

Development of a co-ordinated invasive alien species research programme in the Kruger National Park: providing a clearer understanding of the dynamics of alien invasions

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Abstract

The Kruger National Park (KNP) provides an excellent and largely untapped opportunity for studying and quantifying the adverse effects of invasive alien species on natural ecosystems. Furthermore, it provides an opportunity to monitor the impact and efficacy of control programmes initiated against such species. The KNP Invasive Alien Species Research Programme outlined here will allow scientists to explore these and other aspects of biological invasions in a co-ordinated framework which will contribute towards KNP management efforts.

Key words: Invasive alien species, research, monitoring, Kruger National Park

Introduction

The mission of the Kruger National Park (KNP) to “..maintain biodiversity in all its natural facets and fluxes...” (Braack 1997) is clearly compromised by the presence and spread of invasive alien species (Foxcroft & Richardson 2003). The additional threats posed by invasive alien species (IAS) are considerable, when a broader regional view is taken. The KNP covers an area of nearly two million hectares and has seven major rivers flowing through it, which all originate in the highly transformed and intensively utilised escarpment to the west of the KNP and which are invaded by a wide range of aquatic and terrestrial alien species (Foxcroft & Richardson 2003). In addition, approximately 370 alien plant species have already been identified within the KNP (Foxcroft *et al.* 2003) and threats from other alien invasive taxa (e.g. birds, snails, fish, disease) are increasing. Similarly, other parks under the auspices of South African National Parks (SANParks) are also undergoing varying degrees of transformation due to alien species invasions.

In an effort to prioritise management actions and research foci in the KNP, a number of alien impact objectives were defined in the objectives hierarchy of the KNP management plan (Braack 1997). These objectives are currently being revised in the KNP five-yearly objectives and management review process to ensure that they remain aligned with new knowledge and changing needs. Significant changes to the revised objectives will be the inclusion of all invasive species under the alien impact objectives (previously these objectives focussed mainly on plants) as well as a more holistic approach to invasive species research and management in the KNP.

Significant funding allocations through the Working for Water Programme, an alien plant clearing initiative of the Department of Water Affairs and Forestry, have made a major contribution towards the control of IAS in the KNP (and SANParks) over the years. However, the KNP should not be totally dependent on this source of funding for future programmes and should position itself strategically to deal with ongoing and potentially escalating levels of invasions. This will require a co-ordinated and focused research and monitoring

framework to inform management at all levels and ensure ongoing knowledge reintegration (Biggs & Rogers 2003). Although a few research projects are currently registered, the scope for research on all facets of invasive species in natural and protected systems is considerable. Ideally the overall objective should be the development of a robust, long-term, co-ordinated and focused programme, which could be modelled on the KNP Rivers Research Programme (Breen *et al.* 1994; Breen *et al.* 1998; Rogers & Bestbier 1997). Single projects, while useful in providing answers to many of management's immediate problems and satisfying academic and other training requirements, often require more effort for less return than a number of integrated projects working in collaboration to answer a particular set of key questions.

Proposed KNP IAS research programme:

The fundamental aim of the proposed initiative is to address IAS problems, threats and concerns in the KNP, through promoting and developing a co-ordinated research programme which will provide a clearer understanding of the dynamics of alien species invasions. In particular, the initiative will focus on (a) providing insights into the impacts of IAS on the biodiversity and heterogeneity of the KNP, and (b) providing guidelines for developing and maintaining cost-effective, long-term, sustainable control programmes.

The KNP would thus like to encourage management-orientated, practical research on the ecology of alien invasions which is underpinned by sound ecological paradigms and principles, while still allowing room for important fundamental research and satisfying the needs of students' academic requirements. An underlying requirement is the need to ensure that knowledge gained through the initiative is fed back into management programmes, thus updating them and allowing them to make the appropriate adjustments.

Proposed research themes and programme structure:

Three broad research themes have been identified and linked directly to the KNP's alien impact objectives hierarchy (Fig. 1). These comprise (1) Impacts, (2) ecology of alien invasions, and (3) efficacy of control techniques. These

broad themes each incorporate several objectives which give rise to more specific sub-objectives (Fig 1, A-C). These considerations are intended to stimulate thought and interest as well as to guide KNP research activities into the future.

Funding and Logistics:

Unfortunately the KNP is not in a position to actively fund research projects on alien invasions, and will rely on research partners who wish to participate in the proposed initiative to secure funding. The KNP will, however, provide logistical support (the scale of this is dependent on the direct relevance of research projects to KNP). As is well known, collaborative and well-defined, structured programmes can often secure funding far more easily than single, stand-alone projects. In this manner, the KNP hopes to, through this proposed research programme, lobby for funding which can be utilised by registered projects within the proposed programme.

Conclusion:

We envisage that the KNP will attract the research interest that this ecosystem provides as a natural laboratory for careful experimental studies on the ecology of alien invasions. Overall objectives include identifying the factors and processes involved in alien invasions and how savanna ecosystems and ecosystem services are adversely affected and altered as a result. Such baseline information will allow managers to predict more accurately the outcomes of alien invasions and to prioritise corrective measures aimed at both halting the spread of alien organisms and reducing their existing populations. As a result, the KNP will be better placed to wisely and sustainably apply and protect its limited resources.

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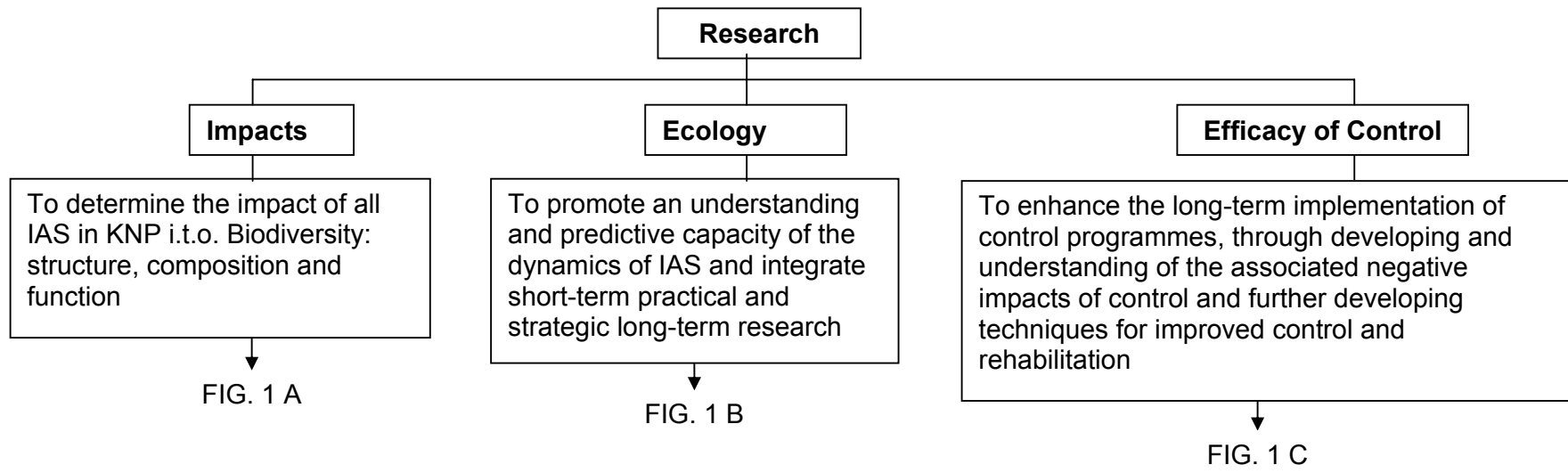


Figure 1: Schematic hierarchy of the KNP IAS Research Programme

Impacts

**To determine the impact of all IAS in KNP
i.t.o. Biodiversity: structure, composition
and function**

To evaluate the long-term impacts of IAS

To evaluate the impact of Knock-on effects of
undesirable impacts;
To determine the effect of changing species
composition on higher trophic levels (those
species not directly linked to the alien
organism)

To evaluate the impacts of IAS on ecosystem
services

To determine the impacts of IAS on specific
threatened or valuable species and quantify the
extent where required

To determine the impacts of IAS on structure,
function and composition e.g. fish, insects,
birds, mammals

To predict likely increases of IAS and their
impacts; to carry out predictive modeling under
varying aspects such as global climate change,
nutrient availabilities etc

FIG. 1 A

Ecology

To promote an understanding and predictive capacity of the dynamics of IAS and integrate short-term practical and strategic long-term research

Invasion dynamics

To develop an understanding of the dynamics of alien invasions

To investigate patterns, processes and rates of invasion in the KNP

To develop an understanding of Large infrequent disturbances (LID- e.g. floods, droughts etc) and the impact thereof on IAS and ecosystem

To develop an understanding of modified disturbance regimes, and the impacts thereof

To develop an understanding of dispersal and transmission

To develop and carry out Risk analysis

Autecology and disease epidemiology

To develop knowledge on specific species, its invasion capabilities, and ultimately how to better manage them

To develop an understanding of reproduction, transmission and dispersal

To investigate competition / Allelopathy and the interactions between invasive and indigenous species

To investigate changes in food web dynamics and the potential consequences

To investigate and quantify alien plant Seed banks and seed dormancy

To evaluate and quantify age / time to seed production

To evaluate and quantify plant growth rates

To understand disease epidemiology of high priority

FIG. 1 B

Efficacy of Control

To enhance the long-term implementation of control programmes, through developing and understanding of the associated negative impacts of control and further developing techniques for improved control and rehabilitation

To evaluate and quantify the potential impacts of control on non-target (indigenous) species

To evaluate and quantify the efficacy of control measures

To carry out cost/benefit analysis of control

To evaluate and quantify the impacts / effects of control on specific areas under control and after control

To develop rehabilitation strategies and monitor these to determine the long-term efficacy thereof

To evaluate the establishment and success of new biological control agents following their release

To determine the long-term impacts of biological control and quantify its contribution to integrated management

To develop detection, diagnostic and vaccination strategies that are safe and effective

FIG. 1 C