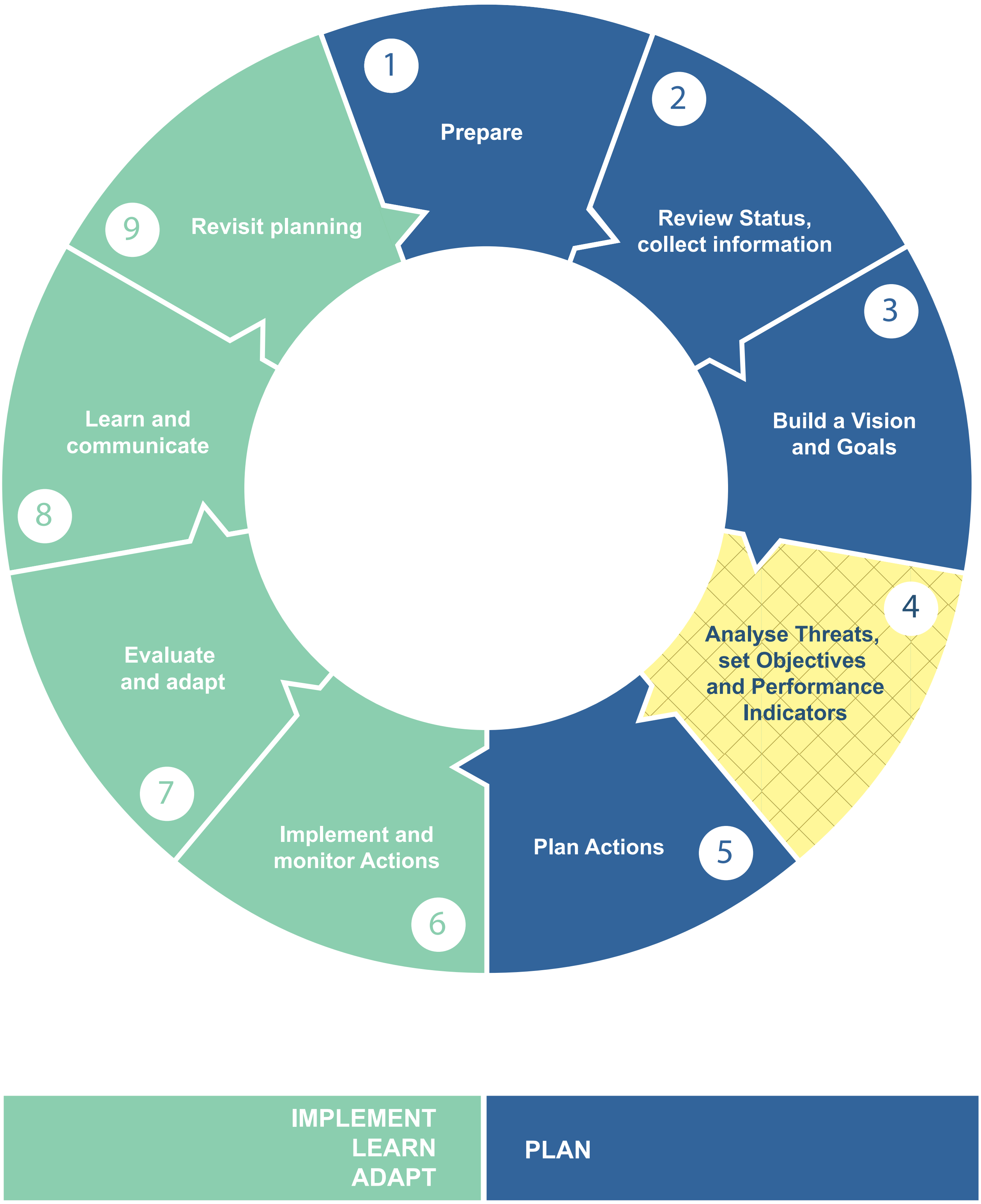
- There is strong public awareness and government support.
- Cross-country collaboration is strengthened and long-term financial support has been secured (Ang et al., 2017).

During the setting of Goals, it will become apparent that there is no single 'right' Goal or Goals: there are choices and alternatives, each of which may be suited to a particular planning approach. There are tools to help define quantitative Goals,[1] and both the IUCN-SSC Handbook (2008) and the Cat Compendium (Breitenmoser et al., 2015) describes how Goals can be formulated.

These alternative approaches will be reflected in the options to be considered later over Actions and adaptive management (Murphy and Weiland, 2014).

1 www.cbsg.org/abruzzi-table-1-planning-tools-index

4. Analyse Threats, set Objectives and Performance Indicators



Chapter 4

Analysing Threats, setting Objectives and Results

Planning cycle stage 4

Chapter overview

1 The purpose of analysing Threats.
2 One simple way to construct a Threat analysis.
3 Key outputs: Threats, Drivers of Threats, Constraints.
4 Ranking the severity of Threats.
5 Connecting Goals with Threat-based Objectives.
6 Checking the Objectives will meet the Goals.
7 Indicators of Objectives being met: Results.

4.1 Analysing the Threats

This stage of the planning process will usually take place in a workshop setting (Section 2). The starting point is the Threats which were listed in the Species Review (Chapter 2).

The aim of this analysis is to:

- Assess the list of threats, and add to or modify it;
- Group separately the Threats and their Drivers according to their impacts;
- Identify the Constraints that allow the threats and their Drivers to operate;
- Construct a Problem Tree (below) from the agreed Threats, Drivers and Constraints;
- Identify which are the most important ones to address through the conservation Strategy;
- Use this information to identify Intervention Points (Chapter 5).

The results of the analysis of threats are the basis for specifying the Objectives of the Strategy.

4.2 Constructing a 'Problem Tree' from Threats, Drivers and Constraints

There are several ways in which Threats can be analysed and the relationships between them displayed.[1] The Problem Tree is a common approach to analysing and organising Threats, their Drivers and Constraints. It is best done in a workshop setting (Section 2), taking advantage of the multiple perspectives, interests and experiences across all the stakeholders present. The Problem Tree becomes the basic conceptual model for making decisions in the later stages of planning (Chapters 5, 6).

The starting point is the direct Threats and their Drivers identified in the Species Review. Constraints are more likely to be identified in the workshop, based on the principle of asking 'Why'? (Chapter 2). Figure 2.1 shows the generic structure of a Problem Tree.

There are several ways in which a Problem Tree can be constructed and populated with identified Threats.[2,3] A popular workshop method has each Threat written on a coloured card; the cards can then be ordered and reordered to depict the best-effort conceptual model of the impacts of Threats and their underlying causes.

Figure 4.1 shows a Problem Tree with clusters of similar Threats and Drivers sorted into Themes or Factors based on their similarity.

Figure 4.2 shows an example of an actual Problem Tree.

While construction of a Problem Tree, as above, can be largely straightforward, planners should be aware of the following:

1 www.cbsg.org/threats-analysis-processes
2 http://cmp-openstandards.org/download-os/
3 www.catsg.org/index.php?id=293

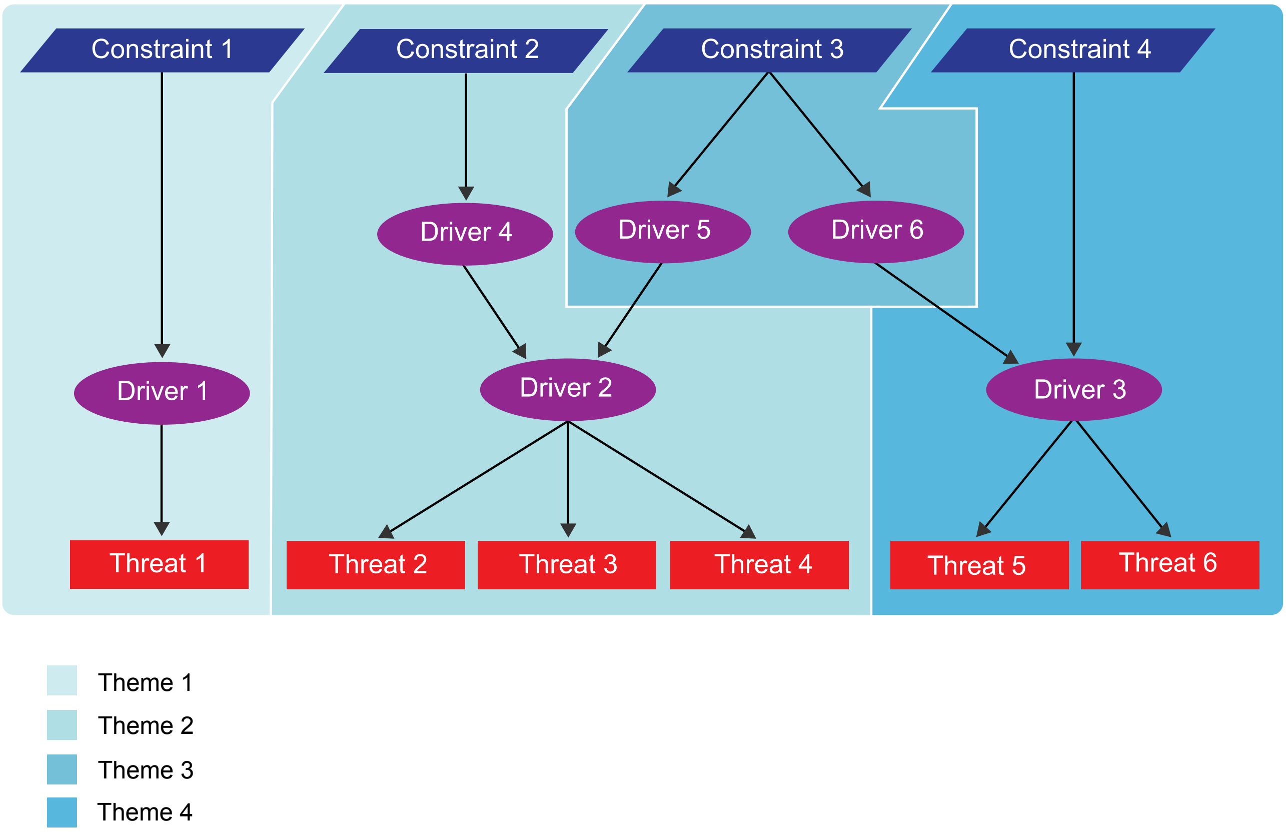


Figure 4.1: A model Problem Tree showing Themes

- It may prove impossible to distinguish between direct Threats and their Drivers, and indeed some factors may be either depending on the situation.
- Threats are often linked and may have a cumulative effect or interact with other Threats, so it is not always easy to differentiate between them clearly.
- Some root causes or Constraints, such as policy issues, do not directly relate to individual threats, because their mechanisms are complex and indirect.

4.3 Identifying the most important Threats

The most important Threats are those which the conservation Strategy and Plan will prioritise to address.

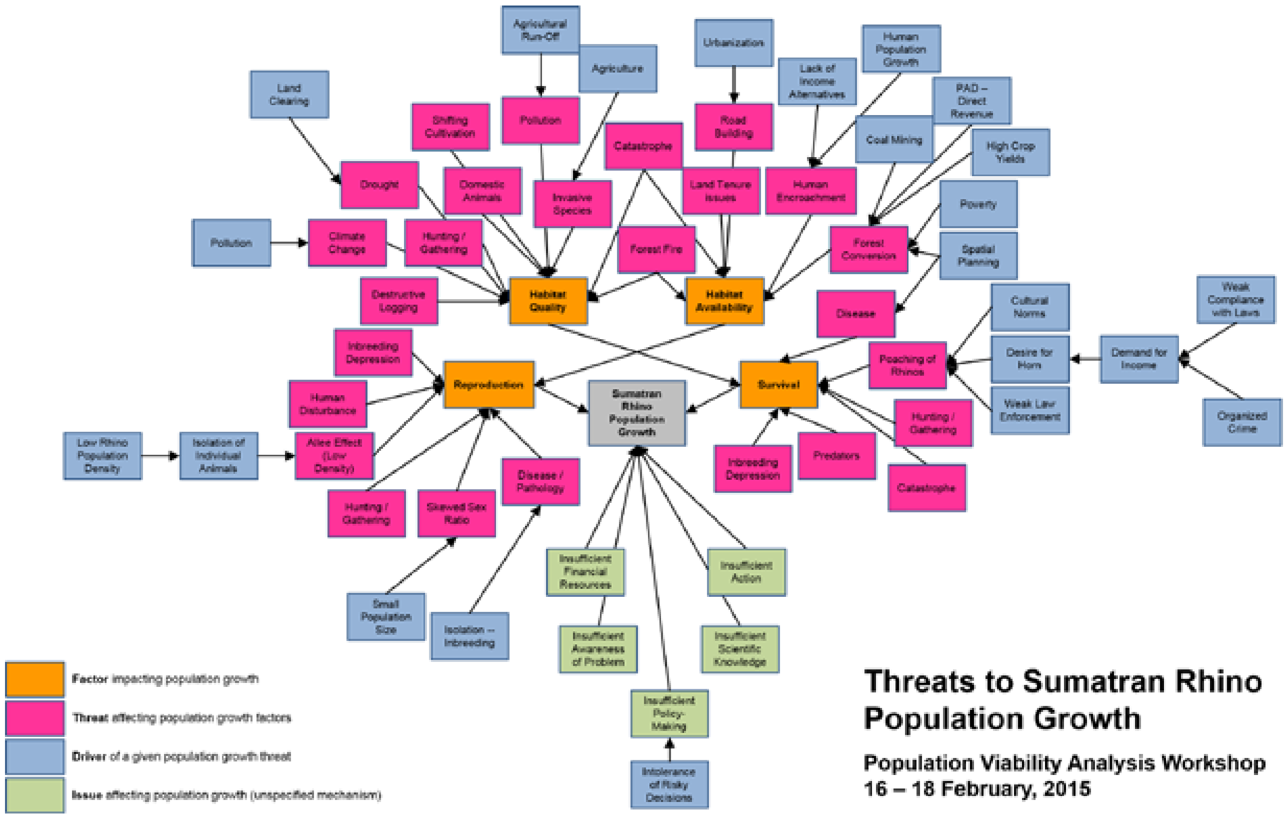
It is important to prioritise the Threats because (a) tackling the priority Threats may be the most cost-effective and most direct way in which to make a significant improvement in the planned species' status; and (b) it may be impossible to address every Threat if there are many, for reasons of human capacity or other resource limitations.

For the purposes of assessing the impact of a Threat or comparing Threats, the following questions might be helpful:

- Is the Threat expected to remain at the present level, or to increase or decrease?
- What is the urgency? Is the Threat in the past and gone, or effective now, or expected to become a Threat in future?
- How much of the population is affected?
- How severe is the effect of the Threat?
- How reversible is the Threat?

Threats can be ranked quantitatively on a combination of their scope, severity and irreversibility, and detailed guidance on methods, with examples, is easily accessible.[4]

4 www.cbsg.org/tools-library-threat-ranking-tool-miradi-software



An actual Problem Tree (Miller et al., 2015)

4.4 Developing Objectives

Developing Objectives is the next step in the planning cycle.

An Objective is a positive statement of what is to be done to contribute to meeting a Goal. An ideal Objective is both specific and quantitative. Each Goal should have as few Objectives as are necessary for it to be met.

One starting point is to create Objectives around the themes identified in the Problem Tree. If followed through, then the Objectives can be checked to ensure that (1) they will meet the Goals, and (2) they address all Threats.

The Objectives are the framework on which Actions (Chapter 5) will be developed.

When developing Objectives and Actions (Chapter 5), a useful principle is that they should be 'necessary and sufficient' to meet the Goals. This means that if the range of Objectives and Actions do not meet the Goals, then the Strategy will be incomplete. Conversely, if some Objectives and Actions are not necessary to meet the Goals, then they should be dropped.

The potential for *ex situ* activities to address Threats should not be overlooked when developing Objectives. The 'IUCN Guidelines for the Use of *Ex Situ* Management for Species Conservation' show when and how this can be a valuable tool for species conservation.[5]

Box 4.1 contains selected Goals and Objectives from two strategies.

4.5 Results

The Objectives have the dual purpose of contributing directly to meeting the agreed Goals while at the same time addressing the priority Threats. They are, therefore, perhaps the most critical planning element to be based on best evidence and rigorous thinking.

5 www.cbsg.org/iucn-ssc-ex-situ-guidelines

Box 4.1 Goals and Objectives: extracts from conservation strategies

1. Adriatic marbled bush-cricket, ***Zeuneriana marmorata,*** Slovenia

Goal 2: Species support

To increase the population size and area of occupancy of *Zeuneriana marmorata* in the Ljubljansko *barje*, obtain full protection under national law and develop approaches to protect the species from potentially detrimental effects of climate change.

OBJECTIVE 2.1 PROTECTION
To add *Z. marmorata* to the list of nationally protected species in Slovenia including a whole revision of Annex II facilitating the conservation of other threatened species.

OBJECTIVE 2.2 TRANSLOCATION
To create a new population of *Z. marmorata* by translocating it to a potentially suitable habitat that is currently not occupied and might serve as a backup population also facing the threat of climate change.

OBJECTIVE 2.3 MONITORING
To monitor the population trend, distribution, habitat trend and threats of *Z. marmorata* in the Ljubljansko *barje* (Hochkirch et al., 2017a).

2. Raffles banded langur, ***Presbytis femoralis femoralis***, Malaysia and Singapore

Goal 3: To secure the necessary resources and commitments for long-term conservation of Raffles banded langur (RBL), ensuring that:

- There is strong public awareness and government support;
- Cross-country collaboration is strengthened and long-term financial support has been secured.

Objective 14. Create a platform for intergovernmental cooperation to address a unique conservation opportunity.

Objective 15. Build on existing personal relationships to establish an interagency platform for participation and prioritisation of the RBL.

Objective 16. Provide an education and outreach programme on the unique identity of the RBL and the urgent need to conserve it: (a) to raise the profile and increase awareness of the RBL and (b) to increase ability to distinguish local primate species and increase tolerance towards them.

Objective 17. Communication from existing knowledge base to agencies and policymakers to develop a plan to connect forest fragments and other actions (e.g. preserving and protecting gazetted areas).

Objective 18. Use results from further study of RBL to create awareness and guide policies, particularly in Peninsular Malaysia.

Objective 19. Identification of all stakeholders who play and can play a role in effective conservation of RBL, as well as providing a platform for sharing information and customising the message to motivate individual stakeholders.

Meeting an Objective will probably take many years and require many Actions (Chapter 5).

To help assess progress over such time spans, Results are an intermediary element (*see* Figure 4.3), acting as performance indicators for the effectiveness of the Actions. Thus, if the Actions are correctly defined and implemented, then their Results should directly support the attainment of their Objective. For this purpose, it is preferable to have no more than one or two Results for each Action. Figure 4.3 shows the role and position of Results in the planning hierarchy.

The performance indicators for the Actions are the Results (Chapter 4). To ensure the Results are as useful as possible, each should be defined following the criteria as used in the Cat

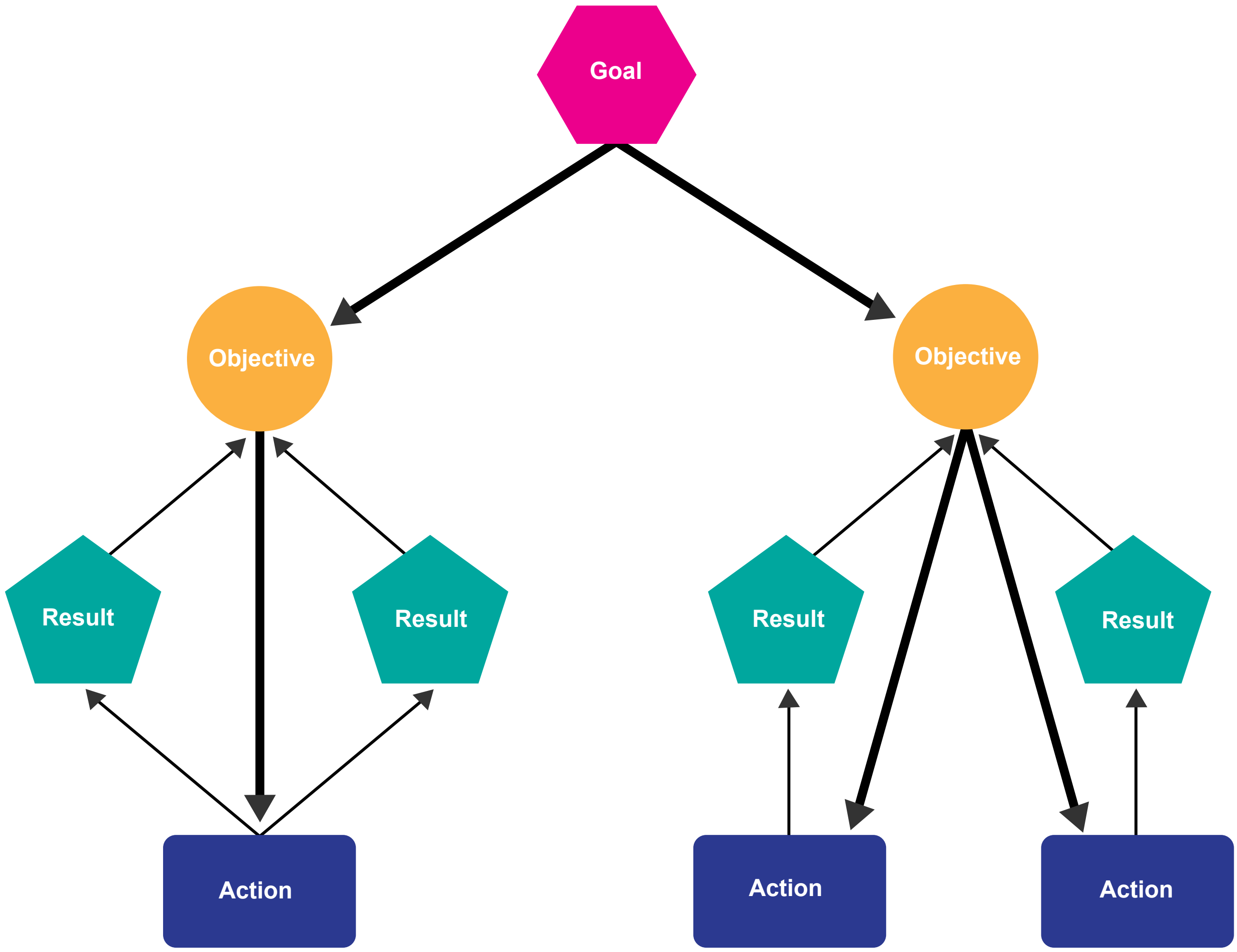


Figure 4.3: The position and role of Results

Conservation Compendium (Breitenmoser et al., 2015):

S: it must be Specific in its phrasing so that the desired result is clear and that an action is needed to achieve it.

M: The result must be Measurable so that it is evident when it has been achieved; this serves as an Indicator that the actions to meet the result have been implemented and are successful.

A: The Result must address identified Threats and opportunities, as well as considering the Constraints whose impacts can be lessened, so that it is Achievable.

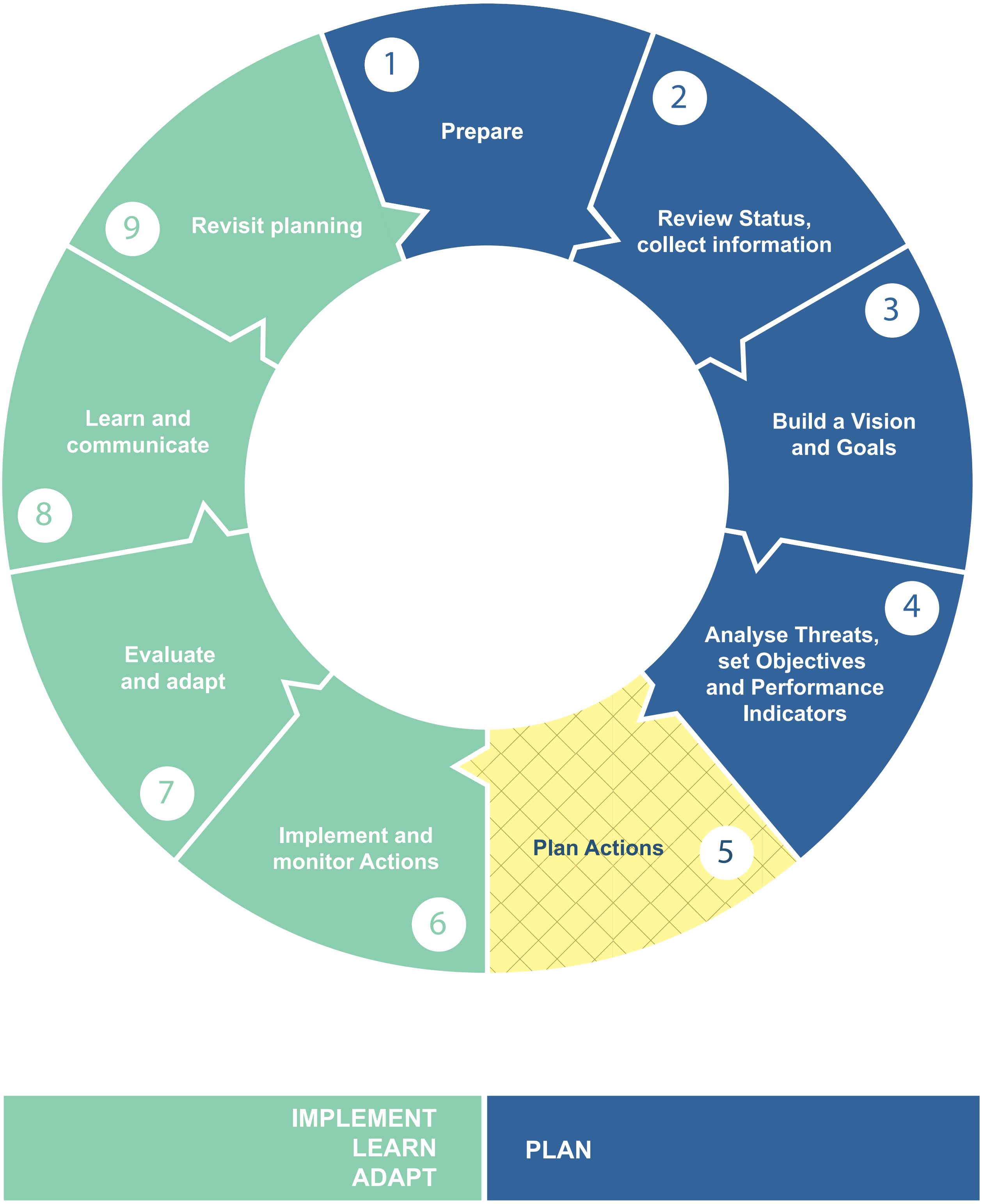
R: Even if the Result is in principle Achievable, it must be Relevant: this acts as a check that it is in the plan because it is necessary and sufficient (above) to meet the Goals.

T: To enable delivery of Actions in the right sequence and to address urgency or other priority, every Result should be Time-bound.

Defining a Result forces analysis in terms of 'If this Action is taken, what will be the Result?' and 'Will this Result contribute to meeting its Objective?' This thinking in terms of cause and effect is the basis for Results Chains (Chapter 5) which help in testing sequences of Actions and Results in support of Objectives.

If formulated correctly, a Result is not just a record of an Action being taken but comprises a genuine conservation impact, such as a new law being enacted, a new protected area established, or a demonstrable reduction in illegal offtake.

5. Plan Actions



Chapter 5

Planning Actions

Planning cycle stage 5

Chapter overview

1 What are good Actions?
2 Combining Actions into a plan.
3 Where to act most effectively: Themes and Intervention Points.
4 Deciding between alternative Actions.
5 Clarifying the intended outcomes of Actions.
6 Making decisions in complex situations.
7 Adapting the Plan through Learning.

5.1 What are Actions?

Chapter 4 described how each Objective can be met by a set of Results.

Each Result is achieved through implementation of one or very few Actions. Actions are the building blocks of a conservation Strategy or Plan; their collective implementation will ensure the Objectives are met, thereby addressing the Threats, and these will contribute to achieving the Goals.

A good Action should be defined in the following terms:

- What is to be done?
- When is it to be done?
- Who will do it?
- Who is responsible/accountable for it being done?
- What resources are needed?
- What shows it has been done?

The close and precise relationship between Actions and their Results is a key aspect of an effective Strategy. Box 5.1 shows detail on Actions (Activities) and their intended Results from the conservation Strategy for cheetah and African wild dog in southern Africa.

Annex 7 has a further example from the strategy for the Madagascar pochard (Woolaver et al., 2015), showing use of two languages and details on risks and opportunities around Actions.

5.2 Prioritising: targeting Intervention Points

Determining which Actions to implement as priorities is one of the most critical steps in the planning process, for a range of Actions may be available to meet an Objective through addressing critical Threats and the political, economic, social and technological Drivers of those Threats.

Many teams develop their implementation plan based on what they know how to do, not necessarily what is most needed or strategic.

To overcome such subjectivity, the Problem Analysis and Tree provide a conceptual model from which key Intervention Points can be identified as those factors that need to be influenced to best meet the Objectives and reduce Threats to the target species. This narrows the potential Actions that could be taken.

The grouping of threats into themes may allow a suite of Threats to be addressed at the same time by tackling the Theme itself.

Considerations for prioritising where to develop Actions include:

- Maximising the contribution of an Action in reducing Threats; or
- Developing an Action for the Threat which will influence multiple other Threats or factors in the conceptual model; or
- Selecting related Threats or factors which need to be urgently addressed.[1]

1 http://cmp-openstandards.org/

Box 5.1 Example Vision, Goal, Theme, Objectives and Activities taken from the strategic log frame of the revised and updated 2015 Regional Conservation Strategy for the cheetah and African wild dog in Southern Africa (RWCP and IUCN-SSC, 2015).

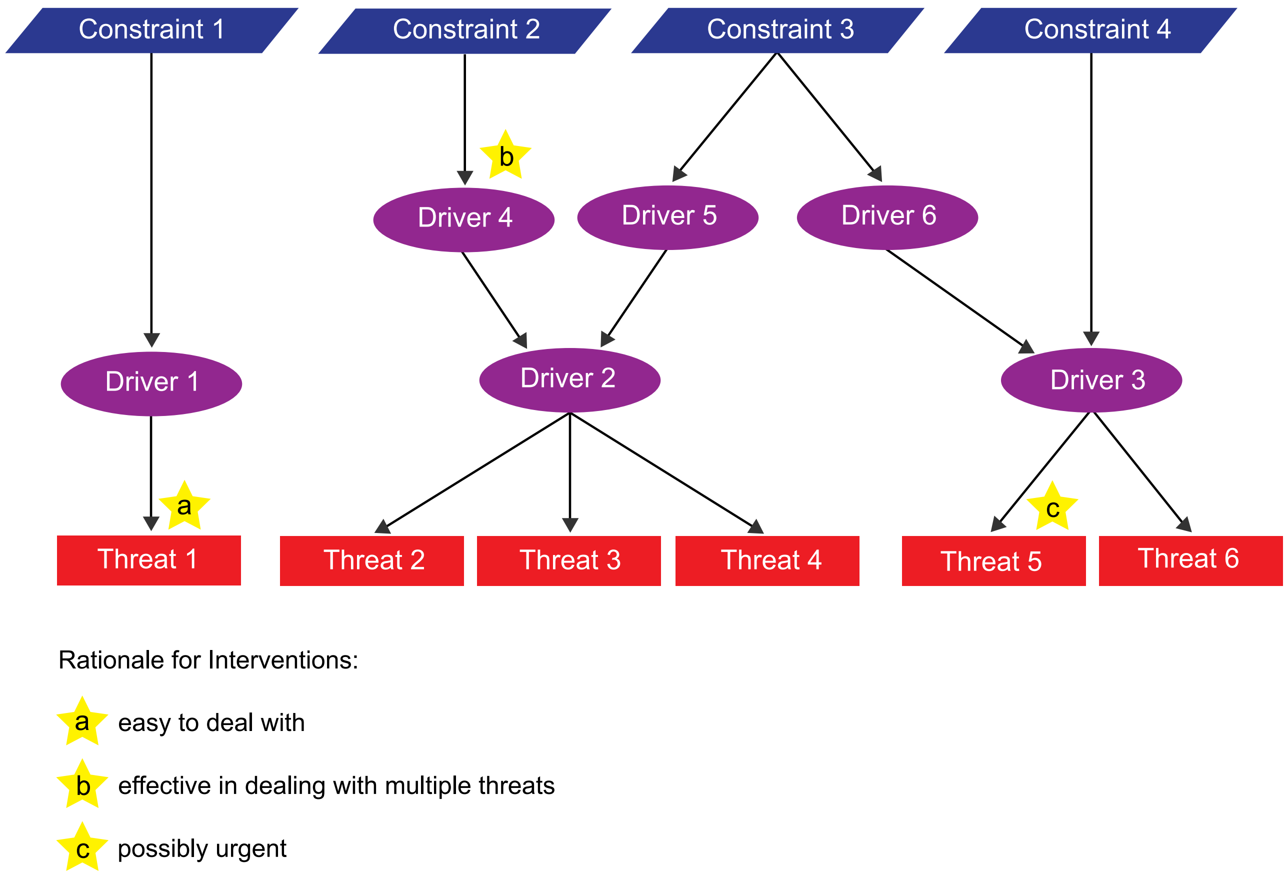
Note: 1 'Activities' here are the same as Actions; 2 The 'Theme' heading is as in Figure 4.2

VISION: Secure, viable cheetah and wild dog populations across a range of ecosystems that successfully coexist with, and are valued by, the people of southern Africa.

GOAL: Improve the status of cheetah and wild dogs, and secure additional viable populations across their range in southern Africa.

Theme	Objective	Results	Activities
Capacity Development	1. To develop capacity in all aspects of cheetah and wild dog conservation in southern Africa	1.1 National gaps in capacity in all areas of cheetah and wild dog conservation in the region are identified and documented	1.1.1 Establish current situation and identify gaps for all capacity components (law enforcement, monitoring and research, education outreach, protected area management, political, etc.) in each country
			1.1.2 Integrate national reports into a regional synthesis
		1.2 A regional strategy is developed for capacity development (based on the regional synthesis report) across all levels	1.2.1 Identify a committee member from each country to develop the Regional capacity development strategy
			1.2.2 Develop the results and activities required for capacity development at the national and regional level, aligned where possible with international initiatives
			1.2.3 Identify and engage with appropriate training institutions
			1.2.4 Activate and source funds to implement the capacity development strategy at the national or regional level, wherever appropriate
		1.3 The Regional Capacity Development Strategy is implemented and evaluated	1.3.1 Implement the activities identified by the Regional Capacity Development Strategy (in 1.2.2 above)
			1.3.2 Make use of the RWCP website to disseminate the Regional Capacity Development Strategy and relevant resources, and facilitate networking
			1.3.3 Establish mechanisms for evaluating effectiveness of Regional Capacity Development Strategy
			1.3.4 Evaluate the effectiveness of the Regional Capacity Development Strategy using the mechanisms established in 1.3.3

Figure 5.1 shows how Intervention Points can be identified from a Problem Tree.



5.3 Will the Actions meet the Objectives and deliver the Goals?

Assumptions and alternative Actions

Despite prioritising Actions, as above, it is possible that the first choice set of Actions will not lead to the desired Results.

There are three classes of causes for the possible situation of less than effective Actions:

1 *Assumptions*

- Holding a subjective belief that an action will yield the required result.
- Holding a subjective, possibly prejudiced, view on the causal relationship between action and result.
- Errors were made in the analysis of the relationships between the Goals, Threats and Objectives.
- Inadequate understanding of the biological or socio-economic system is being planned.
- Failure to appreciate that what may be conventionally accepted as fact is actually an untested assumption.
- All Actions by different parties will be implemented according to the plan's schedule, and that the desired outcomes from interventions will also happen on schedule.

2 *Uncertainty*

- There is genuinely a lack of essential knowledge about the planned species or their ecosystem (e.g. Bradley et al., 2015).
- There was genuine uncertainty over the consequences of an Action, or the causal relationships between sequential Results.

3 *Decision-making*

- With the intention of reducing the chances of unintended consequences, that might be harmful to the species, least-risk decisions were taken but they were not the best ones to meet the aims.

- Planners decided on an Action which allowed them, conservationists or authorities to remain in their comfort zones.
- A decision to proceed with a course of Actions was taken without adequate assurance that all resources needed were available.
- There are methods for addressing all these situations:
  1. Generate alternative Actions.
  2. Test the outcomes of proposed Actions.
  3. Use a structured approach to decision-making in complex situations.
  4. Build adaptive management into implementation and monitoring of the plan.

Each is described below. Between them they allow construction of second or third choice strategies, based on different Actions or combinations. The alternative choice strategies can be ranked according to the considered likelihood of their being effective.

Developing Actions takes place in the final stages of the participatory workshop. Rigorous thinking is needed to formulate good Actions which include all the elements listed above; this will increase the probability that the Actions best able to yield the desired Results will be identified, which will in turn contribute to meeting an Objective, and then a Goal. This same process is explicit in the 'IUCN Guidelines for the Use of Ex Situ Management for Species Conservation'.[2]

Sections 5.4 to 5.8 address ways in which Actions and alternatives can be assessed.

5.4 How can the best Actions be chosen?

Optimising the selection of Actions will be an iterative process that may require rapid assessment and prioritisation of potential actions in relation to each other, further testing using some of the qualitative and quantitative methods available (below) and reassessment of alternative Actions before finalising the optimal choice.

Numerous tools exist to support teams in the selection and testing of optimal actions[3] (Gregory et al., 2012b). Some of these tools require more or less investment and depend on the skills of the participants or facilitators using the tools. For example, the Open Standards for the Practice of Conservation (CMP, 2013) supports the rapid assessment of potential impact and feasibility.

The fundamental test for any possible Action is that it will deliver the intended result. Much conservation thinking and selection of Actions are still based on belief or tradition, rather than on an evidence base. If there is evidence that an Action has yielded such Results in the same or similar circumstances, then one can have some confidence in the Action. Hence, the selection or validation of Actions can be assisted through evidence-based analyses and methods.[4,5] Although there are models for using scientifically based knowledge as a support for conservation decision-making (e.g. Dicks et al., 2014), in reality a lack of evidence can lead to risk-averse decisions and hence inaction. This may be more damaging to the planned species than acting quickly on best available information (*see* Section 5.9) and being prepared to plan again as Results or further information allow.

5.5 Outcomes and Results Chains

Predicting the outcomes of Actions

Carefully constructed analysis can increase the likelihood that Actions will deliver the desired Results. This is especially important when more than one Action is feasible and appears promising.

This section outlines various methods for making such analyses, starting with more qualitative methods, continuing with simple quantitative methods and ending with more complex and comprehensive approaches.

Results Chains

Results Chains are a useful planning tool that enable teams working together to clarify and test assumptions about how actions are believed to contribute to threat reduction and achieve the

2 www.cbsg.org/iucn-ssc-ex-situ-guidelines

3 http://cmp-openstandards.org/

4 www.cebc.bangor.ac.uk/

5 www.conservationevidence.com/

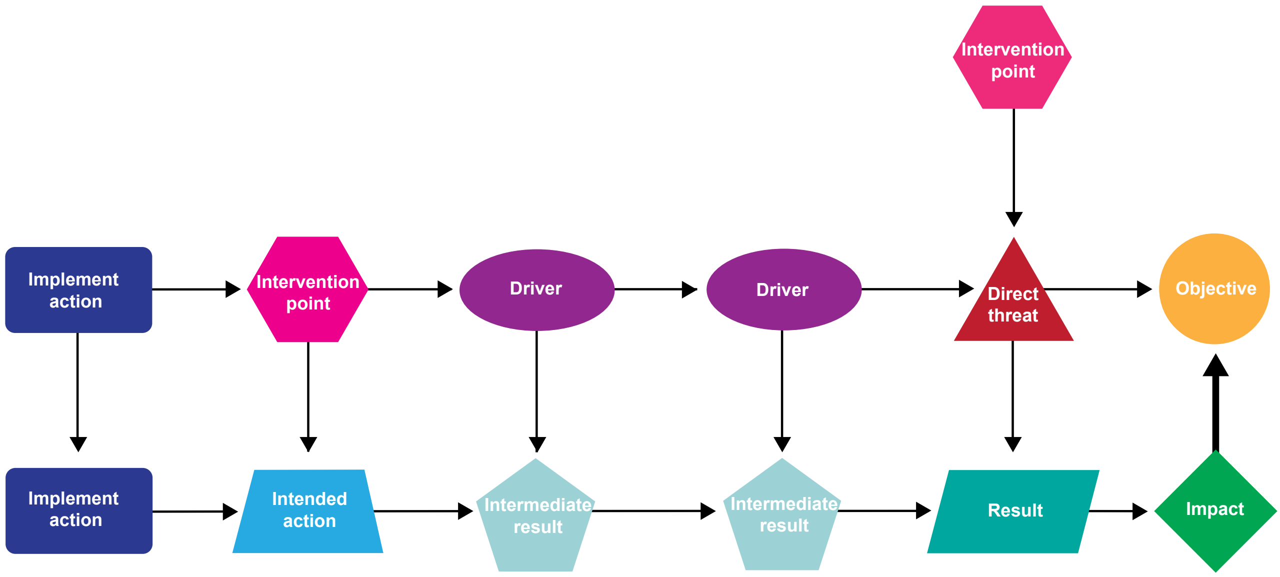


Figure 5.2: A general Results Chain, based on Open Standards and re-drawn (CMP, 2013)

conservation or protection of target species.[6] They may be especially useful in the early stages of planning when information is limited, for they can be used for explicit testing of assumptions to determine whether potential strategies are likely to achieve desired results.

A Results Chain is a diagram that maps out a series of causal statements that link factors in an "if … then …" fashion. Results Chains are composed of an action, a desired result or results and the ultimate impact that these results will have on the planned species through contributing to a Goal.

Figure 5.2 shows a generic Results Chain.

Annex 8 has a more complex Results Chain, using the terminology of the 'Open Standards for the Practice of Conservation'.

5.6 Quantitative approaches to testing the outcomes of Actions

Quantitative methods allow comparison of conservation outcomes more objectively and transparently than other approaches. Further, they allow consideration of multiple factors, constraints and dynamics, which cannot be done reliably with qualitative methods.

6 http://cmp-openstandards.org/

Quantitative and qualitative methods are not mutually exclusive and can be combined in useful ways to enhance the insights derived from planning. For example, quantitative methods allow determination of the importance, relevance or effectiveness of each 'arrow' between the Actions and the Results boxes in a qualitative Results Chain. Quantitative methods need not be complex or difficult.

The range of methods and their selection are covered in Annex 9.

Selecting methods

This section sets out various methods; these include both simple and complex approaches such as calculations, statistical analyses and quantitative models.

Using more than one method to answer the same question increases confidence in the results, or allows discovery of uncertainties, hidden assumptions, and other issues that need to be resolved.

The first task is to specify the exact question(s) to be answered. The more specific the question, the easier it is to determine the best method to use. For example: Which placement or configuration of protected sites maximises species viability? What is the minimum number of individuals to translocate in order to increase the overall chance of species survival? What is the maximum level of collecting or hunting or illegal poaching that could be sustainable? How large an area of habitat needs to be restored/protected to ensure long-term recovery of the species?

After specifying the questions for the analysis to answer, select the simplest method that can potentially answer the question, and the most complex method that is feasible (given any limitations on data, time and expertise).

The most common quantitative methods for predicting the species' responses to Actions include the following:

- Statistical analysis of experimental results;
- Statistical comparison of cases (correlational analysis of 'natural' experiments);
- Statistical analysis of monitoring results;
- Habitat models (mapping habitat; see also 'habitat needs', above);
- Population models (demographic projections or population viability analysis).
- Each of these is described in more detail in Annex 9.

5.7 Cost-effectiveness analysis

In many situations, more than one conservation action will have the potential to give a positive conservation outcome (such as increase in population size, or reduction in extinction risk). In such cases, it is necessary to compare both the cost and the conservation benefit of all possible conservation actions. Cost-effectiveness analysis is a way of doing this comparison.

A very simple approach is to first set a conservation threshold (e.g. the recovery to X individuals in Y years), and select the least expensive method that meets this threshold.

Another simple approach is to set a feasibility threshold (e.g. there are X dollars to spend in Y years), and select, from among the actions that costs less than this amount, the one that results in the most positive outcome (e.g. the largest population increase).

More sophisticated methods simultaneously consider the cost, the benefit and the feasibility of the action, where feasibility is the probability that the Action will be successful times the probability that the action will be taken up (Carwardine et al., 2012).

It is important to consider uncertainties both in the cost of each conservation action and in the conservation benefit that it is projected to result in.

5.8 Structured decision-making around the trade-offs involved in finite resource allocation

Earlier chapters accept there will be planning situations in which there is either less than complete knowledge of the species, its community, ecological relationships and the underlying factors that have contributed to the Threats, or when that knowledge may be erroneous. In planning for species in complex environmental, social, political and economic contexts, progress may be blocked by the lack of an effective framework for examining areas in which planners or stakeholders agree or disagree about the anticipated effects of management actions.

Under such circumstances, structured decision-making can be used as a more formal and systematic method of analysing cost-effectiveness.

Structured decision-making uses information from all the methods described above, as well other sources of information (such as expert opinion elicited in a structured setting – for example the stakeholder workshop). Such approaches combine the logic and analytical techniques of decision analysis and help assess the best decisions to take given the decision context and objectives.

The basic method for structured decision-making is described further in Annex 10.

5.9 Resolving critical uncertainty through adaptive management

While structured decision-making can help to identify the first choice Actions, there may remain uncertainty or disagreement as to the best course of action in implementation. A common approach to handling such uncertainty during implementation is through adaptive management.

Adaptive management is a process by which a system is managed and the managers learn as they go: 'Learning while doing' (Holling, 1978). The issue is to decide between sets of alternative Actions.

An adaptive management approach can help to resolve critical uncertainties around aspects such as:

- How might species respond to different climate change scenarios?
- How might species respond to different conservation interventions or actions?
- How are conservation alternatives traded off in combination with their costs and in combination with their values to different stakeholders, while always striving to meet the Objectives?

Annex 11 describes adaptive management in greater detail and provides an illustrative example, while the Species Conservation Toolkit Initiative[7] will shortly provide 'how to' guidance on its use.

5.10 What would improve the Strategy or Plan?

There is rarely perfect information on which to build a model to make a prediction and ultimately to base a decision. Instead, the benefit must be weighed up between collecting more data and reducing this uncertainty versus the time and resources that it takes (Martin et al., 2017).

Waiting for perfect information takes time and can lead to a rapid decline in the species and possible extinction as a result of continuing threatening processes (Martin et al., 2012b). What is often needed is good enough information based on the best available evidence of the day, whether it be empirical, elicited from experts or a combination (Martin et al., 2011).

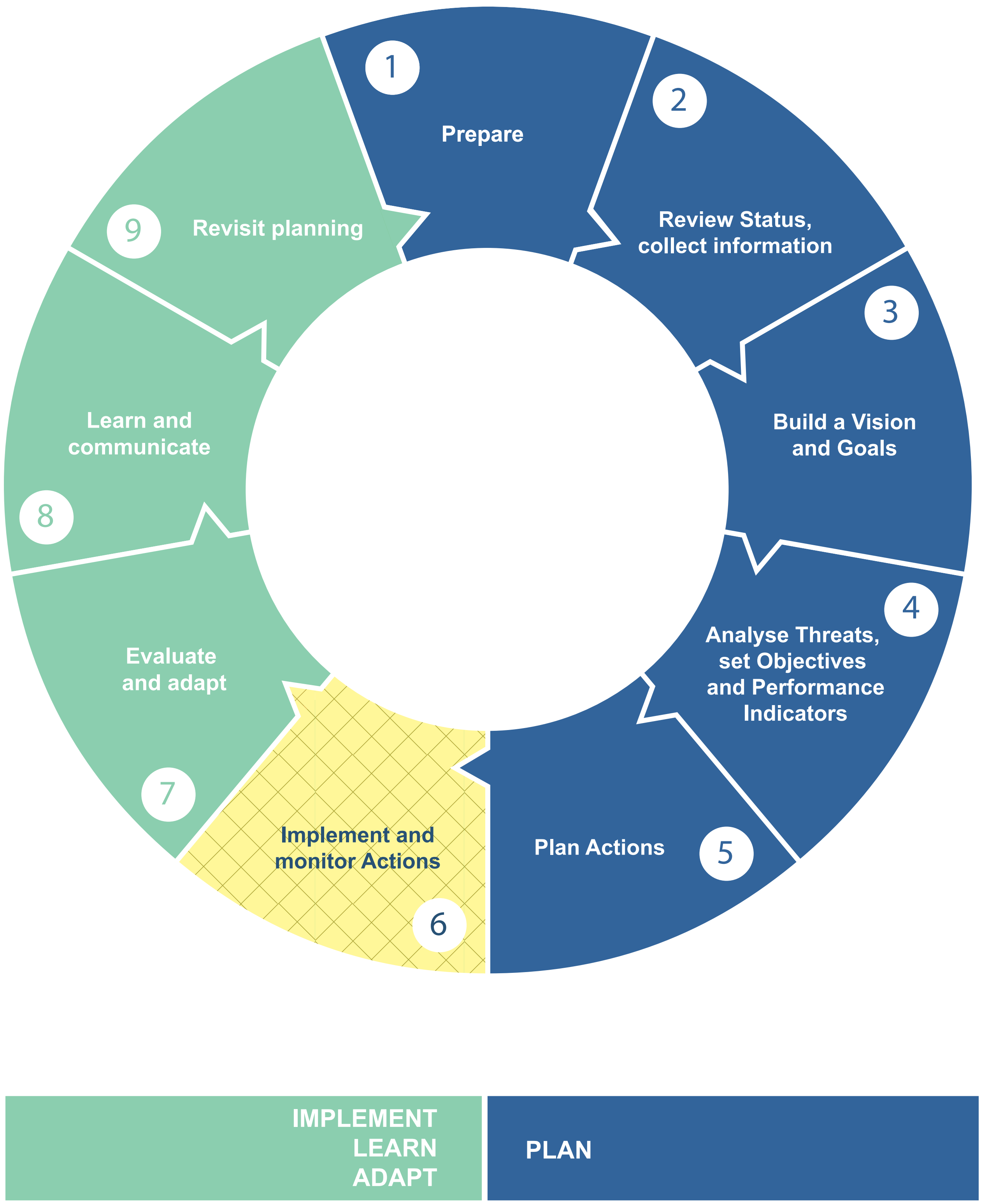
Species conservation management under global change is plagued with uncertainty of many kinds, but not all uncertainties are equally important to resolve. In a decision-making context, any additional information obtained has value only when it leads to a change in actions taken. Specifically, there must be change with enough benefit to species conservation to outweigh the cost of obtaining the information (Martin et al., 2016).

The promise of adaptive management (above) is that learning in the short term will improve management in the long term. The Expected Value of Perfect Information (EVPI) is a decision analysis tool that can determine what uncertainty, if resolved, would lead to different management and is a useful tool for guiding adaptive management. Expert elicitation is used to develop preliminary predictions of management response under a series of hypotheses, and the EVPI is used to determine how much management could improve if uncertainty was resolved (Runge et al., 2011). The Species Conservation Toolkit Initiative[8] will include EVPI.

7 www.cpsg.org

8 www.cpsg.org

6. Implement and monitor Actions



Chapter 6

Implementing and monitoring Actions

Planning cycle stage 6

Chapter overview

1 Turning Actions into a Project as a framework for species conservation.
2 The role of project management.
3 The organisational work plan.
4 The monitoring plan and ideal contents.

6.1 Turning Actions into projects

Planning products, at all scales from the Species Conservation Strategy to a National Action Plan, will contain Goals, Objectives and then Actions. A well-defined Action will state who is to carry it out. The range of Actors may be large: government agencies at various levels, non-government organisations, resource user groups (pastoralist or hunter associations, medicinal plant cooperatives), researchers, local community organisations or their representatives.

Most commonly, these different Actions and Actors are grouped into projects. A series of projects is the most likely means by which the Strategy and Plan is implemented.

The benefits of basing implementation of the Strategy and Plan on projects may include some or all of the following:

- Actions that are functionally related, but implemented by different Actors, can be coordinated.
- A set of Actions that are supported by a single donor or implementing body can be coordinated.
- A set of Actions required at a specific point in time during implementation can be started at the right moment and coordinated.

The project approach is so common because it has many benefits. For this reason, organisations implementing projects are often answerable to a dedicated Steering Committee.

As the planning phase ends, with completion of the Strategy and Plan, and moves into the implementation phase, the focal bodies move from the planning stakeholders to the project implementers. The latter will certainly include some planning stakeholders. For those not directly involved in implementation, there should be the means for them to be kept informed of implementation progress and conservation impacts (Chapter 8).

The Cat Conservation Compendium (Breitenmoser et al., 2015) recommends in detail how the contents of a Strategy and Plan are implemented through project management in an adaptive management cycle.

Project management tools

Efficient project oversight and management may be critical to ensuring conservation effectiveness. There are many tools and frameworks to assist in this. One that is integral to the Open Standards approach is Miradi,[1] a software program that allows development of graphical images for project structure (Conceptual Model and Results Chains), for single or multiple species as well as habitats. It also stores additional project or programmatic information around Goals, Objectives, Actions, Indicators and Results, Monitoring plans and basic project management.

Because Miradi needs specific skills and training for its use, requiring considerable data input and updates, it is resource heavy. While undoubtedly helpful for large projects, it is not essential, and it should certainly not hold up planning efforts that will not use it.

1 www.miradi.org/

6.2 Developing an implementation plan

The focus has now moved from the organising or planning team to an implementation or project team, whose composition in terms of both organisations and individuals may change.

A high-level work plan and budget helps the project team understand how each member will contribute to project implementation, and allows allocation of the resources necessary for project activities. Having a good work plan aligned with budget is also an essential first step in effective project management, and provides a foundation to report on the status of project implementation going forward.

The simplest work plan is created from the Goals, Objectives and Actions in the Strategy. As the Actions should each have a time line attached, this information can all be combined into a chart, as in Figure 6.1.

			Year 1												**Year 2**
			Month												
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**
Goal 1		Who													
Objective 1															
	Action 1.1.1	ABC, JS, MSP													
	Action 1.1.2	XYZ, NR													
	Action 1.1.3	CL, JKL, MNO													
Objective 2															
	Action 1.2.1	MSP, NR, DES													
	Action 1.2.2	SSC, CBSG,													
Goal 2															
Objective 1															
	Action 2.1.1	KLM, YOU, NR													
Objective 2															
	Action 2.2.1	ABC, SSC, OPQ													
	Action 2..2.2	QR, YOU,													
	Action 2.2.3	DES, TRN, XYZ													

Figure 6.1: Generic example of a work plan for one year.

There are many programmes available to construct work plans. Miradi provides this facility, which can then be integrated with any planning information already entered into it. Miradi also allows further enhancement through the addition of budget information, so that it can track expenditures against Actions and by accounting code or donor sources. Miradi can then monitor project progress and track results.

However the implementation plan is created and visualised, the key information needed comprises:

- WHAT activities are required and how they are aligned with defined Actions?
- WHO will be involved in implementing activities and hence Actions?
- WHEN activities will occur and over what timeframe?
- HOW MUCH each activity will cost (both financially and in terms of other resources), helping understanding how much money is required for each Strategy and, ultimately, the entire project?

Much of this information for each Action should have been explored and crystallised in the Actions in the Strategy/Plan and can, therefore, be transferred across to the implementation plan. These Guidelines emphasise engagement with local communities as critical stakeholders in many situations. Accordingly, the Actions and any implementation plan should ensure they have the fullest possible roles and responsibilities for implementation and management. This should be accompanied by fair determination of the benefits and costs to be borne by local stakeholders.

It is important that individuals or organisations assigned responsibilities for Actions are fully aware of this and have agreed to take them on.

6.3 The realities of Strategy implementation

The plan with its Actions, time lines and responsibilities for organisations and individuals reflects an ideal world. In reality, implementation has to cope with issues around the collaboration of diverse agencies – government departments (possibly from several ministries), parastatal bodies and multiple NGOs, all of whom are stakeholders in the conservation of the planned species. Further, each organisation has to include its Actions and other tasks into its own work plans, and the necessary funding and other resources may not all be available according to the plan schedule.

Such situations raise many issues for effective collaborating: specific mechanisms for the governance and oversight of implementation may need to be established; ‘softer’ aspects will include the development of trust between all parties, collegial working relationships, and appropriate leadership.

It is impossible to prescribe a single model for this situation, but species conservation efforts have failed from neglecting the mechanisms for effective and efficient implementation.

There are two approaches to reduce the risk of this situation:

1 The planning workshop specifically designs the overarching framework for implementation so that all collaborating agencies subscribe to it. This framework should contain some mechanism for assessing overall project progress, such as a Steering Committee comprising all key stakeholders, whose role will be distinct from the monitoring of conservation progress and success.
2 Larger projects may be able to create a dedicated post for coordinating implementation and holding partners to their agreed Actions and schedules. The Range-wide Conservation Program for Cheetah and Wild Dog has a regional coordinator in three African regions, tasked to catalyse implementation of regional strategies and develop National Action Plans for these species as key obligations.

6.4 Developing a monitoring plan

A monitoring plan is essential:

- Over the short term, to assess whether the implemented Actions are achieving the desired Results;

- Over the longer term, to allow conclusions on whether the Goals are being met;
- So that information from monitoring is the objective basis for making any changes to Actions through the process of adaptive management (Chapter 5) or, potentially, after a greater period of time, the Goals and Objectives (Chapter 9).

This means that, for most species, monitoring will have to continue for many years until the Goals are met.[2] In designing a monitoring plan, the key aspects are:

1 Who needs the resulting information and why? Users of such information are likely to be a wide range, from species managers and their organisations, diverse politicians, the general public.
2 How little information is needed to meet the users' requirements?
3 How can this information be collected at least cost and with least effort?

The implementing team or responsible authority should establish:

1 What is the least amount of information needed to assess whether Actions are having the intended Results and are contributing to Objectives and Goals?
2 What is the most cost-effective means of collecting this information? This will lead to specification of sampling methods, their intensity and frequency of use, and so on.

In a resource-limited world, the resources allocated to monitoring may be small. Further, as a monitoring plan may be long term and the collection of data may be costly, it is essential that the plan is cost-effective and sustainable. This requires:

- Very careful definition of the data to be collected, so that they accurately and unequivocally describe what Results are being achieved through the implementation of Actions.
- Data collected should also be tied specifically to assess progress towards Objectives and Goals.
- More generally, monitoring of wildlife health and disease can provide information on the effectiveness of risk management methods (Jakob-Hoff et al., 2014), and the wider picture of ecosystem health.
- The scope of monitoring should be flexible: while the performance of the planned species is central, the monitoring scheme should detect and record significant events in other sectors, such as any new major planning process for infrastructure, or major policy change, which might affect the species.
- Assured mechanisms should be in place for analysing and storing the data, potentially over the long term.
- There is the capability for prompt analysis of incoming data to provide near real-time updates, for managers or politicians.
- There are institutions or agencies that are committed to the monitoring for the necessary number of years; in view of the limited duration of project funding, longer-term monitoring may often be the responsibility of a government body.
- That those responsible for monitoring will ensure consistency of methods over the years, so that trends and conclusions over the monitoring period are robust.
- That the organisations and individuals involved in monitoring are willing to use new methods or tools if these help reduce uncertainty, or are more resource efficient.
- That there is a policy about sharing the information or allowing its use by third parties; this may be especially sensitive in the early years of project implementation.
- The monitoring plan should also cover more practical aspects of its implementation, such as:
    - Who has overall responsibility for the monitoring plan and will be the point of contact for disseminating results or responding to queries? Designation of a single person as monitoring coordinator is often the solution here.
    - Who is doing each part of the monitoring process (who is in charge of collecting the data, who is in charge of analysing and interpreting the data, who is in charge of using the interpreted data?)?
    - When will monitoring occur?

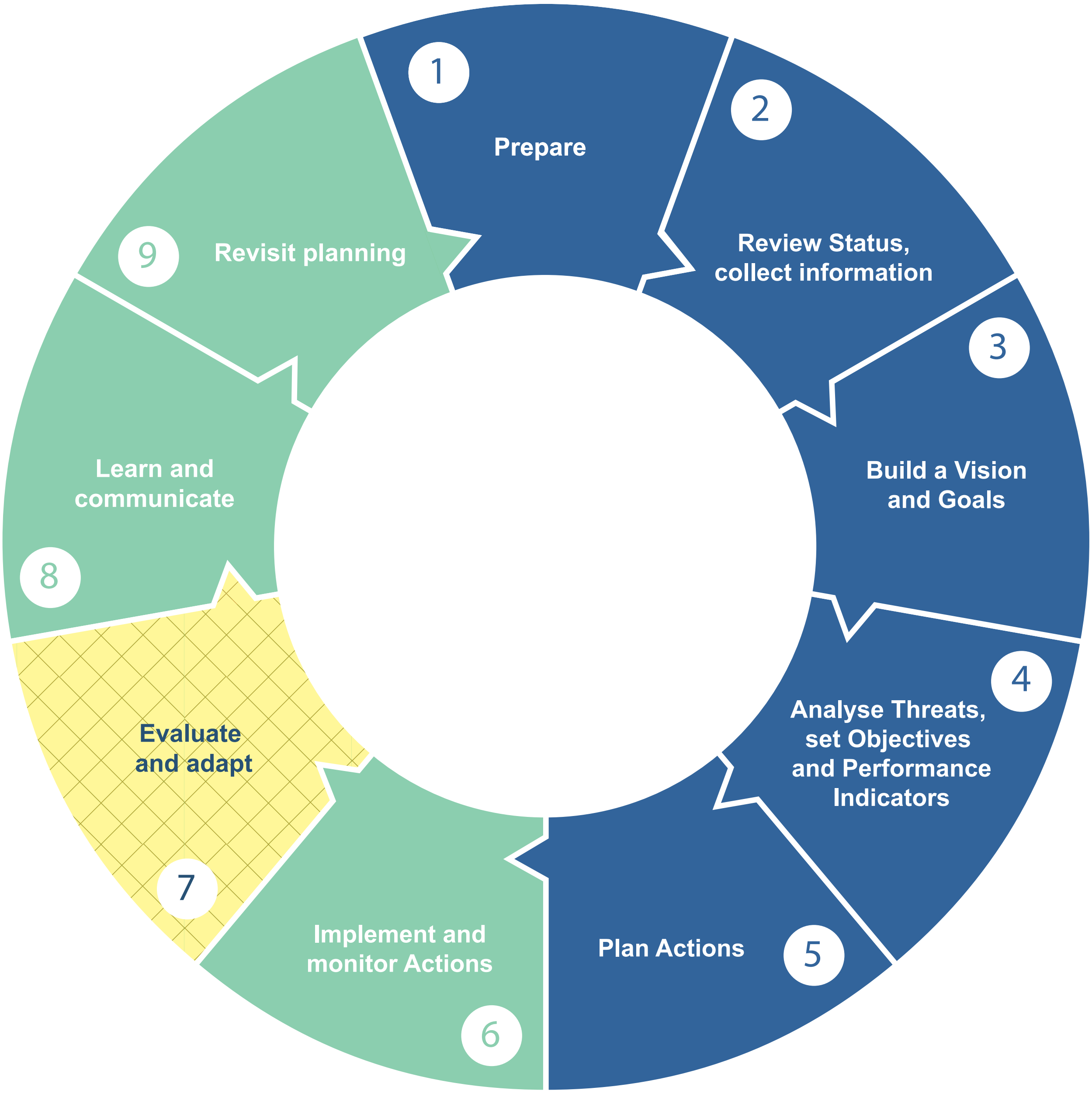
2 There should be further monitoring of the species or populations after the Goals are met, but this is likely to be qualitatively different.

- Where does the monitoring take place?
- How will the data from monitoring be used?
- Who is providing the funding for monitoring?

6.5 Information sharing

Once implementation of a species conservation project has started, the information from monitoring will be the main way in which conservation, political and public interests are satisfied. Hence, there is merit in a communications strategy (Chapter 8).

7. Evaluate and adapt



Chapter 7

Evaluating and adapting

Planning cycle stage 7

Chapter overview

1 Assessing results and progress.
2 Adaptive management.

7.1 Assessing progress and results

The results of the monitoring are the means by which project or Action performance is checked. This is a key part of the results-based management process which allows:

- Seeing whether Actions are being implemented in the right order and to schedule;
- Assessing whether Actions are having the desired results;
- Review of whether the prioritised strategies are producing the desired results;
- Prompting whether the alternative strategies should be considered in pursuit of better results.

Project management allows teams and managers to assess whether activities are on track, identify additional factors influencing project implementation, and modify or update an existing scope of work. Numerous resources exist on best practices in project management.

The existence of monitoring data allows testing of adapting strategies or alternative strategies of choice (Chapter 5) as well as assumptions about what is going on across a project. This is critical for ensuring implementation of the best strategies based on available knowledge as well as evaluating which strategies have the greatest return on investment.

This process of evaluation can often use a portfolio approach; this means using (1) quantitative impact data tied to specific goals and alternative strategies of choice, as well as (2) qualitative data about what is working well or not well and with what possible mitigating circumstances (DeWan and Lentz, 2016).

Bringing together key stakeholders to explore quantitative and qualitative data is an important step in the evaluation of whether the results of a project or actions are achieving the desired results. This involvement of key stakeholders can be done in highly structured evaluative formats or in less structured qualitative conversations such as in-depth interviews or focus groups.

Team discussion on the need to adapt or change strategy based on new information is a valuable process of self-reflection. This may mean returning to, and revising, the Results Chains.

By evaluating progress in this way, teams and stakeholders understand relevant risks, uncertainty, and interpretation of existing qualitative and quantitative data to support decisions; everyone can then feel they have shaped alternatives and 'own' any revised plan.

7.2 Have Actions been implemented?

A good plan details when actions are to be implemented, and their sequence may be central to planning success. The first test of plan effectiveness is to examine whether implementation has proceeded to schedule and in sequence.

7.3 Have the impacts of Actions contributed to meeting the Objectives?

Having a clear statement of cause and effect or impacts through a Results Chain (or similar) is critical for evaluating success.

The alternative strategies of choice should be based on clear understanding of the species' situation and the factors affecting it, while acknowledging uncertainties (above). With such a clear conceptual basis in place, one can assess whether the results of the project are meeting the short- and longer-term Objectives based on data collected and analysed. Further, testing whether assumptions of impact are correct and can be done, whether timeframes of measurable Objectives are reasonable given current assessment, whether new assumptions need to be tested, and whether the first choice Strategy needs to be modified or replaced.

This process of assessment should be integrated with the consideration of adaptive management (Chapter 5), which handles uncertainty. The results at this review stage should be considered in light of alternate interpretations of cause and effect, and how best to obtain the desired results.

7.4 Why and how have some Results not been as expected?

The desired Results may not be achieved for a number of reasons including: inadequate execution (project management); incorrect understanding of cause and effect to achieve results; limitations in data collected in the monitoring phase; unexpected external factors; unexpected magnitude in expected challenges; or even unforeseen consequences of the Actions.

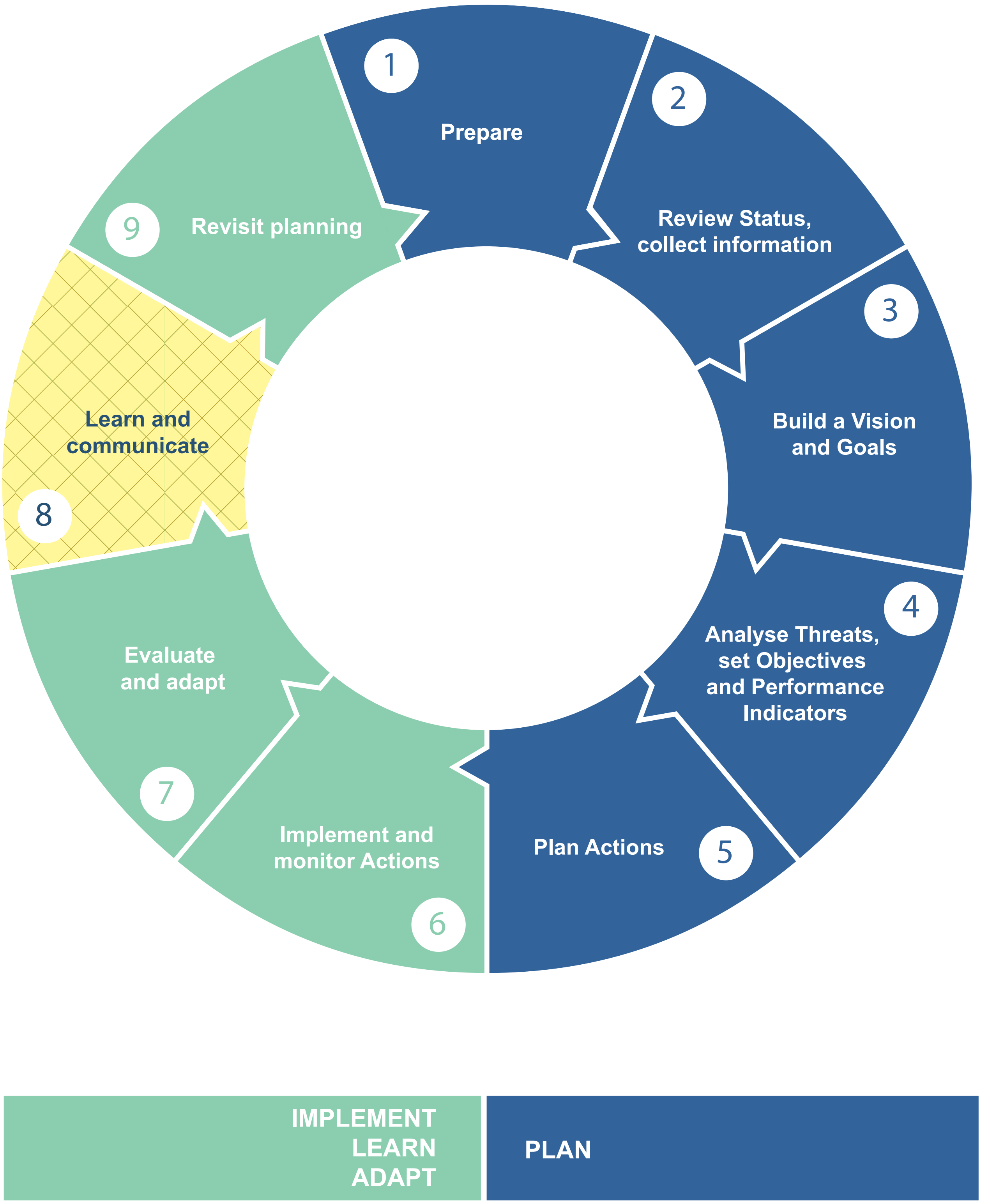
This step is valuable in understanding why results have not been achieved and diagnosing relevant changes that need to be made in order to correct the situation: under-achievement might be due to errors or omission in implementation, or the wrong choice Strategy being used, continued uncertainty, or circumstances beyond the control of the project. Regardless of the reasons why, the information should be used to help teams make more informed decisions about how and where to continue to implement their work.

Under the circumstances of either (1) outcomes are not as intended, or (2) assumptions need to be tested further, the Theory of Change approach may be useful.[1] On the basis that the Goals are already clearly stated, this approach works backwards to identify all the conditions that must be in place and the Actions necessary to achieve the Goals, challenging the sequence of causes and effects. While Results Chains are based on the Theory of Change, the latter requires greater explicit determination of underpinning assumptions (Biggs et al., 2016). Biggs et al. (2016) give an example of how the Theory of Change can be applied in the context of community-based responses to illegal wildlife trade; they also emphasise the merit of societal engagement in planning around biodiversity conservation problems.

Periodic reflection by all stakeholders on the impact of interventions as the project proceeds also allows adjustment due to the fact that often conditions change and progress towards desired Results may not be as direct as the plan envisages.

1 www.theoryofchange.org/what-is-theory-of-change/

8. Learn and communicate



Chapter 8

Learning and communicating

Planning cycle stage 8

Chapter overview

1 The value of communicating.
2 What should be communicated?
3 Who should it be communicated to?
4 How should it be communicated and how often?

8.1 Communications strategy

Learning and communicating are often relatively neglected considerations in planning for species conservation. Yet, given suitable attention they are a powerful means for helping those responsible for the planning and implementation if others can learn from their experiences and can provide feedback.

Spreading awareness of methods, successes and challenges will also benefit others in their planning work. The accumulation of species conservation planning under diverse conditions and needs will demonstrate the importance of planning for conservation intervention. In turn, this should attract further resources into planning.

There is merit in developing a **communications strategy** for any project, which will lead to clarity on:

- Why do you need to communicate?
- What will you communicate?
- With whom should you communicate?
- How will you communicate with them?

The scope of Learning and Communicating may be thought to overlap with the Stage 7 of the Planning Cycle (Chapter 7) 'Evaluating and Adapting'. However, the latter is more directed internally, that is, to the agencies and individuals concerned with planning and implementation and hence the impacts on the focal species.

Therefore, Stage 8 of the Planning Cycle, 'Learning and Communicating', is both relevant for project and organisation staff, and also externally to other planners, funders and donors, the conservation community, governments and civil society more broadly.

As Learning covers the whole process of planning through to implementation, it should be natural to want to ask 'What went well and according to plan?' and 'What went less well?' with further queries such as 'Why did we change our Strategy during implementation, and was this more successful?'

As such aspects will be of interest to other planners, observations should be made available through suitable communication such as, preferably, published papers. Their value would be enhanced through a bank of strategies, plans and experiences from implementation.

8.2 Creating a learning culture

Establishing a learning culture needs sensitive leadership, and a solid team in which each person knows their role, and their strengths. Throughout project design and implementation, team members should live by the following:

- What have I just heard, or what have I observed?
- What does this mean in the context of our Objectives?
- What do I need to do with this observation or deduction?

A learning culture also means that success is celebrated and those responsible identified and recognised; as a corollary, when things go wrong, individuals and the team join together in the spirit of 'What can we do better next time?'.

The benefits of a learning culture within a project will be evident when there is any scheduled, periodic evaluation of the project. This is common after a period of one, three or five years. The specific purpose of an evaluation may vary, but the key purpose will be to measure progress and impact against the stated Goals and Objectives.

A project may also be the subject of an audit, which involves assessment against an external set of standards.

8.3 Why communicate?

The value of planning and implementation is greatly reduced if there is no effort to establish an information trail. This should be done systematically and continuously from the initial scoping stage through to implementation and monitoring. The information collected will include facts, activities, observations and experiences. These are the basis for learning from projects for the benefit of the individuals and team members involved, their organisations, funders or donors, and the wider conservation community and civil society.

The completed Strategy or Plan will be the result of work by many people over many months. Through the Status Review, all relevant information on the planned species will have been compiled, and hence it will be an important and authoritative source. It may merit publication on a standalone basis (e.g. Ng et al., 2015).

Importantly, while the origination and development of many strategies may have been driven by NGOs, the party ultimately responsible for species is the holding government. It is most likely that, to be effective, the Strategy should have formal endorsement as the official policy of government(s). While the review by government and an endorsement process may not be swift, it adds immeasurably to the value of this Strategy (Section 2).

A completed Strategy has great potential as a fund-raising tool and as a rallying point to gather support, political goodwill, permissions and other resources that are all likely to be needed for implementation, and with the further benefit of public support.

The impact of a high-quality Strategy or Plan is further enhanced through insertion of a suggested citation and, preferably, an ISBN identifier.

While every planning situation is different, and the planning approach needs to be adapted, there is also a large body of widely applicable experience arising from species conservation planning. Every case history has lessons and information that will help someone else do their planning.

Given the fact that there are great numbers of species that need even the most basic planning as a start to their conservation, every planning situation should be available as a source of demonstration, experience and possible insights into how future planning can be designed, or take short cuts, or be more cost-effective.

As well as being an authoritative source of information on the planned species, a widely available Strategy can become a model for other planners and situations. A good Strategy may allow subsequent planning efforts to assume its species are subject to the same threats or require the same conservation interventions; such reasonable assumptions allow short cuts to be taken confidently, making such planning processes quicker and less costly. In addition, planners for other species may be able to take lessons from planning activities that did not yield the desired results, if these have been carefully and fairly recorded. More shared experience and insights will lead to quicker collective learning, all for the benefit of species conservation.

Once implementation has started, communicating results may also be a periodic requirement of donors or governments, in which case continuing support may depend on timely and accurate description of activities that demonstrate progress, if not necessarily impacts.

Project leaders are likely to have to produce progress reports for donors or for submission to a Steering Committee. Junior staff may be required to submit progress reports, which can then be incorporated into the leader's reports with a monthly or half-yearly frequency.

Therefore, there are many compelling reasons for developing a simple communications strategy through which a Species Conservation Strategy or Plan can be disseminated, with provision of regular information as implementation proceeds. The combined opportunities of the internet and social media allow information to be uploaded easily, and hence frequently, with potential global impact in minutes.

8.4 Who needs to know?

A good communications strategy should be clear as to who is to be reached. In the case of species planning experience, there are four obvious audiences:

1 The people and bodies that have been involved in the planning process, and the wider stakeholder group. In each case, the stakeholder individuals present at the planning workshop or involved in other stages of the planning cycle will usually be part of larger organisations. Therefore, communication about any species planning should be targeted at whole organisations, not just the individuals who were directly involved.
2 The most directly relevant governments and agencies will have been involved in (1), but there is merit in promoting the widest possible awareness of planning work and products across any government. The agencies and individuals responsible for government planning and policy, and for protected area and land management will be key targets.
3 The wider conservation community, and businesses and institutions involved in infrastructure development projects should at least be aware of species planning efforts, so that they can learn from planning examples.
4 There is a yet wider potential audience in the form of the general public. Effective conservation should have a good Strategy or Plan behind it. Given the public interest in conservation, and the need for showing success stories, this is a sound reason for widening awareness of efforts on behalf of species conservation. Priority planning is likely to target rare or endangered species, with a leveraging message that sound planning leads to effective conservation.

8.5 What will be communicated?

Announcing the very start of planning for a species conservation effort can have value for engaging the public and creating support for the effort. The occasion of a planning workshop may be a newsworthy opportunity for local media.

The first, and major, product will be the results of planning – a Strategy or Action Plan. Ideally, this should contain enough detail so that a reader can understand the process, the rationale for doing things as they were, can accept the Threats and the logical rationale for the Actions in order to address them.

During the implementation and monitoring phases, the information that will lead to new knowledge or lessons may need to be kept within the implementing organisations. But it is desirable that these results are analysed and made publicly available as soon as possible

Depending on whether the early years' implementation leads to changes of action or course (Chapter 9), the Plan or Strategy may be updated, and this again should be made available. This has been the case with the regional plan for cheetah and wild dog: the Southern African Regional Strategy was developed in 2007 and it was revisited and revised in 2015 (RWCP and IUCN-SSC, 2015).

In the longer term, there is scientific value in publishing in high-quality journals case-history accounts that cover the species conservation effort, in terms of a situation analysis, planning, interventions and ultimately impacts. This can be even more valuable if there was less than total success.

8.6 How to communicate?

A large part of the impact of any message is due to the way in which it is transmitted.

While species plans and strategies are designed as standalone documents, it is increasingly uncommon for them to be produced as hard copies, or in anything but limited numbers. On the other hand, they may be increasingly accessible as web-based documents on multiple websites. Within IUCN, a Strategy might be on the websites of IUCN's publications, several Specialist Group(s) including the Conservation Planning Specialist Group, as well as on the websites of all the NGOs involved, the funding agencies, and the relevant government agencies.

The use of well-articulated social media campaigns has been shown to have enormous positive impact on communication strategies in many situations.

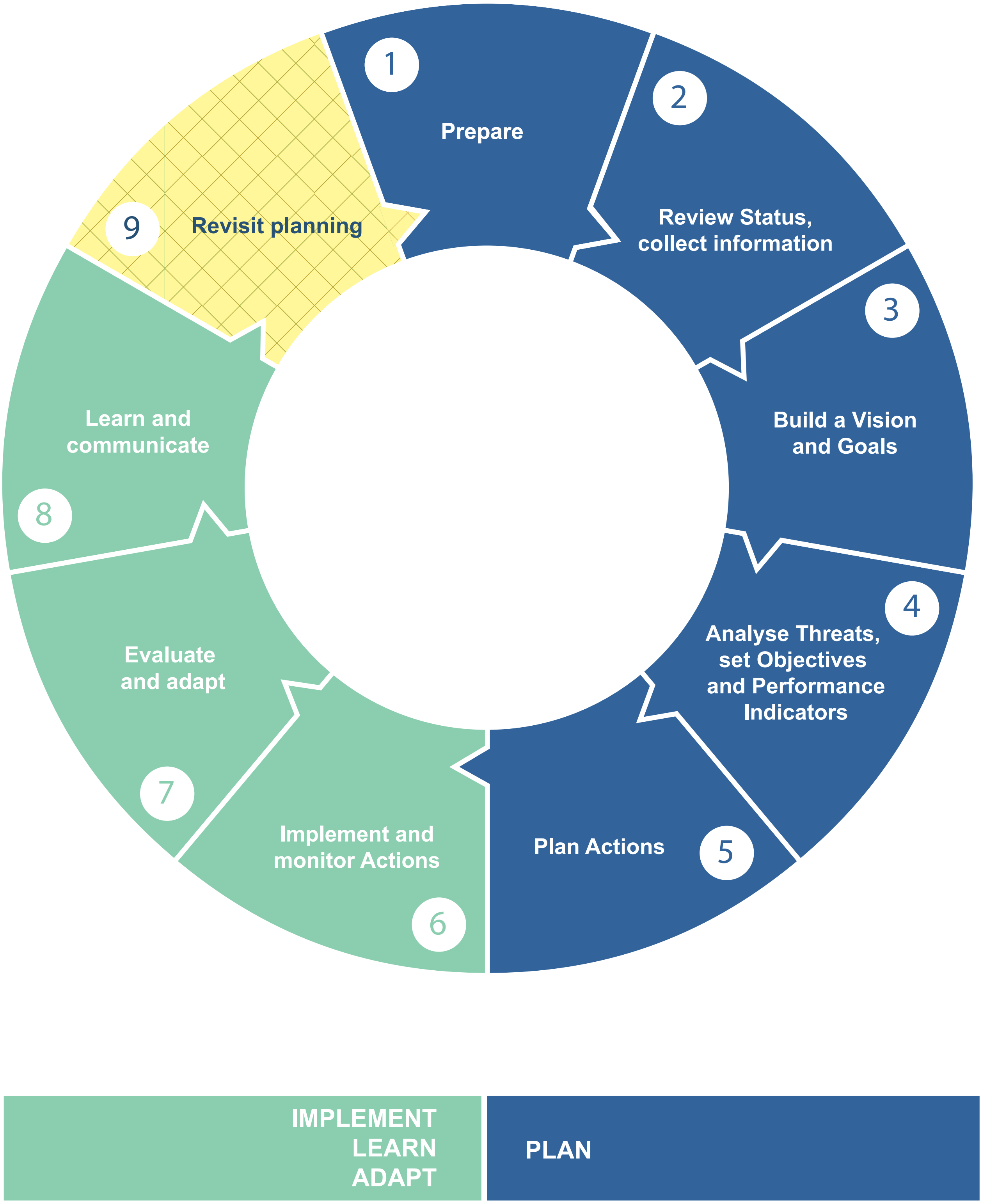
Public interest in conservation, especially for endangered species, offers many opportunities for dissemination: the range of *ex situ* facilities, including zoos, aquariums, botanic gardens, nature centres and rehabilitation facilities are all opportunities for messaging whether at their sites or though their own media.

The potential impact for users is undoubtedly enhanced if the Strategy's appearance has been designed to professional standard in terms of layout, the use and insertion of figures, diagrams and images to maximise attention and readability.

Although strategies and plans tend to be large files, social media can be used advantageously to spread awareness of the existence of these products across many constituencies and geographies.

Language: while very local languages may be a significant reality in a planning workshop, the finished Strategy is likely to be in a major global language or languages and one with which all key stakeholders are familiar. Translation of all into a second, often national, language may be costly but highly worthwhile (e.g. Woolaver et al., 2015) or, alternatively, an executive summary in a second or further language may increase a Strategy's reach and impact.

9. Revisit planning



Chapter 9

Revisiting planning

Planning cycle stage 9

Chapter overview

1 The value of review and learning from experience.
2 The basis for a further cycle of planning.

Monitoring results are the basis for determining progress in implementing the Strategy through an effective project or suite of connected projects.

The duration of species conservation projects will vary greatly depending on many factors, but will generally take many years. In contrast, species conservation receives funding for fairly short time spans: most donors grant for three years, with a few for five years. In many conservation situations these periods are short to medium term for recovery efforts, rather than providing long-term support. Accordingly, these considerations will influence the timing and process of review and analysis, and any consequent changes of course in a project.

In the short to medium term, the monitoring results will be the basis for regular reports from the project executant or manager to his/her organisation; donors may require reporting to a different format or schedule. Over this time span, the adaptive management approach is most likely to be applied at the level of Actions.

The time span of 3-5-10 years is the suggested life span of a conservation Strategy (Chapter 2), at the end of which the Strategy should have a thorough review. Such a review would ask:

- What progress has been made towards meeting the Objectives and Goals?
- How is this progress measured objectively?
- What are the specific outcomes and impacts?
- What are the stand-out project successes?
- What has the project succeeded in less well or failed in?
- What are the reasons for success or lack of success?
- Were some key aspects about the focal species not known?
- Were some critical activities not identified?
- Were some Activities not carried out as intended?
- Were some assumptions not correct?
- Were there adverse changes in the social, economic or political environments of the project?
- Did some extreme event have major negative impacts?

Such an analysis will assess performance and the reasons for it, and will be the basis for designing any further phase of the project.

At this stage, revisiting the higher-level elements of the planning cycle should be considered. If the Activities have been monitored and managed adaptively over the short to medium term, and the review identifies areas of lesser success, then the Objectives and Goals can be reviewed. While the original Vision should have been aspirational, and possibly over-ambitious, the Goals and Objectives must be realistic, albeit over differing timescales. Early stage performance may indicate they should be examined and redefined.

If these higher elements need revision, then the process should follow the same steps as in the Planning Cycle (*see* Figure 9.1). The Status Review can be updated following project experiences, and these may also have identified further stakeholders who should be involved in the re-design.

For many species, conservation outcomes may take years or decades, with time spans longer than most project lifetimes. If conservation support on a project basis ends, it is likely that responsibility for the species will rest more, or solely, with a statutory agency. In this case, the final project review must include consideration of the robustness of success up to that point and then how future conservation effort can be as sustainable as possible.

For this reason, those responsible for the planned and conserved species should be encouraged to continue to monitor conservation progress and to update the ongoing conservation Strategy or Plan at regular intervals.

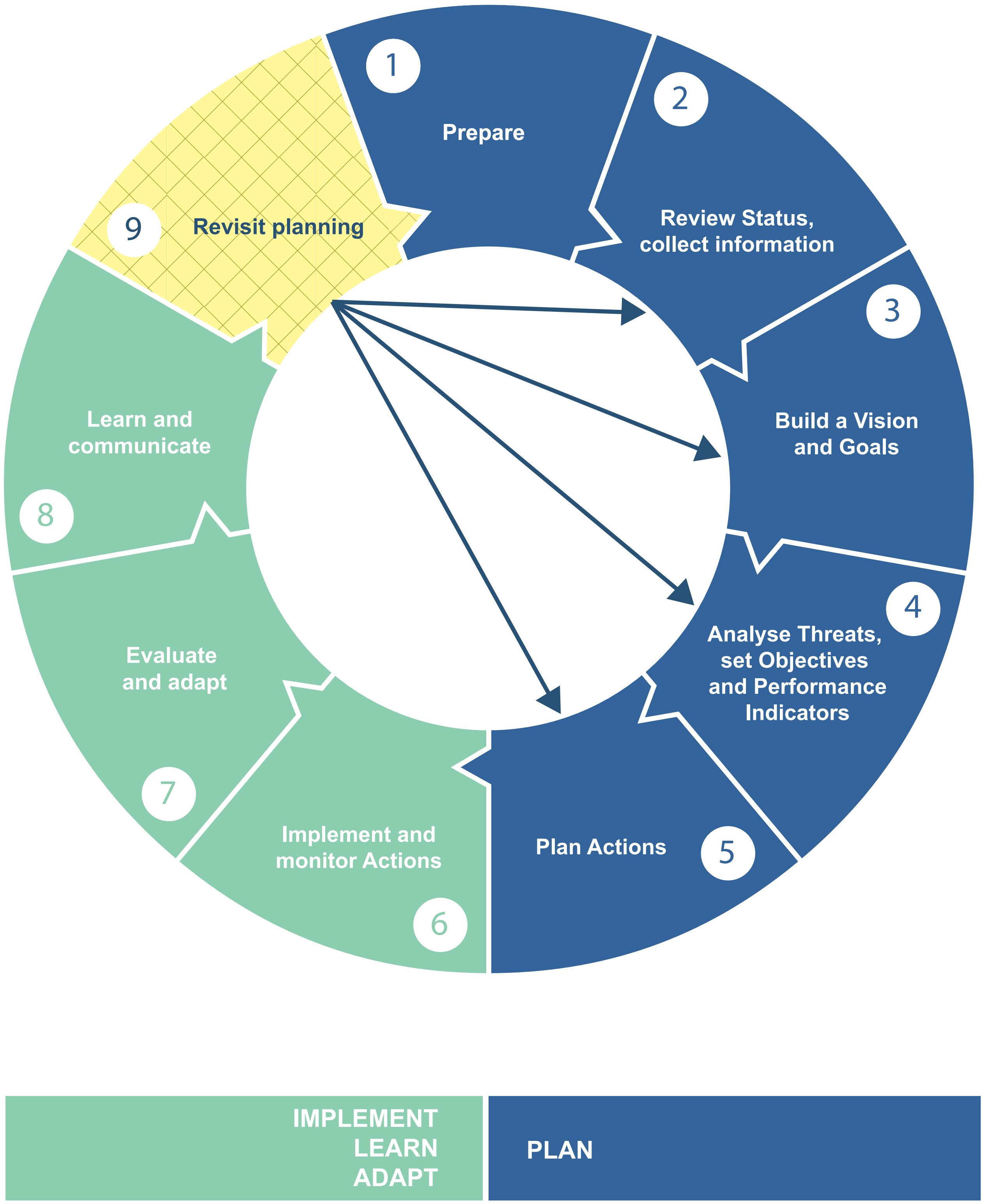


Figure 9.1: The options for revisiting planning

SECTION 2

The planning process

Introduction

Chapter 1 in the first section asks the planner to be clear as to what is to be planned, in terms of species and the area occupied, and why it is necessary. Further, it was stated there are many aspects for consideration in moving from the 'Why' to the 'How do you plan?' The 'How' is the subject of this section.

The topic of 'How will you do the planning?' will have direct impacts on the quality of the resulting planning product and on its chances of being adopted formally and then implemented. In turn, this increases, or even maximises, the probability of improved survival prospects for the planned species over the longer term.

Experience in species conservation planning shows that an effective planning process is most likely to exhibit a few key characteristics (Section 2 Box 1):

Section 2 Box 1: Key characteristics of an effective species conservation planning process

- There must be a sound baseline of information, which will be used through good science and rigorous thinking.
- *Participation*: all the organisations and individuals with legitimate interests in the species or the area must be present and fully involved, ensuring relevant decision-makers are appropriately represented.
- *Technical*: the appropriate technical expertise must be engaged.
- *Support*: the planning product should have support by all those involved in developing it.
- *Responsibilities*: for the planning product and its implementation are assigned.
- *Logistics and administration*: these must be efficiently done, with specific responsibilities assigned.
- *Resources*: a full and formal species planning process can be costly in terms of time, personnel inputs and direct costs, and these should be assessed and assured before any proposed planning process is judged feasible.

1 Who will do the planning?

The initiative for a species planning process can arise in many different ways, often depending on the nature of the organisation needing the planning (e.g. government agency, non-profit conservation body, SSC Specialist Group) and the nature of its interest (e.g. overcoming the rarity of species, exploring serious and enigmatic decline, exploring the role of disease, planning for species recovery and sustainable use, assessing the impact of climate change).

Despite this diversity, a few major or essential roles are evident. These roles, based on experience, are given names, but it should be noted that given the diversity of planning situations, and the processes used (Chapter 1), these roles may be performed in very different ways. In general, the organisation of planning and its participants will become more complex and more formalised in proportion to the following aspects:

- The number of species being planned;
- The complexity of their ecological context, and pattern of intra-specific genetic diversity;
- Whether their conservation status and possible solutions will prove controversial;
- The scale of geographic area under consideration;
- The number of formal jurisdictions or countries involved;
- The number and nature of NGOs involved.

2 The start of species conservation planning

The need for conservation planning for a species or group is likely to have arisen from a prioritisation exercise using any number of criteria. Deriving from this conclusion, a small team is likely to be assembled, with the following tasks:

- To propose the process;
- To engage with the necessary organisations, such as government agencies, for support to proceed;
- To identify and assemble the necessary technical expertise;
- To prepare the background information needed;
- To provide technical expertise throughout the course of the planning process;
- To access relevant traditional knowledge;
- To be involved with production at least of the planning product in draft.

Such a team of diverse contributors is likely to be engaged on the species planning through concept to design origination, then to planning activities, to post-planning activities and development of the final product.

The team may include individuals or organisations as the originators or champions of the planning, government representatives and others. They may or may not have a formal but short-term existence as a committee, but the diversity of arrangements will here be referred to as the 'planning team'.

Section 2 Box 2 shows how the Cat Specialist Group recommends an organising committee.

Section 2 Box 2: Establishing the foundations for a species planning process, as done by the Cat Specialist Group (extracts from Breitenmoser et al., 2015)

At the beginning of the process an organising committee should be formed that is responsible for identifying, inviting, and consistently informing all partners involved in the process. The core of the organising committee will be the initiators, but the committee should include a member from every country or stakeholder group concerned. It needs to include experienced people and local partners. The Committee identifies the proper facilitator(s). To secure the proper logistical support, cooperation with a local NGO and the relevant government institution (e.g. the wildlife or conservation department of the national Ministry of Environment) is recommended. The Committee has also to (help) raise the funds for the participatory workshop. Depending on the geographic scale, the complexity of the situation and the number of participants, the costs vary greatly. The development of a Regional Conservation Strategy for a wide range species may require $50,000–100,000, while a National Action Plan may cost $10,000–20,000. A proper fund-raising process needs to be established with international private and governmental donors. The development of National Action Plans is often organised and financially supported by national agencies.

Once formed, the planning team will assume overall responsibility for the planning process and delivery of its products. This will involve:

- Refining the Purpose of the planning (Chapter 1);
- Specifying how a comprehensive Status Review (Chapter 2) will be developed, including possible use of expert elicitation of key information (Martin et al., 2012a);
- Confirming the final planning process, after suitable consultation;
- Agreeing on the products to be delivered;
- Ensuring collection of the information needed as the basis for any quantitative assessment of extinction risk for the species, such as through a population viability analysis (below);
- Modelling exercises may usefully be done as a preliminary to any planning workshop (below);
- Developing a budget for the process through to formal acceptance of the Strategy or Plan;
- Ensuring that the financial and other resources needed for planning are adequate;

- Developing a time line for development of the Strategy with way point dates for key stages,
- Identifying the host for any meetings, which will ideally be a government agency,
- Ensuring any formal invitations, if necessary, are sent by the formal host,
- Identifying key stakeholder groups and individuals,
- Identifying facilitators, if the planning process requires them,
- Being responsible for any meetings and workshops during the planning process;
- Establishing administration methods and assigning responsibilities;
- Providing oversight and guidance throughout the planning process;
- Having oversight or a catalytic responsibility for finalisation of the planning products.

3 Stakeholders

The success of conservation work relies on the actions of people living within the range of the threatened species as well as on established national and international interests. Decisions about how best to conserve species should be built on the best available knowledge and experience of the species' biology and ecology but should also take account of relevant cultural, socio-economic and political dimensions. Traditional knowledge should be used in a variety of instances for planning and implementation purposes (IUCN-SSC/CEESP SULi, Unpublished).[1]

Hence, building effective solutions for species depends on the involvement of a wide range of individuals or organisations that have a legitimate interest in the species. They are collaborators or 'stakeholders'. The following criteria characterise stakeholders:

- *Concern*: individuals or agencies with an interest in the outcome of a conservation planning process, either positively in support of the species' conservation or negatively in opposition to the potential impacts of that planning on them or their livelihoods;
- *Knowledge or expertise*: individuals or agencies with relevant data resources, knowledge or skills, including local communities;
- *Influence*: individuals or agencies with the capability – organisationally, legally, or financially – to support or block the implementation of the resulting plan.

Consequently, the planning process is likely to include: stakeholder groups such as government agencies, conservation NGOs, scientists (from university or other sectors), park rangers, land managers, hunters, local community leaders and relevant industry representatives, sociologists, the *ex situ* community, relevant IUCN-SSC Specialist Groups and representatives of IUCN Commissions.

Resource users are a significant stakeholder group as the majority of species are actually or potentially used by humankind, and such users often possess valuable traditional knowledge that can aid planning (IUCN-SSC/CEESP SULi, 2016); as it is not in the long-term interests of the latter to over-exploit the resource, consideration of sustainable user needs may enhance conservation success and even generate additional resources.

Depending on the scope and focus of the planning project, the initial list of potential stakeholders may be large. Where the primary vehicle for planning work is a face-to-face workshop (below), space may be limited and participation will need to be prioritised. The Species Conservation Tool Library contains a simple tool for this purpose.[2]

Finally, it is not helpful for the planning process to be influenced by large numbers of participants with only peripheral interests in the species or who are from beyond the species' range (although involved captive-breeding bodies will often be situated out of the species/range).

4 Political context

As any government is ultimately responsible for the biodiversity of its country, comprehensive implementation of a strategy or plan is unlikely without

1 https://www.iucn.org/sites/dev/files/final_guidance_for_ilk_-_for_commission_sign_off.pdf

2 www.cbsg.org/stakeholder-prioritization-tool

the endorsement of the relevant statutory agency. Ideally this endorsement approves the plan as official policy. Endorsement may be needed at one or more levels of sub-national agency, national ministry or government, or by several governments, or by an international organisation with membership from multiple countries.

Obtaining this endorsement should be part of process design from the start. At the outset, the political and bureaucratic framework within which conservation will be carried out for the planned species should be understood. Some of the possible factors for consideration are shown in Section 2 Box 3.

Having these questions answered early in the planning design stage is the best guarantee that support for the planning project will be secure and apparent to all stakeholders, and that the appropriate government persons will participate willingly and constructively in the planning process.

Section 2 Box 3: Some factors concerning government involvement in species conservation planning

- Do the relevant government agencies have any specific requirements of the planning process?
- Will a government or ministry insist that it is the official host of a planning process, and should, therefore, issue invitations to participants, or even approve them?
- Does it require a specific form of planning documentation, which the planning process can deliver?
- Which government agencies will need to endorse any resulting plan and how is that endorsement secured?
- Who will need to review draft versions of a strategy?
- Who will lead the implementation of planned actions and under whose authority?
- How is that authority secured?
- Are resources available for implementation of the strategy or plan, or will there be a commitment to raise them in good time?
- Will the government monitor progress, report on it and adapt management as necessary?

5 Time horizons in planning

The period for which any strategy or plan is realistic will depend on many factors around the species being planned, such as their biology and life history, their conservation status, and their ecological, social, political and economic environments.

Some of these factors will be reflected in the time span stated in the Vision for the planned species (Chapter 3.)

Accordingly, most strategies and plans will have a three to ten year time horizon. Evaluation and reviews usually take place after three to five years of implementation by which time impacts should be evident and well documented. This review and the opportunity to adjust course is fundamental to the planning-implementation cycle (Chapters 7, 9).

This timescale of three to five years of implementation progress accords with a common period of donor support which is often the driver for strategy development and implementation.

Realistically, however, effective conservation intervention usually requires more than three to five years of project funding. Therefore, those responsible for such projects have to strive for more sustainable support beyond the first three to five years, either through continuing donor support or from in-country government agencies.

The reality is that effective long-term conservation of most species cannot succeed on short-term project-based funding.

6 Developing trust and partnership

A completed and approved conservation strategy or plan is an agreement for conservation actions based on the accumulated knowledge, assumptions, attitudes and values of the stakeholders. This may mean that the product is a compromise between many different perspectives and interests, and its production will have seen many complex interactions and emotions among the participants.

Accordingly, human behaviour and its management are central aspects of effective planning.

There are recognisable patterns of human behaviour that cut across disciplines and cultures and which affect our ability to communicate, collaborate and solve problems effectively. In planning, these may be evident in:

- The acquisition, sharing, and analysis of information relevant to the conservation needs of the species;
- The way that risks to the species arising from human activities are perceived and dealt with;
- The development of trust among stakeholders;
- 'Localism' by which personal, institutional, local, or national cultural sensitivities have disproportionate influence on the course or outcome of planning;
- 'Territoriality' in which participants take positions that protect their interests rather than those of the planned species;
- Lack of awareness: some legitimate stakeholders may be ignorant of the planned species at the start of the process, but can then become supportive.

7 The stakeholder workshop

Noting the features of a successful planning process (Section 2 Box 1), much planning work can be done by email, tele-conferencing or small group work. Most usually, a planning process will include at least one participatory, face-to-face meeting of stakeholders in a workshop format. A workshop is especially valuable where:

- Collaborators/stakeholders do not know each other or have never worked together before.
- The species involved, or the issues surrounding its conservation, are high profile or politically charged.
- Issues are complex, divisive or controversial among stakeholders.
- The situation is urgent.

Such a workshop may be preceded by many months of preparatory work (Chapter 2) by the planning team.

For the future, limited resources for planning and/or new technologies may enable development of species strategies without any face-to-face meetings or participatory workshops. Currently, there is no example of a strategy developed solely through remote means. However, the Conservation Planning Specialist Group has explored methods and processes for this eventuality.[3] The conservation Strategy for the multiple species of invertebrates on St. Helena island was developed through a unique combination of simultaneous workshops on St. Helena and in UK, with frequent interaction and coordination over Skype (Cairns-Wicks et al., 2016).

There will be further significant work after a workshop from which the planning product will be developed, reviewed, improved and gradually moved to completion and political endorsement (Chapter 2).

The planning workshop for stakeholders provides a managed environment that will stimulate the best thinking and creativity around the species to be planned. Section 2 Box 4 lists the main benefits of an effective stakeholder workshop.

An effective workshop observes a set of rules that ensures equitable input and participation by all present, and generates a productive atmosphere. It acknowledges and encourages diversity of opinion provided it is presented in a manner that is respectful of others, and the reactions to others' opinions are accorded the same attention and respect.

Section 2 Box 5 lists the commonly accepted rules of conduct and participant behaviour for effective workshops.[4]

3 http://cpsg.org/search/node/virtual
4 http://www.cpsg.org/phva-workshop-planning

Section 2 Box 4: The benefits of an effective stakeholder workshop

The fundamental benefit is to develop an agreed, common framework and gain stakeholder buy-in, which is achieved through:

- A face-to-face environment allows diverse stakeholders to meet and learn about one another, despite the diversity in backgrounds, interests, motivations, cultures etc.
- Developing familiarity between participants generates trust and partnership for common objectives, and allows understanding of why stakeholders may have differences of opinion.
- The common forum allows open dialogue with all views and perspectives encouraged to be presented.
- It creates the right environment for creativity, origination and innovation in ideas, and should be a forum for challenging entrenched positions or prejudices.
- The group format allows contributions from different personality types including those who 'think to speak' (the introverts) and those who 'speak to think' (extroverts).
- The workshop is held once all background information has been collated but no planning decisions taken; hence the stakeholders are being involved right from the start of deliberation and decision-making.
- Early involvement and buy-in by local resource users can be especially valuable when specific management alternatives are under development.

Section 2 Box 5: Workshop professional standards:

- Personal and institutional agendas are put aside in the interests of the agreed Purpose (Chapter 1).
- All ideas are valid.
- Everything is recorded on flip charts or directly into a computer, ideally linked to a projector.
- Everyone participates; no one dominates.
- Participants treat each other with respect, and listen carefully to what all speakers say.
- While seeking common ground among participants is valuable, differences of opinion and problems that cannot be resolved are acknowledged and recorded.
- The agreed time schedule is followed closely.
- The workshop scheduling must ensure Actions will be fully developed by the collected stakeholders.
- Workshop materials and outputs should be consolidated in a form that allows easy production of a workshop report and/or draft strategy by the planning team.
- The workshop should be conducted primarily in the most commonly used language of the assembled stakeholders; if translation into other languages is needed, it is greatly preferable to have this done in parallel at the same time, despite the equipment and costs involved; sequential translation greatly reduces the rate of progress, and also risks losing the attention of participants who do not need the translation.

8 Workshop facilitation

A critical factor in creating a successful workshop lies in the quality of its management or facilitation. This is helped if the facilitator has been involved in design of the planning process and any workshop from the earliest stages, and ideally should be a member of the planning team.

Facilitator duties and roles

The facilitator(s) must sensitively monitor the progress and process of the workshop, ensuring compliance with the standards in Section 2 Box 4, and should:

- Be very familiar with the intended agenda and programme;

- Know the names and backgrounds of all participants, through prior preparation;
- Ensure the programme of the workshop is delivered on time, with the desired outputs;
- Adjust the times of sessions depending on session progress and the overall schedule;
- Consider the inclusion of aspects that are relevant to the workshop objectives but which are not on the agenda;
- Solve procedural problems or inter-personal difficulties;
- Promote the programme flexibly and adaptively through, for example, setting up short-term working groups, assigning draft products to small groups to improve outside the main meeting;
- Ensure inclusive and equitable participation by all;
- Be very sensitive to the feel and mood of the workshop;
- Should be neutral in their position on issues around the species planning, treat all participants and stakeholders fairly and equitably, and be culturally sensitive;
- Be involved in the follow-up from the workshop; they should review any report from the workshop to ensure it reflects their record of proceedings; they will also be useful in reviewing drafts of the strategy or plan.

More than one facilitator

Facilitating a workshop requires high-energy input and constant attention on the part of a facilitator. If resources allow, it may be beneficial to have two facilitators who take turns, which means that:

- The changes of person and style help maintain the engagement of participants;
- The off-duty facilitator can watch and assess the mood of the workshop, while planning for his/her next spell of facilitation;
- It can be especially beneficial if, between them, the two facilitators can offer more professional expertise in facilitating, technical expertise in the subject and local cultural awareness.

9 Workshop preparations

The planning team is responsible for all activities, among which any workshop is likely to be the largest and most complex.

In summary, the practical preparations include assessing the number of participants, their travel arrangements and any immigration requirements, logistics, meeting duration, accommodation and in-country transport, meeting venue and its facilities and the resources needed for the meeting.

These aspects are detailed further in Box 4 of the Cat Conservation Compendium.[5]

10 Tasks after the workshop

This will include:

- Preparation of a workshop report, to be prepared in one to two months as an interim outcome;
- The persons best able to collate and edit this will be identified at the workshop, and are likely to include some persons from the planning team;
- Stakeholders should have the opportunity to review the draft workshop report;
- The final strategy is drafted from the workshop report, most likely using the same editors;
- Representatives of the planning team are likely to be the best persons to present the draft strategy to government agencies and to deal with them, possibly through successive strategy drafts, until approval;
- Optimally, the workshop will identify the person(s) who will have immediate responsibility for follow-up and ensuring the approved strategy/plan is implemented based on its priorities and schedule (Chapter 5);
- Having the final strategy, or at least its highlights, translated into appropriate local language(s) may significantly promote implementation.

5 www.catsg.org/index.php?id=293

11 How long will development of a Species Conservation Strategy take?

The time line for development of a Species Conservation Strategy, from initial idea to endorsement of the product, will be highly variable, depending on many factors. In general terms the following will be reasonable:

- *Preparation*, including information-gathering, identification of stakeholders, design of process, workshop dates and logistics: a minimum of six months unless the situation is simple, resources are abundant and it is not an emergency situation; much computer modelling (such as PVA, see Annex 5) can be done during this phase, with draft results available at the workshop.
- *Workshop duration*: a workshop of less than two days is likely to lead to a rush at the end without adequate attention to detailed Actions (Chapter 5), resulting in an inadequate strategy; anything over four days may risk early departures of participants and/or loss of commitment and energy.
- *Draft strategy/plan*: the need for this will depend on the complexity of the planned situation; if the workshop threw up new information or insights into population dynamics or risk factors, then further modelling such as PVA, or other analyses may be needed after the workshop; in these circumstances, a complete draft strategy may take six to nine months after the workshop; it should then be subject to wide review, certainly by all stakeholders, and may require several iterations until all reviewers (including interested stakeholders) are satisfied with the product, Again, depending on circumstances, full government endorsement may require months or in some cases years of additional public consultation and revision; where this is the case, with suitable permission, the draft plan may be used on an interim basis to enable implementation to start.

12 What tools and resources will planners need?

While the basic process for developing a strategy is relatively simple, complications and complexity soon become evident in designing the process. Fortunately, there is a large array of tools to help the practitioner or facilitator through the whole species conservation planning cycle or for tackling individual stages within.

The IUCN-SSC Conservation Breeding (now Planning) Specialist Group has collaborated with the Species Conservation Planning Sub-Committee to develop the Species Conservation Planning Tools Library, a dynamic resource within which practitioners can locate well-tested planning methods and tools and select those that best fit their circumstances.[6] It includes details and links to case studies and guidance on:

- Commonly used planning methods (e.g. Population and Habitat Viability analysis-based planning, Open Standards-based planning, structured decision-making);
- Alternative tools for completing each of the steps in a typical planning cycle;
- Assessments of the value of these methods and tools to different planning circumstances (e.g. data rich/poor; well/poorly resourced; culturally straightforward/complex).

The value of using established tools, many of which can be flexibly adapted to particular situations, is shown in Section 2 Box 6.[7]

6 www.cbsg.org/new-initiatives/species-conservation-planning-tools-library

7 www.cbsg.org/using-tools-species-conservation-planning. Text modified with permission from NatureServe's Ecosystem-based Management (EBM) Tools Network text.

Section 2 Box 6: What tools can do for an effective planning process

- Help groups visualise problems more clearly;
- Help incorporate a wider array of ecosystem and human considerations into decision-making for species;
- Help build on (rather than repeat) the work of others by using parameter databases, algorithms, and analyses built into tools;
- Help identify and clarify where there are gaps, uncertainties, or disagreement in knowledge about potentially important aspects of the species biology, threats, and conservation options;
- Help to identify what assumptions are being made in the analyses and planning;
- Help guide through processes so planning can move from information to decision-making more quickly;
- Save time and help exploration of a wider range of alternatives by automating analyses or processes that occur repeatedly;
- Help document what inputs and parameters were used in analyses and reasons that decisions were made;
- Help build collaboration among diverse project participants by creating a forum where stakeholder groups learn about and are encouraged to account for each other's goals and concerns.

ANNEXES

Annex 1

The One Plan Approach

The conservation planning processes for *in situ* and *ex situ* populations still often run largely in parallel (Redford et al., 2012) rather than as one integrated process. Many species conservation plans have been developed with limited consideration of the broad range of conservation options offered by *ex situ* tools, while many *ex situ* collection plans and species management programmes have been developed without interfacing with the field community to address the real conservation needs of the species, with the result that *ex situ* activities often do not have the best design to effectively contribute to conservation.

A more effective approach is for all parties to be involved in the joint development of management strategies and conservation actions to produce a single, comprehensive conservation plan for a species. This approach has been coined the 'One Plan Approach' by the IUCN-SSC Conservation Planning Specialist Group (Byers et al., 2013).

The One Plan Approach can be implemented within the species conservation planning process by including relevant representatives from the *ex situ* community in the planning process, and by applying the IUCN 'Guidelines for the Use of Ex Situ Management for Species Conservation' during the planning process.

Ex situ community participation

Relevant members of the *ex situ* community to involve in the species conservation planning process include appropriate Taxon Advisory Groups representatives from regional zoo associations or equivalent for botanical gardens, programme coordinators of existing managed *ex situ* populations or biobanks, *ex situ* partners of existing *ex situ* conservation activities (e.g. headstart or release programmes), and experts on *ex situ* management of the species (or similar taxa, as necessary).

Application of IUCN Guidelines on *ex situ* management

These Guidelines (IUCN 2014) outline a five-step decision process for evaluating *ex situ* options and their relevant value and feasibility in order to reach recommendations on whether *ex situ* options are appropriate within the conservation plan for a species and, if so, then recommendations on their objectives and structure. These steps mirror the general species conservation planning process and can be incorporated directly within a species conservation planning (SCP) workshop or can be conducted as a separate activity that informs the larger SCP process (McGowan et al., 2016). In either instance, it is critical that both *ex situ* and *in situ* species experts and managers are involved in this *ex situ* evaluative process.

Steps in this process are to:

1. Compile a Status Review of the species, including a threat analysis;
2. Define the role(s) that *ex situ* management might play in the overall conservation of the species;
3. Determine the characteristics and dimensions of the *ex situ* population needed to fulfil the identified conservation role(s);
4. Define the resources and expertise needed for the *ex situ* management programme to meet its role(s) and appraise the feasibility and risks; and
5. Make a decision that is informed (i.e. uses the information gathered above) and transparent (i.e. demonstrates how and why the decision was taken).

This process can be applied to all taxa and is relevant whether or not current *ex situ* management or activities are under way.

A critical component and outcome of this process is the realisation, by both the *in situ* and *ex situ* community, of the diverse breadth of *ex situ* conservation tools available, and how these tools might address identified threats, both primary threats and secondary stochastic effects. *Ex situ* conservation activities can support species conservation and prevent extinction in various ways (Traylor-Holzer et al., 2013), by:

- Offsetting the impact of threats. *Ex situ* activities can improve the demographic and/or genetic viability of a wild population by counteracting the impacts of primary or stochastic threats to the population, such as reduced survival, poor reproduction and genetic isolation – for example, through headstart programmes that remove juveniles from the wild for *ex situ* care and return them once they are less vulnerable, or by cross-fostering captive-born neonates to wild parents.
- Addressing the causes of primary threats. *Ex situ* activities can help reduce primary threats such as habitat loss, exploitation, invasive species or disease through specifically designed research, training or conservation education activities that directly and effectively impact the causes of these threats – for example, through *ex situ* research to detect, combat, or treat infectious diseases.
- Buying time. Establishment of a diverse and sustainable *ex situ* rescue or assurance population may be critical in preventing species extinction when the wild population is declining and primary threats are not under control – for example, populations facing widespread infectious disease epidemics or decimation by invasive species.
- Restoring wild populations. Once the primary threats have been sufficiently addressed, *ex situ* populations can be used as a source to re-establish wild populations.

By carefully defining the precise roles and goals of any recommended *ex situ* programme within the overall conservation plan for the species, its form and function can be tailored to maximise the chances of fulfilling the role(s) identified (McGowan et al., 2016). Further explanation of all steps in the process and of *ex situ* options can be found in the IUCN ‘Guidelines on the Use of Ex Situ Management for Species Conservation’.

Annex 2

Species conservation planning for certain taxa and ecosystems

This Annex covers some particular considerations for species planning for plants, fungi, invertebrates, amphibians, reptiles, marine fishes and invertebrates, and freshwater ecosystems.

Conservation planning for birds is not included here because of the existence of BirdLife International's Methodology for Bird Species Recovery Planning in the European Union.[1] The same is true for mammals as there been so much planning done for this group (for examples, see IUCN-SSC, 2008; and the work of the Conservation Planning Specialist Group).[2]

2.1 Species conservation planning for plants

Conservation planning for plants is both important and in need of expansion, for several reasons. Plants are a very diverse group with an estimated 391,000 vascular species (plus about 20,000 non-vascular plants) being scientifically recognised (Royal Botanic Gardens Kew, 2016), as well as significant but unquantified intra-species genetic diversity.

The plant kingdom provides the primary production for all life on Earth; plants provide multiple ecosystem services and have enormous economic values. Consequently their loss or decline in diversity is likely to have severe economic, social and ethical consequences for humankind. Hence it is critical their conservation planning is prioritised, followed by implementation of the plans.

Further, plants exhibit high levels of endangerment: possibly 20% of plant species are Threatened with extinction and another 10% are Near Threatened using IUCN Red List criteria (Brummitt et al., 2015). Furthermore, although the loss of genetic diversity within species is difficult to quantify, the rate of loss is likely to be at least double that of species diversity (Maxted et al., 1997).

Planning for the conservation of plant species is often hampered by lack of detailed knowledge in areas such as breeding systems, including the identity of critical pollinating agents, or of basic biology such as habitat needs and dispersal systems and distances. The nature of their ecological relationships with other species and their community is also often poorly known.

Plants are also particularly at risk in an era of changing ecological conditions; the slow growth rates and long generation times of tree species makes them vulnerable to climate change as migration rates are slow and local adaptation may not be able to cope with such change. In addition, many threatened plant species, whatever the length of their generation time (including annuals), have poor dispersal, low seed regeneration rates, and/or extreme habitat specificity. Individually, and certainly collectively, this makes all vulnerable to both climate change and other causes of habitat quality reduction and loss.

Therefore, in common with the invertebrate situation, plant conservation planning is challenged by the sheer breadth of taxonomic diversity and the largely unknown range of genetic diversity being targeted.

1 http://ec.europa.eu/environment/nature/conservation/wildbirds/action_plans/docs/final_report
2 www.cbsg.org/document-repository

On the positive side, good taxonomic checklists and distributional data are available, for at least the flora of developed countries. At global level, centres of diversity have been identified, which facilitates the use of spatial distribution modelling and climate resilience modelling for effective conservation planning.

Even though little is understood of patterns of genetic diversity within taxa, techniques such as ecogeographic land characterisation (Parra-Quijano et al., 2012) and gap analysis (Maxted et al., 2012) are employing ecogeographic distribution as a proxy for genetic diversity (Annex 4 Box 1) These tools are increasingly used to plan the genetic conservation of plants.

When planning for the effects of climate change, it is worth noting that the responses of co-occurring species to climate change may be highly species-specific, and that the response of other species on which the focal, planned species may be critically dependent may also not be the same as the focal species.

Plant conservation has the benefit of many intervention options. Effective planning may result in the conservation of multiple taxa in multiple locations employing a range of *in situ* (formally protected areas, or extra protected areas *in situ*,[3] or on-farm or home gardens) and *ex situ* (seed storage, in vitro storage, DNA storage, field gene bank or botanic garden) techniques.

Commercial wild harvest of plants

Many plant species that are important for food, medicines and other products are harvested from wild populations. Planning for population viability should address sustainable levels of harvest, needlessly destructive harvest methods, and impacts on other species resulting from confusing taxonomic identification or deliberate mixing with other products. Conservation planning should be incorporated in the management of sustainable collecting from the wild (for example, the FairWild Standard),[4] developed with the support of the IUCN-SSC Medicinal Plant Specialist Group[5] and the IUCN-WWF joint programme TRAFFIC.[6]

2.2 Species conservation planning for fungi including lichen-forming species

Until the last ten years, the conservation of fungi was overlooked relative to that of animals and plants. This is partly explained by lack of awareness of the diversity and ecological importance of fungi, the lack of relevant information for their conservation planning, and the lack of expertise.

The widely cited and conservative global estimate of 1.5 million fungi species (Hawksworth, 1991) reflects their life-sustaining role in decomposing remains of producers (algae and plants) and consumers (animals), and in supplying mineral nutrients to algae and plants through lichen and mycorrhizal symbioses. Fungi are critically important for most plants through mycorrhizal associations, and should be conserved jointly. Lichens, fungi and their symbionts dominate huge areas, forming the bulk of ground cover in many parts of the Antarctic, Arctic, high mountains, sand dunes and taiga.

Areas low in animal and plant diversity may have huge fungal diversity. In boreal conifer forest, for example, over 1,000 fungal species are associated with Scots pine, *Pinus sylvestris*,[7] alone. Fungal diversity may also be high in places rich in animal and plant diversity: for example, South Africa has 20,000 plant species and an estimated 200,000 fungal species (Crous et al., 2006).

Conservation planners must be sensitive to the specificity of substrates and habitats. Substrate is the material on which the fungus is growing. It is also usually, but not always, a source of nutrition. Many fungi occur only on substratum of one or a few animal or plant species. Some fungi with complex life cycles require different substrates and different associated organisms for different

3 Extra protected areas are areas outside the formal *in situ* protected area network; they are also managed for *in situ* conservation but in a less formal manner.

4 www.FairWild.org

5 www.iucn.org/ssc-groups/plants-fungi/medicinal-plant-specialist-group

6 www.traffic.org/

7 www.cybertruffle.org.uk/pinefung/eng, accessed 13 February 2017.

developmental states, leading to a complex definition of habitat. Habitat use by fungi may also vary with seasons.

Fungal habitats may be an order of magnitude smaller than those of animals and plants, and should be included as essential micro-habitats in conservation plans for multiple species. The following are examples of key fungal habitats and ecological roles:

- Saprobes on dead plant material (fallen leaves; attached leaves; fallen twigs, branches and trunks; attached twigs, branches and bark; heartwood; stumps; roots; herbaceous stems; flowers, fruits, capsules, cones and seeds);
- Mutualists or parasites on an equivalent range of living plant material;
- Hosts of parasitic plants (for example, orchids);
- Saprobes or parasites of other fungi, including lichenicolous species;
- Saprobes or parasites of animals (for example, insect pathogens);
- Mutualists with animals (for example, termites, fungus garden ants, rumen fungi);
- Agents of biodegradation and biodeterioration (for example, dung-inhabiting species).

Commercial and recreational picking of fungi

Many wild fungi are subject to commercial or recreational collecting for food and other uses. Indiscriminate picking or picking followed by discarding because of uncertain identification may affect more than the target species. Impacts on population viability are generally unknown, but need to be considered in any conservation plan for fungal species which are harvested.

Sources of information and expertise

For fungal species conservation planning, it is essential to have good information about associations between species (for example between a plant and the mycorrhizal fungi which provide it with mineral nutrients, or to predict future threats from accidentally introduced invasives). The Global Biodiversity Information Facility[8] database, for example, supplies excellent geographical distribution maps, but no information about ecological associations. Conservation planners should therefore be aware of the specialist databases which provide such information. For the fungi, Cybertruffle,[9] Mycoportal[10] and the US Department of Agriculture Fungal Databases[11] are international in scope. Several other databases exist at a national level. These include the Checklist of Fungi of the British Isles[12], the Fungus Conservation Trust CATE2 Database [13] and Landcare Research New Zealand.[14] Others can be found using internet search engines.

Protecting fungi is an essential component of conservation planning. To cover the full range of biological diversity, conservation planners should consult not only botanists and zoologists but also suitably experienced mycologists. The fungal Specialist Groups of the IUCN Species Survival Commission,[15] and societies such as the International Society for Fungal Conservation[16] and the International Association for Lichenology[17] can provide advice about who to contact.

2.3 Species conservation planning for invertebrate conservation

While the basic principles of species conservation planning are applicable to the vast array of invertebrates, this group has a number of attributes that will influence their conservation planning.

The sheer number of species means that many taxonomic problems are far from resolved and also that data on the life history attributes and ecology of individual species can be very limited. Further, information on many invertebrates is also often limited, and there are fewer sources of expertise. Consequently, many conservation strategies for invertebrates include a significant component of further research.

The range sizes of invertebrates are very variable: many marine invertebrate species have extremely

8 www.gbif.org

9 www.cybertruffle.org.uk
10 www.mycoportal.org
11 http://nt.ars-grin.gov/fungaldatabases
12 https://nt.ars-grin.gov/fungaldatabases/specimens/specimens.cfm
13 www.abfg.org
14 http://nzfungi2.landcareresearch.co.nz
15 www.iucn.org/ssc-groups
16 www.fungal-conservation.org
17 www.lichenology.org

large ranges as do, among terrestrial invertebrates, some species with high dispersal capabilities, such as large dragonflies or migratory butterflies. In contrast, the majority of terrestrial invertebrate species have small spatial distributions.

The common occurrence of short generation times and small body size means that many species can reach large populations sizes quickly and in small areas. But, with fast population increases, they may be more vulnerable to stochastic or environmental fluctuations; and, being ectothermic, they may be especially vulnerable to climate change.

From a planning perspective, in situations of high densities of invertebrates in small areas, population recovery or population reduction can happen quickly; consequently, plans can often cover short time spans, and even relatively small areas for less mobile species. Inclusive participation in planning may, therefore, involve fewer stakeholders, making it easier to organise and less costly, and conservation success may be more attainable.

In contrast to the long history of marine fishery management for species such as lobsters, crabs, shrimps, clams and oysters, terrestrial invertebrate conservation has been rarely regarded as a conservation priority; this means that:

- There is a good case for planning for multiple species of invertebrates at the same time.
- Invertebrate planning and conservation may have to integrate with the plans and interests of those conserving, for example, charismatic vertebrates.
- Invertebrate conservation strategies should be exploited as a means of raising public awareness of the need for invertebrate conservation.

2.4 Species conservation planning for amphibians

Worldwide there are about 7,000 species of amphibians belonging to three main orders: the Anura (toads and frogs), the Urodela (salamanders) and the Apoda (caecilians). About 90% of all amphibian species are frogs. Amphibians can range in length from frog species that are a few millimetres to the Giant Chinese salamander that is over 1.5 m.

Amphibians do not occur in marine habitats but occupy specific habitats in freshwater ecosystems, and also live in trees and underground. Amphibians are unique is that their skin is a respiratory surface and, therefore, they generally require a moist environment for survival. In general, amphibians require high humidity across the wide range of habitats or micro-habitats in which they breed. Many species breed only in aquatic habitats, which makes them susceptible to a wide range of environmental threats but, importantly, they can act as environmental indicators.

Amphibians are susceptible to many threats such as disease, habitat destruction and conversion, pollution, chemicals such as pesticides, competition with introduced species and ultra-violet radiation. Major declines of frogs worldwide are due to disease such as the chytrid fungus, and salamander populations are now increasingly at risk from fungal disease.

Species planning for amphibians should acknowledge the great variety of breeding systems, and consequent habitat requirements, such as the use of aquatic and terrestrial habitats at different stages of the life cycle. This is especially significant when planning for any amphibian restoration through translocation or reintroduction.

Amphibians are also susceptible to competition from invasive amphibians and can themselves be aggressive invaders. When conducting planning exercises, it is crucial to look at the impact of invasives, as they can both cause direct competition and also introduce diseases into amphibian habitats.

2.5 Species conservation planning for reptiles

Reptiles comprise turtles, crocodilians, snakes, amphisbaenids, lizards and the tuatara, with approximately 10,000 known species. This array of species can be found across most of the Earth's terrestrial habitats with the exceptions of both polar ice caps. Reptiles also occur in a variety of aquatic habitats, both freshwater and marine. Thus, species conservation planning for this group can be challenging. Out of the 19% of reptiles threatened with extinction, 12% are classified as Critically Endangered, 41% are Endangered and 47% Vulnerable.

Species planning for reptiles frequently experiences a lack of information on ecology, distribution and taxonomy. Cropan's tree boa in Brazil was rediscovered in Brazil in 2016, some 64 years after it was feared extinct. In the case of such rediscoveries, where the species may be on the brink of extinction, conservation action has to be based on available information and willingness to try interventions (Section 1, Chapter 6).

Species conservation planning for reptiles needs to take into account the size of individuals, ranging from tiny forest dwelling dwarf chameleons (size ~45 mm), found in tiny forest patches, to the massive saltwater crocodiles (size >5 m) that are distributed all across Southeast Asia's coastal habitats.

Mobility is also highly variable. Marine turtles move around the world's oceans, usually returning to breed on their own natal beach. In contrast, some reptiles may only occupy relict habitats such as the forest on isolated mountain tops.

Many reptiles exhibit temperature-dependent sex determination during embryonic or larval development. In certain species, high temperature leads to development of males, whereas females predominate at medium temperatures. This may make such species very sensitive to climate change, which may also affect reptiles through changing rainfall patterns and hence the flooding or drying out of critical breeding habitats.

Conservation planning for reptiles should also consider the impacts of invasive alien species. These may predate native reptiles or invasive plants may significantly harm reptile habitats. Alien reptiles may also have serious impacts, such as the Burmese python which predates the native America alligator in the Everglades, USA, and they are also implicated in the introduction of diseases into native reptiles.

As reptiles can benefit from both *in situ* protection and the *ex situ* maintenance of breeding colonies, with the potential for reintroduction, *ex situ* conservation may be a common component of conservation planning for reptiles.

2.6 Species conservation planning for marine fishes and invertebrates

Species conservation planning in marine systems encompasses a wide range of climate regimes (arctic, temperate, tropical), ecosystems (estuarine, coastal, reef, open ocean etc.) and a large array of major taxa: animals (fishes, invertebrates – a massive grouping including crustaceans, corals and molluscs), fungi, heterokonts (diatoms, seaweeds) and plants (sea-grasses and mangroves), reptiles, mammals and birds, with extraordinary species and planning diversity. This Annex is a brief summary around planning for marine fishes and harvested marine invertebrates, with some wider applications.

For most purposes, 'marine' can include nearshore coastal and estuarine tidal systems as well as massive offshore ocean systems of very large areas. In addition, a variety of offshore demersal and pelagic fish species can use nearshore systems as juveniles, with habitat shifts across continental or insular shelves as individuals mature. Almost all marine fishes are external fertilisers, broadcasting spawn like some invertebrates. The periods of dispersal of fish and invertebrate larvae in the open ocean, which may span only days up to several months, are important in determining metapopulation connectivity and other aspects in conservation planning efforts.

The distributional ranges of individual marine species can be very broad (e.g. global or more than 30 coastal countries in the Western Atlantic). Some very widely distributed groups can be subject to complex transboundary international management planning structures, such as tunas, conchs, lobsters, marine turtles and marine mammals. In addition, hundreds or thousands of species can co-occur within very limited spatial areas (e.g. on coral reefs) that are very difficult to sample or monitor. Some marine species are targeted individually, while many are also caught in multi-species fisheries (e.g. with nets and traps). Many coastal marine and pelagic species have extremely high commercial value and importance in human food security and are over-harvested. These factors combine to create formidable challenges for species planning.

Many countries manage their commercially harvested marine fish and invertebrate species through individual Fishery Management Plans; most are oriented towards harvesting for sustainable production. As such, these plans are complex, reflect national or regional legislation, policies and management regulations, can involve substantial litigation in some regions, and represent very significant socio-economic policy domains. In addition, management plans may require complex modelling of biological parameters for which empirical data may or may not be available. Habitat types of particular value that are impacted by coastal construction or water quality degradation (for example, mangroves, seagrasses, hard bottom) are occasionally protected by fishery management regimes.

Multi-species management plans have been used in several countries to manage such fisheries (for example, the Snapper-Grouper Complex of the US South Atlantic Fishery Management Council originally had 73 species from ten reef fish families in one planning document, reduced recently to 60 total species). Because of shared habitats and non-selective fishing gears used, many co-occurring species are harvested simultaneously without regard to species-specific biology or productivity.

Although there is an increasing interest in conservation plans for marine species, a number of challenges arise:

- Many, diverse species can occur in great concentrations of biodiversity.
- Information on many species is either sparse or very incomplete, with information typically absent on unregulated harvesting or by catch.
- Many oceanic species are highly mobile, with often poor information on seasonal movements and natural and fishing-induced variability in population dynamics.
- Many species use different ecosystems and habitats at different stages of their life cycles.

The approaches to species conservation planning in these Guidelines can be applied to marine species of many groups, particularly for single species stocks that are managed with traditional tools such as size limits, amounts and seasonality of catch using demographic information on population sizes and variability. The multi-species nature of many marine communities and bulk harvesting methods has produced a recent focus on ecosystem-based management for conservation planning, sometimes based on marine protected areas. These areas are often characterised by site-based limitations on fishing for most or all of the species within the zoning boundaries. Marine protected area planning and other fishery management tools often prove more successful for species conservation when local ecological knowledge is engaged early in the planning process.

2.7 Species conservation planning in freshwater systems

Species conservation planning in freshwater systems has been less developed and practised than in terrestrial systems, through a combination of:

- The multi-faceted nature of the threats facing freshwater species;
- The ways in which threats can be transported over large distances;
- The connectivity and complexity of water systems;
- The physical challenges for survey and census underwater.

Freshwater systems are integrators of often diffuse uphill and upstream threats, in addition to receiving direct impacts from threats such as dams, water withdrawals, overharvest and point-source pollution. The effects of human activities across a watershed are transported downhill and downstream into freshwater systems, with impacts ultimately observed as far away as coastal zones.

Planning for freshwater species therefore needs to account not only for protecting or restoring aquatic habitat but also for land-based activities, sometimes at locations distant from any planned species.

Furthermore, freshwaters, with the exception of some isolated systems, are hydrologically connected longitudinally (upstream-downstream), laterally (rivers and their floodplains) and vertically (surface and groundwater).

These connections are critical to aquatic species' movements, whether as migrations to complete their life cycles, dispersal to new habitats, and small-scale regular movements to access refugia and resources. Concomitantly, this connectivity often allows exotic species to become invasive with severely detrimental impacts on indigenous animals, fungi and plants.

Ensuring the viability of these connections often requires going beyond protecting discrete areas to conserving dynamic systems. Such dynamic conditions may conflict directly with the interests of people whose lives and livelihoods depend on relatively regulated systems such as near-constant river flow volumes.

Finally, freshwater systems may be seen almost as islands within the terrestrial landscape, which means that obligate aquatic species can have highly constrained dispersal options. For instance, in the face of climate change-induced warming, often envisaged as a northward or southward movement of suitable climate conditions (depending on the hemisphere), fish inhabiting east-west flowing river systems may have limited adaptation responses, such as access to climate refugia.

Added to these complexities, most freshwater species exist below the water's surface and thus are harder to survey. Hence, it is understandable why conservation planning for freshwater species has until relatively recently lagged behind efforts in the terrestrial realm.

That is changing, however, with the availability of new high-resolution hydrographic datasets and hydrological models, as well as new planning software and methods that allow users to optimise for a variety of attributes simultaneously, including maintaining upstream-downstream connectivity.

Conservation planning may be catalysed by the plight of one or more endangered species but, in general, planning and implementation of conservation interventions in freshwater systems focus on the protection and restoration of habitats that serve larger aquatic communities. This is because the primary threats to freshwater species are typically (though not always) habitat-based rather than focused on one or more species. However, some conservation solutions, such as fish ladders or other passageways to facilitate instream movement across impoundments, may be designed with particular species or species groups in mind.

Annex 3

Further information when compiling a Status Review

3.1 Historic account, across all known or inferred range

The sources of information are varied and the historical period to which they might refer is also varied; sources that can be used, approximately from the earliest to the most recent, can include:

- The fossil and sub-fossil record;
- Fungal spore and pollen core analysis;
- Aboriginal artwork, such as cave paintings or rock carvings;
- Oral tradition;
- Fungarium, herbarium and museum specimens;
- Evidence of wild individuals being taken into captivity;
- Historical records from zoos, botanic gardens, fungaria and any other living collections;
- The written accounts of travellers;
- Historical records of harvests, trade, legislation, diet;
- Artworks, historical maps;
- Natural history/scientific publications;
- Management and agency publications;
- Indigenous local knowledge;
- Inference from the natural distribution of the species' habitat.

Information from such sources needs always to be challenged on the grounds at least of (1) taxonomic compatibility with current forms; and (2) the accuracy of the geographical locations to which any observation or record refers (Boakes et al., 2010).

Direct evidence of past distribution will depend on many factors:

- Some species may leave behind better evidence of presence; for example vertebrates compared to invertebrates.
- The historical period for which these sources are suitable is variable.
- There will be bias in which species are more memorable to humans and/or whether they are incorporated into their cultural traditions.

For all such reasons, historic ranges based on direct evidence will tend to underestimate true range; this may be better assessed through 'indigenous range'.[1] The indigenous range of a species is the known or inferred distribution generated from historical (oral or written) records, or physical evidence of the species' occurrence. Where direct evidence is inadequate to confirm previous occupancy, the existence of suitable habitat within ecologically appropriate proximity to proven range may be taken as adequate evidence of previous occupation.

Information from all such sources can be combined into a presumed historic distribution, but the observations comprising this should be distinguished by source and date, and presumed reliability.

Historical records can provide more information than just presence in an area; some sources may describe or suggest a level of abundance or seasonal presence only.

3.2 Taxonomy and management units

The deliberate splitting of an already threatened species into two or more separate management units requires careful consideration. Inbreeding poses a significant threat to the viability of small, isolated populations. For naturally outbreeding species this risk is expected to outweigh that of any outbreeding depression that might result from inter-breeding with individuals from other sub-populations of the same species. Tools are

1 www.iucn.org/content/new-guidelines-conservation-translocations-published-iucn

available to predict the relative risks (for example, Frankham et al., 2011). Concerns about altering historic patterns of genetic diversity as a result of linking sub-specific units should be assessed in an informed way against the possible increased risk of extinction through isolation. Installing or maintaining low levels of gene flow among sub-specific units may offer the best overall solution to maintaining biodiversity in many cases.

As splitting can considerably increase the work of planning and conservation, any case for splitting for planning purposes must be rigorously argued.

3.3 Species biology

Present distribution

Distribution data can originate from many and diverse sources, based on collation from written sources and expert knowledge,[2] from specimens in fungaria, herbaria or museums, and surveys either for the focal species or as part of multiple species surveys. It is important to add details to distribution and locations with the source, the method used, and likely reliability of the data. This becomes especially significant if information from multiple sources is combined as meta-data for an overall understanding, and gap analysis or species distribution modelling is planned.

As habitat fragmentation is a common challenge for many species, distribution maps may have scattered and disconnected areas of range, or areas that are barely connected through occupation by the species. The 2008 Handbook (IUCN-SSC, 2008) describes the development of distribution maps distinguishing between the Area of Occupancy and Extent of Occurrence, which are elements in the Red List criteria[3].

Where a species' total range is divided among several disconnected areas, it may be preferable to regard each as supporting a sub-population, with each requiring consideration as a separate conservation unit.

While current distribution can be represented as a simple map, other methods may yield more insights. A Geographical Information System allows comparable maps or layers, of for example, habitat or vegetation types, infrastructure developments to be added, all of which may help identify the Threats that the species face. Further, it can be used to predict the impacts on the species of anticipated future developments or habitat change. In addition, Species Distribution Models (Annex 9) can be used to integrate species occurrence records and environmental variables to develop environmental suitability maps for species in space and time, exemplified in planning for the Chacoan peccary, *Catagonus wagneri* (Altrichter et al., Eds. (2016)).

Current numbers and demography

Effective planning needs the most comprehensive and accurate information possible on a species abundance, level of fragmentation and population trends. Where population size is thought to be particularly small it can also be valuable to gather more detailed information or estimates of sex ratios and age structures, and age-specific mortality and fecundity, as these can provide insights into past and likely future population dynamics (see below).

In some cases, there will be a series of surveys or censuses at intervals of some years, using the same methods, resulting in comparable total counts or precise population estimates with tight confidence limits.

More usually, information is patchier, and is based on multiple survey methods, or there is information only from a short period. In some habitats direct sightings and estimation of population size may not be feasible in which case proxies or models built on observed age or sex ratios can be used.

There are many methods for survey and census, many of which are usually suited only to certain taxa, and these can be found in standard textbooks or published works. The key aspect is that the options are explored in advance of planning, and the most appropriate method used,

2 From Martin et al. (2012a): "Expert knowledge is substantive information on a particular topic that is not widely known by others. An expert is generally considered someone who holds information about a given topic and who should be deferred to in its interpretation" (Barley & Kunda, 2006). This knowledge may be the result of training, research and skills, but could also be the result of personal experience (Burgman et al. 2011).

3 www.iucnredlist.org/static/categories_criteria_3_1

to increase certainty that adequate estimates of population size and vulnerability are being used.

Population dynamics

Survival rates are valuable information in planning and, again, they can vary between species in which small numbers of young are produced, with high survival due to parental care and long learning periods, to those in which the parents play no part after eggs, seeds or spores are released.

Where data are available, age-specific survival rates are especially useful in modelling. These can be estimated using data from marked (banded, tagged) individuals using methods generally known as mark-recapture analysis.

Known causes of mortality are valuable, especially if they can be linked to threats to the population (Randall, C.J., and R. Van Woesik, 2015). Disease can be a major source of mortality, often catastrophic (Dybas, C.L., 2009; Munson et al., 2008), and there is already evidence of more disease epidemics or of diseases increasing their ranges due to climate change.[4] For many marine and terrestrial species, legal or illegal harvesting is a major source of mortality.

As population abundance and dynamics are rarely constant across sites or for long periods of time, planning must acknowledge and incorporate fluctuation in demographics. Some of the possible questions to be asked about this are covered in Section 2.1.

Minimum viable population size can be a valuable component of planning, and will shape the Vision, Goals and Objectives (Chapters 3, 4). The information collected in the Status Review may provide a basis for population modelling, if data are adequately accurate. Conversely, existing models can feed into the Status Review.

The most common population-scale modelling approach used in species conservation planning is the population viability analysis (PVA), through which population models area applied to the estimation of extinction risk under differing circumstances, for example under a range of different population sizes, threat intensities or management strategies (*see* 'Predicting the outcomes of actions' below; further detail on this important tool is given in Annex 4).

Key population attributes to consider in planning can include:

- Planning should take account of the extent to which planned populations fluctuate in size: they may remain relatively constant between years or their numbers may exhibit wide swings in numbers due to varying ecological conditions (including excessive offtake).
- Does the reproductive rate or success change with density or number of individuals, especially if a species' numbers decline significantly?
- Does species distribution, within overall range, vary greatly between years depending on ecological conditions?
- Is the species able to persist through periods of adversity, for example as spores or cysts, or with seeds that can remain dormant for decades or centuries? (Maxted, 1995).[5]

Life history and ecological role

Planning will not be effective if critical aspects of the planned species' life history are not accurately known or have been ignored. There is a risk of this happening when planned species:

- Have very specific habitat requirements at different stages of their life cycles;
- Have specific, essential ecological requirements;
- Have critical inter-specific relationships or dependencies;
- Have narrow ecological tolerances or niches;
- Have poor dispersal capability;
- Are naturally rare; or
- Are vulnerable to complex or less-than-evident threats.

4 Noting, however, that the Rio Conventions recognise the right of all organisms, including the sources of disease, to persist and be conserved if necessary, www.cbd.int/rio/

5 Maxted (1995) called for a control to Bedouin grazing in the Jebel Druse plateau in Syria as overgrazing was seriously threatening native, endemic species populations. Such a limitation was introduced in 2005 and within a few years endemic species populations had recovered simply from limiting grazing and allowing the soil seed bank to replenish natural population levels.

Habitat selection including at different life stages

Care must be taken in the use of species distribution models as they assume the modelled species are in equilibrium with their environment (Elith and Leathwick, 2009); this assumption will negatively affect the prediction of future performance of a decreasing population, or its response to changing climate. While species distribution models can help in many aspects of the decision-making process in conservation (Guisan et al., 2013) they should be used with care and understanding of their strengths and limitations for species planning, and any model should be kept as simple as possible, with complexity progressively added as necessary for meeting the objectives of the modelling (Merow and Silander, 2014).

For invertebrates and all non-mammalian vertebrates, different stages of their development from egg to emergent adult may depend on very particular environmental conditions such as vegetation condition with narrow tolerances, different habitats occupied during individual development, or the presence of other species.

Many fungi also have very different habitat requirements for their different developmental states. Some, for example, colonise living leaves as specialised parasites, but only produce fruiting bodies after the leaf has died.

If experimental work is needed to gather very specific information, such as the restriction of a plant species to a very specific substrate, this need not delay planning work. The necessary work can be included as a research activity in the conservation plan.

For many species, such as aquatic ones in both in marine and freshwater environments, and subterranean or nocturnal taxa, it may be difficult to gather direct observations on habitat selection. Any species distribution model used in such conditions should acknowledge the consequent uncertainty and its implications for conservation planning. One caution is that the last areas in which a species is persisting may not be the species' best habitat; rather these may only be refuge areas in which the threats facing the species elsewhere are reduced or absent for some reason. This situation is a common consideration in any proposed reintroduction to the wild.

In many cases, one species may be critically dependent on another species for its survival at some stage in its life cycle. This could include a specific pollinator-pollinated species-pair, or a fungus which can only grow on a particular animal or plant species or genus, or an invertebrate that will feed on only one plant during the last instar before it pupates. The persistence of such species-pairings will require conservation solutions that meet the needs of both at the same site. Awareness of such relationships will help assess a species vulnerability to climate change (below).

Diet and nutrition

Diet and feeding ecology may change during an individual's development, and this can be substantial for many taxa. Desirable information includes characterisation of the feeding type, describing both the food type and how restricted the species is to that food type.

Further aspects connected to feeding and diet, relevant to planning, may include:

- For herbivores, the major plant species or item eaten;
- For animal-pollinated plants, the species that eat the pollen or honey and which pollinate the plant;
- For relatively sedentary species, seasonal changes in abundance or quality of food species, especially;
- Seasonal changes in the distribution of food species, causing migration or movements by their consumers;
- Sensitivity of food sources to anthropogenic disturbance, such as dam-building on fish populations, consequently also affecting fish predators;
- The effects of excessing harvesting of species on their consumers;
- Variation in diet during different phases of the life cycle.

Reproductive biology

The following lists factors related to reproduction that may be considered in a Status Review:

- The critical numbers or density of individuals that are needed to stimulate breeding;
- Ensuring suitable conditions of humidity or standing water for amphibians, with 38 known breeding systems;
- The appropriate day length or temperature regimes for plant growth and flowering;
- The impact of temperature regime on sex determination in some reptiles;
- The presence of specific pollinators;
- The impact of individual body condition for successful reproduction;
- An appropriate ratio of male and female plants for obligate out-crossing plants;
- The availability of oviposition sites for invertebrates, and then optimal micro-climate conditions for egg development;
- The existence of concentrated spawning aggregations of fish.

Genetics

Assessment of the genetic status of a population is helped by having baseline information before any decline or fragmentation, but this may not always be available.

Much can be inferred about a population's genetic history following application of non-invasive sampling of hair, scats, urine, buccal swabs (Schulte et al., 2011) from living individuals or even from museum specimens.

For plant species conservation, an understanding of genetic population structure throughout the species range is often critical to conservation planning. The species will have maximum chances of survival if the full breadth of genetic diversity is maintained; but, genetic diversity is rarely evenly distributed throughout the species range, so knowledge of its distribution is ideal to enable both *in situ* and *ex situ* plant conservation planning. However, the availability of such data is too often limited due to the cost of collection. Ecogeography is then commonly used as a proxy for genetic diversity, the assumption being that populations found in different habitats or remote locations will be genetically more differentiated than those found in close proximity. Species distribution modelling such as ecogeographic land characterisation (Parra-Quijano et al., 2012) is being used to aid populations with the maximum range of genetic diversity.

Genetic profiling of populations may be especially important if a conservation solution involves reinforcing low numbers with individuals from distant areas or from captive-breeding. Where reintroduction is planned, success may be enhanced by selecting founder individuals with the maximum possible genetic diversity (Witzenberger and Hochkirch, 2008).

Mobility

The extent and nature of mobility in any planned species is relevant to planning. Key aspects include:

- To what extent do different age-classes move differentially?
- What are the seasonal movements within habitats on a local scale, with the apparent aim of exploiting habitat conditions optimally?
- How much are different habitats used seasonally?
- How much movement between seasons would be better described as migratory?
- How much of the species' movements are nomadic, moving in an opportunistic fashion, probably responding to erratically changing ecological conditions?
- To what extent does the species occupy the same habitat and site throughout the year?
- What is the median movement distance (per year and lifetime); what proportion of individuals move over different distances?

Dispersal

Plants:

- Is fruit/seed dispersal passive (through wind or water) or does it depend on ingestion and dispersal by particular animals, to be identified if possible?
- Is it possible to estimate average and maximum dispersal distances, which may be critical as a response, for example, to climate change?

Animals:

What is the normal situation for dispersal among offspring:

- Do young males or females leave their birth area or family group?
- At what age do individuals disperse?
- To what extent is dispersal capability influenced by habitat fragmentation?

3.4 Values

In this and other aspects, there is particular value in ensuring that indigenous local knowledge is incorporated early and fully into species conservation planning (IUCN-SSC/CEESP SULi, 2016). Eliciting such values may require surveys of different groups and age-classes across local communities and other stakeholders.

The Status Review should attempt to define and collect the values that stakeholders within the geographical scope of the plan attach to the planned species. These might include:

- Traditional values and cultural attitudes of communities, noting that such attitudes might be either strongly for species persistence or for its reduction or removal;
- The species' very existence is valued;
- The potential for commercial or recreational offtake, or traditional harvesting;
- Species' habitat as a contributor to human recreational value;
- The range of ecosystem services provided by the planned species' community, and/or by the planned species directly;
- Wild fungal or plant species that have direct socio-economic value as human and animal food sources, crop trait sources, medicines, or for construction or fuel;
- The species' value as a bio-indicator: along roads in Alaska, USA, the number of moss plants, *Hylocomium splendens*, is inversely related to the levels of pollution from aluminium, zinc and cadmium (Holt and Miller, 2010).

3.5 Conservation context and resources

At broad scale, primary sources include:

The IUCN Red List of Threatened Species[6] has assessed the conservation status, in terms of extinction risk, of approximately 86,000 species across all major taxa; these assessments are authoritative on the status and demographic trend of species, contain analyses of the causes of decline and are a valuable data source for planning.

The large body of taxonomic-based SSC Specialist Groups[7] is an authoritative source of information on species. The thematic Specialist Groups have interests and expertise that are directly relevant for species conservation planning. They comprise the Specialist Groups for Conservation Planning; Invasive Species; Reintroduction; Species Monitoring; Sustainable Use and Livelihoods; Wildlife Health.

The Convention on Biological Diversity[8] is an international treaty for the conservation of biodiversity, the sustainable use of the components of biodiversity and the equitable sharing of the benefits derived from the use of genetic resources. In 2010, its Parties (member states) adopted the Strategic Plan for Biodiversity 2011–2020[9] with the purpose of inspiring broad-based action in support of biodiversity over the decade by all countries. This contained the Aichi Biodiversity Targets, within which the most relevant to species conservation planning is Target 1; "By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained."

The Convention on International Trade in Endangered Species (CITES),[10] is concerned with the international commercial trade in endangered species of animals and plants. Although fungi are also subject to international trade, they have no

6 www.iucnredlist.org/
7 www.iucn.org/ssc-groups
8 www.cbd.int/
9 www.cbd.int/2011-2020/about/goals
10 www.cites.org/

explicit protection from CITES, and hence need particular and special consideration.

The Convention on Migratory Species[11] is concerned with migratory species in danger of extinction throughout all or a significant portion of their range or which face a very high risk of extinction in the wild in the near future.

As a further resource, Species+[12] contains infor mation on all species that are listed in the Appendices of CITES and the Convention on Migratory Species, as well as in the Annexes to the EU Wildlife Trade Regulations.

This section should also include consideration of the status and trends within the physical areas occupied by the species. Three spatial approaches are especially relevant:

1 Species' ranges may be included partly, wholly or not at all in formal protected areas. Such situations will be significant for planned conservation actions. ProtectedPlanet.net[13] is the online interface for the World Database on Protected Areas, a joint project of IUCN and UN Environment, and the most comprehensive global database on terrestrial and marine protected areas.
   For marine species planning, the UNEP-WCMC Ocean Data Viewer[14] is a rich source of background information.

2 Several taxon-specific approaches to identifying critical sites are now unified within the concept of Key Biodiversity Areas (KBA).[15] They are terrestrial or marine sites of global significance for biodiversity conservation, identified using globally standard criteria and thresholds, and based on the occurrence of species requiring safeguards at the site scale. They will become the global standard for improving the global cover of the system of protected areas. Hence, planning for species within KBAs will confirm their priority for conservation action, and the resulting strategy will contribute to more effective conservation of that KBA.

3 Conservation will always be limited by the financial and technical resources available. However, its efficiency can be significantly improved by clearly identifying the most effective conservation action to be implemented. The tools widely used to aid conservation planning are some form of ecogeographic survey/gap analysis (Castañeda Álvarez et al., 2011; Maxted et al., 2012) (*see* Annex 3 Box 1).

Annex 3 Box 1 Ecogeographic survey and gap analysis

Ecogeographic analysis is defined as the process of gathering and synthesising information on ecological, geographical, taxonomic and genetic diversity. The results are predictive and can be used to assist in the formulation of complementary *in situ* and *ex situ* conservation priorities. For example, *Vavlivia formosa* (Vavilov's pea) is always found growing in west Asia on limestone scree over 2,000 metres. Therefore, any *in situ* conservation should be attempted in a protected area with these conditions, or collected for *ex situ* backup. Thus past ecological, geographical, taxonomic and genetic data enables us to plan future conservation.

Increasingly, ecogeographic analysis is accompanied by the more explicit gap analysis methodology, which involves a comparison of the target species diversity that exists in nature with the sample that is already actively conserved, the identification of key elements of target species diversity that are under-conserved, and therefore the location of 'gaps' in the current conservation strategy.

11 www.cms.int/
12 http://speciesplus.net/about
13 www.protectedplanet.net/
14 www.unep-wcmc.org/featured-projects/ocean-data-viewer
15 www.iucn.org/theme/protected-areas/wcpa/what-we-do/biodiversity-and-protected-areas/key-biodiversity-areas

Annex 4

Disease risk assessment (DRA)

Based on the One Health principle, DRA assumes that some disease is ever-present in biological systems, and that both this and the hazard of outbreaks of currently absent or symptom-free diseases should be factored into species conservation planning.

World Organisation for Animal Health (OIE) and International Union for Conservation of Nature (IUCN, 2014) offers a risk analysis process:

Annex 4. Figure 1: Steps in the disease risk analysis process

This is very similar in concept to the Species Planning Cycle (*see* Figure Introduction 1).

The Guidelines contain examples of DRA in practice and its value. Based on wide survey, the needs for DRA by users are ranked thus:

1 Human-wildlife interactions.
2 Domestic species – wild species interactions.
3 Management of wild species (*in situ*).
4 Translocation of wild species.
5 Management of wild species in captivity (*ex situ*).

The risk of accidental disease being imported through animal or plant translocations is also emphasised in the risk assessment section of the Guidelines for Reintroductions and Other Conservation Translocations (IUCN-SSC, 2013).

The DRA Guidelines are accompanied by a Manual of Procedures for Wildlife Disease Risk Analysis (Jakob-Hoff et al., 2014), containing much further advice and case histories.

Annex 5

Population viability analysis (PVA)

PVA is used to estimate the future likelihood of a population's extinction and indicate the urgency of alternative management efforts, and to identify key life stages or processes that should be the focus of those efforts. This is typically accomplished through computer simulation modelling of demographic, genetic and ecological processes that define a given species in a specific habitat. PVA can be a valuable tool for investigating current and future risk of threatened animal or plant population decline under specific scenarios of human-mediated activities, locally and globally, which may compromise the population's ability to reproduce successfully and/or survive (Morris and Doak, 2002). In addition, PVA can be a key step in identifying management options to reduce the risk of population decline and enhance opportunities for the population to recover in its natural habitat.

PVA methods are not intended to give absolute and accurate 'answers' for what the future will bring for a given wildlife species or population. This limitation arises from two fundamental facts about the natural world: it is inherently unpredictable in its detailed behaviour; and we very rarely fully understand its precise mechanics (Lacy, 2000). Consequently, many researchers have cautioned against the exclusive use of absolute results from a PVA in order to promote specific management actions for threatened populations (e.g. Ludwig, 1999; Beissinger and McCullough, 2002; Reed et al., 2002; Ellner et al., 2002; Lotts et al., 2004). Instead, the true value of an analysis of this type lies in the assembly and critical analysis of the available information on the species and its ecology, identification of data gaps, and in the ability to consider and compare the quantitative metrics of population performance across simulated scenarios. Each simulation represents a specific scenario and its inherent assumptions about the available data and a proposed method of population and/or habitat management. Interpretation of this type of output depends strongly upon knowledge of species biology, habitat characteristics, the threatening processes affecting the population, and possible future changes in these processes.

PVA has a long history of application by the Conservation Planning Specialist Group and its partners and clients. Its document library contains many and diverse examples of the use of PVA and its complementary Population and Habitat Viability Analysis.[1]

Two of the widely used PVA software programs (the RAMAS family of software, provided by Applied Biomathematics; and Vortex, provided by the Species Conservation Toolkit Initiative) are available from www.Ramas.com and www.vortex10.org.

1 www.cbsg.org/document-repository

Annex 6

Climate change vulnerability assessment and adaptation planning

6.1 Background

Climate changes have been observed across multiple components of the climate system, and have already had measurable impacts on numerous taxa and ecosystems across the globe (Parmesan, 2006; Scheffers et al., 2016). These impacts may sometimes be beneficial but are usually interpreted as adverse within the parameters of conventional conservation.

Responsible species conservation planning should take account of climate change for at least the following reasons:

- Climate change is already affecting species.
- Climate change may be affecting species in ways that are less observable currently but potentially catastrophic for long-term survival.
- Climate change often interacts synergistically with other threats on species, even when the latter may appear more significant and need to be tackled more urgently.
- Other species with which the planned species has a critical relationship (such as between plant and pollinator) may be affected and then respond differentially to climate change, thereby breaking the critical, synergistic relationship.
- Over the longer term, climate change may cause profound changes in community structure and composition, which would be likely to have some direct or indirect impacts on the planned species.
- The direct and indirect effects of human responses to climate change may have profound further impacts on biodiversity.
- Climate change impacts may not be evident or present at the time of planning, but might become so during the time span of the resulting strategy or plan, with unknown but likely harmful impacts on the planned species.
- Denying or ignoring the potential impact of climate changes on biodiversity in planning will lead to less effective plans and decreased impact of conservation interventions, particularly in the *in situ* context where it would be wasteful of scarce conservation resource to implement *in situ* conservation of a species if climate change vulnerability assessment would have indicated the site would be unsuitable for that species in 20–50 years' time; in such a case choosing a less impacted site or *ex situ* conservation would be the preferable option.
- Responsible species conservation requires adaptive management; this includes monitoring, and regular review of conservation objectives and plans (Chapters 7, 9). Monitoring should be designed to track climate change impacts, including responses to shifts in the speed or magnitude of climate change, as well as the effectiveness of conservation interventions.
- Many measured and modelled attributes of climate change are predicted to change in non-linear ways; rapid amplification of these trends may occur by mid-century with impact potentials that are higher than current rates.
- Similarly, biological impacts may be non-linear and subject to thresholds; species may appear to be coping with incremental climate changes until a critical threshold is reached.
- It is difficult to consider climate change *ad hoc* and then adapt species planning instead of making planning 'climate-smart' from the start.

6.2 Incorporating climate change into species conservation planning

Climate change should be integral, and not be treated as an add-on, to any planning process. It is essential that planning is 'climate-smart', and the core concept in this is intentionality:

- Being intentional means having explicit assumptions about how climate will/may affect the species of concern, and how conservation actions are linked to those climate-related impacts and vulnerabilities;
- Simply assuming that 'doing more of the same only better' is not an adequate climate adaptation approach: sometimes that will make sense, and sometimes not, but there is a need to have a clear and climate-informed rationale for such assumptions;
- Transparency is another core component of intentionality; being clear about assumptions, rationale, and logic used to inform decisions and plans allows these to be revisited, and actions refined in light of new information or changing threats.

In the context of *in situ* species conservation planning, the key question is 'How will the climate in which the planned species live(s) change over the planned period?'

If the answer to this is known or suspected to be 'yes', the key to incorporating climate change into species conservation planning is an understanding of possible future changes in the climate affecting the species. Climate change may affect species in many ways through their physiology and ecology.

Many climate variables can be measured and projected, among which some variables are more ecologically relevant than others. Ranging from average temperature or precipitation to the frequency of extreme events, the focus should be on those climate variables that are biologically significant for the planned species (such as temperatures exceeding a certain threshold) rather than simply relying on averages.

Hence, the vulnerability of species and ecosystems to climate change must be included in the assessment of threats identified as affecting the planned species. However, somewhat distinct from other more conventional threats, the implications of climate change for effective planning requires both a deliberate climate change perspective, using a variety of tools and scenarios, and the acceptance of, and ability to incorporate, uncertainty.

Climate change, and how to cope with it, may seem daunting because of:

- Uncertainties over future climates, especially at temporal and spatial scales that are relevant to species;
- Knowing which climate scenarios are most realistic;
- Uncertainty over assessing the extent of species' exposure to climate change and how they might respond;
- Knowing how to apply scenarios, or models;
- The interactions between climate change and other threats and stressors;
- Knowing how to develop adaptation strategies for species at risk from climate change and a range of other threats.

These challenges can all be accommodated, as demonstrated in sub-sections 6.3–6.14:

6.3 Working with uncertainty around climate change

Planning is based on the best available knowledge (Section 2, Chapter 2). Even if perfect knowledge is not available and some facts or interpretations may be shown later to be wrong, an iterative planning process should identify and reduce the impacts of these shortcomings.

Further, the world in which planning takes place is not constant: extreme and sudden events, such as major change in a country's politics and policies can have profound effects on the socio-economic environment in which conservation must operate. Good planning should take account of uncertainty and such risk factors.

Uncertainty in climate projections is one of the major impediments or concerns for many conservationists in incorporating climate change into their planning, but:

- Uncertainty is nothing new in species conservation and resource planning, and should not be an excuse for inaction.
- There are a number of emerging approaches for dealing with uncertainty in climate projections (and other aspects of adaptation such as

ecological and human responses to climate impacts).
- There may often be reasonable confidence/certainty in the directionality of changes, even if there is less certainty in the rate or ultimate magnitude of change; for example, in most places sea level rise is highly certain, although the rate and magnitude may be less so.

The uncertainty over the trajectory of climate change at a species scale translates further into uncertainty over the results from any climate change vulnerability assessment (below).

6.4 Selecting climate change projections and scenarios to assess exposure

As noted above, determining the 'exposure' of species, habitats, or ecosystems to climatic changes is an important aspect of assessing climate-related vulnerability. Consequently, accurate assessments of future climates at spatial scale relevant to the planned species and within a defined timescale are necessary.

Any vulnerability assessment is therefore made in the context of a specific, changing or changed climate. There are many sources of climate information for species planners to choose from.

It is generally agreed that good planning does not rely entirely on the input of one, probably arbitrarily chosen, climate scenario; more acceptable results are obtained by running the same approach with more than one climate scenario (McSweeney et al., 2015). Annex 6 Box 1 describes the use and benefits of scenario planning.

Annex 6 Box 1. Scenario planning

Scenarios are a tool that managers can use to test decisions or develop strategy in a context of uncontrollable and uncertain environmental, social, political, economic or technical factors.

Scenarios describe plausible alternative futures; hence, they are not forecasts or predictions. They provide an excellent tool for organising information and exploring the future.

While climate models may indicate the impacts that might affect an ecosystem or its species, they cannot reveal when, where or how these impacts will occur, nor predict when extreme events might take place.

Scenario planning can help address these uncertainties and questions about future climates. Further detail and methods are provided in, for example, National Park Service (2013).

6.5 Balancing climate and non-climate threats over the short and long term

Many conservationists and managers feel so overwhelmed by urgent, short-term threats that they feel they do not have the 'luxury' of thinking about or addressing climate-related threats. There are several issues to consider regarding the relationship between climate and non-climate threats:

- Climate change impacts are already here; although climate impacts will grow over time, climate impacts can no longer be considered as something that will happen only in the distant future.
- Climate change impacts are often manifest through existing threats. This often is in the form of amplifying or exacerbating existing 'non-climate' stressors.
- Climate change impacts vary between species and from location to location, so failure to incorporate climate change analysis in conservation

planning could unnecessarily invalidate long-term conservation implementation and actually postpone necessary conservation action.

The need is to develop a sufficient understanding of the direct and indirect threats that climate change brings, and to craft conservation strategies and actions that align short- and longer-term needs.

For present purposes, climate change in species conservation planning is treated here as two stages:

1 Assessing the vulnerabilities of species to climate change.
2 Incorporating adaptation planning.

6.6 Technical resources and assistance for including climate change in species conservation planning

To orientate and guide planning practitioners, there is now a wealth of literature on topics such as:

- Observed changes in climates and the impacts of these on natural systems;
- The prediction of future climates on an increasingly fine spatial basis;
- Diverse tools for the assessment of the risks of climate change for species;
- Modelled cases of species impacts.

The rest of this Annex is based almost exclusively on two resources:

Foden, W.B. and Young, B.E. (eds) (2016). *IUCN-SSC Guidelines for Assessing Species' Vulnerability to Climate Change*. Version 1.0. Cambridge, UK and Gland, Switzerland: IUCN Species Survival Commission. x+114pp.[1]

In addition to guidelines, this work also includes copious real world case studies on vulnerability assessments, covering a wide range of approaches, species and ecosystems, spatial scales and resource scenarios.

Stein, B.A., P. Glick, N. Edelson and A. Staudt (eds). 2014. *Climate-Smart Conservation: Putting Adaptation Principles into Practice.* National Wildlife Federation, Washington, DC.[2]

The following is no more than an overview into the thinking, requirements and resources needed and available for climate change vulnerability assessment and adaptation planning. Species conservation planners are urged to refer to these two sources, at a minimum, for further detail and encouragement.

6.7 Assessing the vulnerability of species to climate change

What comprises vulnerability?

Species vulnerability should be determined by evaluating:

1 To what extent is/are the species exposed to a climate change?
2 To what extent is/are these species sensitive to climate change?
3 To what extent is/are species adaptable to climate change?

Annex 6 Figure 1 shows these factors of exposure, sensitivity and adaptability diagrammatically and how they may affect species singly or jointly.

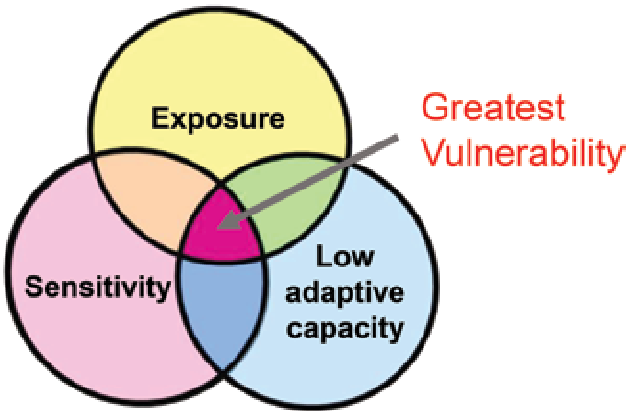


Diagram showing three components of vulnerability in climate change vulnerability assessments. The greatest vulnerability to climate change occurs when species are exposed to large and/or rapid climate change driven alterations in their physical environment, are sensitive to those changes, and have low adaptive capacity (adapted from Foden et al., 2013).

1 http://iucnccsg.com/resources/

2 www.nwf.org/What-We-Do/Energy-and-Climate/Climate-Smart-Conservation/Guide-to-Climate-Smart-Conservation.aspx

Assessments have already been carried out for a wide range of species from a limited range of taxa (e.g. all birds, amphibians, warm-water reef-building corals) to predict species' vulnerability; exposure is typically assessed using climate projections while sensitivity and adaptive capacity are inferred from biological traits, life histories and ecological relationships (Foden et al., 2013). Establishing the potential mechanisms of climate change impacts on species is particularly important for making a reliable assessment. Where specific information about particular focal species is lacking, assessments of similar species can be helpful.

What approaches are available for assessing vulnerability?

There are three major approaches for assessing vulnerability to climate change (below). Each has its specific data requirements and outputs, as well as particular merits and drawbacks. In some situations, one or more approaches many be combined.

While carrying out an assessment from nothing can be challenging and time-consuming, shortcuts may be possible. A growing body of existing models and assessments are becoming available, and inferences can be made if planned species are taxonomically close or ecologically similar to one for which a reliable assessment is available (below).

6.8 How can vulnerability assessments be used?

Climate change vulnerability assessments can have a range of practical uses, including:

Information for priority-setting:

- The species predicted to be most climate-sensitive could be used as sentinels or indicators of climate change impacts for their community.
- The conservation priority of species vulnerable to climate change might increase.
- Areas or regions with high numbers of vulnerable species can be identified.

Establishing impact mechanisms and pathways:

- Such assessment should lead to identification of how the species will be affected, whether through demographic parameters, physiological tolerance etc.

Informing conservation planning:

- Consideration of the possible impacts of climate change on vulnerable species should lead to scoping potential conservation responses beyond those that might be employed without consideration of climate change.
- Taxonomic and spatial priorities can be addressed.

6.9 Defining the situation, aims and objectives

Both the type of assessment approach and the essential information for assessing vulnerability are dependent on the types of outputs required.

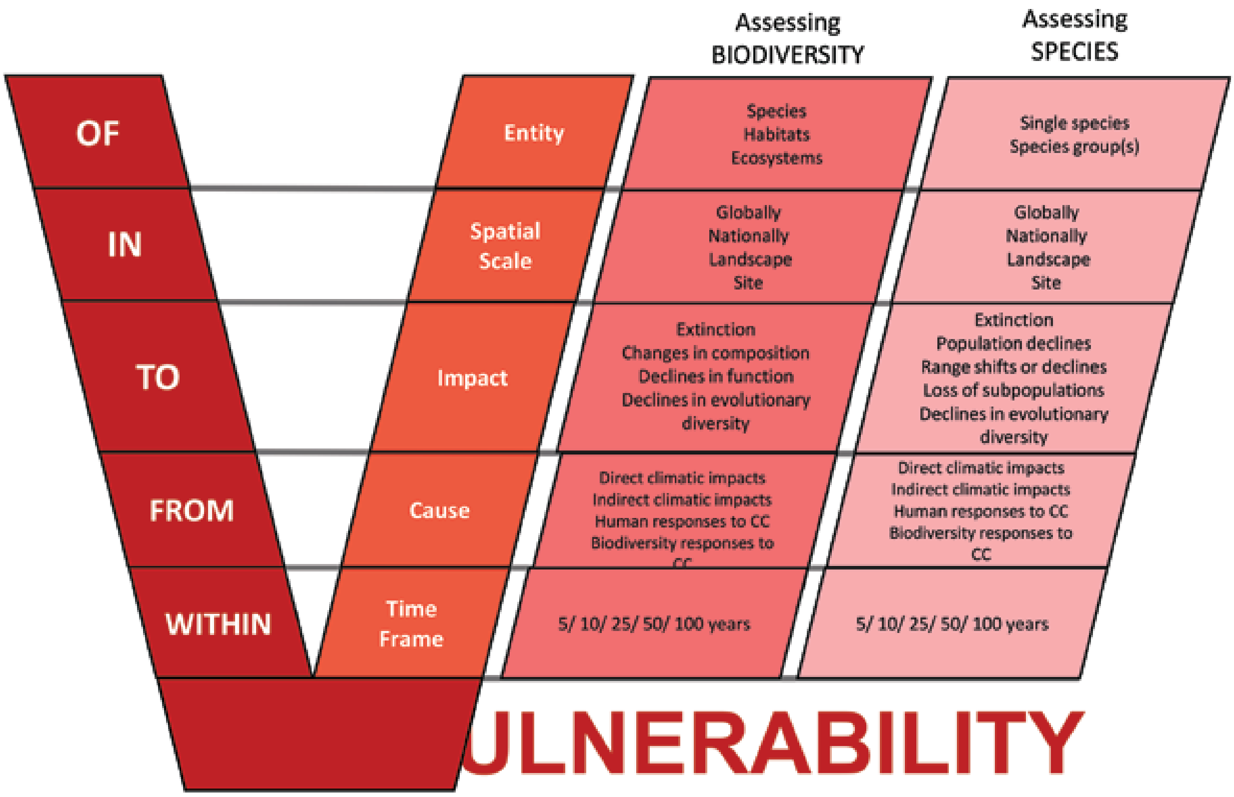
Carrying out vulnerability assessment is not usually a trivial exercise. It is therefore useful to state the justification for such an assessment being done. A well-defined aim will answer the following:

1 Why are you carrying out this vulnerability assessment?
2 Who is your audience?
3 Which decisions do you hope to influence using the results?

As the next step, just as species conservation planning requires boundaries to be specified, so does assessing vulnerability of climate change, through a set of objectives. Annex 6 Figure 2 shows the five key parameters for describing vulnerability (Figure 4 of Foden et al., 2016a).

The key objective categories are these:

- Which (single or multiple) species or other taxonomic unit are under consideration?
- In which areas or at what sites do we think they will be vulnerable?
- When will this vulnerability occur?



Five key parameters for describing vulnerability of biodiversity to climate change. An example of a specific use for assessing an ecosystem is: "Vulnerability *OF* temperate forests *IN* North America *TO* declines in carbon storage *FROM* temperature and precipitation changes and pine bark beetle damage *WITHIN* the next 50 years". An example of specific use for assessing species is: "Vulnerability *OF* tuna species *IN* the southern Atlantic *TO* range shifts and population declines *FROM* rising ocean temperatures *WITHIN* the next 10 years" (from Foden et al., 2013).

- Why will they be vulnerable: through what mechanisms?
- How serious will this vulnerability be?
- What do we not know about adequately?

The objectives for a climate change vulnerability assessment will depend on the taxonomic focus (single species, group or community), the spatial focus (range-wide for a species, a single site for the species, Key Biodiversity Area etc.) and on the timeframe (accepting that ten years may be maximum for an effective conservation planning exercise, whereas climate change predictions often cover 25, 50 or 80 years into the future). Examples of climate change vulnerability assessment objectives covering the diversity of such foci are given in Table 2 of Foden and Young (eds) 2016.

Identify and evaluate existing climate change vulnerability analyses

Growing numbers of vulnerability studies have been conducted to date and many are published in academic and management-related literature, as well as online. Before embarking on a climate change vulnerability analysis, web and literature searches are recommended, to establish whether the focal species, site(s) or region(s) has/have already been assessed. If they have, next steps are to find out if the assessments are accessible, and whether they are suitable for the purpose and meet the Goals and Objectives.

Even if they prove unsuitable, such assessments may still provide information about previously unknown data and expertise, as well as on how region- or context-specific challenges were addressed.

Foden and Young (2016) highlight a range of freely available species-level assessments, along with other resources (Table 6), and their Figure 8 demonstrates how they can be evaluated for reliability and suitability.

6.10 How to carry out an assessment: three user situations

Foden and Young (2016) highlight three situations in which assessors[3] may find themselves when considering climate change vulnerability assessment in a Red Listing context. These are adapted here for the species conservation planning context. The situations are arranged from lower data availability and/or modelling expertise (Situation 1) to those where greater data and modelling expertise are available (Situations 2–3):

- Situation 1: Consider the species' ecological and biological traits to determine the likely mechanisms of climate change impact and quantify these using expert knowledge.
- Situation 2: Use correlative (species distribution) model outputs to quantify climate change impacts on species' distribution ranges.
- Situation 3: Use mechanistic model outputs to quantify climate change impacts on populations and ranges.

Since assessors with expertise in correlative and mechanistic modelling are likely to have experience in climate change vulnerability assessments, they should refer to the more detailed guidance in Foden and Young (2016). For less experienced users, however, Situation 1 is more appropriate and is described here in more detail.

In Situation 1, assessors may not have the data or expertise to model climate change impacts, but they do have information and/or expert knowledge on focal species' biological traits, physiology, behaviour and ecology. As a first step, assessors should make a comprehensive list of the mechanisms through which climate change may impact the focal species. As discussed, climate change can affect populations through a wide range of different mechanisms, including directly (for example, through heat stress, drought stress or flooding) and indirectly (e.g. through interactions with other threats such as habitat loss, disease or competition with invasive species). Impacts from humans responding to climate change (both now and in the future) should also be considered (e.g. building dams and sea walls; human migration; biofuels expansion and other changing land use patterns).

One approach to systematically listing mechanisms of impacts is, first, to consider the rate and extent of climatic change exposure across the species' distribution range. While at a global scale, the general trend of 'warmer with more frequent and severe extreme events' can be assumed, examining climate projections for the specific focal region is essential because localised patterns and extents of change can differ markedly. Variability in rates of change across the species' range should also be considered. Locations of examples of such climate projections are provided in Table 6 of Foden and Young (2016). This table does not cover the risks posed by changes in human behaviour in response to climate change, and these should be considered in addition.

The second step is to consider how, and how much, each aspect of projected climatic changes will impact the focal species (i.e. mechanisms and extent of impact). The species' biological traits will interact with exposure to make it more or less sensitive and/or adaptive to the climatic changes predicted. Thus, trait-based assessment approaches typically provide useful guidance for systematically examining the types of traits linked to particular impact mechanisms. Table 9 of Foden and Young (2016) details those related to higher sensitivity and lower adaptive capacity, and can be used to help list or inventory mechanisms of impacts (e.g. through changing inter-species interactions, or disruption of environmental cues).

Once impact mechanisms have been listed, these should be ranked according to the degree and likelihood of their impact. For dominant mechanisms, the extent of risk posed by each should then be evaluated according to:

- Their plausibility (how likely they are to impact);
- Their immediacy (how soon they are expected to impact);
- Their geographic scope (where they are likely to impact);
- Their severity (how much they are likely to impact the species' population or distribution range).

3 In this section 'assessors' may be species conservation planners or expertise brought in to assist the species planning process.

Since this assessment will rely largely on expert knowledge, as many experts as possible should be involved, and consensus reached wherever possible. Assumptions and rationales must be recorded to document and justify the exposure considered, the mechanisms of impacts, and the roles of biological and ecological traits in mediating species' sensitivity and adaptive capacity.

This approach should result in identification of key climate change impact mechanisms, as well as an expert-based evaluation of the extent of the impacts of each.

A key drawback to Scenario 1, however, is the inherent biases that expert-based quantification can introduce. Consequently, the importance of recording all key assumptions and rationales must be emphasised. Scenarios 2 and 3 provide an advantage over Scenario 1 by using models to provide more objective quantification of some impacts, in addition to considering other possible mechanisms of impact. In Scenario 2, correlative (species distribution) models predict the rate and nature of geographic shifts in areas that are climatically suitable for the species, and hence potentially its distribution ranges. In Scenario 3, detailed changes in species' demography, distributions, interactions and extinction probability may be predicted, and the roles of some conservation interventions simulated.

6.11 Three challenging situations for assessing species' climate change vulnerability analysis

Availability of suitable data is a prerequisite for the conventional climate change vulnerability assessment approaches outlined so far in these Guidelines. Three types of species present particular challenges for their application (Box 3, Foden and Young, 2016).

1 **Poorly known species** are problematic when scarce data on occurrences, traits or physiology preclude application of correlative, trait-based or mechanistic approaches, respectively.
2 **Small-range species** that have naturally small ranges due to, for example, high specialisation.
3 **Declined-range species**, whose ranges have become smaller due to anthropogenic (non-climatic) threats.

As these situations may be precisely the reason for species conservation planning, the solutions are especially significant. These situations and how to deal with them are described fully in Foden and Young (2016) section 4.2.

6.12 Certainty and uncertainty in assessment results

With present understanding, the results of all climate change vulnerability analyses will be subject to uncertainty as a result of the uncertainties associated with *all* of the various data and methods that will be used to perform the assessments. Some sources of uncertainty are obvious (e.g. uncertainty in future climate scenarios because of alternative emissions paths that may be followed), whereas others are often not even acknowledged and are rarely quantified systematically (e.g. uncertainty in the historical baseline climatic data). Generally, methods used to perform climate change vulnerability analyses do not take most of these sources of uncertainty into account. The ways in which the different types of uncertainty can be addressed are in Section 6 of Foden and Young (2016).

6.13 Adaptation planning

This section shows why and how species planning can respond and adapt to the prospect of climate change. This is known as being 'climate-smart'.

While the most important requirement in planning is to be clear and explicit about Goals and Objectives, regardless of climate change, ensuring that Goals and Objectives are climate-smart makes this even more imperative.

Most existing conservation goals emphasise the persistence of a given feature (species or system) in its current state, or restoration of that feature to a prior (healthier) condition. But, looking to the future, it will be important to be clear in goal-setting about when the goal is persistence (or restoration) of a feature, and when it must be acknowledged and accepted that there will be change or transformation due to climate change impacts (Annex 6 Box 2).

Annex 6 Box 2
Some implications of persistence versus transformation (from Stein et al., 2016)

Persistence and transformation can be expressed in different ways and at different scales:

- *Biological level*: Using the classic understanding of biodiversity as having three major components (composition, structure, function) at multiple levels (from genes to ecosystems), Goals may be structured in ways that seek to maintain the persistence of one thing (e.g. forest structure) while acknowledging and accepting changes in the species assemblage (i.e. composition).
- *Spatial scale*: One might wish to maintain the persistence of species (i.e. regional flora and fauna) while acknowledging and accepting changes in the distribution of those species. That would represent a change (loss) at a given site, but persistence across the broader geography.
- *Temporal scale*: One might structure goals to focus on persistence over shorter time periods (e.g. 20 years), acknowledging and accepting that over longer timescales, changes will be inevitable. Being explicit about the temporal scale can allow a sequence of strategies and actions.

6.14 Crafting climate-smart Goals/ Objectives

- Defining or revising conservation Goals can be a psychologically demanding exercise since it pushes planners or conservationists to face some unpleasant truths about what may or may not be feasible given rapid climatic changes.
- Although the concept of 'desirable future conditions' is often used in structuring Goals and Objectives, taking climate change into account will require that thinking must instead be about 'achievable future conditions', as the new reality.
- Defining or revising goals is not an all-or-nothing proposition. Although there may be instances where a complete redirect may be indicated, more commonly it is possible to make refinements or modifications, rather than a complete reworking or abandonment of existing Goals.

The Purpose of planning (Chapter 1) asked 'What is to be planned? Why? Where? and When?' Where a Strategy is being originated now or revised as part of a periodic review the same questions should be asked with respect to climate change. From this, any current Goals that might be climate-compromised and in need of refinement or revision can be identified.

Many existing goals will be seriously affected by growing climate impacts, and realistically may no longer be feasible. Consequently, if an existing Strategy is being revisited, it will be important to reconsider existing goals and objectives in light of climate vulnerabilities (Annex 6 Box 3).

Annex 6 Box 3. Key questions for developing climate-smart goals or objectives (from Stein et al., 2016, Section 7.3.1)

- **What** – is there a need to modify the focus of the goal in terms of the biological entity? This might mean a shift from focusing at the species level to the habitat level, or emphasising ecosystem services rather than a given forest type. From the perspective of most species Specialist Groups, the 'what' is fairly fixed, although it may involve emphasising higher taxonomic units (e.g. genera, families), or full species rather than infraspecific taxa or distinct population segments.
- **Why** – what is the end goal or outcome that we are attempting to achieve? To keep a taxon from going extinct? To rebuild populations and restore the taxon to its historic levels of abundance? To ensure a level of ecological functionality or service for human use (e.g. hunting or consumption)? Often, there are multiple outcomes expressed for conservation of a given species. (For many fish, for example, there is an interest in stabilising populations to avoid extinction, but also to provide recreational fishing opportunities.) The above-described continuum of change (persistence to transformation) is particularly relevant in clarifying and reconsidering the 'why'.
- **Where** – As climate change causes species and habitats to shift across the landscape, being open to redefining the geography of our Goals/Objectives will be increasingly important. Many traditional species conservation goals express a desire to re-establish and rebuild populations across the entire historical range. Climate change will almost certainly render portions of the historical range for many species inhospitable. This might include such things as focusing more on the leading, rather than trailing edge of ranges, climate refugia, or even contemplating managed relocation outside of historic ranges.
- **When** – Even if a Strategy or Plan has a lifespan of less than ten years, the default timeframe for most conservation planning is 'in perpetuity'. However, in the face of rapid climate change, this is no longer a reasonable assumption. Accordingly, it will become important to be clearer about the timeframe over which a given Goal/Objective is valid or operative. In essence, we will need to begin defining the 'shelf life' for Goals and Strategies. As an example, we may feel that following a persistence-oriented goal for a particular species at a particular location may be feasible over the next 10–20 years, but given climate projections after that there will be a need to shift towards a transition-oriented goal for that species or place.

Annex 7

Example of Vision, Goals, one Objective, Actions and further detail from the Madagascar pochard Strategy (Woolaver et al., 2015)

VISION	Populations of Madagascar pochards are increasing and restored and thrive in healthy, well-managed ecosystems, involving local communities and other stakeholders, contributing to sustainable development and being a source of pride as a flagship species for Madagascar. Mitombo tsara sy mihamaro ny Fotsimaso miaina anaty tontolo salama izay tsara tantana iarahan'ny Vondron'Olona Ifotony (VOI) sy ireo mpiara-miombon'antoka hafa rehetra; mandray anjara amin'ny fampandrosoana maharitra ary fitaratra ho reharehan'i Madagasikara.
GOALS	Increase population numbers and expand the distribution of Madagascar pochard in the wild. Ampitomboina ny isan'ireo Fotsimaso ary alehibiazina ny fanaparitahana ny fianakaviany eny amin'ny natiora. Ensure that each stakeholder benefits from the conservation of the Madagascar pochard and the sustainable management of its habitats. Lantohana fa ny mpiara miombon'antoka rehetra dia mahazo tombotsoa amin'ny fitantanana mahomby ny Fotsimaso sy ny fonenany

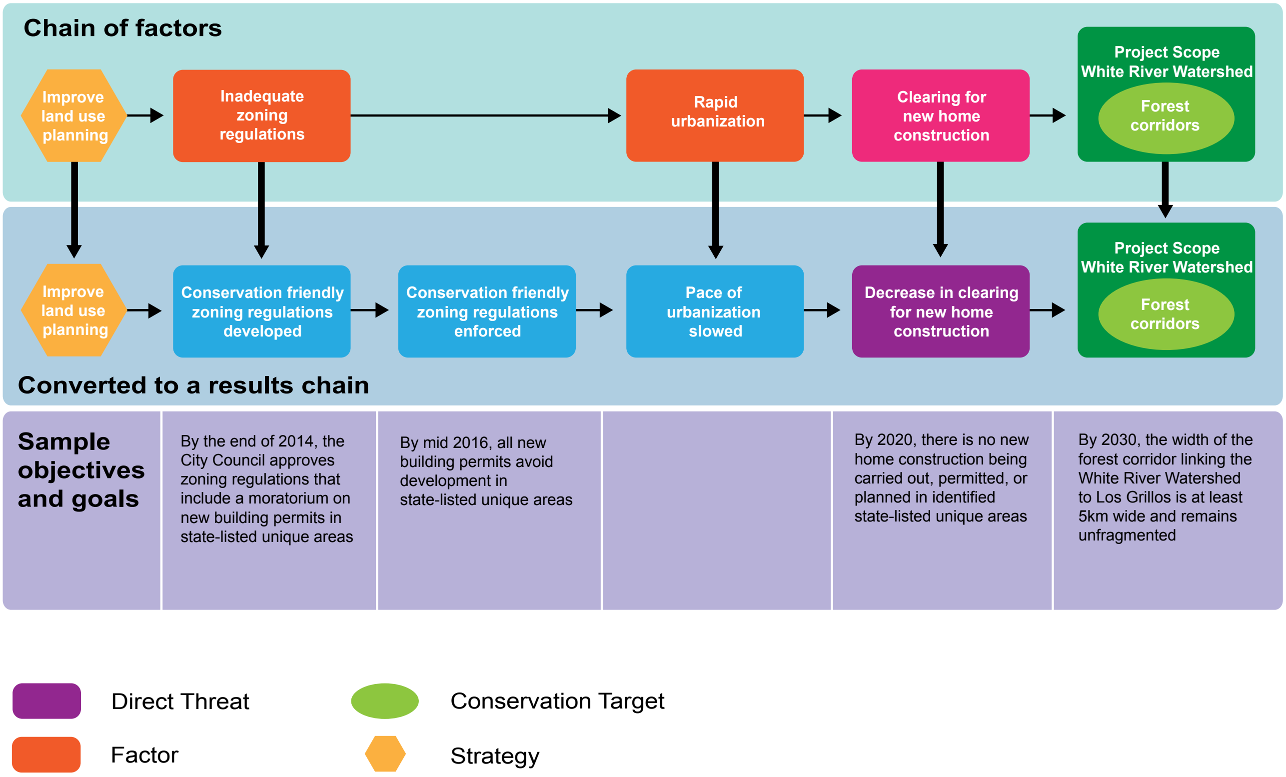
/continued

Objective 1. The wild population at Bemanevika is protected through improved management by stakeholders. *Hamafisina ny fiarovana ny toeram-ponenany ankehitriny*

Action	Project and Activities	Priority	Agencies responsible	Cost (£)	Timescale	Indicators	Risks and opportunities
1.1	Complete the process of the establishment of Bemanevika NPA *Tohizana ny fametrahana ho Faritra Arovana vaovao an'i Bemanevika*	Critical	TPF, MEEF, DCBSAP,VOI	10k	T1 (2014-2016)	Permanent Protected Status granted. PAG implemented.	Lack of funding.
1.2	Manage the wild population to increase productivity and carrying capacity of lake-complex *Tantanana ireo fotsimaso voa-janahary mba hampitombo ny isany sy ny fetra fahazakan'ny toeram-ponenany*	Moderate	Durrell, WWT, TPF, VOI	2-5k	T1 (2014-2016)	Fledging success improves from current and breeding is regular at one other lake.	Need to respect ecological integrity of site. Sufficient experience exists worldwide in improving wetlands for biodiversity.
1.3	Continue research on natural conditions at the site *Tohizana ny fikarohana momba ny toetran'ny toerana*	Moderate	WWT, Durrell, UNIV TAN	1-5k	T1 (2014-2016)	Regular surveys completed and data analysed.	Trained local staff in place on site.
1.4	Strengthen local collaboration between COBA and other stakeholders *Hamafisina ny fiaraha-miasa amin'ny VOI sy ny mpiara miombon'antoka*	Critical	TPF, VOI	5-10k	T1-T4 (Ongoing 2014-2024)	Permanent presence of field teams and regular surveys of lake and surrounding habitats	
1.5	Minimise human disturbance to Madagascar pochard habitat *Hahena ny kotaba sy fanimbana ataon'ny olona eo amin'ny fonenan'ny Fotsimaso*	Critical	TPF, VOI	10-15k	T1-T4 (Ongoing 2014-2024)	Permanent presence of field teams and regular surveys of lake and surrounding habitats	Trained local staff in place on site.

Annex 8

Example of a more detailed Results Chain



Annex 9

Methods of predicting quantitatively the effects of actions on planned species

9.1 Selecting methods

Using more than one method to answer the same question increases confidence in the results, or allows discovery of uncertainties, hidden assumptions and other issues that need to be resolved.

The first task is to specify the exact question(s) that are to be answered. The more specific the question, the easier it is to determine the best method to use. For example: Which placement or configuration of protected sites maximises species viability? What is the minimum number of individuals to translocate in order to increase the overall chance of species survival? What is the maximum level of collecting or hunting or illegal poaching that could be sustainable? How large an area of habitat needs to be restored/protected to ensure long-term recovery of the species?

After specifying the questions for the analysis to answer, select the simplest method that can potentially answer the question, and the most complex method that is feasible (given any limitations on data, time, and expertise).

The most common quantitative methods for predicting the species' responses to Actions include the following:

- Statistical analysis of experimental results;
- Statistical comparison of cases (correlational analysis of 'natural' experiments);
- Statistical analysis of monitoring results;
- Habitat models (mapping habitat; see also 'Habitat needs', above);
- Population models (demographic projections or population viability analysis).

9.2 Statistical analysis of experimental results

- Although controlled field experiments are an effective way to predict the outcome of actions, they are often not feasible; in some cases, small-scale and short duration experiments (field trials or pilot studies) may be feasible; the results of these then need to be extrapolated to the actual temporal and spatial scales of the proposed action.
- When interpreting the results of experiments, especially (but not exclusively) when extrapolation is needed, sound statistical design and analysis is essential.
- Statistical considerations (such as sample sizes and experimental design) should precede the implementation of the field study.

9.3 Statistical comparison of cases (correlational analysis of 'natural' experiments)

- When experiments are not feasible, the variability of conditions for different populations or areas can be used to make inferences about the outcome of conservation actions.
- In such correlative or comparative studies, outcomes (e.g. population change) in different areas are statistically related to the selected predictor variables (e.g. natural conditions, degree of protection, etc.) in those areas.
- Thus, the results are determined to a large extent by the availability of data on these predictor variables (or covariates) and by the number of independent areas or populations from which information is available.
- Sound statistical analysis is essential for correctly separating out the effects of different factors.

9.4 Statistical analysis of monitoring results

- Considerations similar to those in the above two sections also apply to analysing the data from, and interpreting the results of, monitoring programmes.
- Any actual Action should be considered as an experiment, and a data collection (monitoring) and data analysis plan should be put in place before the Action is implemented.

9.5 Habitat models (mapping habitat)

- Also called species distribution models (SDM) or environmental niche models (ENM), habitat models allow mapping the extent and quality of habitat for a species.
- The data required include specific locations where the species is known to occur (occurrence points), and maps of environmental variables that are important for the species (e.g. land cover, climate, topography, roads and other human activity areas).
- There is a variety of methods for habitat modelling; one of the most commonly used is implemented in the programme MaxEnt; however, use of any model requires full understanding of the assumptions and its limitations in the context of what it can do for the planned species.
- The resulting habitat map can be used for planning conservation actions, such as translocation, reintroduction, habitat restoration, and site protection.
- Future habitat can also be projected, by using expected future values of the environmental variables (e.g. future climate, based on results of climate models).
- The areas predicted to be suitable may not be occupied by the species for a variety of reasons (e.g. local extinction due to collecting, hunting or poaching, recent disease outbreak, dispersal limitations, or any factor that is not represented by the variables used in the model); it is essential to consider carefully these reasons before using the results of habitat models in conservation plans.
- Habitat models are also used in Red List assessments, especially in relation to climate change (*see* 'Guidelines for Using the IUCN Red List Categories and Criteria',[1] Section 12), and more generally in climate change vulnerability assessments (Foden and Young, 2016).
- Habitat models can be used together with population models (see below).

9.6 Population models (demographic projections)

- Population models organise and integrate all information about the population dynamics of the species, and allow projecting the changes in population under various future conditions and scenarios, including alternative conservation actions (this is also known as a population viability analysis, PVA).[2]
- Some population models can incorporate genetic data and genetic processes such as inbreeding depression, which is valuable in assessing future viability as well as evaluating population management strategies such as conservation translocations.
- Population models are useful in the primary drivers of population viability and in identifying important data gaps.
- Population models and the other methods presented above are complementary, rather than substitutes or alternatives of each other; in fact, population models are most effective when used with the information obtained with the methods presented above; for example, statistical analyses inform how different actions are represented in the population models, and habitat maps inform the spatial structure of the population models.
- Population models can give a variety of results that can be used to predict the outcome of conservation actions; these include population size, risk of population decline, chance of recovery, proportion of populations or sites occupied, distribution of the population to sexes and/or age-classes and genetic structure.

1 www.iucnredlist.org/technical-documents/red-list-training/red-list-guidance-docs
2 www.cbsg.org/pva-process

- There is a large variety of population models, ranging from simple models with only a few parameters, to complex models with multiple populations, multiple types of variability, and detailed demographic structures (involving age, size, sex, etc.); the most appropriate type depends on the availability of the data, the ecology of the species, the question being addressed, and modelling expertise available.
- Data that can be used to develop population models come from surveys, censuses, mark-recapture studies, monitoring programmes, the types of statistical analyses described above, and habitat models.
- Even the simplest models can give useful results that allow evaluating alternative conservation actions.
- An important advantage of stochastic population models is the ability to quantitatively incorporate biological stochastic processes (such as rare chance events) that can significantly impact small populations as well as other types of uncertainty (such as lack of knowledge) in the analysis.
- For a general introduction and further references, see Stanton and Akçakaya (2013).[3]
- Population models are also used in Red List assessments, especially in relation to Criteria A, C, and E; and, when combined with habitat model projections, in relation to climate change (IUCN Standards and Petitions Sub-Committee, 2016; Foden and Young, 2016).

3 http://life.bio.sunysb.edu/ee/akcakayalab/PVA.pdf

Annex 10

The basis for structured decision-making

In complex situations it may prove impossible to select an obviously best action or solution among an array of options because:

- A single Action may come with evident advantages and disadvantages with respect to a single Result and Objective; or
- One Action may be optimal with respect to desired Result A but actively prevent achieving a separate desired Result B; or
- Possible Actions may be grouped together in different combinations to provide alternative strategies, whose comparative advantages and disadvantages cannot be assessed qualitatively.

In such situation a decision-aiding framework is needed (Gregory et al., 2012a); structured decision-making can provide this.

Six core, interlinked and iterative steps form the basis of structured decision-making, outlined in Gregory et al. (2012a) for a species recovery case history:

1 Clarify the decision context. What are the target species, geographic region, timeframe? What climate change scenarios will be considered? What is the decision to be made by whom, when? What is the range of alternatives and objectives to be considered? What kind of analytical tools will be needed? What level and kind of consultation is appropriate? Who are the key stakeholders?

2 Develop clear objectives and performance measures. Objectives concisely define what matters about the decision. Performance measures are specific metrics for assessing and reporting how well an alternative performs with respect to the Objective.

3 Define alternative actions that can be taken to meet Objectives.

4 Evaluate the benefit of actions. Assess the consequences of each action on achieving the Objective via the performance measure.

5 Assess trade-offs of alternative actions and choose best actions; use cost-effectiveness analysis to compare the benefits of alternative actions, their costs and their feasibilities (Carwardine et al., 2012).

6 Implement actions, monitor and adapt. Are management actions working? Are species as vulnerable as predicted? Have new threats, interactions between threats or new actions arisen?

Annex 11

Adaptive management

There are two key forms of adaptive management: passive and active. In the face of alternative strategies to meet Goals, a passive adaptive manager will assess the probable outcome of each strategy and implement the one most likely to maximise the Objective based on current knowledge.

Under a passive adaptive scenario, the consequences of management are repeatedly evaluated, based on monitoring the impacts of implementation. But, as the name suggests, no attempt is made to impose a management action specifically with the intention of learning (McDonald-Madden et al., 2011).

In contrast, an active adaptive manager anticipates the knowledge to be gained from particular management actions and evaluates that knowledge in terms of its probable contribution to future outcomes. In active adaptive management, managers assess the likely outcome of, and learning from, each of a range of alternative strategies, choosing the one most likely to achieve their objectives overall (McDonald-Madden et al., 2011). By assessing the likelihood of each of the set of strategies in advance of implementation, the manager has a set of hypotheses about how s/he thinks desired change can be brought about. When the first choice strategy has been applied and tested, the outcomes can be assessed against this hypothesis. If the outcomes have not been as required, then there are alternative hypotheses and strategies available to be tested. The considered next best strategy is applied, tested and learnt from. Through this iterative approach, active adaptive management will identify the most effective conservation measures, and maximum learning will have taken place.

McDonald-Madden et al. (2011) demonstrate the application of active adaptive management with respect to the optimal timing for relocating species faced with climate change.

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