

## **Using a local management zoning framework to foster a management continuum. Is the ‘big four’ a defeatist mindset and are there alternatives at a local and regional level?**

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**Summary** The ‘big four’ of weed management (prevention, eradication, containment and asset protection) are widely adopted as discrete objectives when it comes to determining and communicating management aims for invasive species. This has been a particularly useful, though to date perhaps largely an academic, exercise which has enabled delivery of a clear advocacy position (particularly for early intervention and prevention) as well advancing our collective understanding of the all-pervading impacts of weeds.

A constructive criticism which can be directed at the big four approach is that it sustains a mindset of weed management as a one way slide to defeat as the situation deteriorates and achieving each management objective becomes increasingly unlikely. Whilst on a continental scale this is often an all-too-accurate account of our experience, it does little to inspire the optimism of on-ground managers and landholders who (generally) bear the brunt of systematic failures of rapid response, proactive management and program legacy to deliver the goods. We should be working hard to empower local communities to advocate for better solutions by using a management continuum approach which acknowledges local successes and provides recourse to failures by facilitating a dialogue around the perpetual nature of the task at hand.

This paper discusses the local and regional interpretation and implementation of a geographic zoning approach by drawing strongly on a ground-up level of adoption which more accurately reflects the spatial and temporal scales which management is actually implemented on. Importantly, a consultative and negotiated approach requires managers and strategists to answer the hard questions of what we are trying to achieve, and how (on earth) do we think we are going to get there and sustain it?

**Keywords** Management zoning, prevention, eradication, containment, asset protection, local and regional government.

### INTRODUCTION

**Why a continuum?** In the Australian (and New Zealand) vernacular where the notion of the environmental weed is firmly entrenched, the task of pest management is a perpetual undertaking. When we achieve

success in one objective it frees up resources to begin or increase our efforts on another. Success, which was traditionally measured in busy-ness and had a single species focus, is now leaning more toward landscape function driven outcomes. Concepts around resilience, adaptation and abatement are becoming the norm. The pest manager’s task is typically one of trying to ameliorate a legacy of weeds of disturbance with one hand, while trying to suppress a suite of displaced habitat specialists (disturbance or not) with the other. At a locality/regional level (local government administrative area or sub-regions within it) managers and planners often are at the pointy end of implementation and are ultimately charged with delivery of a wide range of national, state and local outcomes simultaneously.

**The big four and the invasion curve** Management zoning as we have come to define it is founded on a conceptualised phase of invasion (lag, explosion, establishment; Kowarik 1995) which determines an appropriate objective response based around the ‘big four’ (prevention, eradication, containment, asset protection). These have given rise to the popular concept of an ‘invasion curve’ (DPI Victoria 2010). The invasion curve articulates the relationship between the spatial and temporal scales of the weed invasion process and prescribes a discrete management objective for each increment along the curve. It applies the logic that as a weed invasion occurs we progress from one end of a management spectrum to the other in a hierarchical progression. At each stage of the progression as the spatial scale of the invasion increases, the implied impact (and required resources) also increases.

The invasion curve also provides/substantiates rationale for numerous national containment lines (primarily WoNS but also long-term institutions like the dog barrier fence) and more recently national management zones (also WoNS but have been present in long-term biosecurity matters such as fruit fly exclusion zones). In most of the above examples the key motivation to zoning geographically explicit objectives has come about *via* awareness in spread prevention, principally the notion of keeping clean areas clean; or quarantining infested areas to reduce

the risk of further spread. This corroborates two of the core national strategic directions in weed management within the Australian Weeds Strategy of preventing (new weeds) and reducing impacts (existing weeds) but in some ways fails to address the third goal of enhancing capacity and commitment (stakeholders) because the strategy is not readily supported by an equivalent spatially explicit objective.

**Zoning is an intuitive and relevant response** The partitioning of the complex, multi-faceted task of weed management into segments and management units is an important development in our strategic thinking. The deployment of a geographically differentiated strategy (Grice *et al.* 2011) is potentially a highly effective and constructive approach to determining and communicating national weed management priorities and actions to a wider audience. A clearly defined conceptual response to invasive species is the end product, but translating these concepts through to implementation is not without its difficulties. Often such concepts are not readily deployed without further interpretation at a locality level where actual implementation occurs. More succinctly, any zoning approach to weed management at locality level needs to be able to be delivered at a variety of scales; offer a transparent and replicable process to respond to actual management dynamics; accommodate locality specific issues; be based on a considered prioritisation process; be derived with a relatively high degree of stakeholder consent; reflect the biology of the target species (the temporal scale of both management legacy and management frequency/intensity); and somehow capture both the altruistic and legislated motivations for management. It is also important to ensure that local efforts contrary to an overarching national objective are not precluded or dissuaded if they are plausible, i.e. locality based eradication/containment in a national asset protection zone (Grice *et al.* 2011).

**Some obstacles to overcome** There are a wide range of issues and miscommunications to overcome at the locality scale of weed management. More often than not these obstacles are not unique to the implementation end of the spectrum and we would do well to better articulate them in a two way dialogue across all scales (on-ground to policy). Below are some of the key obstacles that have informed the regional adoption of management zoning discussed in this paper.

*Mixed messages*—a conceptual understanding of management principles and terminology is often lacking outside of the weed management community (this ranges all the way from community to governance).

*Program legacy*—ephemeral resourcing of long-term management issues consistently rates as one of the most significant obstacles to the success of weed management. Linked to this but not exclusively are the difficulties in maintaining return on investment, especially when programs succeed in reducing the impacts or presence of weeds to such a degree that the priority for management is no longer clear to the community.

*Squeaky wheels*—an inordinate investment in substantiating decisions/inaction on intractable problems can draw resources from higher priorities.

*Scale and relevance*—dealing with the locality/reality versus national/conceptual divide. One of the major hurdles to uptake is the scale divide between local and national rapid response mechanisms.

*Compliance*—legislative measures are not often used to full effect and generally not used at all.

*Underestimating the task at hand*—without the appropriate information (delimitation, seed longevity) and processes (prioritisation, potential distribution mapping) in place we can set unrealistic objectives which cannot be sustained.

*Stakeholder fatigue*—many landholders have witnessed numerous introductions of weeds in their management experience and also the failure of subsequent programs or efforts to address the problems. Most programs will only ever succeed if stakeholders are engaged and have confidence in the duration of the commitment.

*Outcomes versus business as usual*—what is the end point of management and how do we know when we arrive? Are we just moving one weed on to make way for another?

*Planning lethargy*—strategies such as containment have been widely promoted as plausible management objectives and natural progressions within a decision hierarchy without any definitive guidelines on how they can be sustained.

**Revisiting the invasion curve, managing incursions versus infestations** When the invasion curve (Figure 1a) is revisited at a locality level, aspects of the management hierarchy it proposes can be revised to better reflect tangible management outcomes. Principally a thematic distinction can be made between managing incursions (Figure 1b: prevention and eradication) and

managing infestations (Figure 1c: containment and asset protection). This serves both as a communication aid to emphasise the link between management aims and biological outcomes; it also emphasises the importance of due diligence in prevention and early intervention by augmenting a clear threshold between the two themes.

With the distinction made between the management themes of incursions and infestations the opportunity (in certain circumstance) to transition (figure 1d) between the two can be acknowledged. For example, a successful containment objective on a locality level could be transitioned to an eradication objective over time (if the opposite was true it would transition to asset protection). In order to achieve this, stakeholders need to consider the feasibility of success and duration of management required to make the shift from managing the active infestation and its spread, to targeting the reproductive capacity and seed bank.

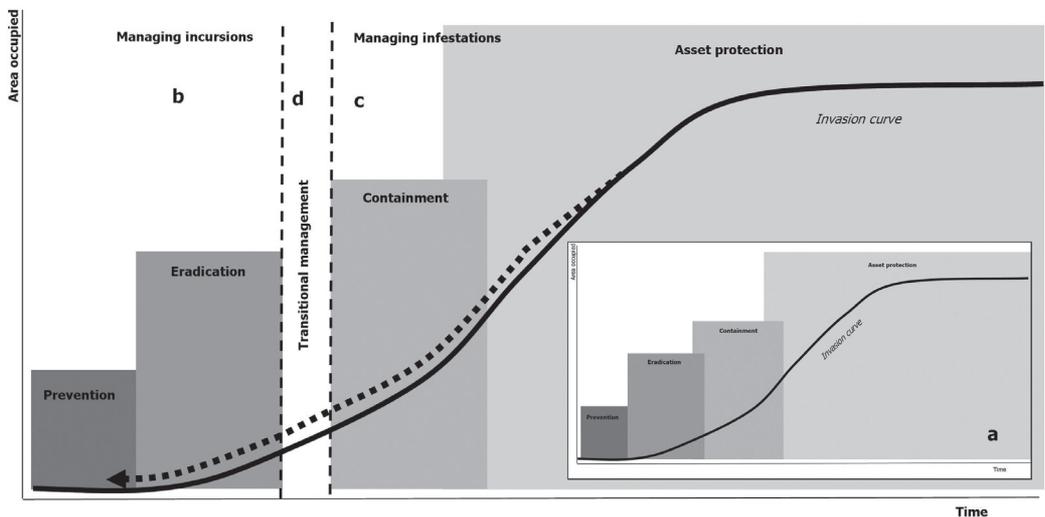
With the improbability of certain continental/regional scale outcomes (i.e. national eradication) removed as an impediment, the negotiation of locality based outcomes which may not be feasible at other scales can be considered. Other factors that in time could influence feasibility on a locality scale which may not influence objectives on a national scale might include the development of refined herbicides/bio-controls or significant success in other objectives/neighbouring zones which free up resources.

By classifying discrete sequential management objectives in an invasion curve and applying the same

to a management zoning approach, the transitions between objectives are inferred but not necessarily clear. Also the notion that each objective of management prescribed is an active task has the tendency to be overlooked i.e. an invasion response generally begins at eradication because a targeted prevention strategy was not in place. In reality there is a tendency to interchange cost effective with cost neutral. In order to facilitate the adoption of a management zoning approach at a locality scale I show how the invasion curve and the subsequent big four can be reinterpreted in a perpetual yet still sequential management continuum.

**Management continuum** In the direct translation of the invasion curve to a management continuum (Figure 2a) the big four (P, E, C, AP) are included in a perpetual cycle of management. From the outset each management objective requires a sustained focus in order to succeed (+) and ultimately progress along the scale. In the event of an objective not being delivered (-) the opposite is true. The (+) and (-) pathways reflect both the decision process in determining feasibility of management objectives as well as evaluating success of existing objectives.

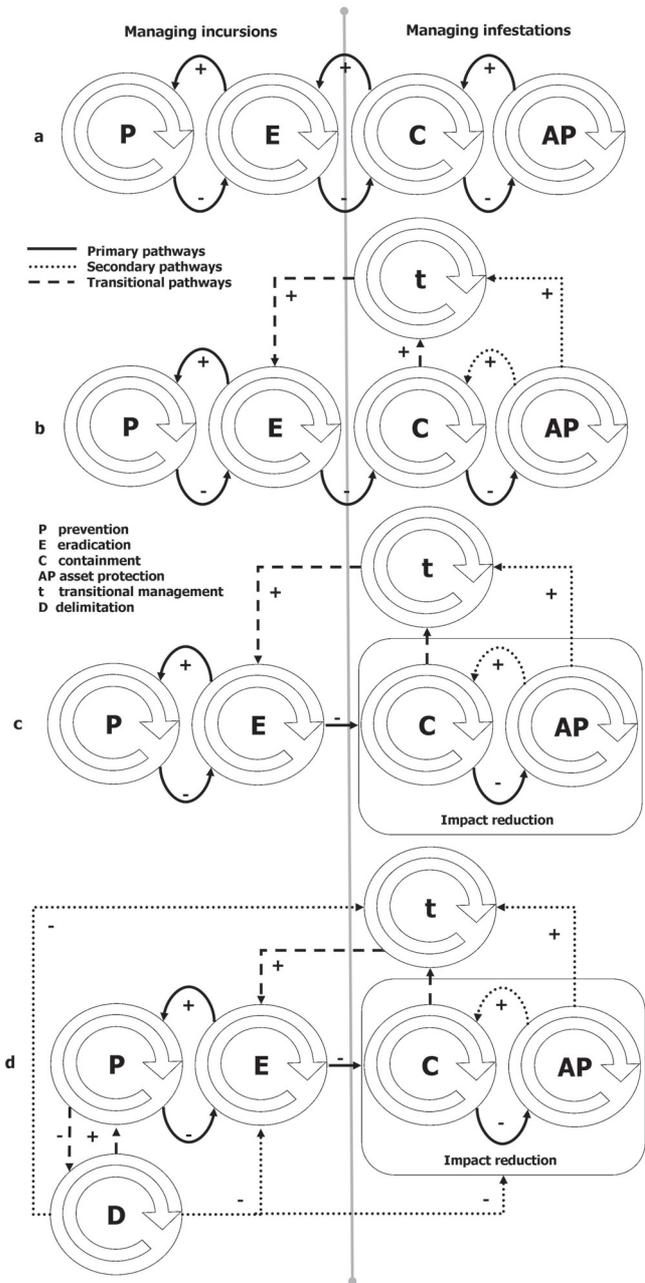
There are clear shortfalls in certain transitions within Figure 2a. Firstly an invasion curve implies that the natural progression from a failure to eradicate or succeed in an asset protection objective is to arrive at a containment objective which is sometimes, but certainly not always the case. The introduction of secondary pathways and a defined transitional



**Figure 1.** Invasion curve.

management objective (t) assist to define these and the shortfalls begin to be addressed (Figure 2b). It now becomes a deliberate decision to make the move from containment to eradication *via* a transition from managing infestations to managing incursions. In a similar way success in asset protection can be sustained within the objective, progress to containment, or perhaps more unlikely move to a transition in management with a long-term eradication objective in mind. The shortcoming in Figure 2b is that stakeholders failing to deliver eradication in reality face a choice of either a containment or an asset protection objective, rather than the implied transition from eradication *via* containment to asset protection. The grouping of containment and asset protection under the banner of impact reduction (Figure 2c) more accurately reflects the tangible decision required when an attempt at eradication fails. Although both objectives are distinctly different (containment in a tactical sense is more akin to eradication) they both deliver an objective in response to an infestation where all reproductive events cannot be managed.

At the other end of the spectrum the invasion curve overlooks the importance and influence of delimitation and delimitation confidence on management objectives. At a locality scale the identification of delimitation objectives is an important contribution to management zoning because it is essential in determining management objectives, and also provides a point of contact in community engagement in implementation by soliciting their knowledge and observation. The introduction of a delimitation objective (Figure 3d introduces its primary function as a transitional phase of prevention). However, delimitation once achieved can equally advise the adoption of eradication, containment, asset protection and even provide a direct pathway to a transitional management program when stakeholders determine it is feasible (i.e. a new infestation not yet ready for an eradication effort, but also not suited to either objective within impact reduction).



**Figure 2.** Management continuum derived from the invasion curve.

**Primary components of a zoned management continuum approach** The essential components of a management continuum already exist in most weed management enterprises which incorporate best management practice principles. The other supporting

Management zone		Management target	Biological target
Big four	Continuum framework		
<b>Managing incursions</b>			
-	Delimitation	The extent of the weed is determined	Prohibit introduction or seed set
P	Prevention	Clean areas are kept clean	
E	Removal	All seeds (seedbank) and plants are removed	
<b>Managing infestations</b>			
-	Intensive control	Infestations are reduced to a size that can be removed	Limit infestation growth and spread
C	Impact reduction	Infestations contained, buffers maintained and important places protected	
AP			

**Figure 3.** Management zones utilised in local adoption.

components required can be developed relatively easily through stakeholder consultation and basic GIS.

*Distribution mapping*—a clear demarcation of the current extent of the issue (ideally supported by some indication in the form of mapping or expert knowledge of potential distribution).

*Invasive biology information/profile*—to assist in determination of the temporal scales of management strategies (and the feasibility of control success, seed longevity, detectability etc.).

*Assessment and prioritisation process*—to assist in a transparent and consultative determination of existing priorities, impacts and threats and capacity to manage.

*Management objectives and reporting tools*—linked to management outcome and behaviours and tailored to and reviewed by local stakeholders.

*Designated zone boundaries*—based on clear and established boundaries (catchment, sub-catchment, locality etc.) these need to be on scale which reflects local land use/identity but also relate to land type and form in a way that makes sense for invasive biology.

*Stakeholder representation*—successful development and implementation of a ground up zoning approach requires reaching some sort a balance between quality control (the hard truth) and local aspirations (motivation and ownership).

*Communication tools*—objectives, expectations and management intentions linked to defined management zones.

**What does the management continuum look like in implementation?** Local governments in Queensland are required under legislation to maintain and implement a Local Area Pest Management Plan and in Far North Queensland are in the process of rolling out zoned and prioritised interpretations of the same. One of the key undertakings in the process was to create a decision making and communication platform around core management objectives. The rationale for the inclusions of delimitation and the combination of containment and asset protection in an impact reduction decision process is outlined in Figure 2 c,d. The term *removal* (i.e. remove all parts, plants and seeds) was opted for *in lieu* of eradication which is often used interchangeably with control. The additional (transitional management) zone was termed *intensive control (and restoration)* in order to reflect the primary objective of a targeted infestation reduction that can in time be subject to a removal objective, often as a component of a whole of catchment or top-down system repair approach.

**Management zones and objectives**

Managing incursions

*Delimitation*—establishes the presence/absence of a weed in areas where we are uncertain of its status. Activities might include survey programs, tracing plant/equipment movement, and targeted extension activities.

*Prevention*—utilises a range of measures and behaviours to ensure a target pest does not establish in an area where it is currently absent. This management objective is specific to the target weed within the designated zone.

*Removal*—targets the seed bank and/reproductive cycle of the pest to ensure that no further reproductive events occur. The management objective is to entirely remove all parts and propagules of the pest from the designated management zone (i.e. make it extinct from that area).

Managing infestations

*Intensive control*—strategically targets whole-of-system management programs which aim to reduce the scale and vigour of an infestation to a point where a transition to a removal program is feasible.

*Impact reduction*—targets the management of infestations where the capacity to deliver a removal target is not a feasible option. Resources are directed towards containment protocols in designated areas, protecting key assets and strategies to contain or reduce the opportunities for further spread or impacts.

#### CONCLUSION

This local consultation and zoning approach has been adopted across five local governments in Far North Queensland and embedded in graphics-based pest management and communication plans. The end results support policy and legislation but also draw strongly on local stakeholders to augment their interaction with weeds and understand the nature of their unique issues and solutions. The approach adopted here will by its nature evolve in time but at the onset of implementation one of the greatest advantages is the development of locally distinct but regionally consistent planning and prioritisation. Importantly this will assist localities in articulating the wins and losses in their own management legacies and to engage more directly in scaleable management zoning initiatives.

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