EVALUATION OF KAURI DIEBACK SIGNAGE

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EXECUTIVE SUMMARY

Implementing changes based on hazard communication theory could increase the effectiveness of the kauri dieback signage. The current signage contains some elements that are good practice and should be integrated into all signage: yellow and black colouring, good pictorials, and appropriate reading level. Kauri dieback signage could be improved by adding a signal word (e.g., DANGER), clearly stating cause and effect of the hazard and the compliant behaviour, and removal of all capitalisations. In addition to these recommendations, researching the differential impact of signs written with normative, attitude, or control messaging (based on the Theory of Planned Behaviour) is suggested as international research has shown normative messaging to be effective keeping visitors on a track. Finally, understanding the visitor experience for each kauri site and how different signage and communication methods (i.e., pretrip information on website, arrival signage in the car park, signage on the trail, physical barriers and signage at the cleaning station, and exiting signage) may interact is necessary to develop effective kauri signage by increasing compliance.

Scope of work

This report provides a desktop review of the kauri dieback signage as shown in the Appendix. As agreed, the specific deliverables were:

- provide professional review of current signs (see Appendix 1 for evaluated signage), noting strengths and weaknesses
- provide professional review of signage at cleaning stage
- base review on scientific literature and best practice, providing references and examples when possible
- 4 page report with references

Kauri dieback signage and park visitors

To effectively reduce the spread of kauri dieback disease, *Phytophthora* taxon Agathis (PTA), people visiting or living in the area of PTA must clean their footwear, equipment, and vehicles. Informing and engaging people to take these actions is a challenge for the partnership of organisations managing the kauri programme: Ministry for Primary Industries, Department of Conservation, Auckland Council, Northland Regional Council, Waikato Regional Council, and the Bay of Plenty Regional Council. Inducing changes in behaviour is difficult however orgnasiations all over the world face the same challenge and we can learn from their successes.

Evaluation framework

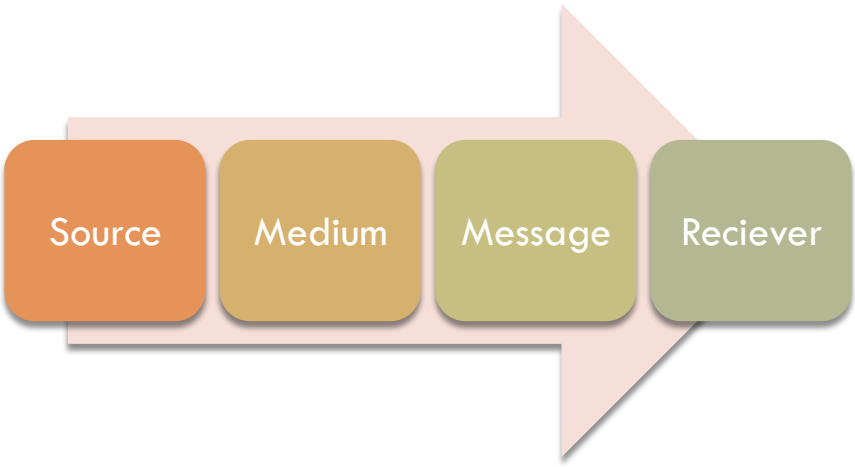
The theoretical basis for effectively communicating appropriate behaviour to mitigate the spread of kauri dieback can draw from the broader field of hazard communication. Hazard communication research is extensive, draws from a wide array of social science disciplines (e.g., psychology, human ergonomics, and behavioural economics), and is empirically based. While kauri dieback does not pose a direct risk to the health and safety of humans, which is often the main focus of hazard communication, the challenges of communicating compliant behaviour are similar.

Managing visitor behaviour in relation to kauri dieback can also draw from the growing empirical field of park management (Hughes et al., 2009). Espiner (2001) provides a detailed review of hazard communication and park management with a case study in New Zealand. Fortuitously, Queensland Parks and Wildlife Services recently commissioned a literature review of safety signs (Weiler et al., 2015). In this review, the authors evaluated approximately 40 articles and reports that communicated safety in parks.

In this report, I first evaluate the kauri dieback signage using the broader hazard communication literature. Subsequently, I look at the field of park safety management and suggest alternative formats or approaches to improve the effectiveness of kauri dieback signage.

Hazard communication

Communication, especially hazard and behavioural compliance communication, is a complex process (Kasulis & Zaltman, 1977). In this report, I use Laughery & Wogalter's (2006) well-researched four-component communication framework[1] for evaluation. The framework states that successful behavioural compliance is based on the following steps:



Based on this model and supporting empirical research there are wide-ranging recommendations that would strengthen the current kauri dieback signage. I also evaluated the individual signs for additional strengths and opportunities in the Appendix.

[1] While the framework is depicted as linear, in reality it is a series of feedback loops with any stage

It is important to clearly articulate the purpose of hazard communication. The success of hazard communication is measured by behavioural compliance and not awareness of the message (Kollmuss & Agyemen, 2002; Wogalter et al., 2002). In some instances, awareness and knowledge can be increased but the impact on attitudes and compliance can be minimal (e.g., Sharp et al., 2012). Furthermore, in some cases there is an inverse relationship between awareness and action- people who cite more knowledge and awareness are the *least* likely to comply (de Oliver, 1999). Therefore focusing on increasing awareness of the hazard rarely results in a change of behaviour (Ajzen & Fishbein, 1980).

Recommendation: review each piece of signage to determine its purpose, i.e., advocate compliant behaviour or raise general awareness of kauri dieback disease. If the purpose is to communicate a specific compliant behaviour (e.g., wash boots, stay on track), apply a theoretical framework to maximise effectiveness

In some instances, the purpose of the signage may be to raise general awareness. In these instances, general communication and marketing principles may apply. For this report, I focus solely on recommendations to facilitate compliant behaviour.

Source

The credibility of the source (the organization or sender of the message) can impact receptivity.

Fundamentally the source must be credible and reliable (Ham, 1992). In all signage evaluated, the source of the message is the partnership of organisations (Tangata whenua, MPI, DOC, Northland, Auckland and Bay of Plenty Regional Councils). By displaying the names of the partnership organisation on the signage, it is assumed that these agencies are well respected by the park visitors and information communicated from the partnership is trusted. The list of partnerships is presented in a simple and coherent style.

In addition to the partnerships, most of the signage evaluated also has the brand and logo "Keep kauri standing. Stop kauri dieback disease from spreading." This brand and logo, possibly a unifying feature of the partnership organisations, is redundant if the names of the partnership organisations are listed. Communication theory states that only minimal and relevant information should be presented to achieve compliance and reduce cognitive load[2] (Laughery & Wogalter, 2006), thus removing of the logo is suggested.

Furthermore, the phrase and logo are general statements about the plight of kauri dieback. If the objective of the signage is to have visitors engage in a specific behaviour (e.g., clean their boots), the logo and brand will have negligible impact on compliance. If the purpose of the brand and logo are to raise awareness of the brand itself, then keeping the brand would be appropriate. It is essential to evaluate the purpose of each piece of signage to determine if it is to advocate compliant behaviour or simply to raise awareness.

[2] Cognitive load refers to the way information is processed in the brain. There is an inverse relationship between the amount of information on a sign with reading and acting upon the information (Allen, 2007).

Recommendation: Because it has no direct relevance to the targeted behaviour, remove the brand and logo "Keep Kauri Standing. Stop Kauri Dieback disease from spreading" on signage that communicates a specific compliant behaviour and also has the partnerships organisation listed.

Medium

The medium of the message is also known as the communication format or channel. There are two basic communication mediums, visual or auditory. Each of these mediums can be furthered presented in numerous forms (e.g., communication via the visual medium could be presented on a sign, a notice in the newspaper, a bumpersticker, or a billboard). For this report, the communication medium for all signage is visual.

For the visual medium, effective communication is increased by:

- font size- body of text should be 48 point when the sign is read 1.5 -2m away (Moscardo et al., 2007)
    - font size appears appropriate on evaluated signage but needs to be confirmed based on actual size of signs and location
- number of words- 30 words or less on the sign (Serrell, 2015)
    - word count is appropriate on evaluated signage
- white space- the visual weight of the sign must be balanced (Ham, 1992)
    - white space is an appropriate proportion on evaluated signage
- readability- text written at a reading age of 10 -12 yrs old (Kool, 1985)
    - calculated for key signage (see Appendix), written at appropriate reading level
- signal word – printed in red (Smith-Jackson & Wogalter, 2000)
    - Recommendation: add signal word in red (see below for an explanation of a signal word)
- colour- the use of black and yellow indicates a hazard (Smith-Jackson & Wogalter, 2000)
    - black and yellow colour of the signage is appropriate
- boarder – around the text (Wogalter & Rashid, 1998)
    - Recommendation: add a boarder around the signage
- outline format – more effective than paragraphs (Wogalter & Shaver, 2001)
    - signage utilizes appropriate outline format
- capitalisation – font in all caps increases mental effort to read the sign and more recently seen as aggressive by younger visitors (Bucy, 2015).
    - Recommendation: do not use all caps in signs
- pictorial symbol – a symbol or graphic is more effective than just words or a picture (Wogalter et al., 2002)
    - Recommendation: consistently use pictorial symbols over pictures (see individual evaluation)

Message

The message is the content or information that is presented, i.e., the words (and when applicable pictorial) used to relay the safety message.

Fundamentally, signage can only be effective if it attracts the visitor's attention (Moscardo et al., 2007; Laughery & Wogalter, 2006). For safety signs, the heading should be a signal word such as DANGER, CAUTION, or WARNING (Wogalter et al., 2002). The use of a safety words significantly increases the reading of the sign and the effectiveness of the warning.

Recommendation: Remove 'please' from signs and replace with a safety word such as DANGER[3]. Safety word should be in red.

The content of the sign must also identify the hazard, explain the consequence of the hazard, and state the compliance behaviour. The message must also be explicit and not leave the cause or effect implied (Laughery & Wogalter, 2006). Current kauri dieback signage varies in stating the hazard, the consequence, and the compliant behaviour.

Recommendation: Ensure all signage state the cause and effect of kauri dieback and the compliance behaviour required (see individual evaluation for more detail)

Combining the above two recommendations, an alternative heading on signage could be:

DANGER: deadly kauri dieback disease in area.
Staying on the track prevents spreading the disease.

While the above phrases may appear extreme, research has shown the more explicit a warning message is, the greater the compliance (Laughery & Wogalter, 2006).

Finally, the effectiveness of the sign is increased if it combines words with a pictorial (also known as a symbol or graphic). Signs with only text or an actual picture are less effective compared to a sign with text and pictorial. The pictorial can be the hazard or the compliant behaviour (Laughery & Wogalter, 2006).

Recommendation: Use pictorials such as those found in sign #2 in the Appendix.

Receiver

The receiver is the target audience and the context they are in when viewing the signage. Understanding the receiver, their visitor journey when viewing the hazard sign, their competence, and their motivation to comply is key for successful hazard communication (Laughery & Wogalter, 2006). A warning could be noticed, read and understood but still fail to achieve the compliant behaviour because

[3]The signal word DANGER has the most salience and NOTICE the least; WARNING and CAUTION have an intermediate impact (Wogalter et al., 2002)

of the attitudes and beliefs of the receiver (Hughes et al., 2009). To date, there is little information on the receivers of kauri dieback signage.

It is not possible to evaluate the effectiveness of the signage on the receiver in this desktop report. However, it is vital to test the effectiveness of the signs with the target audience and that should be a focus of future research.

Recommendation: conduct research on the receivers of the kauri dieback message to understand the motivations and beliefs of compliant and non-compliant visitors. Results of the research should be used to write the content of the message (see Hughes et al., 2009, Lackey & Ham, 2002).

Similarly, while pictures of the signs and their general purpose were supplied for evaluation (e.g., cleaning station and keep out signs), the specific context in which the signs were placed was not provided. Location of the signage (e.g., position in the parking lot, site on the trail; Moscardo et al., 2007), what other signage is in the area (other regulatory or informational signs; Wogalter et al., 2002), and the presence or absence of physical barriers or assets to reinforce compliant behaviour (Laughery & Wogalter, 2006) all have an impact on the attracting power of the sign and compliance.

Recommendation: review the overall context of the signage to ensure appropriate location, reduced visual clutter, and complementarity to physical barriers or assets (if present).

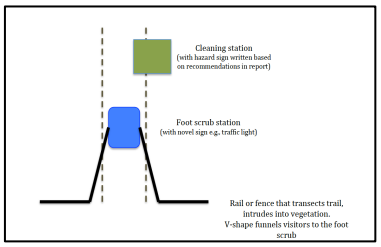
If more detailed pictures and schematics are supplied, this aspect can be explored in a future amendment to this report. Two examples of a site-specific evaluation are given below, the later one is located at Whangarei Heads[4] and the other is an unknown location[5]. The final picture is a recommended schematic of foot bath sites.

A key way to strengthen both foot bathing sites is to increase the use of physical barriers. In the scenarios depicted in the first two pictures, visitors still have the option of walking around the foot bath, albeit in the later they would have to squeeze past vegetation. Installing a fence or rail that transects the path, intrudes into the vegetation by 1m on each side, and is shaped so it funnels people in a v-formation to the foot bath would increase compliance (see the third picture for a recommended lay out). To avoid the foot bath visitors would have to climb over the barrier or walk into dense vegetation.

While I am unable to read the signage at the first location, the two signs (one on the post and one on the disinfectant drum) do not appear adhere to best practice (e.g., size, colour, safety words). Rewriting based on recommendations in this report is suggested.

[4] Whangarei Heads have installed novel foot bathing sites (http://www.backyardkiwi.org.nz/protecting-our-kauri)

[5] the first picture was sourced from New Zealand's strategy for managing kauri dieback disease



At Whangarei Heads, the use of the novel traffic light sign may increase the use of the foot bath (see below about a discussion of novel signs). The sign uses appropriate pictorials and clearly articulates cause and effect. Pairing the novel sign with a traditional hazard sign based on recommendations outlined in this report may strengthen overall compliance (e.g., best practice sign located on the disinfectant station as shown in the picture and/or at the beginning of the trail).

There is one final point to consider about the receiver and the current scope to evaluate current kauri dieback signage. The receiver does not operate in a vacuum and it is a mistake to assume that a visitor would be influenced by one sign. While evaluation of each sign is provided, hazard communication is most effective when it takes a systems approach to influencing compliant behaviour (Wogalter et al., 2002). While I have made recommendations to strengthen the current signage, a review of the overall kauri visitor experience is suggested. Understanding the visitor experience for each kauri site and how different signage and communication methods (i.e., pretrip information on website, arrival signage in the car park, signage on the trail, cleaning station signage, and exiting signage) may interact is necessary to develop effective kauri signage by increasing compliance. For example, the suggestions offered above could lead to a prototype signage that could be tested in multiple locations (i.e., black and yellow, safety words in red, pictorials, cause and effect stated). However, people quickly habituate to signs. Thus there is a need to balance the use of signs that are developed on best practice with novel signs. The use of novel signs at foot cleaning locations, such as those used at Whangarei Heads, may be effective when paired with best practice signs at the beginning of the trail. Ultimately, it is essential to take a systems approach to evaluating the kauri signage and determine the best combination of signage at each location.

Theoretical basis for safety signs and park management

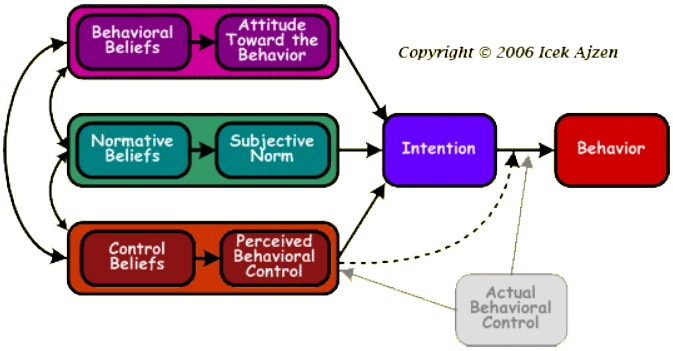
In this section, I discuss the emerging field of theoretically based park management and the handful of studies that have implications for the kauri dieback signage.

I do not attempt to summarise the entire park safety signage literature. As noted earlier the Queensland Parks and Wildlife Services recently conducted a literature review of approximately 40 park safety signs (Weiler et al., 2015). Furthermore, Espiner (1999, 2001) reviewed the safety literature and outlined best practice for safety signs at Franz Josef and Fox Glaciers with some success. The recommendations made from his findings are similar to my above recommendations in regards to colour, pictorials, and context.

There is an emerging and robust field in park safety management that is empirically based. These studies focus less on the design aspects of the sign (e.g., colour, size, pictorials, safety word, and location) and more on the content to facilitate behavioural compliance (Ham, 2013; Hughes et al., 2009). Rather than the effectiveness being determined by park management or experts (Mandredo, 1992), with

numerous internal disagreements about design and content, alternative forms of a sign are developed based on different theoretical aspects and effectiveness is measured by visitor compliance.

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) has been widely used to identify the influences on numerous environmental behaviours (Kaiser et al., 1999; Bamberg and Moser 2007; Ham et al., 2008). More recently TPB has been used to develop and test safety sign compliance in national parks. TPB was designed to predict and explain human behaviour in specific contexts because previous research showed general attitudes did not predict specific behaviour (Ajzen and Fishbein 1980). TPB states that people's behaviour and intention to engage in the behaviour is generally influenced by a combination of their attitudes, subjective norms, and perceived behavioural control (see figure below). The influential combination of attitudes, norms, and control on a behaviour will vary amongst behaviours (Ajzen & Driver, 1992). For example, norms have been instrumental on facilitating recycling behaviour (Barr, 2007) while attitude and norms were shown to be influential in bringing cats inside at night (MacDonald, 2015). Perceived control appears to have less of an impact on environmental behaviours compared to health behaviours (Kaiser & Gutscher, 2006).



Examining TPB studies with behaviours that are similar to the kauri dieback context, such as staying on the designated trail, have found normative messaging to have greater influence on behaviour over traditional regulatory/informational signs (Goh, 2015; Winter, 2006). However, Bullock & Lawson (2011) found signs communicating an message based on attitudinal beliefs with care words such as 'please, preserve, and fragile' were more preferred by visitors. However, the methodology of the later research was a preference test and did not evaluate for compliance *in situ*. All the kauri dieback signs evaluated in this report are based on attitudinal beliefs (e.g., "save our kauri trees") and greater compliance may be achieved if written with normative content.

Recommendation: conduct a pilot study to determine which constructs of TPB (attitude, norms, or control beliefs) improve compliance. Test *in situ* (see Winter, 2006; Curits, 2008; and Lackey & Ham, 2002 for examples) and measure success by an increase in compliant behaviour.

A strength of theoretically based signage is that it often avoids a fallacy held by park management (Manfredo, 1992) that often manifests into ineffective signage. Park management often believe that non-compliant visitors do not respect nature. However, it has been repetitively shown that

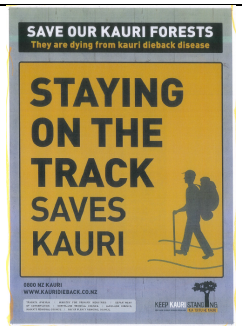
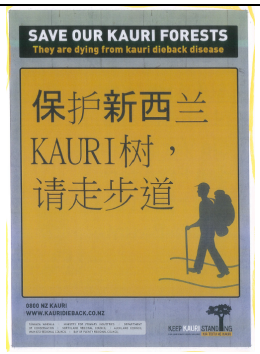
visitors to parks have strong pro-environmental values in general but don't associate their non-compliant behaviour as harmful (e.g., Goh, 2015). Thus, signage that is written to appeal to visitors' pro-environmental attitudes is often ineffective.

Conclusion

In summary, I have suggested modifications to the current kauri dieback signage based on the hazard communication literature. Simple changes to the design of signs such as safety words, articulating cause and effect, and reducing cognitive load by removing peripheral text, may increase compliance. It will be important to look at the signs as a system, and not single entities. A combination of best practice and novel signs based may increase compliance. Finally, I strongly recommended conducting *in situ* theoretically based tests on the content of the sign to determine if other cognitive constructs such as behavioural norms would be more effective at stimulating behavioural compliance.

APPENDIX

#	Sign	Location/type	Strengths	Improvements
1		Trailhead sign	• Written at a reading level of a 8.5 yrs. old • Yellow and black colouring	• Remove all caps • Add safety word in red, i.e. DANGER or WARNING • Remove repetitive phrases "please keep out" and "do not enter fenced area" • State cause and effect clearly e.g., "DANGER: deadly kauri dieback disease in area. Do no enter fenced area to prevent the spread of the disease." • Remove brand/logo
2		Cleaning station sticker	• Written at a reading level of a 8.3 yrs. old • Cause and effect of hazard stated but slightly repetitious • Good use of pictorials	• Remove all caps • Use black and yellow colours, remove grey (see #1 as preferred colour palette) • Add safety word in red, i.e. DANGER or WARNING • Remove 'save our Kauri forests' and 'act now' • Number the actions required • Possible text: DANGER: deadly kauri disease in area. To prevent spreading the disease by soil: 1. Clean all soil from footwear 2. Spray footwear to disinfect 3. Stay on the track and off kauri roots • Remove brand/logo

3		Trailhead sign	• Use of pictorials • Black and white	• Use black and yellow colours, remove third grey (see #1 as preferred colour palette) • Add safety word in red, i.e. DANGER or WARNING • Explicitness of text; state cause and effect • Possible text: DANGER: Deadly kauri dieback disease in area. Staying on the track prevents spreading the disease.
4		Trailhead sign		Similar recommendations as #3 (assuming German tourists are receiving the message in the same context and motivational state as English speaking visitors – must be tested to confirm)
5		Trailhead sign		Similar recommendations as #3 (assuming Chinese tourists are receiving the message in the same context and motivational state as English speaking visitors- must be tested to confirm)
6		Car window sticker		• Identify the purpose of the car window sticker: communicate compliant behaviour or to raise general awareness • change text to be more effective • Lacks cause and effect, clearly articulate what “act now’ action is

				▪ Alternative formats: ❖ for compliant behaviour: "I clean my boots, I'm saving the kauri forest" ❖ for awareness campaign: "Save our kauri forest, visit www.kauridieback.co.nz to learn how"
7		Bumper sticker		• Identify the purpose of the bumper sticker: communicate compliant behaviour or to raise general awareness • change text to be more effective • Lacks cause and effect, clearly articulate what "act now' action is ▪ Alternative formats: ❖ for compliant behaviour: "I clean my boots, I'm saving the kauri forest" ❖ for awareness campaign: "Save our kauri forest, visit www.kauridieback.co.nz to learn how
8		Kids activity guide		• Identify the purpose of the activity guide: communicate compliant behaviour or to raise general awareness

9		Kids activity guide		• Identify the purpose of the activity guide: communicate compliant behaviour or to raise general awareness • If purpose is compliant behaviour reduce the number of behaviours communicated (currently 6)
10		Brush	• Good action statement – 'clean your gear' • Effect of not cleaning is implied (keep kauri standing)	• State the effect of not cleaning clearly: 'clean your gear, stop the deadly spread of kauri dieback disease'
11		Billboard		• Use pictorials not real photographs • Identify the purpose of the billboard: communicate compliant behaviour or to raise general awareness • Clearly articulate the action required to 'save our kauri forests' for awareness campaign specific action could be visiting the website. If so give equal font size to "Save our kauri forest, visit www.kauridieback.co.nz to learn how" • Billboard could advocate a single behaviour (i.e., 'clean your boots') that is strategically picked based on location of billboard

12		Billboard		Similar recommendations as #11
13		Poster		• Use black and yellow colours, remove grey (see #1 as preferred colour palette) • Use pictorial rather than real pictures • Add safety word in red, i.e. DANGER or WARNING • Remove 'save our Kauri forests' and 'act now' • Number the actions required • Possible text: DANGER: Deadly kauri disease in area. To prevent spreading the disease by soil: 1. Clean all soil from footwear before and after visit to forest 2. Stay on the track and off kauri roots • Remove brand/logo
14		poster		Similar recommendations as #13

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