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Factors Affecting People's Responses to Invasive Species Management

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Introduction

Natural areas managers contend with an increasingly diverse array of invasive species in their mission to conserve the health and integrity of ecosystems under their charge. As users, nearby neighbours and de facto 'owners' of the lands where many significant natural areas reside, the public is often highly supportive of broad programme goals for management and restoration, but becomes less enamoured when specific actions such as prescribed burning or biocide applications are called for (Barro and Bright, 1998). Frequently these actions are aimed at invasive plants and animals, mostly non-native exotics but at times invasive natives that due to their abundance or location may also interfere with restoration objectives.

On the surface, negative public sentiment surrounding invasive species management might be explained as a reaction to having been sold a false bill of goods: restoration connotes life and putting back in order to make ecosystems whole again, yet invasive species management is by and large an activity of death and taking away (Gobster, 2005). But most people have no compunction about swatting flies in their house or plucking dandelions from their yard in order to maintain a sense of order and quality of life, and in managing the natural world they may also accept the need to value some species over others. How such distinctions are made is critical to many natural areas programmes that take place on public lands since the success of managers in gaining social acceptance for their programmes will often determine effectiveness in attaining ecological goals (McNeely, 2001).

A more nuanced view is needed on how people perceive invasive species and the actions to control them if managers are to better gear their natural

areas programmes to meet public acceptance and reduce conflicts and controversy. In this chapter I outline a heuristic model for thinking about how people respond to a given invasive species based on a number of factors and their relationships. The model draws from a wide variety of examples where there has been public reaction to invasive species management and is presented with the intent to promote discussion, systematic study and more accurate specification. After discussing the model factors and their relationships I apply the model to case studies of Asian longhorned beetle eradication in Chicago and feral cat control in rural Wisconsin. I conclude by considering the model in the context of natural areas restoration and suggest its potential use in future research and decision making.

Surveying the evidence

The impetus for this work stems from my study of stakeholder conflicts in the restoration of natural areas in Chicago and San Francisco (Gobster and Hull, 2000; Gobster, 2007). The control of invasive species has played a central role in both conflicts, pitting nearby residents, recreational users and other interest groups against natural areas managers and volunteer restorationists who on the whole all share a common love for nature and desire to see it protected. In Chicago, prairie and savannah ecosystems are primary targets of restoration efforts, and the removal of trees to restore the structure and function of these open communities has been contentious. This has been especially true in the removal of large diameter non-native trees, which are seen as having high aesthetic value, but in some cases concerns have also been voiced about removing saplings and immature trees such as black cherry that are native to the region but not a part of the ecosystem being restored. Restoration critics in Chicago have been less concerned with the removal of invasive ground-cover plants such as garlic mustard and shrub species such as European buckthorn, though the use of herbicides and prescribed fire for controlling these plants has often been controversial because of perceived dangers to people and wildlife. Moreover, while some shrubs like buckthorn are seen as problematic, they may provide value as bird cover and for the visual screening of development, both of which can be compromised if the buckthorn is not replaced with a comparable native species. Finally, while white-tailed deer are native to the Chicago region, actions by restorationists to control their numbers to protect vegetation has been highly controversial, particularly the use of rocket nets and sharpshooting which have ethical implications for an increasing proportion of urbanites.

I began studying the Chicago restoration conflict in 1996, and when another conflict broke out in San Francisco six years later it provided an opportune comparison. In examining the two conflicts I noticed that, while the botanical aspects of the native ecosystems and their unwanted invaders were quite different between the two cities, there were some strong similarities in the overall landscape structure, in patterns of cultural landscape change, and in how critics responded to invasive species management. Like Chicago's prairies, San Francisco's dominant native coastal scrub and dune ecosystems

are open, largely treeless landscapes, but fire suppression and a long history of dedicated afforestation have made both the non-native Eucalyptus and nearby native Monterey pine and cypress trees familiar elements in the landscape. Removal of mature tree cover has been a major point of conflict among those who value its aesthetic and historic qualities, and while many residents find dense mid-storey growths of Himalayan blackberry unattractive and difficult to traverse, the plant does have wildlife value as a food source. In fact, it has been argued that several non-native shrubs and ground plants have considerable functional value for wildlife, to stem hillside erosion, and other purposes. Like Chicago, the use of herbicides has been contentious in some areas, and concerns over air quality and a collective memory of the fires that devastated the city after the Great Earthquake of 1906 have generated acute opposition to the use of prescribed fire as a management tool. While deer overpopulation is not an issue in the city, domestic animal control has been highly disputed. The reduction of feral cat populations has raised many ethical issues of protecting the life of a species to which people hold strong bonds, and while the right for people to run their dogs off leash in public parks has been mostly cast as an access issue, restorationists also see off-leash dogs as an unwanted invader that tramples native plants, adds excess nitrogen to the soil, and disturbs birds and other sensitive wildlife.

From my study of these two conflicts I began to notice some common patterns in how people responded to an invasive species issue based on characteristics of the species itself, the management situation and other factors. If data from additional case studies were compiled, I thought, perhaps one could develop a systematic way to anticipate what people's reaction might be and in so doing, gear management strategies in ways that would accomplish restoration objectives and reduce social conflicts. While few social science studies have examined the human dimensions of invasive species (e.g. Fischer and van der Wal, 2007; Norgaard, 2007), I have found considerable indirect information in ecological studies that mentioned social repercussions of managing for invasive species in popular books about invasives, newspapers and magazine articles. Table 16.1 shows a sampling of individual invasive species that have been the subject of these accounts, from diseases and insects to small and large plant species to small and large mammals. These accounts do not provide sufficient detail for a case-by-case analysis, but in looking across them they begin to suggest a set of factors and relationships. What follows is a preliminary attempt to bring these emergent patterns into model form.

Specifying the model

Proposing a model or theory without rigorous study is a risky proposition, yet a first approximation can help reveal relationships and suggest hypotheses for further study and testing. The model (Figure 16.1) considers people's response (R) to an invasive species management scenario as a function of the perceived value of the invasive (V), the perceived threat (T) and impact (I) it has on a native species or ecosystem, and the perceived benefits and costs of management

$$R = \Sigma C_i S_i \left(\frac{V}{T + I}\right) - M$$

(WARNING: a first approximation)

- R = response to the exotic/invasive species
- V = value of the exotic/invasive
- T = threat
- I = impact or value of the exotic/invasive on the species/ecosystem/object of concern
- M = impact of management control mechanisms
- C = context
- S = stakeholder group factors

Notes:

$R = W_1(C,S)V + TW_2(C,S)I + W_3(C,S)M$

R = Response to an invasive species management scenario
- $R > 0 \Rightarrow$ acceptable, stakeholder–manager agreement
- $R = 0 \Rightarrow$ neutral, unconcerned
- $R < 0 \Rightarrow$ unacceptable, stakeholder–manager conflict

V = Value or likeability of the invasive
- $V > 0 \Rightarrow$ liked, valued, hold positive feelings for
- $V = 0 \Rightarrow$ neutral, no value one way or the other
- $V < 0 \Rightarrow$ disliked, disgust sensitivity, hold negative feelings for

I = Impact of invasive on a native species/ecosystem/other object of concern
- $I > 0 \Rightarrow$ beneficial impact (e.g. assists in endangered species recovery)
- $I = 0 \Rightarrow$ benign (no effect)
- $I < 0 \Rightarrow$ negative impact (loss, degradation, cost of replacement)

T = Threat – imminence of or adaptation to invasive impact
- $0 \leq T \leq 1$
- $T = 0 \Rightarrow$ no threat or foreseeable impact
- T = low $\Rightarrow$ low threat or adaptation to impact
- $T = 1 \Rightarrow$ imminent threat, certain impact

M = Management actions – benefits/costs
- $M > 0 \Rightarrow$ positive/beneficial outcomes (effective control, positive externalities)
- $M = 0 \Rightarrow$ benign or without impact
- $M < 0 \Rightarrow$ negative/deleterious outcomes (ineffective, negative externalities)

C = Context factors (e.g. physical, social setting)

S = Stakeholder factors (e.g. centrality, education)

W_1, W_2, W_3 = Weights that depend on Context (C) and Stakeholder (S) factors

Figure 16.1 *Model for predicting human response to management of an invasive species*

actions (M) instituted to deal with the invasive. This additive model recognizes that each value, impact and management action for a given scenario can be perceived as positive, negative or neutral in nature, and that people's responses are influenced by these factors as well as by various contextual (C) and stakeholder group (S) factors that recognize the heterogeneity of responses

to a given situation. People's responses can thus vary depending on the nature of the individual factors within this relationship, and for each factor I outline of some of the major issues and questions that should be considered in determining people's responses to a given management scenario (see references in Table 16.1 for further information).

Value (of the species of concern)

The value of an invasive species can be thought of as its likeability, irrespective of the damage it might do to a natural area or protected species. While many people dislike or are even disgusted by bacteria, nematodes, insects and snakes (e.g. Bixler and Floyd, 1997), the value of an invasive seems to increase as species get larger in size and their physical qualities are more readily perceptible. As I mentioned in the Chicago and San Francisco case studies, big trees hold important aesthetic value for many people regardless of whether they may be invasive, and they may also provide important recreational (e.g. shady sites), functional (e.g. cooling), and economic (e.g. enhancing property value) values. Colourful plants and animals such as purple loosestrife and monk parakeets may also endear people because of their aesthetic qualities, and animals with furry coats and big eyes such as deer, grey squirrels, feral cats and wild horses can have considerable charismatic appeal. Despite their invasive and destructive tendencies, some purposefully introduced exotics herbs such as Italian fennel and animals such as feral pigs hold cultural value for particular ethnic groups, and maintenance of sufficient populations may be important to keep alive cultural traditions. Finally, the value of protecting native biodiversity and ecosystem integrity is sometimes weighed against the value of alternative ecologies that non-native species provide. Here again trees can be effective in moderating urban heat island effects, filtering air pollutants, sequestering carbon and performing other ecosystem services, and it is hard to argue that these values are less important than those provided by native ecosystems.

Impact (of an invasive on a native species or ecosystem)

Native species and ecosystems can also be valued for their aesthetic, recreational and functional qualities, but because their use-oriented values are sometimes less readily apparent, restoration groups and natural areas managers often argue for the protection of native species and ecosystems on the basis of more intrinsic values such as biodiversity or ecosystem health, or for educational, option and existence values (Millennium Ecosystem Assessment, 2005). Beyond these values, the sheer rarity of some native species and ecosystems can heighten their value, particularly if they are endemic or endangered. The impact of an invasive is thus the loss or degradation in the value(s) of a native species or ecosystem or the cost of its replacement (e.g. Pimentel et al, 2005). While the impact of an invasive species is usually thought to be negative, some species may serve beneficial functions for native species and ecosystems – such as providing wildlife habitat or food supply (e.g. Shapiro, 2002) – which should be considered in a management assessment.

Table 16.1 *Selected non-agricultural invasive species, characteristics and case studies*

Species	*Latin name*	*Origin*	*Place of introduction*	*Year of intro*	*Ecosystem type*	*Documentation*
Chestnut blight	*Cryphonectria parasitica*	Europe	Northeastern USA	1906	Cities and forests	Friederici, 2006; Freinkel, 2007
Dutch elm disease	*Ophiostoma ulmi*	Europe	USA	1931	Cities and forests	Campanela, 2003
Earthworms	e.g. *Lumbricus terrestris*	Europe, Asia	USA	1800s	Northern forests	Bohlen et al, 2004; Friederici, 2004
Asian longhorned beetle	*Anoplophora glabripennis*	Asia	USA	1996	Cities (NY and Chicago)	Antipin and Dilley, 2004
Emerald ash borer	*Agrilus planipennis*	Asia	Midwestern USA	2002	Cites and forests	BenDor et al, 2006
Gypsy moth	*Lymantria dispar*	Europe, Asia	Northeast USA	1860s	Cities and forests	Liebhold and Muzika, 1996; Pearson, 2002
Garlic mustard	*Alliaria petiolata*	Europe	Midwestern USA	1800s	Forest	Neumann, 1999
Purple loosestrife	*Lythrum salicaria*	Europe	USA	1800s	Wetlands	Hager and McCoy, 1998; Slobodkin, 2001
Italian fennel	*Foeniculum vulgare*	Europe	California	1800s	Hillsides	Shapiro, 2002
Cattail	*Typa* spp	native	USA	native	Wetlands	Apfelbaum, n.d.
Zebra mussels	*Dreissena polymorpha*	Europe Asia	Midwestern USA	1988	Lakes and streams	Johnson and Padilla, 1996
European buckthorn	*Rhamnus cathartica*	Europe	Midwestern USA	1800s	Forest, savannah, prairie	Whelan and Dilger, 1992; Gobster and Hull, 2000
Eucalyptus	*Eucalyptus spp.*	Australia	California	1700s	Scrub, dune	Williams, 2002; Slack, 2004
Black cherry	*Prunus serotina*	USA	Central Europe	1600s	Forest	Starfinger et al, 2003

Table 16.1 *(Continued)*

Species	*Latin name*	*Origin*	*Place of introduction*	*Year of intro*	*Ecosystem type*	*Documentation*
Brown tree snake	*Boiga irregularis*	Australia	Guam	1949	Forests	Burdick, 2005
Northern snakehead	*Channa argus*	China	Maryland	2002	Lakes	Dolin, 2003
Brown trout	*Salmo trutta*	Germany	USA	1880s	Rivers	Todd, 2001
Pigeon (rock dove)	*Columba livia*	Europe	USA	1600s	Urban and rural	Todd, 2001; Humphries, 2008
Parakeets	e.g. *Myiopsitta monachus*	S. America	USA	1960s	Cities	Todd, 2001; Bittner, 2004
English house sparrow	*Passer domesticus*	Europe	USA	1851	Parks and woodlands	Burdick, 2005; Mann, 1948
American grey squirrel	*Sciurus carolinensus*	USA	England, Italy	1800s	Woodlands and cities	Max, 2007; Bertolino and Genovesi, 2003
Feral cats	*Felis catus*	Egypt?	Worldwide	1600s in USA	everywhere	Beversdorf, 2008; Robertson, 2008
Domestic off-leash dogs	*Canis lupis familiaris*	Eurasia, N. America	USA	?	Urban natural areas	Forrest and St Clair, 2006; Banks and Bryant, 2007
Mountain goat	*Oreamnos americanus*	W. USA and Canada	Olympic Peninsula, Washington	1920s	Alpine	Todd, 2001
Feral pigs, European wild boar	*Sus scrofa*	Polynesia, Europe	Hawaii, many places in USA	1500, 1912	Forests	Van Driesche and Van Driesche, 2004; Burdick, 2005
White-tailed deer	*Odocoileus virginianus*	native	Eastern USA	native	Woodland and savannah	Kilpatrick et al, 2007; Lauber and Brown, 2006
Wild horses	*Equus ferus caballus*	Europe, Asia	Western and Eastern USA	1500s	Rangelands, seashore	Flores, 2008; Welch, 2009

Threat

The degree to which an invasive is seen as a threat to a native species or ecosystem must also be considered along with impact in gauging people's response to a management scenario. Threat might best be construed as the perceived probability or likelihood that an impact will occur, and the gypsy moth exemplifies how the element of threat can operate. This invader came to the USA in the 1860s and has been widespread throughout the north-east for many years. People who have lived with it have to some degree come to accept the damage from its tree defoliation as well as developed some scepticism over the effectiveness and consequences of management (see below). However, where the gypsy moth is just arriving in some areas of the Midwest, unfamiliarity with it has raised the perceived threat and the urgency with which some people feel control efforts should be instituted. Perceived threat thus may have temporal and spatial dimensions that relate to the imminence and rate of spread of invasions. Knowledge of how threat perception operates can be helpful in spurring public awareness about invasives, but overplaying the 'fear factor' can also have negative repercussions such as loss of trust (Mackenzie and Larson, 2010) and maladaptive responses (Gobster, 2005).

Management actions (benefits and costs of intervention)

As mentioned previously, factors related to the management of an invasive species can work to heighten conflicts between managers and the public even if the latter group holds little or no value for the invasive or shows little concern about its impact on the native species or ecosystem. These factors have to do with the perceived impact of the management action, its duration of implementation, and its probability of success. In some cases, people may be willing to accept a management treatment even if it is perceived as harsh or has significant negative externalities as long as it is applied only once or a few times before an invasive is eradicated. People may grow disenchanted, however, if treatments occur again and again without clear success. This may be the case with gypsy moth control programmes in the northeastern USA, where annual aerial applications of the bacterial pesticide *Bacillus thuriengensis* or 'Bt' lessens tree defoliation but also kills other leaf-eating caterpillars, including rare and valued butterfly species.

Context factors

The context of a natural area can modify how people respond to an invasive management scenario. Context factors that influence people's responses include the physical and social setting (e.g. land use, proximity to residences, and location along an urban-to-wilderness remoteness gradient) and previous site disturbances. The effect of context is a complicated one, for even if an invasive is seen as intruding upon a person's home environment, such as an insect that defoliates a backyard tree or nearby natural area, that person may be less willing to put up with a management activity such as insecticidal spraying

than if that action were to occur in a more remote location. Because of this heightened sensitivity, urban natural areas management programmes are often the locus of intense social conflicts over such issues as animal control, herbicide application and prescribed burning. But this does not mean that remote natural areas are exempt from invasive species management conflicts, for if those sites are viewed as pristine or free from human interference people may be less willing to accept management interference and instead favour 'allowing nature to take its course'.

Stakeholder factors

A range of individual and stakeholder group factors can also modify how people respond to an invasive species management scenario. If an invasive is valued in some way, by definition it has some measure of centrality to particular stakeholders, and those who may depend on it or similar species for income (e.g. pet or horticulture industry) or as part of a cultural tradition may be more resistant to its control than those whose value is more casually aesthetic or recreational in nature. The heterogeneity and strength of stakeholder interests can also complicate public responses, and in some cases a dominant but weakly supportive majority can be upset by a small group of highly vocal critics who makes it difficult for managers to reach public consensus on how an invasive should be managed (Bertolino and Genovesi, 2003). Other factors that can influence individual and stakeholder views on invasive species are many and include education, urban versus rural residency, regional and cultural factors and differing meanings of nature. Knowledge and expertise often play important roles in challenging stakeholder positions on issues, and while they may be helpful in negotiating consensus for managing invasive species, they are also open to challenge and alternative interpretations that further complicate resolution of contested issues.

Response

The factors described above work in combination to describe people's response to a management scenario. A positive response is one where people find the management scenario acceptable; for example, the invasive has low value relative to its impact on a native species or ecosystem, and the impact of managing the invasive is low or justified in order to achieve reasonable success. In contrast, a negative response points to an unacceptable management scenario or one where people's values conflict with natural areas managers'. In either case, the value of the response is mediated by context and stakeholder factors; thus the weights (W) placed on V, I and M can change the acceptability of a management scenario depending upon where it is implemented and who is included in the assessment.

Testing the model

As can be seen by this brief discussion, the factors that influence people's response to an invasive species are numerous and may relate to each other in

complex ways. Yet a thoughtful analysis of a given situation may illuminate potential pathways and roadblocks to successfully garnering public favour in addressing management issues. To illustrate this potential I apply the model to two recent invasive species control efforts, one that was largely successful and the other that in hindsight was doomed to failure from the very start.

Asian longhorned beetle in Chicago

Antipin and Dilley (2004) describe a successful effort in the city of Chicago to eradicate the Asian longhorned beetle, *Anoplophora glabripennis*. The fairly large (2–3cm), slow-moving adult insect lays its eggs underneath the bark of a variety of tree species and the hatched larvae worm their way up and down the tree, feeding on the phloem and eventually killing the tree in the process. The beetle is thought to have arrived accidentally in Chicago on packing crates delivered from China to a business on the city's north side, and was discovered in the nearby Ravenswood residential neighbourhood in 1998. The pest had been discovered in a separate outbreak in New York City two years earlier and thus the city was aware of the potential magnitude of the problem. It mobilized a team of local, state and federal officials who developed a plan to quarantine affected areas and prohibit moving wood materials out of the zone. Then by an intensive system of detection the team identified and destroyed more than 450 infested and suspected trees within the first year and another 1000 in the following five years until the pest was effectively eliminated. Minor outbreaks in four other neighbourhoods within the metro area were similarly contained, and ten years after the 1998 discovery the beetle was officially declared eradicated.

Looking at the case study within the model framework reveals how the various factors contributed to a positive response (R) to support the effort's success. First, the beetle was an accidental introduction and although one could consider it somewhat attractive (in China it is known as the starry night beetle for the whitish speckles that dot its glossy black shell), there was no expressed value (V) in maintaining its presence in the city. In contrast, the threat (T) of the beetle was imminent and its impact (I) would be highly negative; if it were permitted to spread, its potential losses to industry and tourism were estimated at more than US$41 billion. While the management treatment (M) needed to eradicate the beetle also had negative externalities – in the most affected part of Ravenswood nearly all trees were cut and destroyed within an eight square block area – the effectiveness of the identification and control effort was successfully demonstrated within the first few years. The initial strategy to also remove healthy trees within a 0.2km radius of infected trees was very unpopular with residents, but when a new chemical prevention treatment for injecting healthy trees proved effective in tests it was quickly adopted. The severity of this treatment strategy was also tempered by an aggressive reforestation programme which planted large-calliper replacement trees, and a very proactive public relations programme that included numerous public meetings, a supportive media and enlistment of numerous civic groups that offered financial, labour and even emotional support to grieving residents. The success of this effort was also bolstered by the isolated residential context (C) and a homogeneous stakeholder constituency (S), which led to a high degree of engagement and united cooperation in working toward a solution.

Feral cats in Wisconsin

Beversdorf's (2008) video documentary vividly captures the social dynamics of a failed 2005 proposal to control feral cats in Wisconsin and stands in stark contrast to the beetle's success story on nearly every factor. Feral domestic cats (*Felis catus domesticus*) are common worldwide due to abandonment by pet owners, and if not sterilized their local populations can increase rapidly. In both urban and rural areas, cats prey upon birds and small mammals, and while estimates of damage vary considerably, a study in rural Wisconsin (Coleman and Temple, 1996) calculated that a population of 1.4–2 million feral cats and pet cats whose guardians leave them outside kill between 7.8 and 219 million birds annually. Such information spurred a 2004 proposal by a Wisconsin hunter and trapper that the state delist feral cats as a protected species, making an uncollared cat in a rural area not under an owner's direct control fair game to shoot or trap and kill. When the citizen's advisory Conservation Congress decided to put this proposal on the ballot for public vote in hearings held in each county of the state the following spring, it set off a campaign among cat activists that quickly grabbed national and international attention. The Congress, traditionally attended by a small percentage of the state population and dominated by hunting and fishing enthusiasts, voted 57 per cent to 43 per cent in favour of delisting feral cats, but the broader sentiment of state was so far in the other direction that the state's governor urged legislators not to move forward on the issue: 'I don't think Wisconsin should become known as a place where we shoot cats ... everybody is laughing at us.' For the first time in its 71-year history, the Executive Board of Conservation Congress voted against the wishes of its constituents and the proposal died a quick death.

In this case it is clear that feral cats hold considerable positive value (V) to many people. While the negative impacts (I) of cat predation on bird populations are recognized, the wide variance in estimates of the magnitude of the problem may have served to question the reliability of the research. Also, the long-standing presence and acceptance of free-roaming cats around farms and even within the urban landscape probably served to lower their perceived threat (T). The proposed management control mechanism (M) of having hunters shoot feral cats on sight was highly negative to the point of being outrageous to many people, and even scientists who advocated cat control maintained such an approach would not significantly curb cat populations. Cat advocates on the other hand argued that trap-neuter-release programmes provide an effective and humane alternative to curbing populations, though the research backing this approach has also been questioned. Finally, with a resident population that is 74 per cent urban, 88 per cent non-hunting, and 30 per cent cat owners, the context (C) and stakeholder (S) factors likely skewed public response strongly against the proposal.

Conclusion

In this chapter I have argued that, if natural areas managers are to effectively address invasive species in their restoration efforts, sensitivity to the social dimensions of the issue may be as important as understanding the ecological and technical aspects of management. By surveying a range of examples where the social aspects of invasive species management have been dealt with, one begins to gain an appreciation for what factors might be important in anticipating public response to an invasive and its control. While my model of these relationships is certainly a work in progress, it can serve as a useful heuristic device to begin thinking systematically about how one might deal with a particular species.

The case studies of Chicago Asian longhorned beetles and Wisconsin feral cats provide ideal illustrations for how the model might be applied, for both involve a single species and have a clear beginning and end. This unfortunately may not always be the case in addressing invasive species in the context of natural areas restoration and management. In my work in Chicago and San Francisco, conflicts involving invasive species were embedded in larger questions of what restoration means and how it should be approached in urban settings, power and interest group relationships, access and use of public space, and other issues. So while the approach outlined here may be a necessary step forward in addressing the social aspects of an invasive, by itself it may not be sufficient in ensuring the success of a restoration programme.

Although they are not as fully documented as the case studies of Antipin and Dilley (2004) and Beversdorf (2008), many real-world examples of people's response to invasive species management scenarios exist. Systematic documentation of a varied selection of these examples could provide a valuable data base for further study, and with the employment of techniques such as conjoint analysis (e.g. Champ et al, 2005) the model proposed here could be empirically tested. Further work examining how people negotiate or trade off various values and impacts in arriving at a socially acceptable or appropriate alternative (e.g. Brunson et al, 1996) could shed further light on the resolution of management conflicts. The Reasonable Person Model proposed by Kaplan and Kaplan (2003) suggests ways to meaningfully engage stakeholders in such complex decision making, and along with a thoughtful analysis of the factors outlined here, may hold promise in achieving social success in the implementation of natural areas restoration (Phalen, 2009).

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