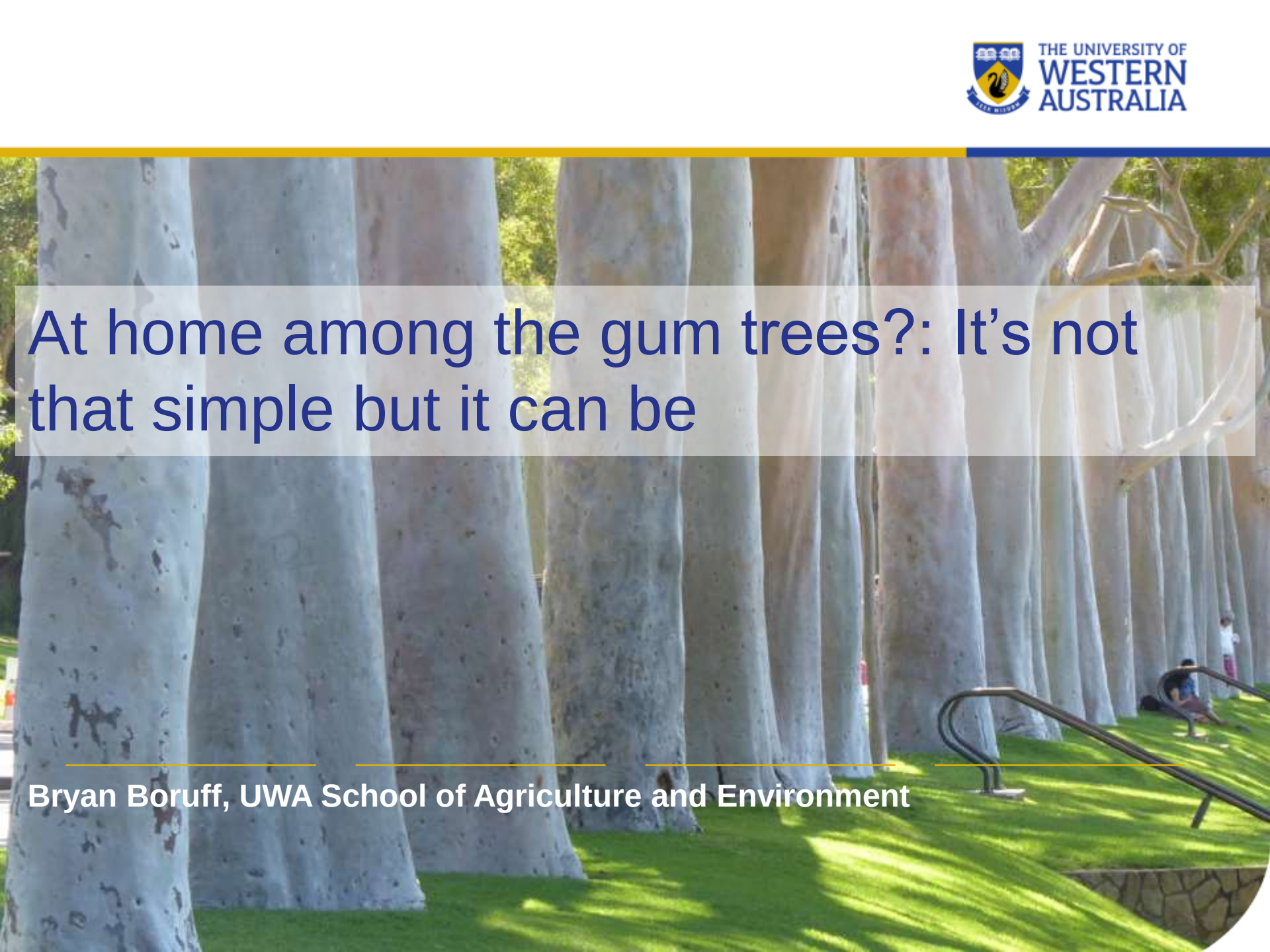


At home among the gum trees?: It's not that simple but it can be

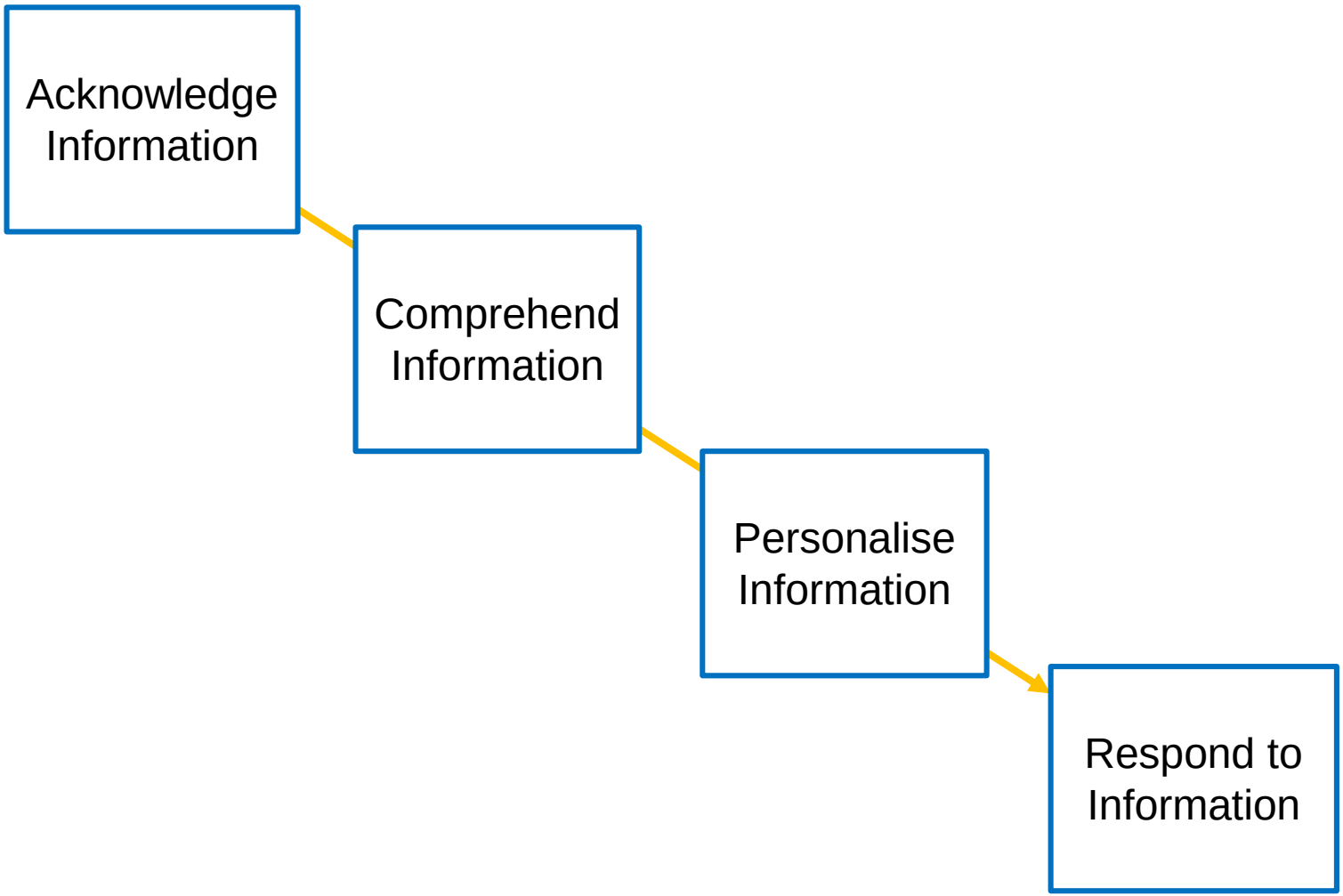
Bryan Boruff, UWA School of Agriculture and Environment

What is happening in each picture?

Overview

This session, will discuss approaches to communicating technical (geographic) information to facilitate planning decision support and community engagement initiatives

Information processing



Mileti and Peek, 2000

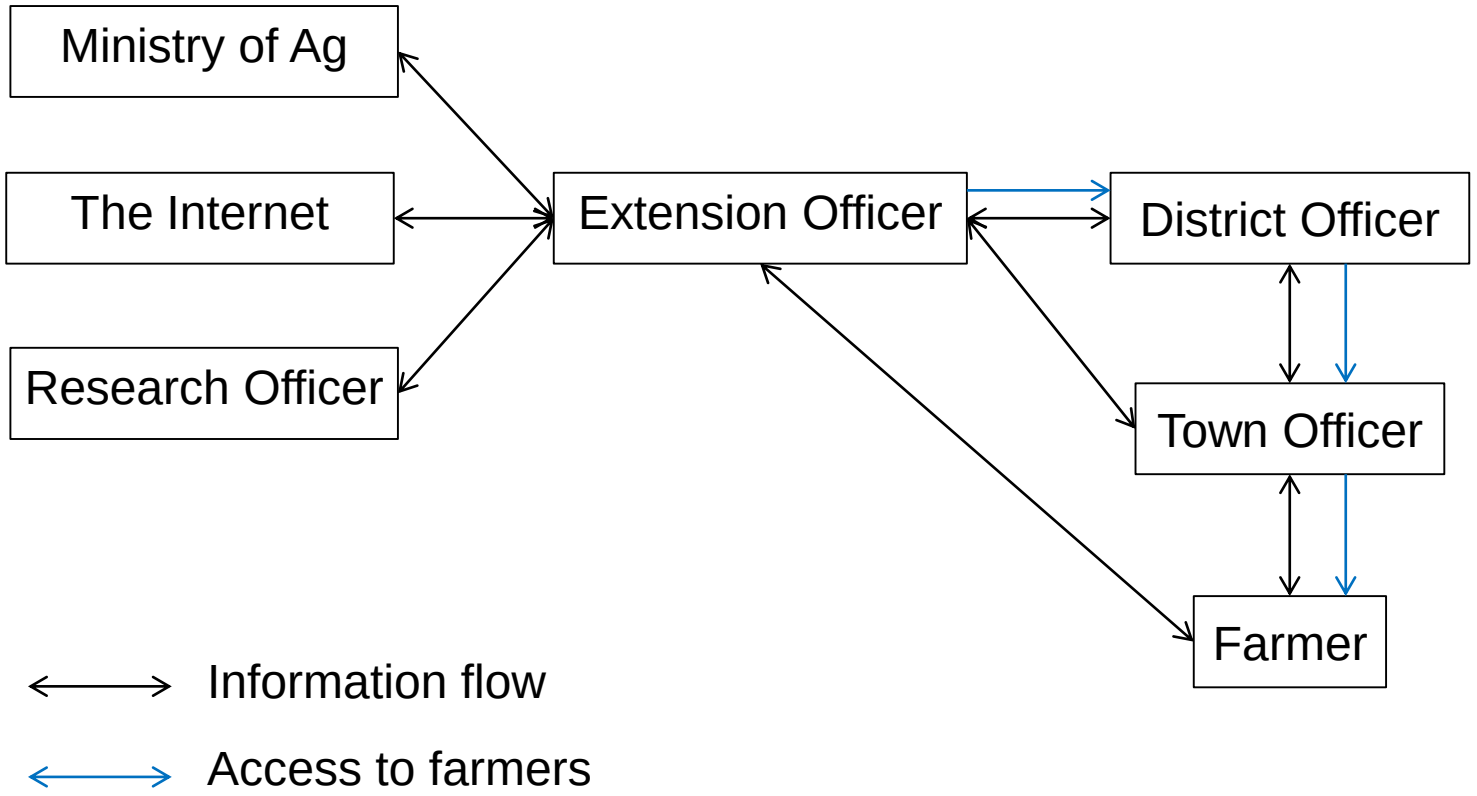
Development process

Low-resource aware framework for development of ICT4D services

Components	Possible methods	Techniques & tools
Context analysis	Action research Roadshow Literature review	Field visits Focus groups Demos Interviews
Needs assessment	Field research Collaborative workshops Participatory rural appraisal (PRA model suite)	Field visits Focus groups Demos Interviews
Use case & requirements analysis	Use case modeling Requirements elicitation Agile Development Methods	Demos & focus groups Rapid prototyping Conceptual modeling
Sustainability assessment	Functional evaluation Business case evaluation Technology assessment Scenarios	Interview, focus groups E3 Value modeling Dynamic systems conceptual modeling
Developing, testing, deploying	Living Labs Agile Development Methods User-centered evaluation	Demos & focus groups Prototypes

Bon et al., 2016

Identifying information flows and barriers



Guiding questions

1. **What information do people want?**
2. **What information are people missing?**
3. **What are the capacities, barriers, and opportunities to act on the information?**

MOTIVATION:

relationship between access to information facilitated by ICT and improved well-being of people and communities .....

YET .....

frequent mismatch between deployed technologies and local goals, needs, and contexts, resulting in unsustainable solutions .....

AND .....

no practical field-validated methodologies .... that offer adequate ways to meet local needs ..... ensuring sustainability

Bon et al. (2016)

Needs assessment

Group Discussion 1

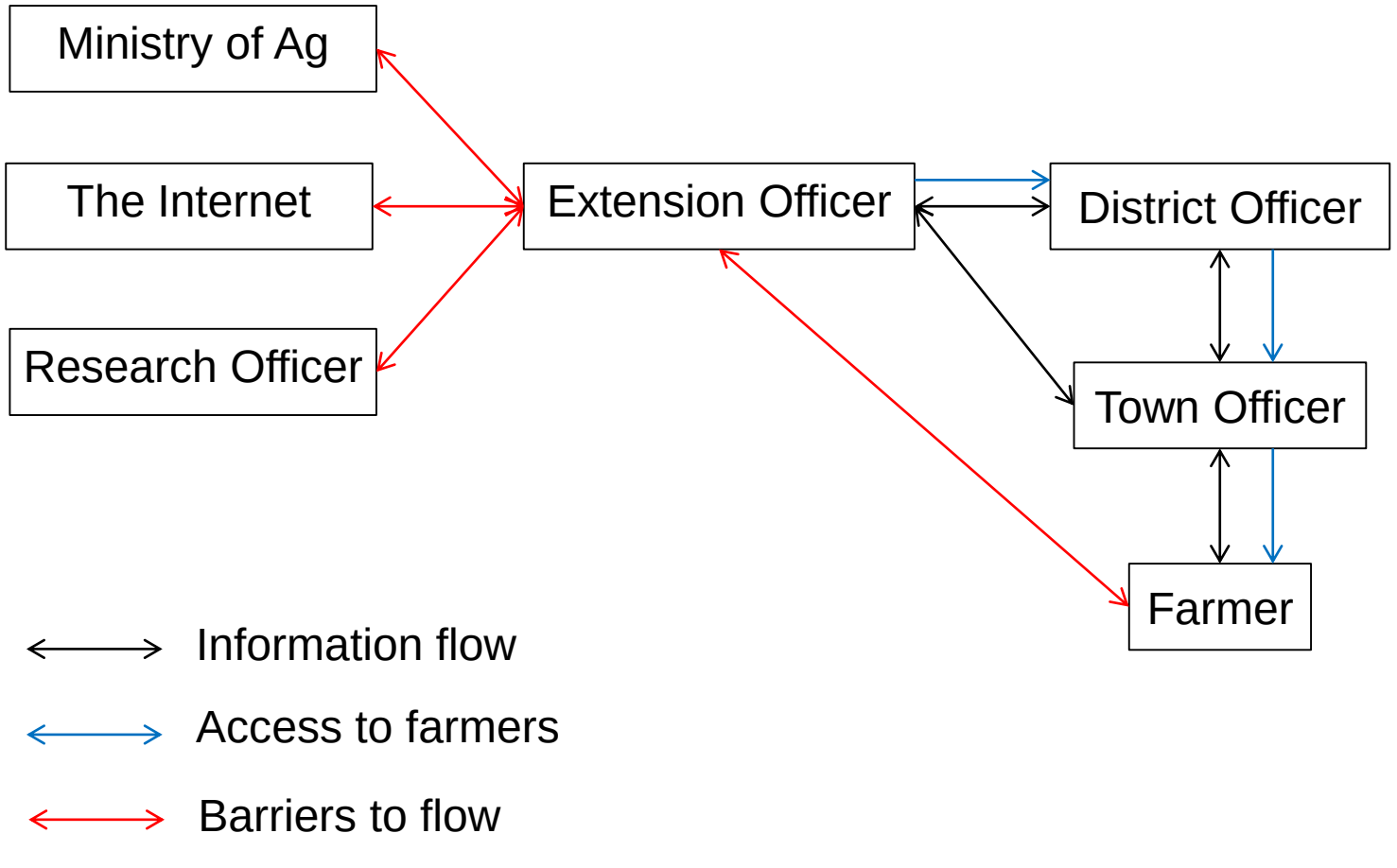
- What is your primary role?
- What information do you use?
- How do you use this information?
- Do you collect any new information?
- How do you collect this information?
- Digital apps etc.

Group Discussion 2

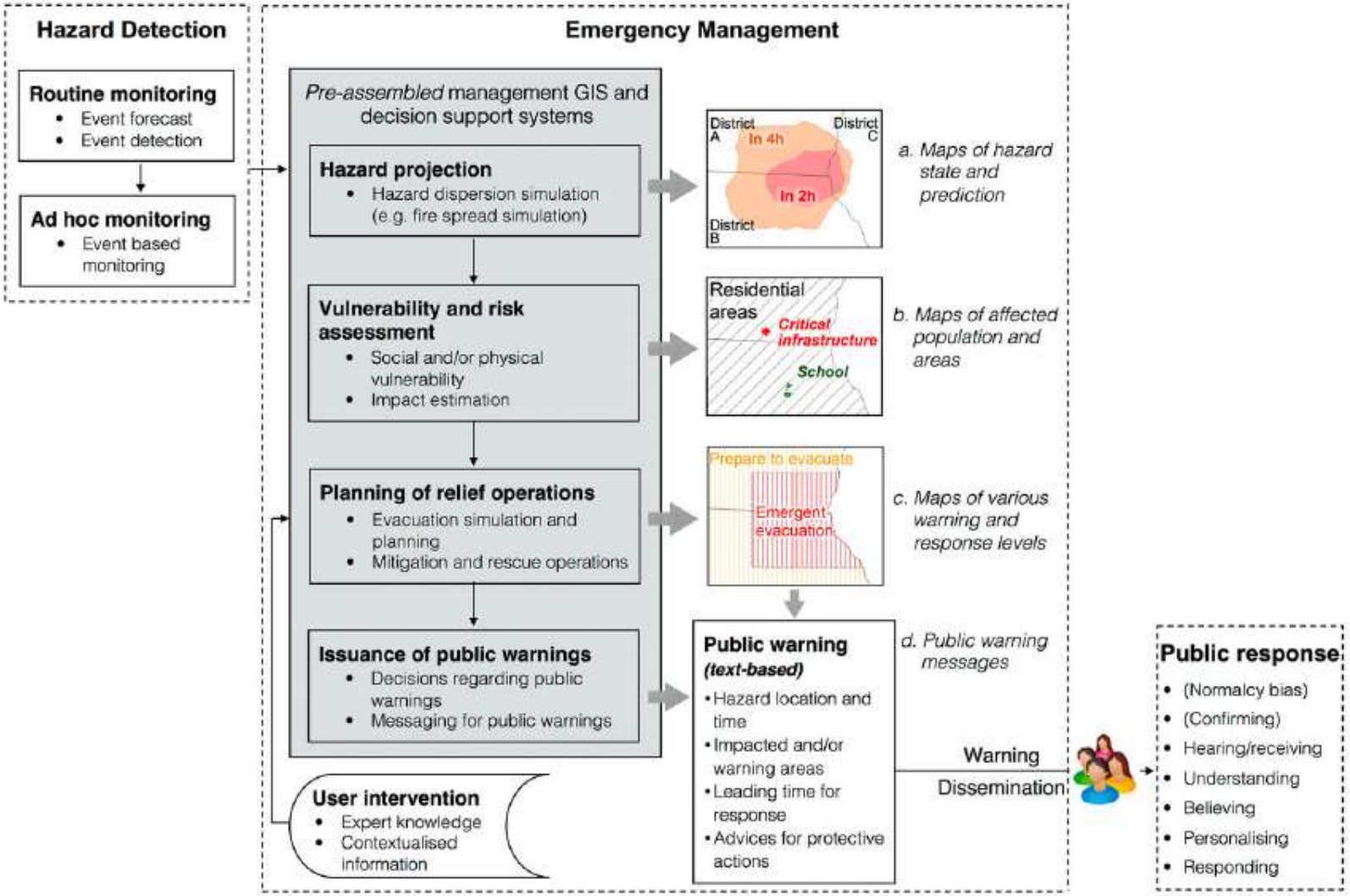
- What information would help you in your job that you do not have?
- Does this information exist?
- If the information does exist what stops you from using it?
- How useful are digital maps or digital information for your job?

Identifying information flows and barriers

Tonga example:



Communication approach



Cao et al., 2016

A picture is worth a thousand words

Dec 2011

A picture is worth a thousand words

May 2012

A picture is worth a thousand words

Dec 2013

A picture is worth a thousand words

June 2014

A picture is worth a thousand words

Sept 2014

A picture is worth a thousand words

April 2017

A picture is worth a thousand words

THE UNIVERSITY OF WESTERN AUSTRALIA

Dec 2007

A picture is worth a thousand words

May 2010

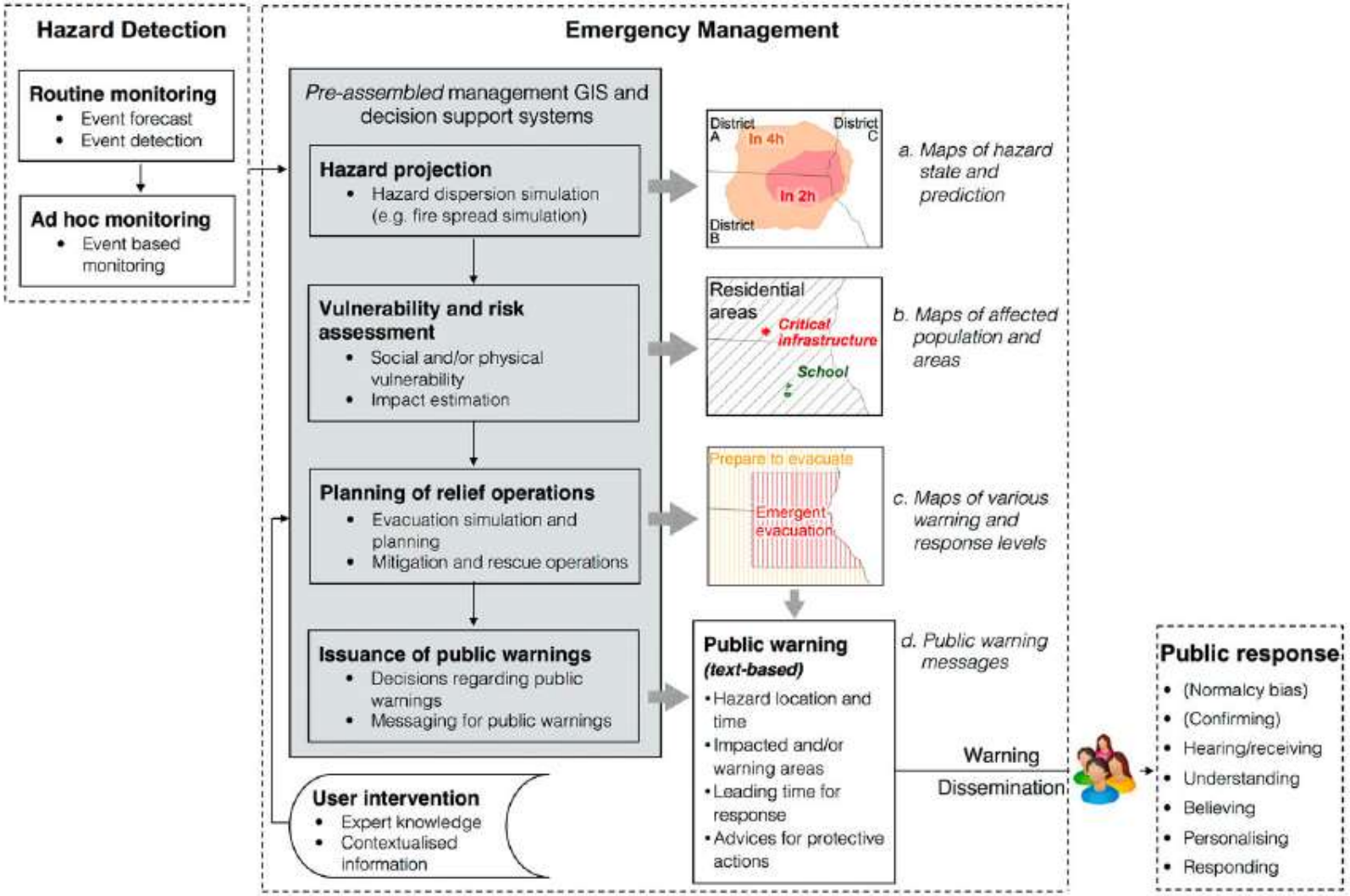
A picture is worth a thousand words

May 2013

A picture is worth a thousand words

April 2018

Eliciting a public response



Cao et al., 2016

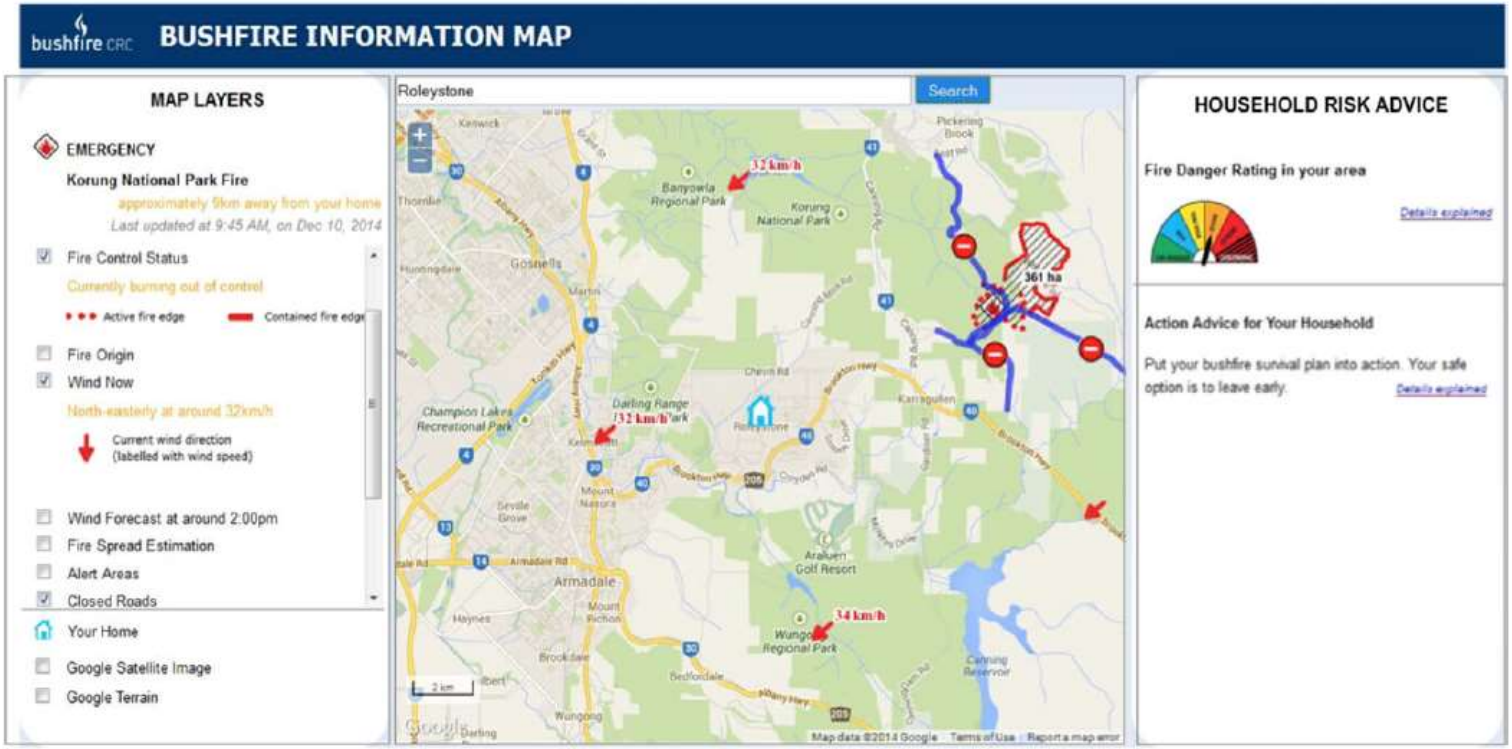
Getting the design right

Nat Hazards
DOI 10.1007/s11069-017-2929-9

ORIGINAL PAPER

The smoke is rising but where is the fire? Exploring effective online map design for wildfire warnings

Yinghui Cao[1] · Bryan J. Boruff[1] · Ilona M. McNeill[2]



Cao et al., 2016

Getting the design right

Table 6 Mean ratings of the importance of each information element (on a Likert scale of 1–5, anchored by 1 = not important at all and 5 = critical), and the associated inter-rater agreement (IRA), listed in descending ordered by the mean rating

Element ID	Name of information element	Information type[a]	Mean rating	IRA (r_{wg})[b]
6	Map of current wind	Spatial hazard information	5.0	1.0
4	Map of active and contained fire edges	Spatial hazard information	4.9	0.9
13	Map of road closure	Spatial response guidance	4.8	0.9
17	Map of one's home	Spatial personalised information	4.8	0.8
21	Google street map	Basemap	4.7	0.9
8	Map of wind forecast	Spatial hazard information	4.7	0.9
18	Approximate distance from the fire to one's home	Spatial personalised information	4.6	0.8
5	Description of fire control status	Spatial hazard information	4.6	0.8
10	Map of fire spread prediction	Spatial hazard information	4.6	0.8
11	Map of warning areas	Spatial warning location information	4.3	0.7
20	Action advice for one's area	Non-spatial response guidance	4.1	0.5
1	Map of burnt area	Spatial hazard information	3.9	0.5
7	Description of current wind	Spatial hazard information	4.0	0.6
9	Description of forecast wind	Spatial hazard information	4.0	0.6
14	Description of closed roads	Spatial response guidance	3.9	0.7
15	Map of evacuation centre	Spatial response guidance	3.7	0.3
16	Description of evacuation centre location	Spatial response guidance	3.5	0.2
19	FDR in one's area	Non-spatial hazard information	3.5	−0.1
12	Description of warning areas	Spatial warning location information	3.4	0.5
22	Google satellite map	Basemap	3.3	0.2
3	Map of fire origin	Spatial hazard information	3.2	0.4
2	Number of hectares of burnt area	Spatial hazard information	3.0	0.3
23	Google terrain map	Basemap	2.2	0.5

Cao et al., 2016

Understanding understanding

Contents lists available at ScienceDirect

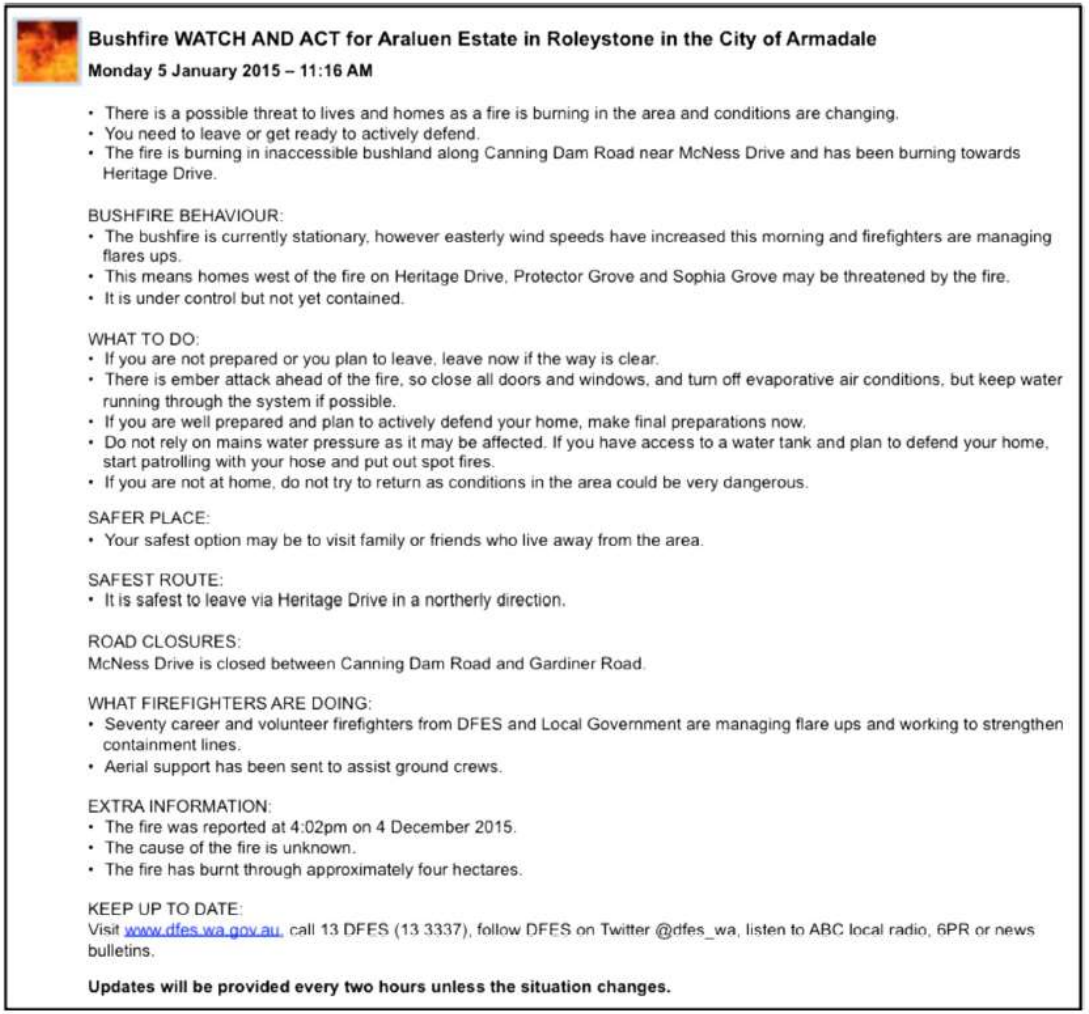
International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

Is a picture worth a thousand words? Evaluating the effectiveness of maps for delivering wildfire warning information

Yinghui Cao [a,b], Bryan J. Boruff [a], Ilona M. McNeill [b]

[a] School of Earth and Environment, the University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia
[b] Melbourne School of Psychological Sciences, The University of Melbourne, VIC 3010, Australia



Bushfire WATCH AND ACT for Araluen Estate in Roleystone in the City of Armadale

Monday 5 January 2015 – 11:16 AM

- There is a possible threat to lives and homes as a fire is burning in the area and conditions are changing.
- You need to leave or get ready to actively defend.
- The fire is burning in inaccessible bushland along Canning Dam Road near McNess Drive and has been burning towards Heritage Drive.

BUSHFIRE BEHAVIOUR:
- The bushfire is currently stationary, however easterly wind speeds have increased this morning and firefighters are managing flares ups.
- This means homes west of the fire on Heritage Drive, Protector Grove and Sophia Grove may be threatened by the fire.
- It is under control but not yet contained.

WHAT TO DO:
- If you are not prepared or you plan to leave, leave now if the way is clear.
- There is ember attack ahead of the fire, so close all doors and windows, and turn off evaporative air conditions, but keep water running through the system if possible.
- If you are well prepared and plan to actively defend your home, make final preparations now.
- Do not rely on mains water pressure as it may be affected. If you have access to a water tank and plan to defend your home, start patrolling with your hose and put out spot fires.
- If you are not at home, do not try to return as conditions in the area could be very dangerous.

SAFER PLACE:
- Your safest option may be to visit family or friends who live away from the area.

SAFEST ROUTE:
- It is safest to leave via Heritage Drive in a northerly direction.

ROAD CLOSURES:
McNess Drive is closed between Canning Dam Road and Gardiner Road.

WHAT FIREFIGHTERS ARE DOING:
- Seventy career and volunteer firefighters from DFES and Local Government are managing flare ups and working to strengthen containment lines.
- Aerial support has been sent to assist ground crews.

EXTRA INFORMATION:
- The fire was reported at 4:02pm on 4 December 2015.
- The cause of the fire is unknown.
- The fire has burnt through approximately four hectares.

KEEP UP TO DATE:
Visit www.dfes.wa.gov.au, call 13 DFES (13 3337), follow DFES on Twitter @dfes_wa, listen to ABC local radio, 6PR or news bulletins.

Updates will be provided every two hours unless the situation changes.

Cao et al., 2016

Understanding understanding

Text 1. Fire location


Map 1a. Fire location map

Text 2. Fire suppression status


Map 2a. Fire suppression status map

Text 3. Wind


Map 3a. Arrow wind map


Map 3b. Meteorological wind map

Text 4. Fire spread prediction


Map 4a. Point spread map

Types of 'understanding' tasks measured	Specific questions asked
E1. Fire location	
Direction[a]	What is the direction of the closest fire edge from your property at 10:45?
Distance[a]	Approximately how far is the closest fire edge to your property at 10:45?
E2. Fire suppression	
Direction	What does the location of the contained fire edge mean in relation to the location of your property? (The fire edge closest to your property has been: contained, partially contained, or not contained.)
Risk	Do you expect the fire to spread towards your property? (yes or no)
E3. Wind	
Direction	Is the wind currently pushing the fire towards your property? (yes or no)
Risk	If the fire is not contained, will it be a greater threat to your property in 4hrs than it is currently given the wind forecast? (yes or no)
E4. Fire spread	
Direction	Is the fire spreading towards your property? (yes or no)
Risk / geo-association[c]	If the fire is not contained, approximately how long will it take for the fire to reach your property? (0 – 4hrs, 4 – 8hrs, 8 – 12hrs, 12 – 16hrs, or it will not reach my house in 16hrs)
E5. Fire Warning	
Geo-association	What is the fire warning level for your property at 10:45? (no warning, Advice, Watch and Act, or Emergency)
E6. Closed roads	
Direction[a]	What is the general direction of the closed road from your property?
Risk	Would you still be able to travel to the Post Office[b] in (your suburb) from your property by car? (yes or no)
E7. Evacuation centre	
Direction[a]	What direction is the evacuation centre from your property?
Distance[a]	Approximately how far is the evacuation centre from your property?

Note. Participants were given the option to answer 'not sure' for each question.

[a] These questions were open-ended.

[b] Used to represent a universally known location within the suburb to test understanding of the impact of road closures on escape routes.

[c] Different operationalisations of 'understanding' were needed for responding to this question using the text and maps. The text required an understanding of distance, fire spread rate, and a further calculation of time, whereas the maps, which modelled time of fire arrival, required the geo-association of oneself with a delineated zone.

Cao et al., 2016

Understanding understanding

Understanding Accuracy, Risk Perception and Response Time measures	Text	Map			
		Map a	Map b	Map c	Map d
IE1. Fire location					
Direction (1,2,3)	2.40	2.58			
Distance (1,2,3)	1.52	1.88***†			
Likelihood (1-7)	3.85	4.32*			
Response time	168.58	188.09			
IE2. Fire suppression					
Direction (1,2,3)	2.77	2.90*			
Risk (1,2)	1.85	1.89			
Likelihood (1-7)	3.83	4.02*			
Response time	75.85	71.72			
IE3. Wind					
Direction (1,2)	1.59	1.74*	1.68		
Risk (1,2)	1.64	1.60	1.56		
Likelihood (1-7)	4.01	4.44*	3.90		
Severity (1-7)	4.75	5.20	4.37		
Response time	87.17	92.25*	126.85***		
IE4. Fire spread					
Direction (1,2)	1.73	1.89*	1.97***	1.97***	1.96***
Risk/Geo-association (1,2,3)	1.83	2.71***	1.70	2.52***	2.11
Likelihood (1-7)	4.01	4.25	5.24***	4.79***	5.19***
Severity (1-7)	4.67	4.54	5.76***	5.24	5.00
Response time	81.68	88.07	111.91**	78.63	78.54
IE5. Fire warning					
Geo-association (1,2,3)	2.37	2.37	2.62		
Likelihood (1-7)	4.42	4.77	4.89*		
Severity (1-7)	5.07	5.07	5.15		
Response time	76.05	74.77	65.93*		
IE6. Closed roads					
Direction (1,2,3)	2.52	2.47	2.76*		
Risk (1,2)	1.99	1.95	2.00		
Response time	58.28	52.89	44.88		
IE7. Evacuation centre					
Direction (1,2,3)	2.65	2.58			
Distance (1,2,3)	1.51	1.83***			
Response time	42.23	52.27***			

*$p \leq .05$; **$p \leq .01$; ***$p \leq 0.005$

† Based on Chi-Square test for dichotomous measures, and Mann-Whitney U test for the non-dichotomous ones. Asterisks following the mean value of a map design denote a significant difference from the corresponding text design.

Mean ratings of *Ease of Understanding* (on a Likert-scale of 1-7) and comparison between designs.

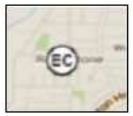
IE	Text	Map			
		Map a	Map b	Map c	Map d
					
1	3.64	6.29***†			
					
2	3.85	6.12***			
					
3	3.91	6.12***	3.71		
					
4	3.47	4.58***	4.33***	6.06***	5.43***
					
5	3.83	4.32***	6.37***		
					
6	4.42	5.52***	6.40***		
					
7	5.81	5.54			

***$p \leq 0.005$

† Based on Wilcoxon signed-rank test between each map design and the corresponding text statement.

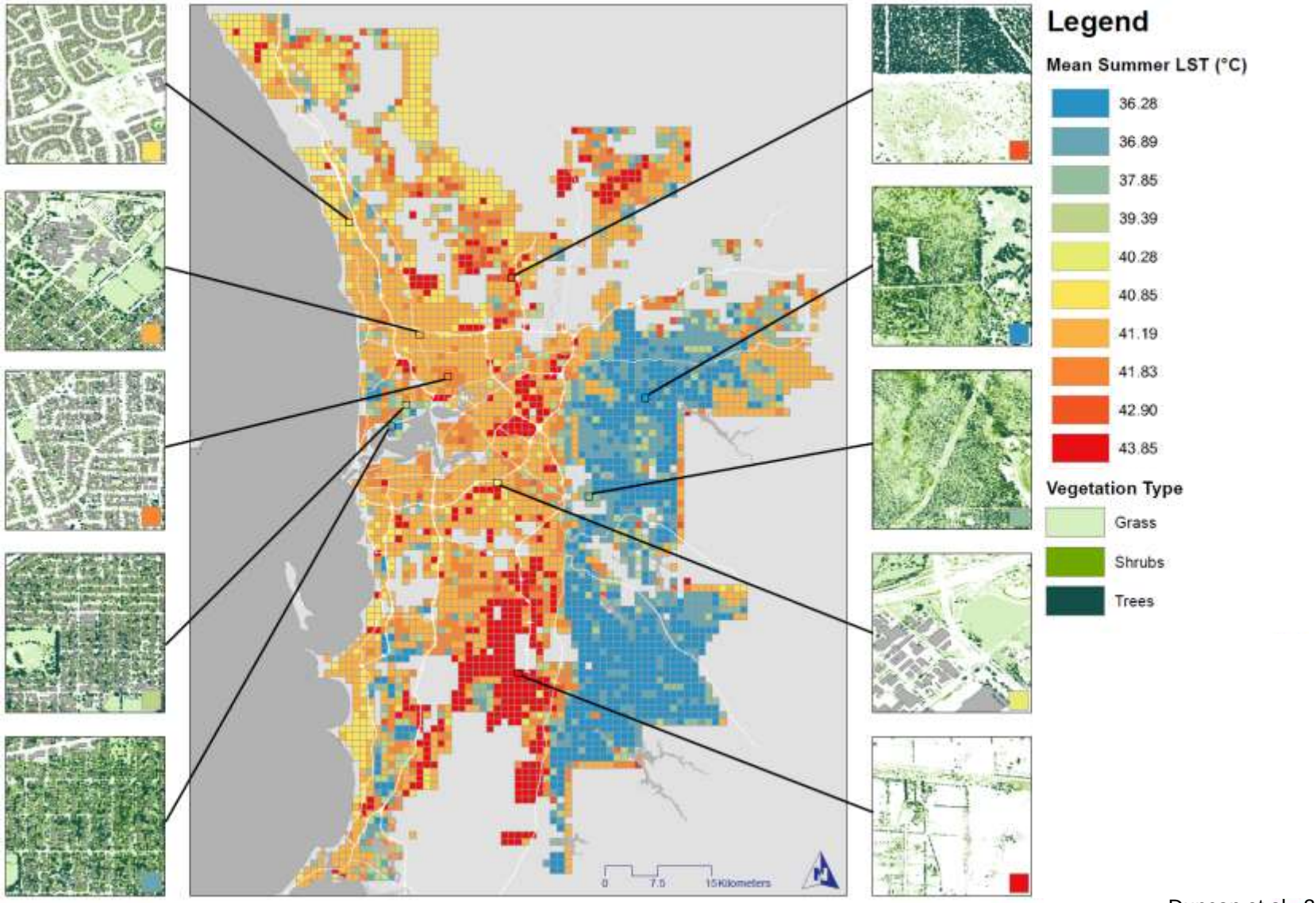
Cao et al., 2016

Understanding understanding

IEs	The most effective design (out of the tested candidates)	Potentially critical text descriptors	Potential improvement for the identified map design
1. Fire location		Road/park names	
2. Fire suppression status		'Out of control'	
3. Wind (current and forecast)			Explore an alternative to 'colour' to better differentiate the changed timeframes.
4. Fire spread prediction			The colour scheme used to represent the four-scale classification may be further examined to ensure easier recognition by a wider audience, including colour-blind populations.
5. Fire warning		Suburb names	
6. Road closure		Road names	Current four-point width, 40% transparency and colour may be improved for higher prominence.
7. Evacuation centre	 + An evacuation centre has been opened at Roleystone Neighbourhood Family Centre at 19 Wygonda Rd, Roleystone.		Use more prominent colour for the map symbol, and adjust the abbreviation (i.e. EC) used in the symbol to yield more telling meanings, such as 'Evac'.

Cao et al., 2016

Break it down don't it dumb down



Duncan et al., 2019

Break it down don't it dumb down

Grass (< 0.5m)	Scrub (0.5 - 3m)	Tree (> 3m)	LST (°C)
< 1 %	-	< 21 %	45.4
1 – 3 %	-	< 21 %	44.07
3 – 6 %	-	< 13 %	43
3 – 6 %	-	13 – 21 %	41.61
> 6 %	< 9 %	< 21 %	41.53
> 6 %	> 9 %	< 21 %	39.21
-	< 8 %	> 21 %	39.65
-	8 – 12 %	> 21 %	37.66
-	> 12 %	21 – 32 %	36.68
-	> 12 %	> 32 %	35.45

Find engaging ways to engage

THE UNIVERSITY OF WESTERN AUSTRALIA

Planning Support Tools

Support the activities of planning professionals

- Store, visualise & analyse spatial data
- Combine custom-built models to link outcomes of interest (i.e., health / physical activity)
- Allow 'real-time' dynamic simulation & exploration of different design concepts
- See how changes to the design of the built environment impact health behaviours

Hopper, Foster, Boulange

Find engaging ways to engage

The Urban Health Check

Data Repository

Data is accessed from
- Spatial Data Platform
- Health Evidence Archive

Design Scenario

Integrate design concept / scenario / plan into the system

Analytics

Custom formulas process information from the design scenario

Feedback

Interactive charts presents performance indicators:
- Spatial Metrics
- Policy Metrics
- Health Impacts

Optimise Design

Users "sketch" alternative design scenarios / edit the design concept

Hopper, Foster, Boulange

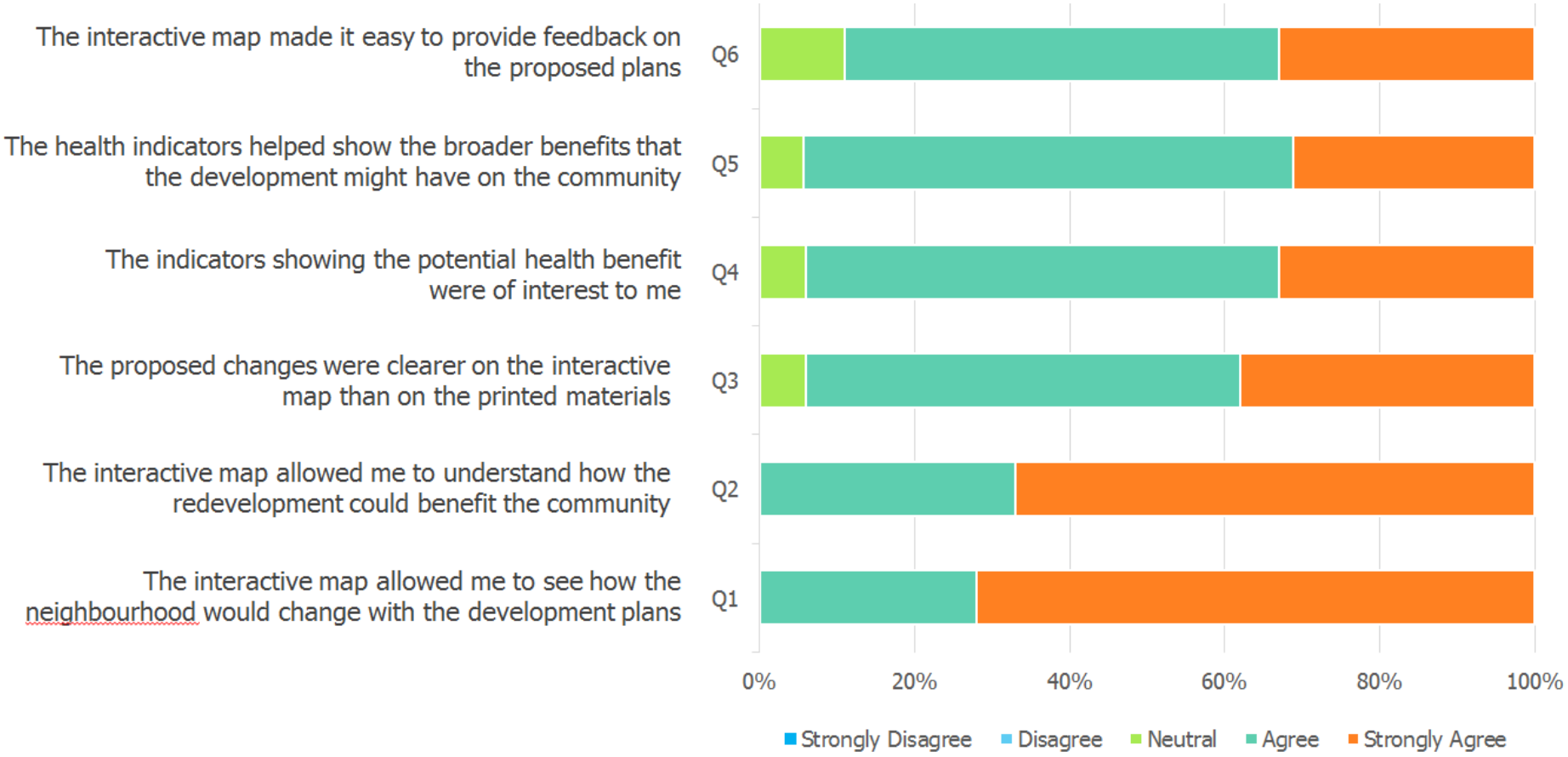
Find engaging ways to engage

The Pilot Projects

Hamilton Hill High School Redevelopment:
Improve community awareness & understanding of the health benefits of an urban infill project?

Hopper, Foster, Boulange

Find engaging ways to engage



Hopper, Foster, Boulange

Conclusions

- Identify the response – or – information needs
- Identify flows and barriers
- Develop the communications approach
  - Picture is worth a thousand words
  - Maps are better (I am biased)
  - Use the 100 most common words in the English language
  - Don’t dumb down break down
- Test the design
- Test understanding
- Listen, pay attention, ask questions