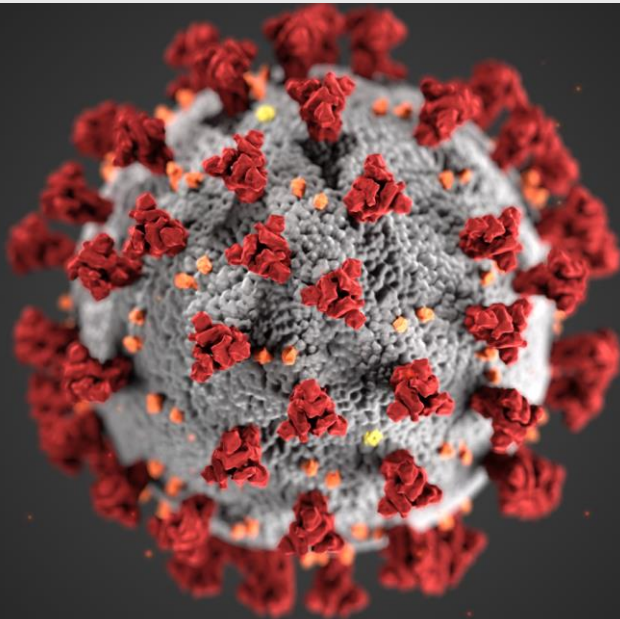


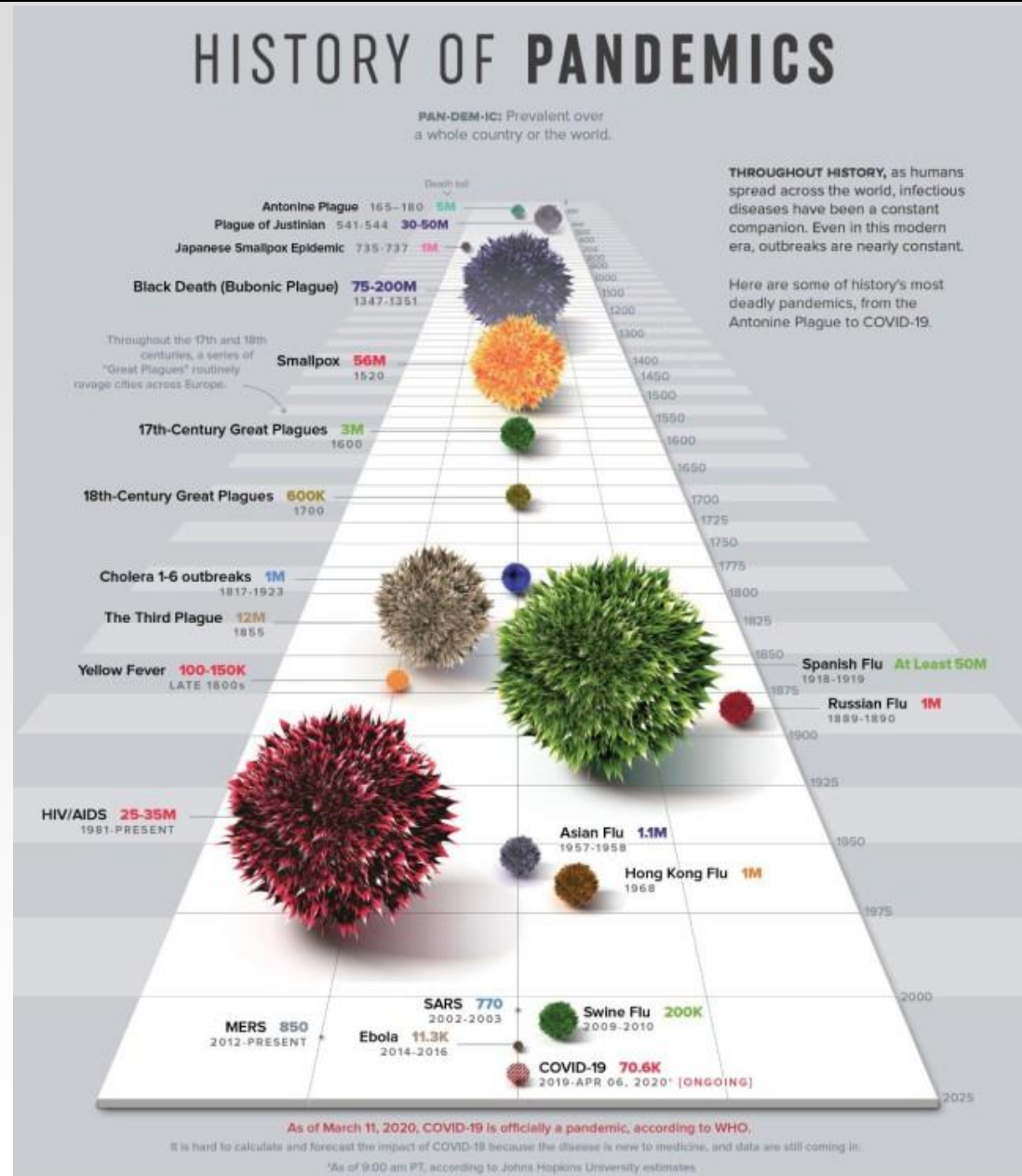
Early Warning Systems (EWS) for Pandemics: Lessons Learned From Natural Hazards



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Workers in South Korea, which has been hit hard by COVID-19, disinfect a subway station in Seoul to slow the virus's spread. NEWSIS/ASSOCIATED PRESS



1. HOW HAVE PANDEMIC EWS WORKED IN THE PAST?

The Pandemic: the warnings were not heard

- A pandemic was expected. Yet, as Mami Mizutori, Head of UNISDR, stated in April 2020:
“Past warnings of a pandemic were often ignored, despite mounting evidence...”.
- In 2019 the Global Preparedness Monitoring Board, a joint initiative of the World Health Organisation (WHO) and the World Bank, warned in their report “A World at Risk’ of:
“Very real threat of a rapidly moving, highly lethal pandemic of a respiratory pathogen killing 50 to 80 million people and wiping out nearly 5% of the world’s economy.”
- In 2017 the International Working Group on Financing Preparedness, issued the report “From Panic and Neglect to Investing in Health Security” warning:
“Multiple pandemics, numerous outbreaks, thousands of lives lost and billions of dollars of national income wiped out – all since the turn of this century, in barely 17 years – and yet the world’s investments in pandemic preparedness and response remain woefully inadequate.”
- The pandemic was expected, but the world was mostly unprepared.
- This is common for many hazards.
- The case for improved pandemic EWS is clear: the rapid spread of the virus SARS-CoV-2 and associated COVID-19 disease has demonstrated that local (e.g. national) and global warning systems for pandemics are woefully underdeveloped.

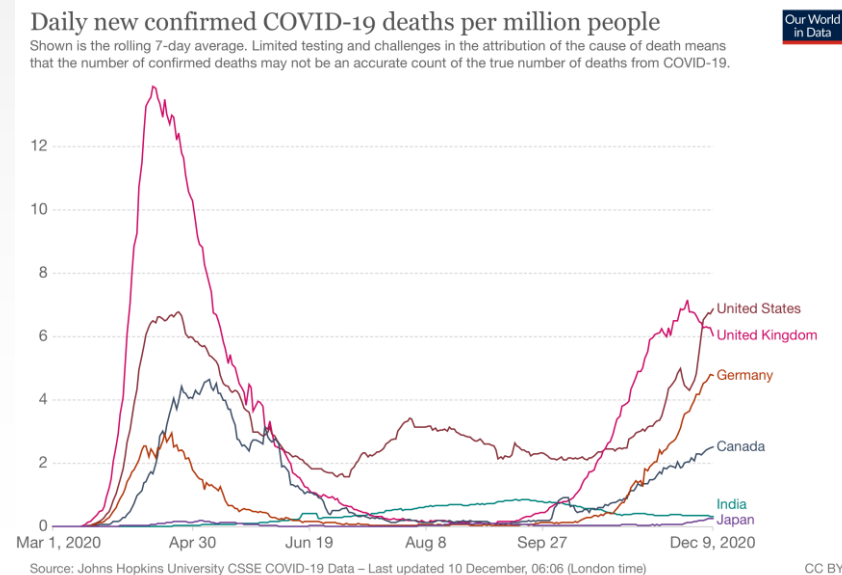
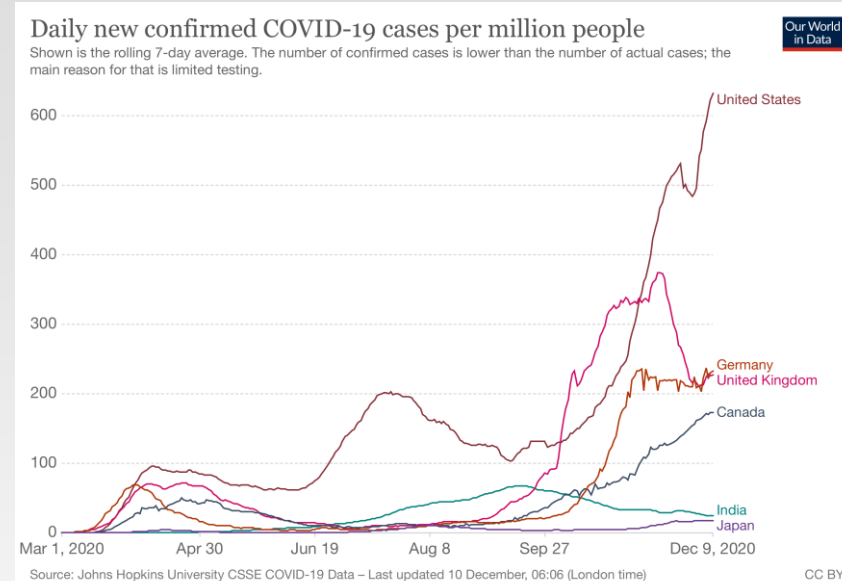
Early Warning Systems (EWS)

- EWS are more than simple systems providing a siren or warning to move
- They are complex yet efficient assemblages of people, protocols and plans
- For EWS to be effective they must be embedded in an extensive system of observation and communication that integrates:
 - different expert and policy cohorts
 - thresholds or tipping points
 - communication mediums and iconographiesfor the provision of timely warnings to people with the aim of minimizing loss of life and reducing the social and economic impacts of disasters.
- EWS should convey risk levels in an easy-to-understand format, ensure credibility and accountability, and help create transparency between different stakeholders
- EWS have been the subject of political as well as scientific experimentation since 1949, and can provide evidenced 'lessons learned' on how to translate scientific observations into alert systems as part of a pandemic response.
- Key examples: Pacific Tsunami Early Warning Centre and the Asteroid Terrestrial-impact Last Alert System (ATLAS).



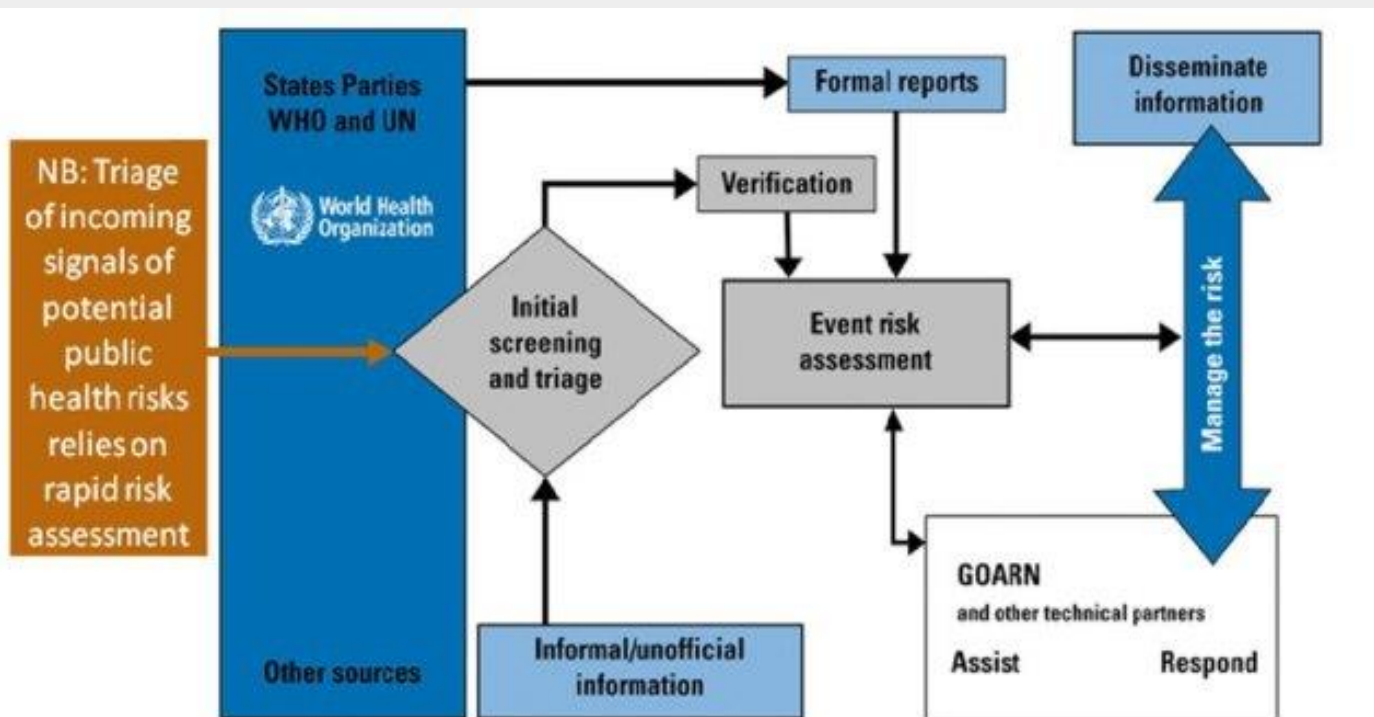
Epidemics as a Hazard

- Disease epidemics have the highest mortality figures of all the natural hazards; only 6 of the 38 deadliest environmental disasters were due to epidemic disease, yet account for 30% of fatalities recorded (Smith, 2013).
- Unlike most natural hazards, however, that require an organised evacuation from a particular crisis point, epidemic disease require people to:
 - Stay put to cut off transmission routes
 - Rather than protect themselves by moving away from danger, people must protect others through their immobility.
- Epidemic disease thus poses challenges for disaster management experts, and the national and supra-national agencies tasked with implementing disaster warning measures.
- Death toll to date is: 1.57 million deaths, and 69.1 million reported cases



How have Pandemic EWS worked in the Past?

- In 2000 the WHO initiated the Global Outbreak and Alert Response Network (GOARN), a global technical partnership to identify unusual agents and pathogens to improve rapid responses.
- Whilst it has demonstrated astonishing successes, these hazard assessment protocols vary in local level implementation, and are generally disconnected from national public outreach alert systems.



GOARN | 2020 YEARS
Global Outbreak Alert and Response Network

An overview of the GOARN process: Detect, assess, assist and inform from Proceedings of the African Field Epidemiology Network (AFENET) Scientific Conference 17-22 November 2013 Addis Ababa, Ethiopia: plenaries and oral presentations 2015

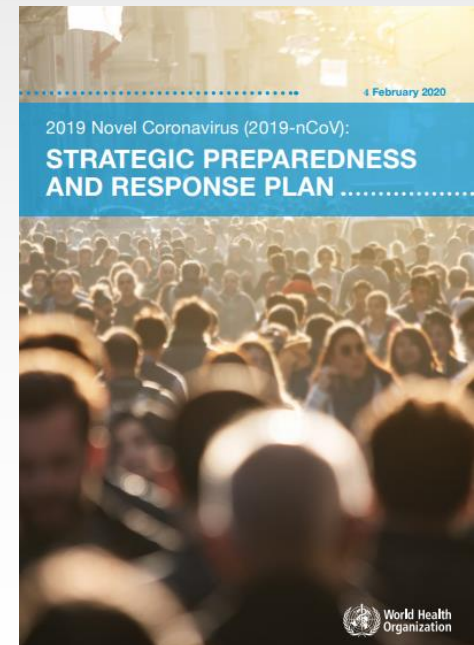
Identifying the need for Pandemic EWS

- In 2015 the UN extended the definition of risk to include biological hazards, adopting the Sendai Framework for Disaster Risk Reduction
- One of the Sendai Frameworks' seven global targets is to:
'substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030'.

Yet, across recent documents 'warning' is only mentioned twice:

- The WHO's 2019 *Novel Coronavirus (2019-nCoV): Strategic Preparedness And Response Plan* (2020)
- The Global Preparedness Monitoring Board report *A World at Risk* (2019)
- The International Working Group on Financing Preparedness' report *From Panic and Neglect to Investing in Health Security* (2017)
- The International Health Regulations' *The Joint External Evaluation Tool* (2016)

Many low-income countries lack the clinical expertise and infrastructure to manage emerging epidemics, and in such an interconnected global environment there is a need for international partnerships to take a longer-term view to helping manage disease outbreaks locally.



Lessons learnt from Epidemics / Pandemics

- Policy has focused on surveillance to identify outbreaks, and building preparedness and health capacity (Smolinsky, Hamburg, & Lederberg, 2003).
- The global community has made progress toward preparing for and mitigating the impacts of pandemics, particularly following the 2003 severe acute respiratory syndrome (SARS) pandemic where delayed reporting led to the World Health Assembly to update the International Health Regulations (IHR) (WHO, 2005).
- The framework put into place generated a more coordinated global response during the 2009 influenza pandemic (Katz, 2009).
- Yet, significant gaps and challenges exist in global pandemic preparedness as identified following the 2014 West Africa Ebola epidemic.

Key questions remain around:

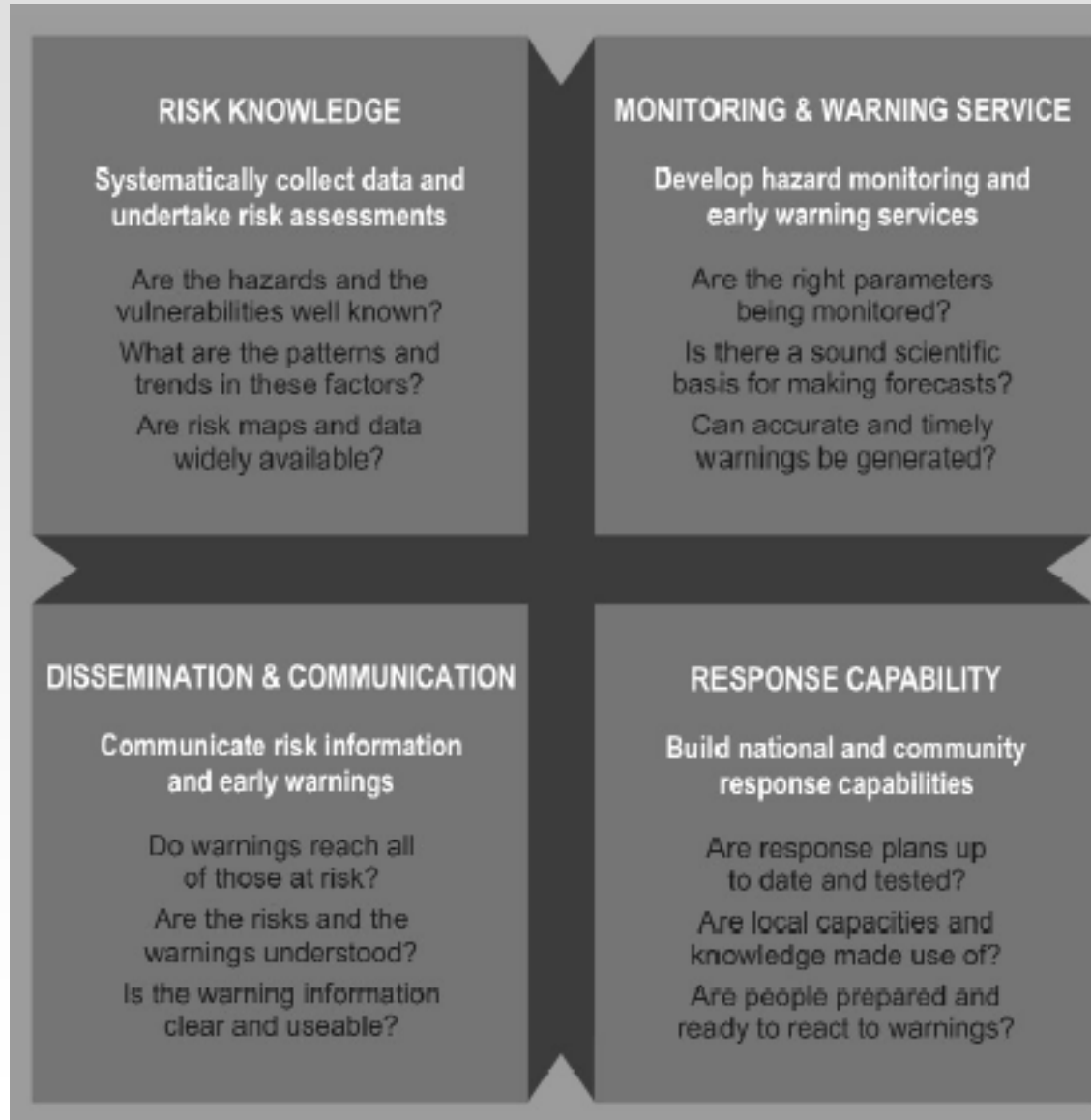
- **The science:** active versus passive surveillance; not knowing what to look for in terms of emergent infections; the difficulty of balancing sensitivity and specificity in tests; the lead in time and costs of preparation of vaccines
- **Basic Healthcare:** availability of basic healthcare, tracing of contacts, quarantine and isolation procedures.
- **Integrating preparedness measures from outside the health sector:** global coordination and response mobilization
- **Low-income countries** with histories of managing epidemic disease have often done much better than high income countries with little historical memory and a stripped back public health system.

People play golf as an ash plume rises from Kilauea volcano, Hawaii (Getty Images)



2. HOW CAN OTHER NATURAL HAZARDS HELP DEVISE AN EFFECTIVE PANDEMIC EWS?

The UN's people centred Model (2006)



EWS effectiveness: understanding critical links

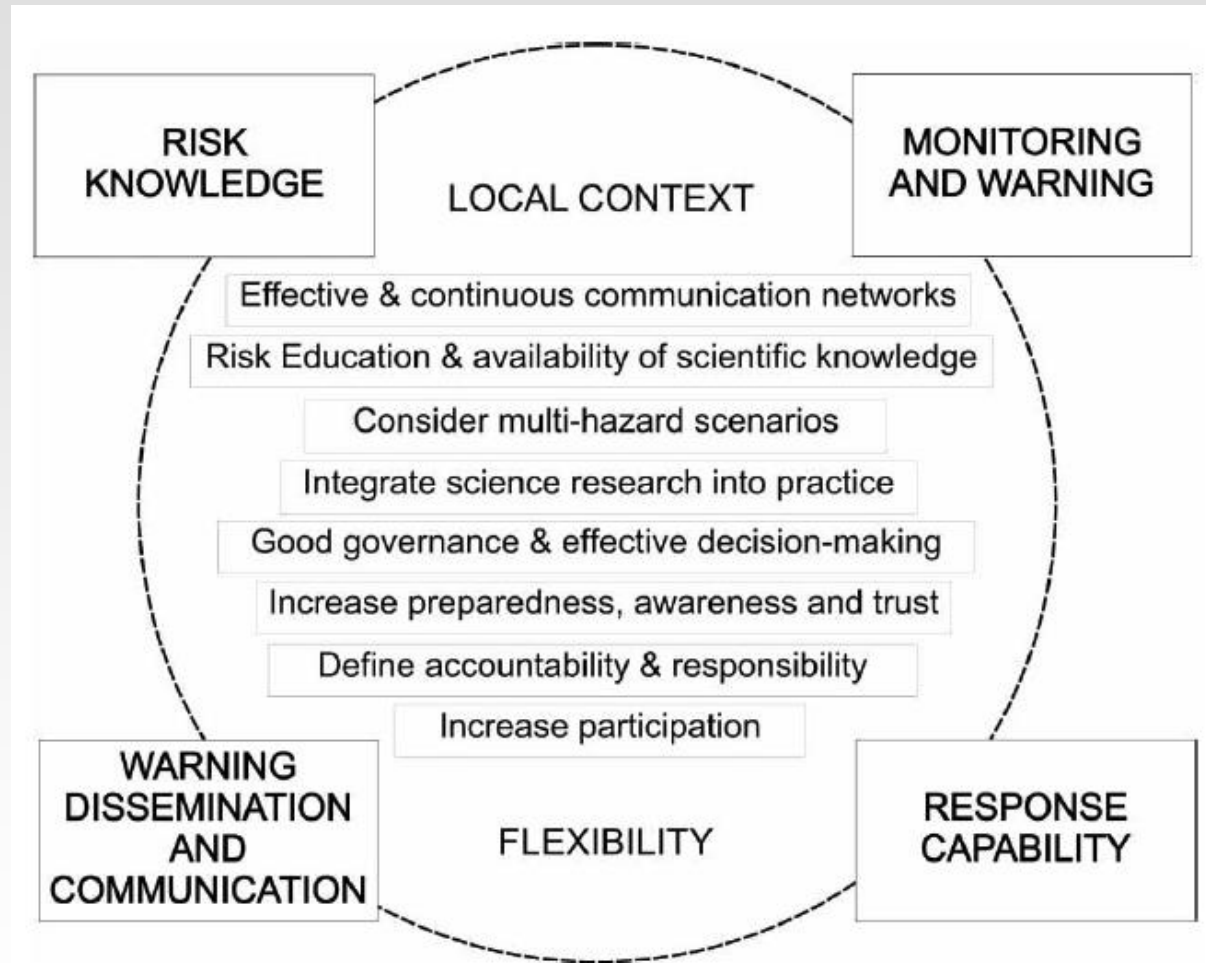
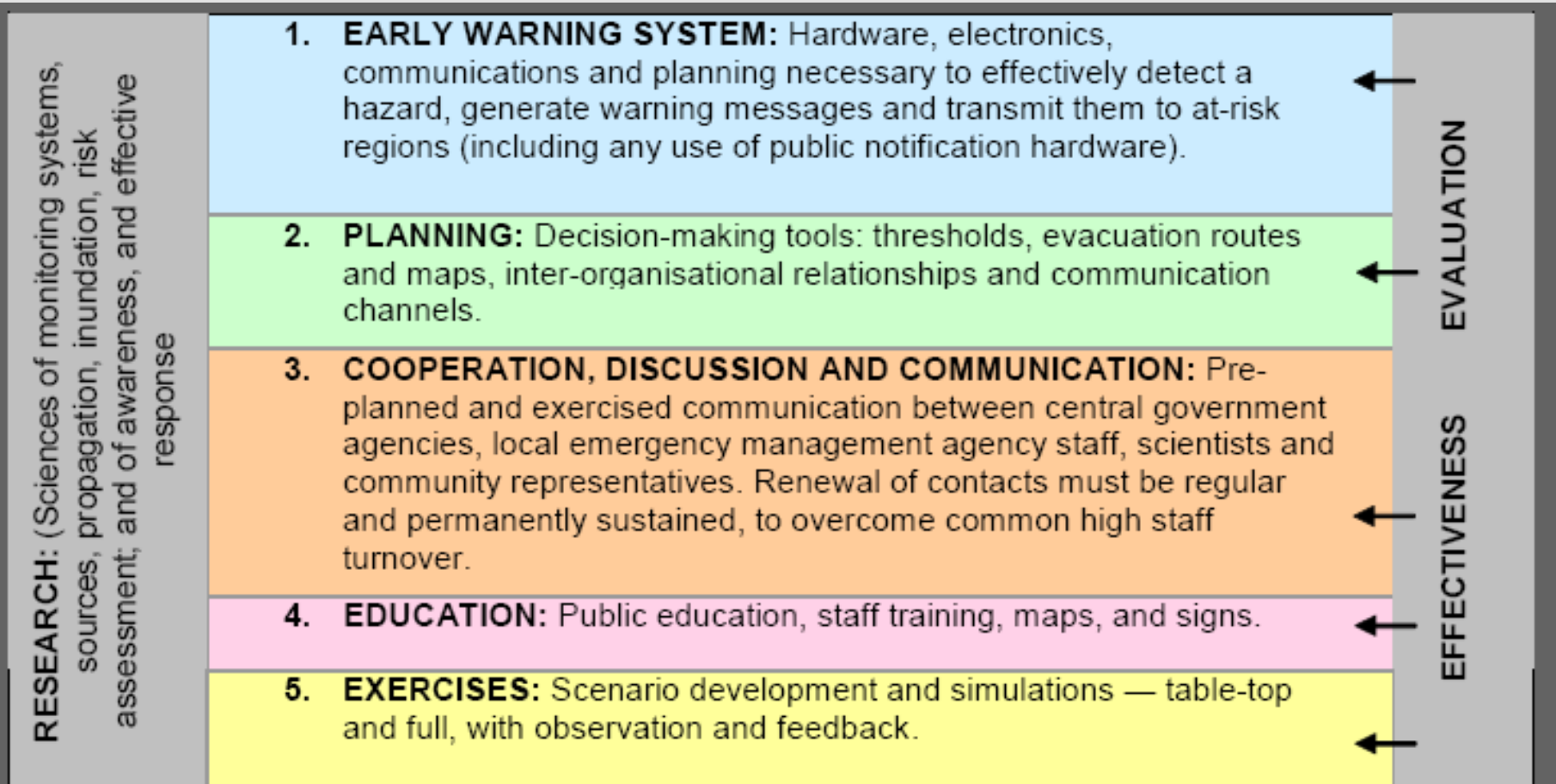


FIGURE 2 Diagram of EWS with factors to improve the linking of sub-systems

Developing an Integrated Warning System



Case Study Site: USGS

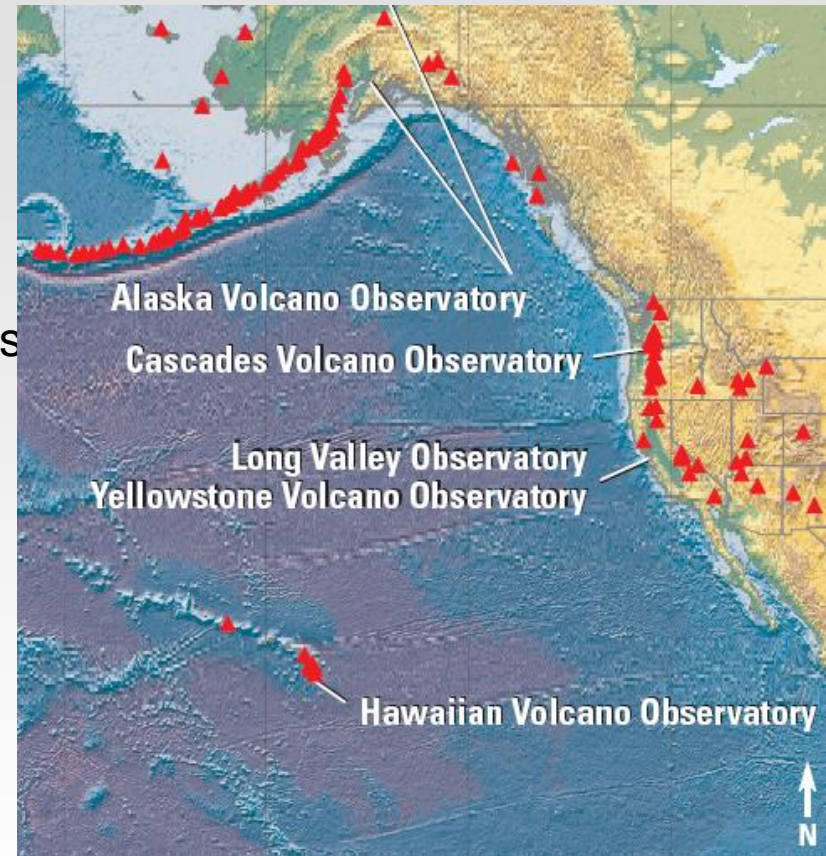
Research Conducted:

Ethnographic studies and 93 interviews in the USA from 2007-2009

- Scientists at the USGS's five volcano observatories
- Users of the VALS at other Federal Agencies e.g. FAA
- Collaborative partners: e.g. Universities and State officials

Rationale for Research Case Study:

- Diverse range of volcanic activity
- The USGS use their recently standardised dual Volcano Alert Level System (VALS)
- Following the new VALS a number of new communication tools have been devised



*Image credit: USGS
N.B Long Valley Observatory is now
California Volcano Observatory*

Volcano Alert Level Systems (VALS)

Purpose:

- **Communicate warning information** from scientists to civil authorities / stakeholders
- Provides a **'bridge'** between the scientific data, to practical actions / decisions
- Provides a **'heads up'** about volcanic activity (size, style, hazards, duration)

Design:

- Embodies a **linear** reductionist approach to decision-making
- Designed around a description / criteria for each alert level **often based on volcanic activity / unrest**



USGS Standardised VALS

Volcano Alert Levels Used by USGS Volcano Observatories

Alert Levels are intended to inform people on the ground about a volcano's status and are issued in conjunction with the Aviation Color Code. Notifications are issued for both increasing and decreasing volcanic activity and are accompanied by text with details (as known) about the nature of the unrest or eruption and about potential or current hazards and likely outcomes.

Term	Description
NORMAL	Volcano is in typical background, noneruptive state <i>or, after a change from a higher level,</i> volcanic activity has ceased and volcano has returned to noneruptive background state.
ADVISORY	Volcano is exhibiting signs of elevated unrest above known background level <i>or, after a change from a higher level,</i> volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
WATCH	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, OR eruption is underway but poses limited hazards.
WARNING	Hazardous eruption is imminent, underway, or suspected.

(Gardner and Guffanti, 2006, p.2-3)

Decision making 1: Scientific uncertainty

Observatory scientists encounter difficulty in interpreting scientific data and making decisions about what a volcano is doing when dealing with complex volcanic processes and high levels of scientific uncertainty.

Each volcano is unique and so you might get generalities out of probabilistic assessments, [...] but it's really more than generality that you really want to know about that particular volcano (HVO senior scientist 5) (16/06/2008).

Challenges in constructing scientific knowledge

- Wide variety of volcanic styles, hazards, durations
- Boxing volcanic activity into four different alert levels when nature is a continuum
- Obtaining scientific data (monitoring capabilities and resources)
- Interpreting monitoring data, which is regarded an 'art form'

Decision Making 2: Negotiating social and environmental risks

The decision to move between alert levels is based upon more than volcanic activity and scientific information, with broader social and environmental risks playing a key role in changing alert levels.

Integrating social risks in the decision-making process

- The plural **social, political, economic, and cultural contexts** within which each VALS is embedded may influence when, and which alert level is assigned
- Understanding the users and their needs / preparedness / knowledge
- This can result in the alert level being used as a strategic tool:

Early colour code decisions are more strategic in nature. I think when you get towards an eruption they are much more tactical; you know an event just happened, what do you do? And those [decisions] have to be very quick.

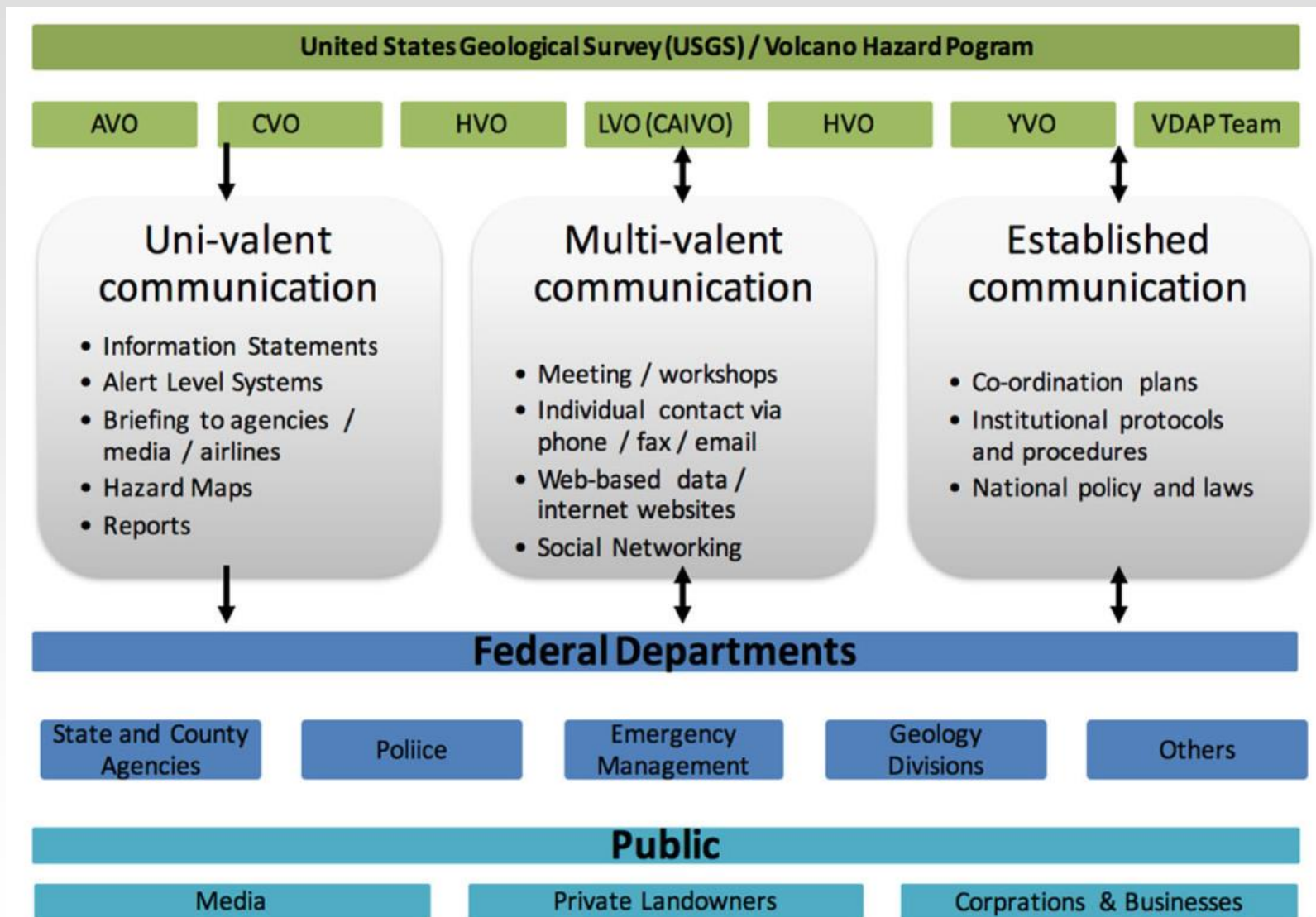
(AVO scientist 3) (11/04/2008) (author's emphasis).

Decision Making 3: It is all about the timing

1. Scientists are discouraged to issue alerts until there is greater ***certainty***
2. During times of non-crisis: focus on ***deliberating plans*** and protocols,
3. During a crisis users ***require information quickly***, regardless of uncertainties

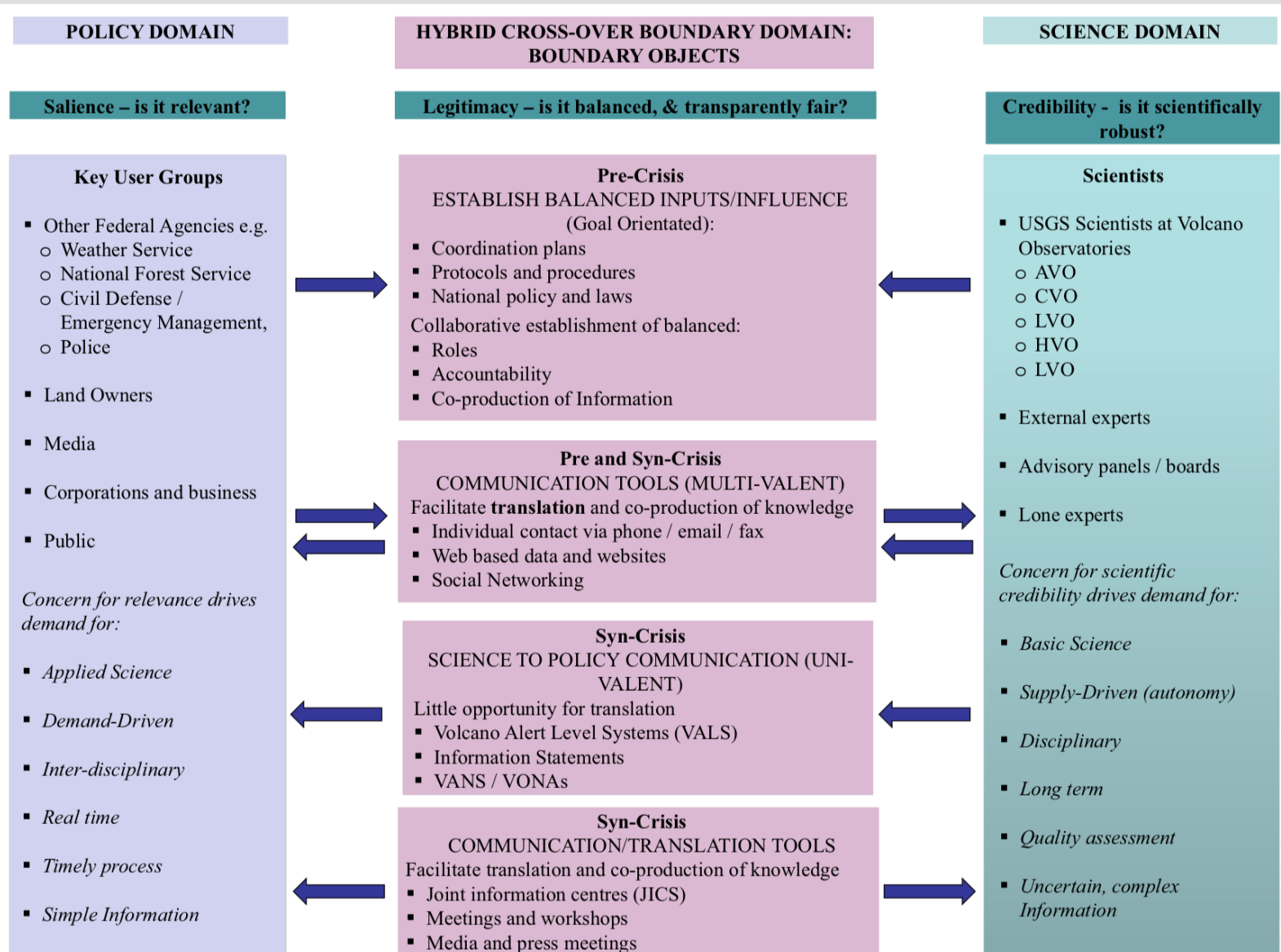


Disseminating Volcanic Communication



Source: Fearnley, C. J., & Beaven, S. (2018). Volcano alert level systems: managing the challenges of effective volcanic crisis communication. *Bulletin of volcanology*, 80(5), 46.

Mapping credibility, relevance and the generation of legitimacy to translate, communicate and mediate volcanic crisis information



Source: Fearnley, C. J., & Beaven, S. (2018). Volcano alert level systems: managing the challenges of effective volcanic crisis communication. *Bulletin of volcanology*, 80 (5), 46.

Adapted from Beaven et al. (2017), Parker and Crona (2012) and Sarkki et al. (2013)

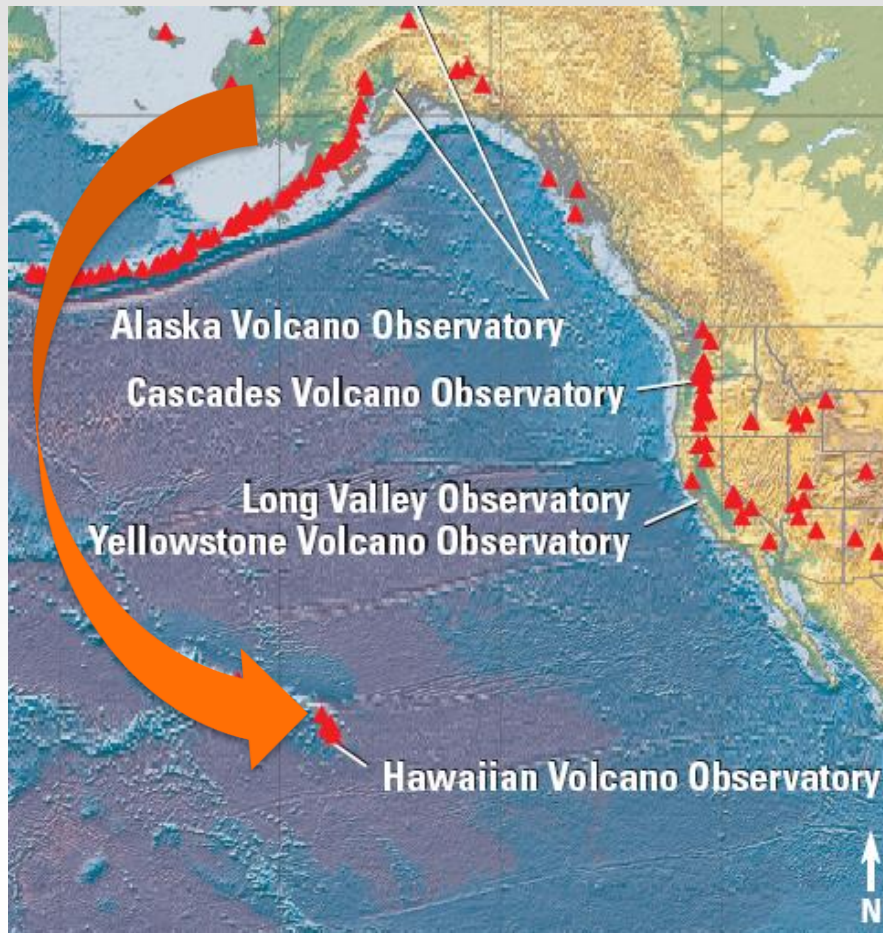
Rationale of the standardisation of VALS

Pressures to standardise came from:

Level	Rationale
International	Aviation users via ICAO wanted national and internationally accepted standards for ash warnings
National	Following 9/11 attack in the U.S. increasing standardisation of warning procedures and protocols, which the USGS VALS had to comply with
State	Federal agencies were confused by using different VALS at each observatory
Local	Emergency managers in the Cascades wanted to use terms they were familiar with for the alert levels to prevent confusion
Internally	For the USGS, standardised levels would provide more consistency

- The process and design of the standardised VALS at the USGS was a socially constructed process, determined by the demands of users and governmental policy

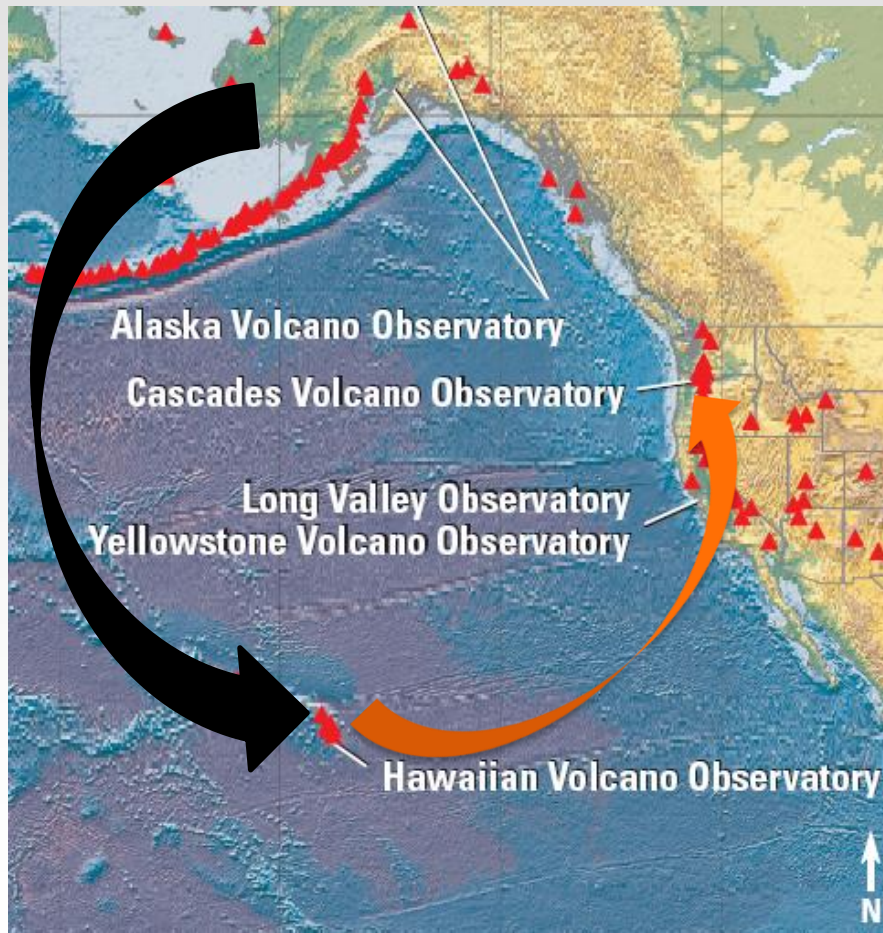
Standardised VALS in practice: travels in the USA



Pilots Trip (Orange)

- Alaska: Significant diversion
- Hawaii: No nearby low level flying

Standardised VALS in practice: travels in the USA



Pilots Trip (Orange)

- Alaska: Diversion
- Hawaii: No nearby low level flying

Lucky Tourists Trip (Watch)

- Hawaii: Eruption underway
- Long Valley: Eruption imminent (hours to days)

- The implication is that alert level terms are standardised throughout the USA, they mean different things:
 - to different users
 - at different locations

Issues raised from the local vs. the national:

Issues	Local (Individual USGS Observatories)	National (new standardised system)
Users needs	Provides flexibility to local community but global users may be confused	Limits flexibility possible, but two systems specific for their users
Communication Methods	Local interpretation likely to be more effective	Common terminology and understanding, but must be known
Decision Making	Gear decision on local needs, circumstances and knowledge	Descriptions provide guidelines / criteria, but implications may vary
Management	Local stakeholders develop close relationships	Streamlines communication within federal agencies reducing confusion



3. HOW CAN ALERT LEVELS COMMUNICATE ONGOING RISKS TO POPULATIONS?

COVID-19 Alert Levels Systems (ALS)

- Globally countries have either implemented, devised, or adopted COVID-19 or more generic infectious disease alert level systems to clearly communicate with the public on what measures are restricted to help prevent waves of the pandemic overburden health infrastructure.
- Key national alert systems include Singapore, Vietnam, South Korea, South Africa, and New Zealand
- COVID-19 ALS are designed to warn on the ongoing crisis rather than provide an early warning

	GREEN	YELLOW	ORANGE	RED
Nature of Disease	Disease is mild OR Disease is severe but does not spread easily from person to person (e.g. MERS, H7N9)	Disease is severe and spreads easily from person to person but is occurring outside Singapore. OR Disease is spreading in Singapore but is (a) Typically mild i.e only slightly more severe than seasonal influenza. Could be severe in vulnerable groups. (e.g. H1N1 pandemic) OR (b) being contained	Disease is severe AND spreads easily from person to person, but disease has not spread widely in Singapore and is being contained (e.g. SARS experience in Singapore)	Disease is severe AND is spreading widely
Impact on Daily Life	Minimal disruption e.g. border screening, travel advice	Minimal disruption e.g. additional measures at border and/or healthcare settings expected, higher work and school absenteeism likely	Moderate disruption e.g. quarantine, temperature screening, visitor restrictions at hospitals	Major disruption e.g. school closures, work from home orders, significant number of deaths.
Advice to Public	<ul style="list-style-type: none"> • Be socially responsible: if you are sick, stay at home • Maintain good personal hygiene • Look out for health advisories 	<ul style="list-style-type: none"> • Be socially responsible: if you are sick, stay at home • Maintain good personal hygiene • Look out for health advisories 	<ul style="list-style-type: none"> • Be socially responsible: if you are sick, stay at home • Maintain good personal hygiene • Look out for health advisories • Comply with control measures 	<ul style="list-style-type: none"> • Be socially responsible: if you are sick, stay at home • Maintain good personal hygiene • Look out for health advisories • Comply with control measures • Practise social distancing: avoid crowded areas

New Zealand COVID-19 Alert Levels

- A recent global survey of the public relations industry put New Zealand's prime minister Jacinda Ardern at the top of the list for COVID-19 response communications. The survey established:
 - “the early setting out of the four alert levels, linked to the progress of the virus and the restrictions that each level would entail, set expectations at the beginning and *have given people a framework for thinking about how their futures might look and feel*. Very few countries have done that, which is one of the reasons why other governments have found it so much harder to manage expectations and get and maintain compliance to restrictions”

The systems provides:

- Clear guidance on the risk assessment
- Range of measures in place
- Each alert level has specific outcomes, summaries, and measures for public health, personal movement, travel and transport, gatherings, public venues, health and disability care services, workplace, and education so that there is clarity in what can and cannot be conducted at each alert level
- A clear, unified source of information giving authorities the credibility, accountability and transparency required so that everyone knows what to do
- It is also clearly available to find online

New Zealand COVID-19 Alert Levels Summary

- The Alert Levels are determined by the Government and specify the public health and social measures to be taken in the fight against COVID-19. Further guidance is available on the [Covid19.govt.nz](https://www.covid19.govt.nz) website.
- The measures may be updated based on new scientific knowledge about COVID-19, information about the effectiveness of control measures in New Zealand and overseas, or the application of Alert Levels at different times (e.g. the application may be different depending on if New Zealand is moving down or up Alert Levels).

- Different parts of the country may be at different Alert Levels. We can move up and down Alert Levels.
- Services including supermarkets, health services, emergency services, utilities and goods transport will continue to operate at any level. Employers in those sectors must continue to meet health and safety obligations.
- Restrictions are cumulative (e.g. at Alert Level 4, all restrictions from Alert Levels 1, 2 and 3 apply).

Updated 28 August 2020

ELIMINATION STRATEGY – New Zealand is working together to eliminate COVID-19

Alert Level	Risk Assessment	Range of Measures (can be applied locally or nationally)
Level 4 – Lockdown Likely the disease is not contained	<ul style="list-style-type: none"> • Sustained and intensive community transmission is occurring. • Widespread outbreaks. 	<ul style="list-style-type: none"> • People instructed to stay at home in their bubble other than for essential personal movement. • Safe recreational activity is allowed in local area. • Travel is severely limited. • All gatherings cancelled and all public venues closed. • Businesses closed except for essential services (e.g. supermarkets, pharmacies, clinics, petrol stations) and lifeline utilities. • Educational facilities closed. • Rationing of supplies and requisitioning of facilities possible. • Reprioritisation of healthcare services.
Level 3 – Restrict High risk the disease is not contained	<ul style="list-style-type: none"> • Multiple cases of community transmission occurring. • Multiple active clusters in multiple regions. 	<ul style="list-style-type: none"> • People instructed to stay home in their bubble other than for essential personal movement – including to go to work, school if they have to, or for local recreation. • Physical distancing of two metres outside home, or one metre in controlled environments like schools and workplaces. • People must stay within their immediate household bubble, but can expand this to reconnect with close family / whānau, or bring in caregivers, or support isolated people. This extended bubble should remain exclusive. • Schools (years 1 to 10) and Early Childhood Education centres can safely open, but will have limited capacity. Children should learn at home if possible. • People must work from home unless that is not possible. • Businesses cannot offer services that involve close personal contact, unless it is a supermarket, pharmacy, petrol station or hardware store providing goods to trade customers, or it is an emergency or critical situation. • Other businesses can open premises, but cannot physically interact with customers. • Low risk local recreation activities are allowed. • Public venues are closed (e.g. libraries, museums, cinemas, food courts, gyms, pools, playgrounds, markets). • Gatherings of up to 10 people are allowed but only for wedding services, funerals and tangihanga. Physical distancing and public health measures must be maintained. • Healthcare services use virtual, non-contact consultations where possible. • Inter-regional travel is highly limited (e.g. for critical workers, with limited exemptions for others). • People at high risk of severe illness (older people and those with existing medical conditions) are encouraged to stay at home where possible, and take additional precautions when leaving home. They may choose to work.
Level 2 – Reduce The disease is contained, but the risk of community transmission remains	<ul style="list-style-type: none"> • Limited community transmission could be occurring. • Active clusters in more than one region. 	<ul style="list-style-type: none"> • People can reconnect with friends and family, and socialise in groups of up to 100, go shopping, or travel domestically, if following public health guidance. • Keep physical distancing of two metres from people you don't know when out in public or in retail stores. Keep one metre physical distancing in controlled environments like workplaces, where practicable. • No more than 100 people at gatherings, including weddings, birthdays and funerals and tangihanga. • Businesses can open to the public if following public health guidance including physical distancing and record keeping. Alternative ways of working encouraged where possible. • Hospitality businesses must keep groups of customers separated, seated, and served by a single person. Maximum of 100 people at a time. • Sport and recreation activities are allowed, subject to conditions on gatherings, record keeping, and – where practical – physical distancing. • Public venues such as museums, libraries and pools can open if they comply with public health measures and ensure 1 metre physical distancing and record keeping. • Event facilities, including cinemas, stadiums, concert venues and casinos can have more than 100 people at a time, provided that there are no more than 100 in a defined space, and the groups do not mix. • Health and disability care services operate as normally as possible. • It is safe to send your children to schools, early learning services and tertiary education. There will be appropriate measures in place. • People at higher-risk of severe illness from COVID-19 (e.g. those with underlying medical conditions, especially if not well-controlled, and seniors) are encouraged to take additional precautions when leaving home. They may work, if they agree with their employer that they can do so safely. • Face coverings required on public transport and aircraft (but not inter-island ferries) – school buses and children under 12 are exempt along with passengers in taxis or ride share services and people with disabilities or mental health conditions.
Level 1 – Prepare The disease is contained in New Zealand	<ul style="list-style-type: none"> • COVID-19 is uncontrolled overseas. • Sporadic imported cases. • Isolated local transmission could be occurring in New Zealand. 	<ul style="list-style-type: none"> • Border entry measures to minimise risk of importing COVID-19 cases. • Intensive testing for COVID-19. • Rapid contact tracing of any positive case. • Self-isolation and quarantine required. • Schools and workplaces open, and must operate safely. • No restrictions on personal movement but people are encouraged to maintain a record of where they have been. • No restrictions on gatherings but organisers encouraged to maintain records to enable contact tracing. • Stay home if you're sick, report flu-like symptoms. • Wash and dry hands, cough into elbow, don't touch your face. • No restrictions on domestic transport – avoid public transport or travel if sick. • No restrictions on workplaces or services but they are encouraged to maintain records to enable contact tracing. • QR codes issued by the NZ Government must be displayed in workplaces and on public transport to enable use of the NZ COVID Tracer App for contact tracing.

UK COVID Alerts

- On May 10th 2020 the UK Prime Minister Boris Johnson introduced the national COVID Alert Levels
- Due to non-standard, changing information that has been haphazardly presented, the UK government introduced an entirely new local COVID-19 alert level system based on three tiers on 14th October 2020

Key challenges for the UK:

- Scotland, Wales, and Northern Ireland have their own systems and rules so there is no standardisation across the UK
- There is a distinct lack of expertise from emergency management or civil protection experts
- Lack of transparency and clarity over the rules, which have changed between the two ALS introduced
- Significant failures in preparedness including testing facilities and providing key workers with personal protective equipment

THE NATIONAL ALERT SYSTEM. UK GOVERNMENT. CONTAINS PUBLIC SECTOR INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE V3.0.

Level	Description	Action
5	As level 4 and there is a material risk of healthcare services being overwhelmed	Social distancing measures increase from today's level
4	A COVID-19 epidemic is in general circulation; transmission is high or rising exponentially	Current social distancing measures and restrictions
3	A COVID-19 epidemic is in general circulation	Gradual relaxing of restrictions and social distancing measures
2	COVID-19 is present in the UK, but the number of cases and transmission is low	No or minimal social distancing measures; enhanced testing, tracing, monitoring and screening
1	COVID-19 is not known to be present in the UK	Routine international monitoring

STAY ALERT • CONTROL THE VIRUS • SAVE LIVES



Lessons from for Pandemic ALS

1. Provide clear guidance, that are transparent, freely available
2. Tie health and social measures to each alert level so the actions are required at each level are clear
3. Avoid a 'terror' security rubric to encourage the public to work together towards a common goal of elimination through actions.
4. The use of the R-value as the criterion needs to be expanded on to review other indicators around the spread of COVID-19. This requires multiple-experts
5. The organisation deciding the alert level needs to establish strong multi-directional communication protocols across national and local governance
6. The alert level system cannot operate in isolation, it needs to be tied with other mitigative activities such testing, protective measures, boarder control etc.
7. If the alert system is to be used regionally effectively, more investment is needed for the public to be aware of the differences between regions
8. National level standardisation significantly reduces confusion whilst also being able facilitating local requirements.
9. Alert levels should be issued to the public through a detailed briefing and made available on a government website and via media as a public safety campaign.
10. Enforcement of the rules are needed



4. WHAT TOOLS CAN BE USED TO INTEGRATE EWS INTO POLICY AND PRACTICE?

Future research and tools required:

With Covid-19 producing monumental loss of life across the globe, a forensic analysis of the crisis needs to address the nature, scope, and failings of such warnings on:

- Local and global scales
- Early warning and warning (alerts) during the crisis
- How cross-border, standardised alert systems *should* be put in place
- Which national systems succeeded and failed to develop good practices

There is a need to:

- Integrate credibility, relevance and legitimacy as part of the science / policy interface
- Adapt a range of tools of communication to work in multiple directions enabling multi-stakeholder engagement in the decision-making process.
- Invest in Disaster Risk Reduction and preparedness by developing a fully integrated warning system
- Devise stronger more robust EWS and Alert nationally and internationally using the expertise of WHO and drawing on well established systems used for other natural hazards e.g. volcanoes, tsunami, hurricanes, as demonstrated.

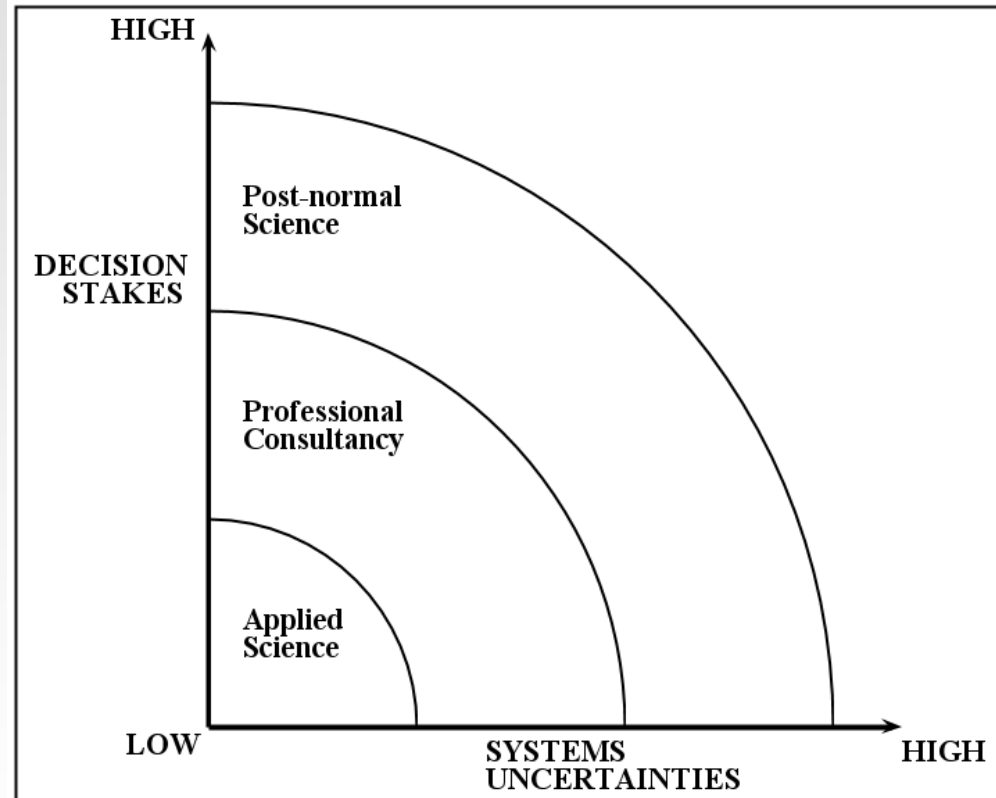
Science is only part of the answer

The realisation we need a new style of science, pandemics are a post-normal science (PNS)

'Facts are uncertain, values in dispute, stakes high and decisions urgent'

Funtowicz & Ravetz, 1993, p.744

- PNS brings together an extended peer community to enter into a dialogue about the uncertainty, ignorance, perspectives and values of each stakeholder, using their expertise.
- Generally occurs at the interface of science and policy



Ravetz, 2004, p.354

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Warning Research Centre

The Warning Research Centre (WRC) at UCL is unique in bringing together global expertise to explore the role of warnings in managing vulnerabilities, hazards, risks, and disasters.

Housed within the Department of Science and Technology Studies, the WRC is an interdepartmental centre focusing on all aspects in relation to warnings for all forms of risks and disasters. Founded in 2020, the WRC brings together expertise already established at UCL with warning expertise at universities globally to work with businesses, government, non-governmental, and intergovernmental organisations to address the growing need for effective warning and alert systems via cutting-edge research, policy guidance, applications, and collaborative expertise. WRC will transform research into warnings and alert solutions by being strongly interdisciplinary and innovative.

The UCL WRC will be formally launched in 2021 with upcoming additions here including WRC affiliates, warning resources, news, and social media.



Warnings save countless lives every year, can be used to support day-to-day living and vulnerability reduction, and are often operated by government organisations with legal remits. However, no dedicated Warning Research Centre currently exists to pool research and experience to develop better knowledge and practices, and to share lessons across risks and disasters. The UCL WRC contributes to filling this gap by bringing together expertise from across a range of disciplines, geographies, and social and livelihood contexts to help establish more effective warnings which are more connected to and used by people.

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UCL Warning Research Centre @UCLWRC
We agree with [@HeadUNDRR](#) that early warning systems are key to disaster risk reduction and as a centre aim to bring expertise together to enhance our understandings on all aspects of warnings see: ucl.ac.uk/sts/wrc [#DRRday](#) <https://twitter.com/HeadUNDRR/status/1316047043136237568>