



## Research article

# The national, regional and city divide: Social media analysis of stakeholders views regarding biological controls. The public reaction to the carp control herpes virus in Australia



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## ABSTRACT

Recent research and practice in environmental management suggest sentiment analysis of social media communication can be a useful tool in stakeholder analysis of environmental policy. This is certainly the case when it comes to the controversial use of biological controls in dealing with invasive species. Current numerical scored approaches of sentiment may not reveal the reasons for support or opposition to environmental policies in this and other areas. In this study, we examine how the use of more in-depth analysis based on what key stakeholders say about this issue in media at a national, city or regional geographic level. The analysis reveals quite different reasons for support and opposition to the biological control of carp in Australia, and that within each stakeholder group it is possible for individuals to hold conflicting views and attitudes on this issue. We find that there are concerns at the national and city level about the impact of the virus and mistrust of government and science and that the carp species may be viewed as a valuable resource. Those responding to regional media expressed hope that the virus may lead to the elimination of the carp problem, however, they were more interested in the possible impact on the local environment. The multi-scaled social media analysis of stakeholder views about the potential biological control of carp in Australia demonstrated how social media comments can be used to explore the nuanced and multidimensional nature of community attitudes and preferences.

## 1. Introduction

Stakeholders are an important aspect of environmental management (Cundy et al., 2013; Lund, 2015; Reed et al., 2009; Ross et al., 2016). Increasingly governments and authorities are engaging with community stakeholders to determine their views regarding specific management practices, with the aim of improving support (Charalabidis et al., 2014; Loukis and Charalabidis, 2015). Engagement with the community is progression toward digital channels, as the abundance of social media data is making it increasing tempting for authorities to explore online commentary (Charalabidis et al., 2012). Utilizing digital channels, e.g., Facebook in order to assess community perspectives is emerging as a vital part of an extensive toolkit (Loukis et al., 2017), which also includes surveys, public hearings and expert opinions (Macnamara, 2016).

The act of digital listening involves examining and analysing online commentary focused on a specific theme or topic (Macnamara, 2013).

Beyond providing an assessment of attitudes and perspectives, such practices can take advantage of the “knowledge and the creative ideas of the [community] concerning the pressing social problems, and also to increase transparency and trust” (Ferro et al., 2013 p.359). Techniques for assessing online community perspectives have evolved to include sophisticated automated approaches that utilize advanced coding of linguistics text (Loukis et al., 2015). This type of analysis provides numerical accounts of attitudes and can accommodate a large corpus. In parallel, scholarly work has also begun exploring complex qualitative methods to better extract the nuances and richness of the data (Mehmet and Simmons, 2018). These methods can generate a more comprehensive account of why people hold the views they express.

Therefore, we suggest that social media analysis is useful in understanding stakeholder views on the management of controversial species (Mehmet and Simmons, 2018), including invasive species, particularly when using biological controls, which are contentious (Saunders et al., 2010). This position is supported by Becken et al.

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(2017) who endorse the use of social media to enhance existing approaches to environmental management, specifically in areas of biodiversity.

An environmental issue underexplored using social media listening techniques is invasive alien species. Invasive alien species or invasive pests (Koehn and MacKenzie, 2004; Saunders et al., 2010) are species that have been purposefully or accidentally released into a native environment (Forsyth et al., 2012; Novoa et al., 2016). Pest status is often granted when an invasive alien species negatively impacts biodiversity, and/or economic output (Bomford and Hart, 2002; Forsyth et al., 2012). Biological controls, which can come in the form of predators or pathogens (Saunders et al., 2010), can be introduced in order to control the invasive alien species.

One such invasive alien species in Australia is carp (Bomford and Hart, 2002; Koehn and MacKenzie, 2004). Carp were introduced to Australia in the mid-1800s (Koehn, 2001; Bomford and Hart, 2002). Carp invasion has had significant environmental impacts throughout the Murray-Darling Basin (MDB) and other freshwater systems across Australia (Bomford and Hart, 2002). It has become particularly problematic since the introduction of the Boolarra strain of the fish in the 1960s (Koehn, 2001). The environmental impacts of carp are well established. They destroy aquatic plants, increase water turbidity, and reduce photosynthetic production and visibility for visually feeding fish (Koehn and MacKenzie, 2004). It has been estimated that carp now make up more than 90% of the freshwater fish biomass in much of south-east Australia, costing the Australian economy more than \$500 million per year (FRDC, 2016).

In this paper we aim to expand on sentiment research by examining the numerical analysis of sentiment concerning environmental policy presented in social media, and provide a means of explaining the underlying motivations and justifications of various stakeholder groups in this context. In doing so, a multi-scaled social media analysis of stakeholder views about the potential biological control of carp in Australia was conducted. The stakeholders in this study are those respondents who felt concerned enough about the issue of environmental controls to post comments on social media platforms which had national, city or regional targets.

## 2. Stakeholder theory

In terms of assessing public and hence political support for environmental action, previous research in environmental management has often considered different groups' interests in environmental policy by stakeholder analysis. Stakeholder analysis or research is defined as "how organizations, projects, and policy makers can identify, explain and manage the behavior of stakeholders to achieve desired outcomes" (Reed et al., 2009, p.1936). Reed et al. (2009) note that the concept of a stakeholder, derived from a 17th century concept of someone who holds a bet or a stake, is a controversial concept in environmental management. This is because of the question of what defines a legitimate stake in an environmental issue. For example, are people who live in cities and are not directly affected by an environmental policy or action taking place in rural or regional areas, legitimate stakeholders? Also of concern is that a static approach has been borrowed from business and political theory, which fails to recognize that "stakeholders, organizations, interventions can interact and change over time" (Reed et al., 2009, p.1935). The process of stakeholder analysis can also by its very means exacerbate and generate conflict. For example, town hall meetings, focus groups, and radical transactiveness can all provide platforms for conflicts to be verbalized among competing stakeholder groups.

Nevertheless, stakeholder analysis has been used successfully in environmental management. Some recent examples include climate change and energy use (Elgin and Weible, 2013), water infrastructure planning (Lienert et al., 2013), soil management (Cundy et al., 2013) and future scenario planning for the environment (Krupa et al., 2018).

Previous stakeholder analysis methodologies all rely on some sort of interview or public engagement and include but are not limited to focus groups, semi-structured interviews (Elgin and Weible, 2013), snowball sampling, interest-influence matrices, stakeholder lead categorization, Q methodology, actor-linkage matrices (Hermans, 2008) social network analysis (used in Krupa et al., 2018; Lienert et al., 2013), knowledge mapping and radical transactiveness (for a more detailed description of all these approaches see Reed et al., 2009).

An emerging stakeholder analysis tool to monitor and understand stakeholder views is via social media (Becken et al., 2017a; Hyvärinen and Saltikoff, 2010; Kirilenko et al., 2015). Social media analysis does not require interviews, avoids creating arenas for conflict and can be used to track how members of the public react to local impacts of big-picture changes such as climate change (Kirilenko et al., 2015). It can also be used as an additional basis for environmental monitoring of weather changes (Hyvärinen and Saltikoff, 2010; Kirilenko et al., 2015), where members of the public 'tweet' information about temperature changes (Kirilenko et al., 2015) or provide images of weather events (Hyvärinen and Saltikoff, 2010).

The use of stakeholder analysis in integrated pest management (IPM) consists of 12 steps (Novoa et al., 2018). These are: (1) identify stakeholders; (2) select key stakeholders for engagement; (3) explore key stakeholders' perceptions and develop initial aims for management; (4) engage key stakeholders in the development of a draft management strategy; (5) re-explore key stakeholders' perceptions and revise the aims of the strategy; (6) co-design general aims, management objectives and timeframes with key stakeholders; (7) co-design a management strategy; (8) facilitate stakeholders' ownership of the strategy and adapt as required; and (9) implement the strategy and monitor management actions to evaluate the need for additional or future actions. In case additional management is needed after these actions take place, some extra steps should be taken: (10) identify any new stakeholders, benefits, and costs; (11) monitor engagement; and (12) revise management strategy. This process, while noteworthy, is likely to cost considerable time and engage resources from the perspective of the policy actor. However, a pest management strategy that fails to engage all stakeholders is likely to cause controversy and conflict and not be accepted long-term politically (Novoa et al., 2018). We do not see social media as a panacea for this process, but we believe it is a vital first step in gauging community sentiment on environmental policy.

Like any method of stakeholder analysis, social media has flaws. These include a self-selection bias of people who feel strongly on issues, how articulate respondents are in communication, and how well social media interactions represent the views of the community as a whole. Nevertheless, social media analysis of environmental policy is seen as politically valuable (Loukis and Charalabidis, 2015) and provides a cost effective and rapid means of engagement and testing of community reactions to environmental policy (Ferro et al., 2013).

It is important to appreciate that the level of awareness and views towards invasive species and the options for their biological control will likely differ between different groups. In this regard, the views of the general public are likely to be very different from those of natural resource managers and environmental conservationists (Sharp et al., 2011). Even if the benefits from the removal of different pest species are widely documented, certain stakeholders may embrace the species given, for instance, their use as pets or for food, sport or other recreational purposes (Caplenor et al., 2017; Novoa et al., 2018; Saunders et al., 2010). Others may view certain lethal biological control techniques as inhumane or distasteful (Saunders et al., 2010; Sharp et al., 2011). In some circumstances, there can also be commercial interests dependent on the availability of pest species as a production input. Take, for instance, the innovative Australian use of carp for food, fertilizer, leather and other products.

Specifically, in regards to biological controls, past Australian proposals have engendered strong public opinions despite the safeguards in place (Saunders et al., 2010). When used, the results have not always

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