Participation and Communication Approaches that Influence Public and Media Response to Scientific Risk: A Comparative Study of Two Biosecurity Events in New Zealand

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Abstract: Participatory science needs wide stakeholder input if scientific decision-making is to be inclusive, interactive, transparent, robust and accountable. This input is particularly important when society is exposed to scientific risk, and within this media have an important role as guardians of the public interest. Since 1996, Auckland, New Zealand's largest city, has twice been subjected to the widespread, repetitive aerial spraying of biological insecticide to eradicate invasive exotic moths as part of the Government's biosecurity response. These eradications generated high levels of both public concern and media interest regarding the risk of aerially spraying urban populations. Using interviews with key stakeholders, and content analysis of newspapers, this paper compares factors that increased community resistance, and influenced media coverage between the two eradications. Community acceptance of the eradications was affected by the extent to which scientific bureaucracies included the public, media and outside expertise. When local stakeholders were excluded and official communication was limited, media coverage was critical, emphasised risk and provided a channel for opposition voices to express their views. This paper argues that scientific bureaucracies must step beyond a narrow operational focus of their statutory responsibilities, and meaningfully engage with stakeholders to build consensus based on participation, trust and understanding.

Keywords: Participatory Science, Risk Communication, Biosecurity, Media Communication

Introduction

In today's age of risk aversion, where scientific experts are increasingly challenged, the call for more democratic and participatory science is timely. Since the British House of Lords' landmark report, *Science and Society* (British House of Lords Select Committee on Science and Technology, 2000), global debate about science's role has begun in many national contexts including New Zealand (Allan, 2002; Dew & Fitzgerald, 2004; MoRST, 2002). This has led to widespread calls for improved dialogue between scientists and the public, more openness in scientific decision-making and a move away from the traditional deficit model of science communication (British House of Lords Select Committee on Science and Technology, 2000; Dickson, 2000), where experts are believed to possess all the knowledge and the public are characterized as having inadequate knowledge (Burns, O'Connor, & Stocklmayer, 2003).

In a participatory science environment, particularly when risk is involved, media can play an important role as guardians of public interest, by ensuring institutional accountability, identifying issues of importance to communities and acting as the site for the public construction, contestation and criticism of risks (Beck, 1992, 1995; Cottle, 1998; Gristock, 2001). How effective media is in this role, remains widely debated.

This research examines aspects of the global debate about science, society, media and risk by investigating it at a local scale. During the past decade, residents of Auckland, New Zealand's largest city, have twice been subject to widespread, repetitive aerial spraying of biological insecticide to eradicate invasive exotic moths as part of the country's biosecurity response. The programmes to eradicate the White-Spotted Tussock Moth (WSTM) *Orgyia thyellina*, from east Auckland (1996-1999) and the Painted Apple Moth (PAM) *Teia anartoides* from west Auckland (1999-2006) shared a number of similarities. These included the nature of the threat, the use of biological insecticide and the high levels of public concern and media interest about the risks of aerially spraying over an urban area. However, there were also noticeable differences, in programme management, involvement of local stakeholders, communication with the affected community and public and media response to the programmes.

Using interviews and content analysis, this research compares the two programmes to identify how participatory and communication strategies employed by the managing government ministries, influenced stakeholder reactions. It then examines how these strategies affected the way the programmes were reported in the press. To gain an understanding of the programme strategies employed and stakeholder responses to them, semi-structured interviews were conducted with a total of fifteen key stakeholders drawn from both programmes, including senior ministry staff (six), newspaper journalists (four) and community group leaders (five). Five of these stakeholders were able to provide perspectives on both programmes. In addition, to examine media coverage of each programme, a content analysis of metropolitan and community newspaper articles was undertaken (638 articles in total). The content analysis involved quantitatively coding specified variables of the texts to enable interpretations and comparisons to be made. Included in this was an analysis of media frames, which while having being criticised as a "scattered conceptualisation" (Entman, 1993: 51), involves the identification of devices or "packages" (Gamson & Modigliani, 1989: 3) used by journalists to make some aspects of a text more salient. The research set out only to identify frames within the media text.

What effect these frames had on audience interpretation was not tested and is beyond the scope of this research. Only specific results from the content analysis are presented in this paper. These relate to criticism of the ministry in articles, stakeholder voice and media frames. The combined methodologies are primarily employed here to provide insight into the way programme communication and participatory strategies influenced public and media response.

The paper begins by describing the programmes separately and then outlining stakeholder and media response to each. Programme similarities and differences in participatory and communication approaches are then examined and compared in the discussion section. The results have implications for global debates about both participatory science and the media's role in a risk-averse society.

The White-Spotted Tussock Moth (WSTM) Eradication (1996-1999)

In April 1996, the White-Spotted Tussock Moth, a potential pest of New Zealand's forests and crops, was discovered in suburban east Auckland. With such introduced pests being a threat to New Zealand's primary production, which accounts for around 60% of export income (Biosecurity New Zealand, 2005), a biosecurity response group was formed immediately. The Ministry of Forestry (MoF) was appointed as lead agency.

A delimiting survey identified an affected area of around 700 hectares, with most insects located within 100 hectares (Hosking, Clearwater, Handiside, Kay, & Simmons, 2003). A multi-disciplinary 'Initial Response Group' recommended an eradication strategy using ground and aerial spraying of Foray 48B. This is an insecticide which contains the active ingredient Btk (*Bacillus thuringiensis* var. *kurstaki*), a naturally occurring bacteria, lethal to caterpillars of moths and butterflies. An environmental impact assessment of aerially spraying Foray 48B was undertaken, drawing on information about the spray's efficacy and safety from North American studies, where it had been used periodically for 30 years.

In July 1996, the New Zealand Government approved 'Operation Evergreen', a programme of aerially spraying Foray 48B over suburban east Auckland during springtime. Legislative provisions were also invoked to enable the Ministry to act without wide public consultation (Ministry of Agriculture and Forestry, 1998; Smith, 1996). Despite this, a comprehensive communication strategy was developed to inform, reassure and support the 80,000 affected residents. In addition, it sought to create a climate of community acceptance so Ministry personnel could undertake their duties (Hosking et al., 2003). The communication strategy included the formation of a community advisory group to advise on public concerns. To reinforce the accountability and transparency of the operation, relevant information was fully disclosed to interested parties.

In October 1996 spraying began over 4,000 hectares of Auckland's eastern suburbs. Although the Minister of Forestry had assured the public only three aerial sprays would be necessary, a total of nine were completed before spraying finished in December 1996.

However, with moths still present, further aerial spraying was undertaken over a 130-hectare zone, with weekly ground spraying in a smaller 'hot zone'.

Although the initial spraying received widespread public and media support, the further spraying, which began in January 1997, evoked considerable concern from affected residents. These concerns focused on health risks associated with long-term use of Foray 48B and the legality of the spraying. By the end of spraying in April 1997 some properties had been ground and aerially sprayed 44 times (Legat, 1997).

Throughout the winter of 1997, 'Operation Evergreen' faced public and media scrutiny over health risks, legal issues and concerns about the 'secrecy' of spray ingredients. Health assessments and reports found no evidence to connect adverse effects, health abnormalities, or disease clusters to the spraying.

In the spring of 1997, with legal action threatened, spraying was abandoned in favour of an extensive trapping regime with volunteer residents being trained to monitor the traps. This had become possible following the discovery of a synthetic pheromone by scientists in New Zealand and Canada.

Declared eradicated in 1999, 'Operation Evergreen' was the world's first successful eradication of a moth pest in an urban environment. At its conclusion, the lead scientist said, "From a standing start in 1996 we have made science, health, operational and communication breakthroughs which will provide valuable guidance for future pest-management programmes round the world." (English, 1998)

Stakeholder Response to the WSTM Programme

Stakeholder interviews revealed that the community was accepting of the Ministry's initial rapid response. It felt well informed and confident the pest would be eradicated. When this proved incorrect, and spraying continued, the community became hostile. However, as the initial spraying had significantly reduced the moth population and its geographical range, hostilities, while loud, remained small and localised.

Of greatest concern to affected residents was the potential for health risks. Health reports embedded in the language of statistics and probabilities only served to amplify their hostility. While community hostility was directed at public health officials, it still perceived the Ministry's continued spraying as arrogant and reckless, displaying little regard for community concerns. Interestingly interviews revealed the scientists suffered personal conflict over how to balance the needs of science and the good of the country, with community concerns about the spray. They saw the only way to resolve this was to focus their efforts on developing a pheromone so spraying could cease. Success in this area was attributed to a collaborative scientific working environment.

This eradication was a huge learning ground for members of the residents' community opposition group. Authority was challenged and community members used their own expertise to gather evidence. They drew heavily on advice from action groups in

Canada. However, challenging authority was both financially and emotionally costly to residents. While some felt empowered through the collection of scientific and health literature, others retain to this day strong feelings of resentment towards the Ministry and health officials.

While in essence the Ministry's preferred method of community consultation involved a top-down approach, a number of effective strategies were implemented to facilitate communication and enable community participation. These included: a comprehensive and innovative advertising campaign to keep the public informed; the early establishment of a community advisory group; successful recruitment and training of community volunteers to monitor traps. Although community members were cautious in their praise of the consultative process, they commented favourably on the access they had to Ministry information. Interviewees suggested that less consultation in the second phase of spraying, when the programme came under the control of a new Minister, led to a decline in community support.

The Ministry regarded media as an important channel for communicating to residents and interviews suggested a positive relationship developed between Ministry staff and journalists. Residential opponents were either indifferent or critical of media. They found access to media difficult and some even suggested that journalist objectivity was compromised by the Ministry's considerable advertising budget.

Media Response to the WSTM Programme

Content analysis of newspaper articles revealed that the novelty of the eradication programme created considerable early media interest. After this, interest only rose with further spraying, when conflict occurred, or when significant health reports were released. Around a quarter of all articles contained some form of criticism. This related mainly to the health risks. Articles criticising the Ministry's consultation or programme management were uncommon.

An analysis of media frames revealed that the dominant frame (29%) emphasized the health risks. This was presented as the INNOCENT VICTIM frame where media told the stories of individuals affected by the spray. The effect of this potentially negative frame on people's perception of the eradication was however minimised by the use of three positive frames. DEDICATED MINISTRY showed committed Ministry staff in the field, DOING YOUR PART showed public displays of support and MOTH MENACE portrayed the moth as an enemy of the state. As a combined group of frames they totalled 50% of the media frames identified in WSTM articles. Rarely, only in 9% of frames, did the media frame the Ministry to show management inadequacies.

Media rarely gave community opposition a voice. Although not totally silenced, community opposition was overwhelmed by the Ministry voice, with official Ministry sources quoted more than twice as frequently as community. As a lone voice in opposition, community access to media was limited.

The Painted Apple Moth (PAM) Incursion (1999-2006)

Just as the WSTM campaign was drawing to a close, Auckland faced another moth incursion in April 1999 when the Painted Apple Moth (PAM), a native of Australia, was discovered in an industrial estate in west Auckland. An eradication programme was initiated as the moth was considered a potential threat to New Zealand's horticultural industry. Leading this was the new Ministry of Agriculture and Forestry (MAF), formed by an amalgamation of the large Ministry of Agriculture and the much smaller Ministry of Forestry, which had led the WSTM eradication. Most of the scientists and managers from the earlier WSTM campaign, no longer worked in the new amalgamated ministry.

A month after the discovery, MAF began ground spraying five industrial properties with an organo-phosphate insecticide. Aerial spraying with the insecticide Foray 48B was initially rejected, because although a prolific breeder, the moths' dispersal was believed to be relatively slow as the female was flightless.

WSTM scientists offered to assist MAF with pheromone development and quarantine facilities to establish a moth-breeding colony for host-feeding trials. Both offers were rejected and the contract went to a newly created government research institute (New Zealand Audit Office, 2003). No synthetic pheromone was ever successfully developed for this incursion.

Early optimism that the eradication programme was proving successful was short lived, when in January 2001, 132 moths were caught in traps. Over ensuing months as moth numbers continued to increase and their geographical spread expanded, interest groups, sector groups, local government representatives, WSTM scientists and local west Auckland scientists, publicly criticised the programme. This prompted an independent review, which recommended aerial spraying, greater efforts to breed female moths and the development of a communication's strategy for households. However it concluded that programme management had been appropriate (Frampton, 2002).

Two and a quarter years after the painted apple moth was found, MAF established a resident elected community advisory group. Continual tensions over the group's demands to be involved in the programme, resulted in it becoming one of the Ministry's strongest critics and eventually led to MAF disbanding the group in late 2002. Only two members from the original community advisory group were retained when a new MAF appointed liaison group was formed.

By the time spraying began in January 2002 the spray area had almost doubled to 560 hectares, affecting up to 5000 households, five times more households than in the original zone. Five months later in the wake of an Audit Office report critical of aspects of the programme, the managing scientist stepped down and a second PAM management team took over. West Auckland faced nine large-scale aerial spray rounds before continuing rising moth counts led the Government to announce in September 2002, a $NZ 90 million, 8000 hectare aerial spray eradication programme. The spray zone contained 40,000 homes, 26 times more than in the original zone. To counteract growing public and media criticism, MAF launched a major advertising campaign, focusing on the need to eradicate the moth and the safety of the Foray 48B spray.

In total west Auckland faced blanket aerial spraying at least 13 times, with 'hot zones' receiving extra aerial and ground sprays. Almost two years after the last spray episode and almost seven years after it was discovered, in early 2006, the Painted Apple Moth was officially eradicated.

Stakeholder Response to the PAM Programme

Most interviewees believed that the failure of the conservative initial management had a lasting negative effect on community perception of MAF as a competent authority. Community group members saw a clear connection between perceived management failures, the resulting expansion of the affected zone and the subsequent exposure of large sections of the community to risk from spraying. While the Ministry managed health risks in accordance with the spray's known risks, the community's concerns focused on unknown risks. Some in the community saw MAF as the source of the health risk while at the same time being responsible for its management.

Community groups demanded to be involved in the programme. They believed their local knowledge, expertise and experience could make a valuable contribution particularly as some members had been involved with WSTM. The Ministry seemed unprepared for such an empowered community and this contributed to the self-selection of a Community Advisory Group at a rowdy public meeting. Seeing the programme as primarily scientific, the Ministry were reluctant to accept any management advice from the Community Group. Community Group members were sceptical about the genuineness of the Ministry's consultative process, which led to ongoing strained relations. The Ministry's reluctance to involve local experts led many to describe the campaign as exclusive.

The second Ministry management team communicated strictly according to the Biosecurity Act, which required them to inform not consult. Public education was to be achieved through a large-scale advertising campaign and the Ministry gauged its success through polls. An important measurement of success as determined by the Ministry, was verbatim recall of advertising messages.

The Ministry's communication with media was strained, leaving journalists sceptical about their openness and accountability. Journalists found access to PAM management progressively difficult. In contrast community groups successfully gained media exposure. While journalists recognised that opposition may have come from a minority of the community, they believed it had a right to be heard. This was made easier by the widespread concern and criticism of the Ministry's handling of the eradication from sources other than residents, including prominent west Auckland officials and personalities.

Media Response to the PAM Programme

Content analysis of newspaper articles showed that media interest in PAM was initially strong, although this quickly fell away as the Ministry maintained a low public profile during the campaign's first two years. When the eradication appeared to be faltering,

media interest was reignited by programme controversy and conflict, with major spray announcements, or when health reports were released.

Controversy in the programme influenced media coverage with around two thirds of PAM articles containing some criticism of the Ministry, more than double the percentage of critical articles in WSTM (see Table 1). Criticism primarily focused on health risks. While articles criticising the Ministry's programme management were uncommon in WSTM, this was not the case in PAM with one third of articles containing criticism of the Ministry's management.

The connection between the perceived mismanagement of the programme and concern over health risks was further identified when media frames were analysed. Both of the negative frames INNOCENT VICTIM, which highlighted health risks and MANAGEMENT MESS, which raised concerns over programme management dominated. As a combined group of frames they totalled 75% of the media frames identified in PAM articles. In WSTM while the INNOCENT VICTIM frame was seen, only 9% of frames were MANAGEMENT MESS (see Table 1).

As a combined group, the positive frames DEDICATED MINISTRY, DO YOUR PART and MOTH MENACE totalled 17% of the media frames identified in PAM texts. This compares to 50% in WSTM where these positive frames often served to offset the impact of any negative frames (see Table 1). In PAM the very low incidence of the first two positive frames reflects the Ministry's endeavours to prevent identification of their field staff in media stories, due to fears for their personal safety.

Analysis of media use of sources revealed interesting differences between the two campaigns. While the Ministry voice overwhelmed the opposition voice in WSTM, the opposite occurred in PAM as opposition voice in PAM was more than double that found in WSTM (see Table 1). This opposition not only included residents, but also experts, government officials and scientists. This dominance of opposition voice is at odds with what is generally reported in the literature, where the voices of those affected by risk are often rendered silent (Cottle, 2000).

Table 1: Summary of the Media Coverage for each Programme

	WSTM (1996 – 1999)	PAM (1999- 2006)
CRITICISM Criticism of the Ministry in article text	(as % of total articles) 25%	(as % of total articles) 60%
SOURCE ATTRIBUTIONS Ministry Voice Opposition Voice	(as % of total attributions) 46% 20%	(as % of total attributions) 28% 43%
MEDIA FRAMES Negative frames *Innocent Victim* *Management Mess* Positive Frames *Moth menace* *Do Your Part* *Dedicated Ministry*	(as % of total frames) *29%* *9%* *22%* *14%* *14%*	(as % of total frames) *40%* *35%* *14%* *2%* *1%*

Discussion

In the initial stages of their campaign, the WSTM Ministry of Forestry team employed a number of features that promoted participatory science. This included: an insistence on openness and transparency; strong leadership combined with a team approach that included operational, scientific and policy input; a comprehensive communication's strategy; the early establishment of a community advisory group; the use of resident volunteers for trap monitoring. These features point to a campaign that recognised the need for stakeholder support and involvement, including engagement with media.

On the other hand, PAM's Ministry of Agriculture and Forestry favoured public education over engagement. Their marginalisation of those who openly opposed them created stronger and louder opposition. Their unwillingness to meaningfully engage with local scientists, and their strained relationship with local and regional government, resulted in a programme beset by widespread criticism. This initially alienated potentially strong and respected community allies and prevented the use of already established community networks. The Ministry's failure to contain the moth when it was confined to an industrial area, despite community and local government calls to do so, led to a rapid expansion of the affected zone, the eventual widespread aerial spraying of residential homes and increased exposure of urban populations to risk.

However, it would be incorrect to suggest that these two programmes lie at opposite ends of the participatory science spectrum. Both programmes exhibit limitations on how to accommodate community expectations and concerns surrounding risk. In both programmes two competing perspectives developed over the definition and assessment of risk. The Ministries' scientific perspective was dominated by technical discourse and risk assessments based on probabilities around known risks. The communities' social perspective drew on people's experiences and their concern about unknown and long-term risks. Their focus was on safety not risk-management leading them to question the

quality, relevance, independence and reliability of public health information and assessments. These two perspectives were irreconcilable and both sides talked past each other. With legislative protection, the scientific perspective dominated.

Both programmes also show that the relationship between experts and the public is not an even playing field. Challenging experts is a costly exercise both financially and emotionally. Communities face enormous and sometimes insurmountable difficulty raising funds to oppose government decisions. It is difficult to gauge from these programmes whether communities will ever be able to significantly influence government on biosecurity decisions, particularly when there is little legislative support to facilitate this. These programmes illustrate that such decisions in New Zealand are determined in the realms of science and politics, not by local communities and the far-reaching statutory protection inherent in New Zealand's biosecurity laws, grants authorities significant powers to carry out such duties.

However, the differences in the approaches by the Ministries in these campaigns in engaging and involving stakeholders, despite both being mandated under the same legislation, provides useful comparisons. Public acceptance of the eradications was affected by the extent to which the scientific bureaucracies which managed the campaigns, listened to and involved community and outside expertise, and engaged in a positive way with the journalistic side of the media, not just their advertising arm. Given the relative success of WSTM in this regard, it seems surprising that the PAM Ministry favoured education over engagement. Interviewees offered several explanations for the differences between the two campaigns.

Organisational culture of the managing Ministries was identified as one reason for the difference. Interviewees contrasted the smaller flatter structure of WSTM's Ministry of Forestry, with PAM's larger, bureaucratic and hierarchically structured Ministry of Agriculture and Forestry (MAF). They argued that MAF was more regulatory and less responsive to criticism, which contributed to its unwillingness to change strategies in the early phase when management of the eradication was failing. In addition MAF was unfamiliar with an urban audience, predominantly working with farmers who were more accepting of their statutory role.

Personalities rather than science may have influenced the management of the PAM programme. The selected use of experts may have impacted many programme features including, the early conservative approach to the eradication, the reluctance to listen to or involve outside expertise, particularly previous experiences gained by WSTM scientists and the unsuccessful development of the pheromone. Implicated in this was New Zealand's competitive science model, which when adopted in 1999 (Devine, 1997, 2003), resulted in scientific agencies competing for funds.

Since no public post-campaign evaluation of WSTM was undertaken, the opportunity to learn from its successes and failings was lost. Similarly no official post-campaign public enquiry of the PAM programme has been undertaken, despite community calls for this to occur. While evaluations may have taken place, the lack of wide community and outside expert input, limits the contribution these stakeholders could provide for future campaigns.

While the Government may have shown limited capacity to learn from WSTM, the community carried their knowledge over to PAM and demanded to be heard. The PAM Community Advisory Group, established in August 2001, was very different to that in WSTM. Some of its members were prepared, knowledgeable and experienced, partly because of their prior involvement with WSTM and the early stages of PAM, and partly because of the personal skills they bought with them. These community members developed extensive programme knowledge. They wrote health reports, presented an alternative spraying proposal and developed relationships with media.

The PAM Ministry seemed unprepared for such an empowered community. Their failure to establish early a representative community group, led to two key opponents from the WSTM programme forming their own west Auckland group. MAF's eventual Community Advisory Group was elected during a rowdy public meeting and consisted of representatives with divergent interests. A number of small fragmented opposition groups, some with strong views also formed over time.

Although the PAM Community Advisory Group consisted of some vocal spray opponents, several members were not initially anti-spraying and sought an environment where they could meaningfully participate in the programme. The Ministry's inability to productively channel their Community Advisory Group's demands to be involved in the campaign, led to ongoing conflict. With the group having official status, its conflict with the Ministry received prominent media coverage.

In contrast, while the WSTM team had the advantage of a naive public as the campaign was breaking new ground, they were proactive in working with the community at the earliest opportunity, establishing a community advisory group using existing community boards. By engaging with established and respected community networks they received the full backing of both local and regional governments.

The Ministries also had differing attitudes to the media. The Ministry responsible for WSTM regularly engaged with journalists and were readily available for comment. While they initially benefited from a media fascinated by the novelty of the event, when conflict arose, journalists did report it. However, with conflict confined to only a small section of the community and unsupported by any government or expert voice, opposition voice in the media was always drowned out by the dominant Ministry voice.

In the PAM campaign growing concerns about the Ministry's integrity and competency triggered a more questioning and critical media. As a result the Ministry developed a more strained relationship with journalists than was the case in WSTM. The widespread and long-lasting conflict that dominated this campaign provided media with ample material. They regarded community opposition as legitimate, and with government and outside experts also speaking out against the campaign, the Ministry voice was drowned out in a sea of opposing voices.

While media gave community a voice in PAM, the media played a limited role in assisting community in dealing with risk. In both programmes they displayed limitations

in reporting uncertainty. Their preference for tangible issues led to a reliance on human-interest stories, a preference for conflict and a focus on events such as the release of health reports, rather than any investigative approach to the wider issues of risk. These programmes suggest that commercial imperatives along with media routines and pressures appear to favour the media's role as the site for the social contestation and criticism of risk, while limiting their ability to assist with the social construction of risk.

Conclusion

Biosecurity campaigns that involve the use of aerial sprays over urban areas to eradicate pest invaders, provide governments with enormous challenges. How those in charge work with affected communities is crucial to the ongoing success of these campaigns and to their public and media acceptance. The two campaigns presented in this research illustrate how communities respond when they are included or excluded from decisions and the resulting effect this can have on media coverage.

Community acceptance of the eradication campaigns was affected by the extent to which ministries included the public, media and outside expertise. When stakeholders were excluded and official communication was limited, media coverage was critical, emphasised risk and provided a channel for opposition voices to express their views.

When conflict arises and media reporting becomes negative, it is easy to point the finger at the limitations of commercial media in reporting science and particularly those issues that involve scientific risk. However, in the campaigns under discussion in this paper, this would be simplistic and would limit any opportunity to meaningfully assess the ministries' roles and the influence they had on media coverage. Government institutions must examine the effect their management and the way they deliberate on issues, can impact on both public and media acceptance of their work. In a liberal democracy the media's role in holding institutions accountable is fundamentally important.

The two programmes presented in this research, exhibit limitations on how to accommodate community expectations and concerns surrounding risk, and both show a dominance of the Ministries' scientific perspective when dealing with risk. However the lack of official public evaluation of these campaigns limits wide and inclusive analysis of their differing approaches. The criteria for judging campaign effectiveness must be based on more than just the successful biological eradication of a pest invader[1].

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[1] Critical analysis of operational strategies on how to ecologically manage pest incursions to establish best practice is beyond the expertise of this author. Operational strategies employed have only been compared to establish the effect these had on both stakeholder perception of each ministry's credibility and stakeholder reaction to risk. Analysis of pest management strategies used in these programmes is best left to scientific experts involved in the fields of entomology and ecology. However as the paper suggests, the criteria for judging overall campaign effectiveness must extend beyond ecological end points. It must include inputs from a range of expertise including residents from the affected communities.

The Biosecurity Act in New Zealand provides the legislative framework under which Ministries involved in matters relating to biosecurity are required to undertake their statutory responsibilities. It contains wide powers for those in authority including protection against liability. It does not require community involvement or engagement. Despite this the WSTM campaign provides tentative evidence that Ministries governed by this Act can still step beyond the narrow operational focus of their statutory obligations and engage with communities affected by biosecurity responses.

Future biosecurity programmes need to incorporate communication and participatory strategies in their design. These should include: rapid assessment of the situation accompanied by open and transparent communication with affected communities; close integration of scientific, policy and technical input; a multidisciplinary team that includes community representation; development and implementation of a communication plan that seeks to listen to as well as inform residents; early establishment of a representative community group with mutually agreed terms of reference; allowance for resident involvement in programme delivery such as use of volunteer networks; open dialogue with local councils/government; effective use of established and trusted official local networks; engagement with the editorial side of media not just their advertising arm.

The participatory approach calls for a win/win relationship, it creates a new balance between experts and the public (Yankelovich, 1991). It requires a commitment on all stakeholders to engage meaningfully in an atmosphere based on mutual trust and understanding. This calls for all sides to work together and to learn from the mistakes of past experiences. During conflict, it is time to engage, not withdraw.

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