Swinley Wildfire Seminar, Greenwich, April 2015

Wildfire Impact - *costs and risks*

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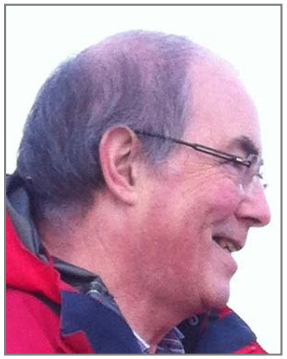


Julia McMorrow, Dr Aleks Kazmierczak, Jonathan Aylen, Rob Gazzard and Gina Cavan

Example: “Swinley Forest” Fire,

in Crowthorne Wood, south of Bracknell

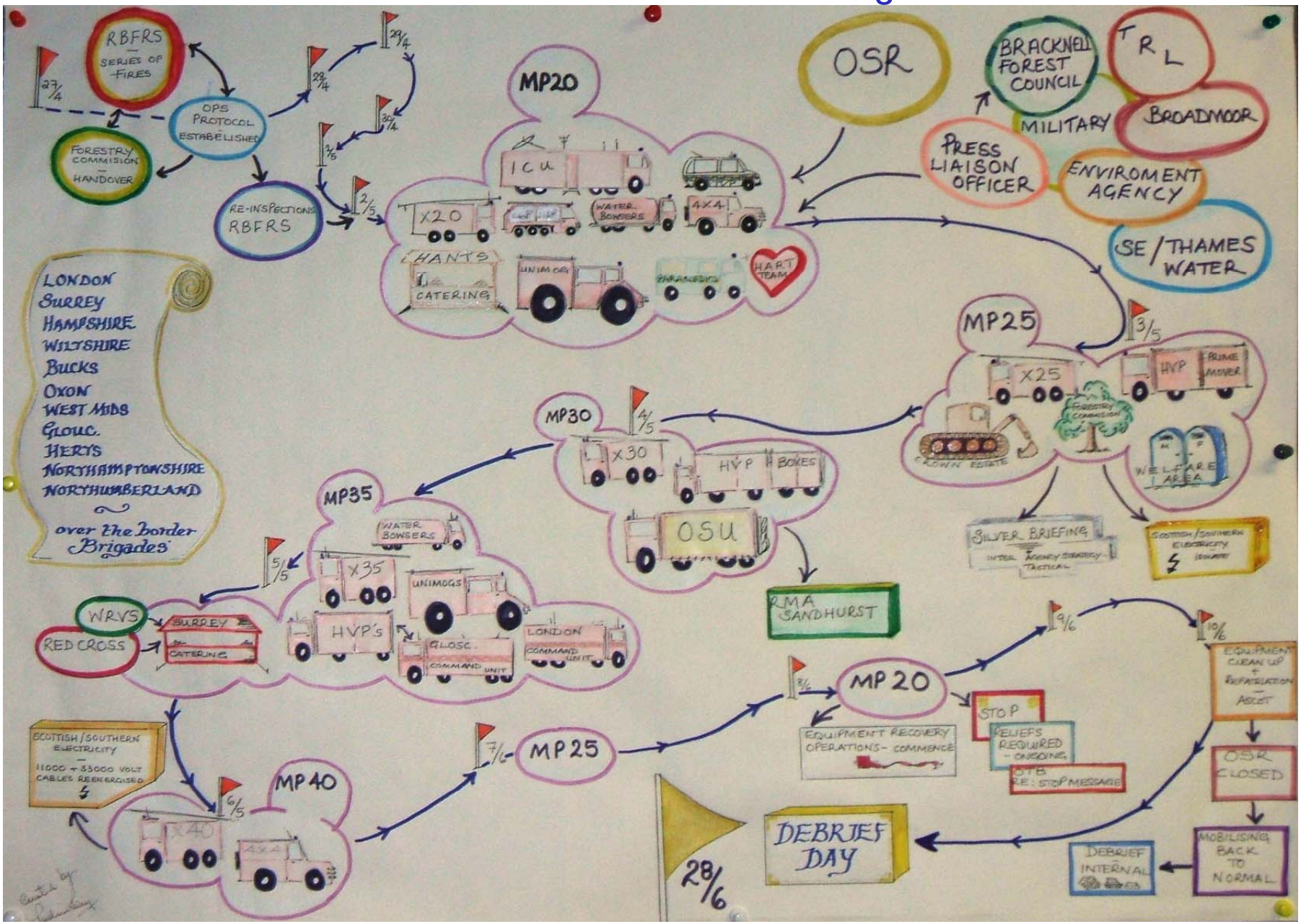
social

/ Costs of the Swinley fire

- Establishing the social costs of wildfire
- A costing template
- Costs of the Swinley fire in 2011
- Valuing ecosystem services?
- Who pays in practice?
- Reducing the risk
- Optimal fire fighting
- Swinley a rare event?

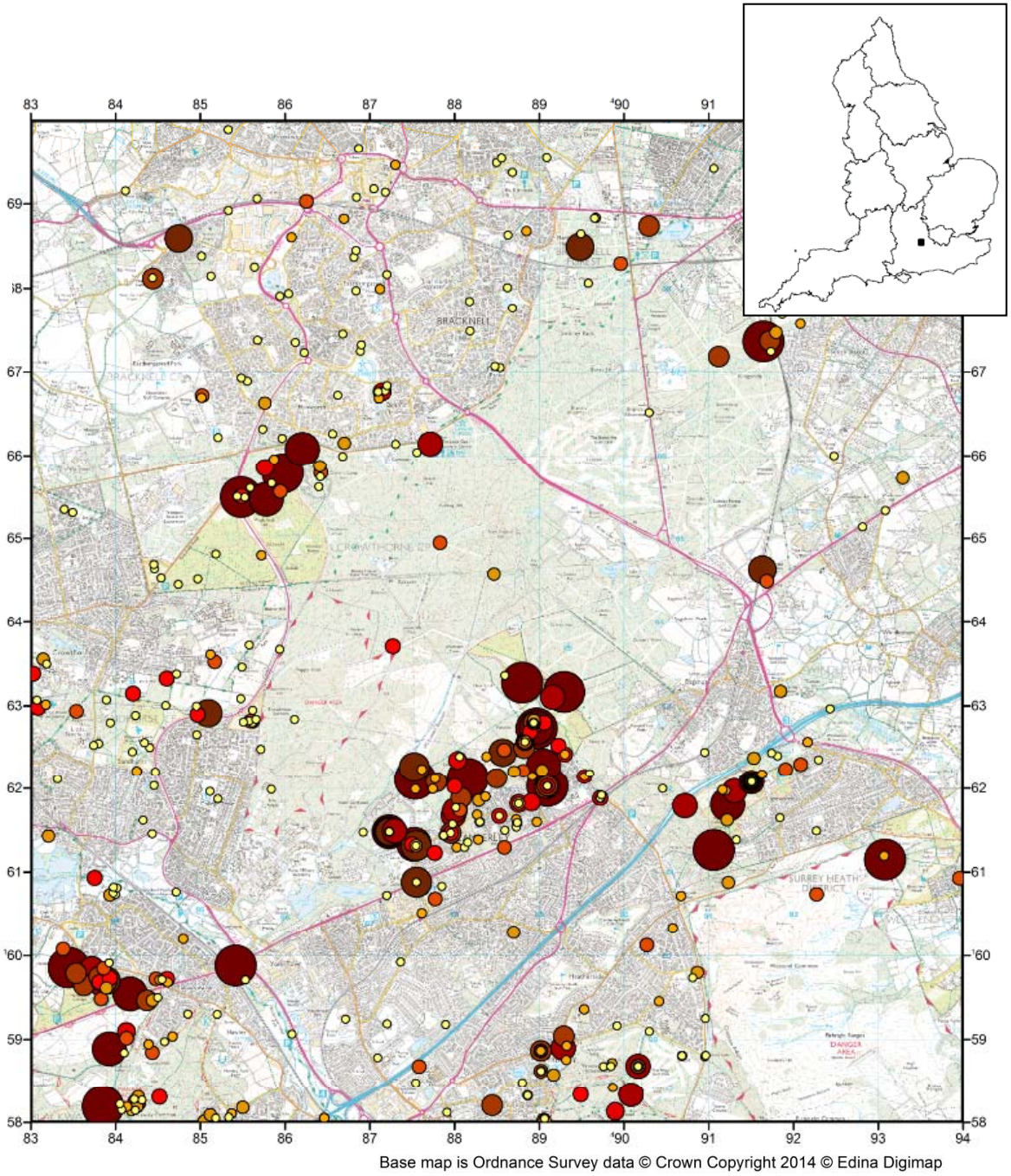
A major fire “make pumps 40”

with thanks to Nick Oxborough



WTA Case study area

964 attended fires in 4 yrs, 2009-2013; Fire Services' Incident Recording System (IRS)



Why social costs of wildfire ?

- Tie-up large amounts of resources
- External impact on transport, water resources, air quality and health
- Encourage management of land/fuel load
- Support less costly approaches to fire fighting and make a case for training and specialised equipment

Torside Fire, 2011 © Jonathan Aylen

Difficult to establish costs of wildfire

- Fire service resource costing for tender and crew “varies”
  - £200 to £1,000 per hour
- Some direct costs omitted
- No direct evidence on ecosystem costs, clean air, damage to water supplies

But:

- Costing vehicle traffic delays is a well established procedure

Difficult to establish costs of wildfire

- Fire service costing for tender and crew per hour:
  - West Yorkshire £380 (2009)
  - Staffordshire £214 (2006) first hour
  - Royal Berkshire £295 (2011)
  - GMRFRS estimate £1,000 (2007)

- Also re-positioning of back-up crews and clear-up costs
- Damage to equipment (£10,000 RBFRS at Swinley)

Costs of Wildfire – a template

- *Direct costs*
  - Firefighting
  - Emergency Services
  - Landowners and Utilities
- *Indirect costs*
  - Transport
  - Homes and businesses
  - Health effects
- *Ecosystem damage*
  - Habitat and species
  - Water supply
  - Carbon loss/gain
- *Total social cost of fire*

Crowthorne Forest, 2011 © Jonathan Aylen

Costs of Wildfire – Swinley/Crowthorne

Direct costs		
- firefighting	**£543,000**	• all FRS involved
- emergency services	**£78,400**	• police + ambulance
- landowners	**£198,000**	• CE & FC
- local authority	**£22,000**	• Bracknell + Berks.
Indirect costs		
- transport delays	**£229,300**	• cars, LGV's, HGV's, PSV's
- homes & businesses	**£59,000**	• business closure, evacuation
- health	***	* respiratory problems
Ecosystem services	***	• not costed
Total social cost	**£1,129,700**	

Costing Road Delays – Swinley

Assumptions

- A3095 Foresters Way closed for a week, traffic diverts to A322
- 25,133 vehicles per day diverted
- Extra distance – 2 miles; Extra time – 5 minutes
- Average speed on diversion route 40 km/hr
- *But*, no peak hour/off-peak distinction

Costing Road Delays – Swinley Fire

Delay costs – (2010 prices)

	car	bus	LGV	HGV	Total
Flow (AADT)	21,847	94	2,393	615	25,133
Occupants (Persons)	1.58	13.2	1.25	1	
Value of time (£/hr)	£12.87	£88.12	£14.31	£12.53	
Operating cost (p/km	5.54p	37.49p	9.15p	21.64p	
Delay cost (£'s week)	£191,303	£5,596	£24,902	£7,491	**£229,292 (£32,756 a day)**

Road flows from http://www.dft.gov.uk/matrix/results.aspx

Costs from Department for Transport, Transport Analysis Guidance, Values of Time and Operating Costs, TAG Unit 3.5.6, April 2011. Values converted from 2002 benchmark using GDP deflator.

Health Effects

- Little evidence on health effects wildfire - half-a-dozen studies, some contradictory
- Some studies look at persistent fires or extrapolate from other forms of air pollution

- Swinley, short lived but high dose of particulate matter, highly localised exposure

- In principle, two stages:
  - Physical impact on health
  - Monetise these effects
    - Impact on those affected
    - Cost of treatment
    - Either “willingness to pay” (*no studies*) to avoid illness or direct “cost of illness” *(rule of thumb willingness to pay twice direct cost)*

Health Effects

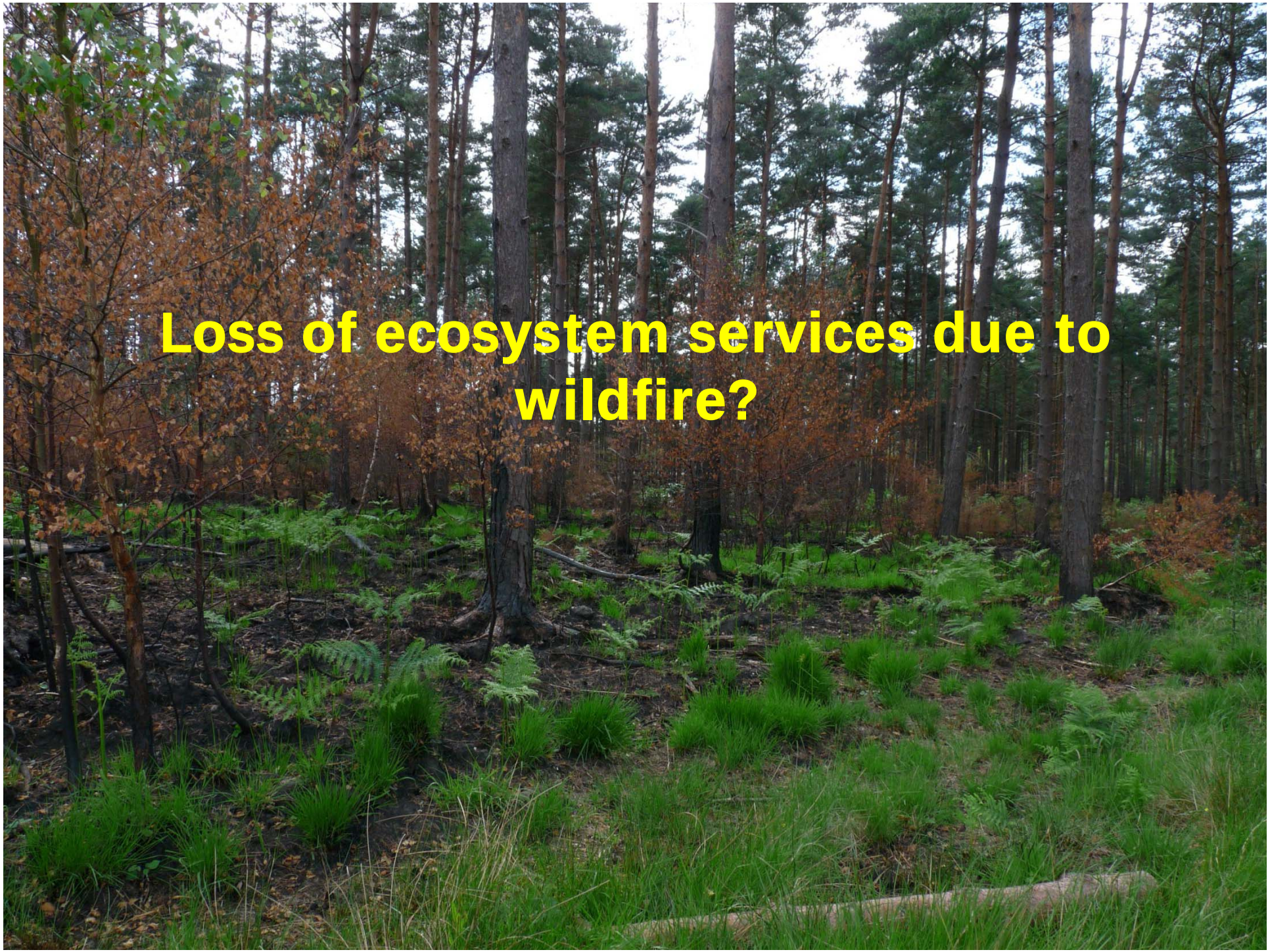
- Little evidence, if any, of excess mortality
- Perhaps work days lost, restricted activity, minor inconvenience
- Hospital admissions, respiratory problems leading to surgery visit and self-treatment
- Studies find *only* respiratory effects, (perhaps more severe than usual pollution) – not mortality or cardio-vascular problems

Some studies find *no* effects:

- Do wildfires have higher profile/evoke more concern than everyday but persistent pollution? Do people avoid exposure?
- But, minor costs could add up if many affected in an urban area

US EPA Evidence on Health Costs of Wildfire in America (£2010 prices)

Hospital Admissions	
All respiratory	£5,930
All cardiovascular	£8,170
Emergency Dept	£167
Respiratory illness	
Acute bronchitis	£38
Asthma attack	£27
Respiratory symptoms	£15
Upper respiratory	£16
Lower respiratory	£10
Shortness of breath	£4
Restrictions on Activity	
Work day lost	£71
Restricted activity day	£32


Loss of ecosystem services due to wildfire?

Ecosystem Services

“Ecosystem services are defined as services provided by the natural environment that benefit people.”

Ecosystem services damaged by wildfire?

Provisioning services

Timber

Regulating Services

Air quality, climate moderation, water run-off and flood,

Cultural Services

Recreation, cultural heritage, aesthetic value, social value, inspirational and spiritual

Supporting Services

Soil formation and retention, nutrient capture, water cycling, atmospheric oxygen, wildlife

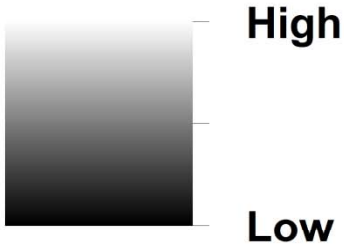
Valuing Ecosystem Services – difficulties

- **Key scientific uncertainties on major issues**
- **The issue of irreversibility**
- **Difficulty of valuing changes in money terms-**
- **Not possible to value some changes, but that does not mean they do not matter**
- **Difficulties in making scientific base line measurements**
- **Conflicts in objectives:**
  - ***differing time horizons***
  - ***differing spatial scales***
  - ***need for trade-offs between one goal and another (say natural grazing versus unfenced recreation access)***

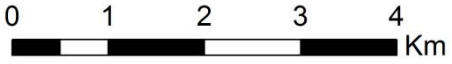
Values at Risk map – stakeholder preferences

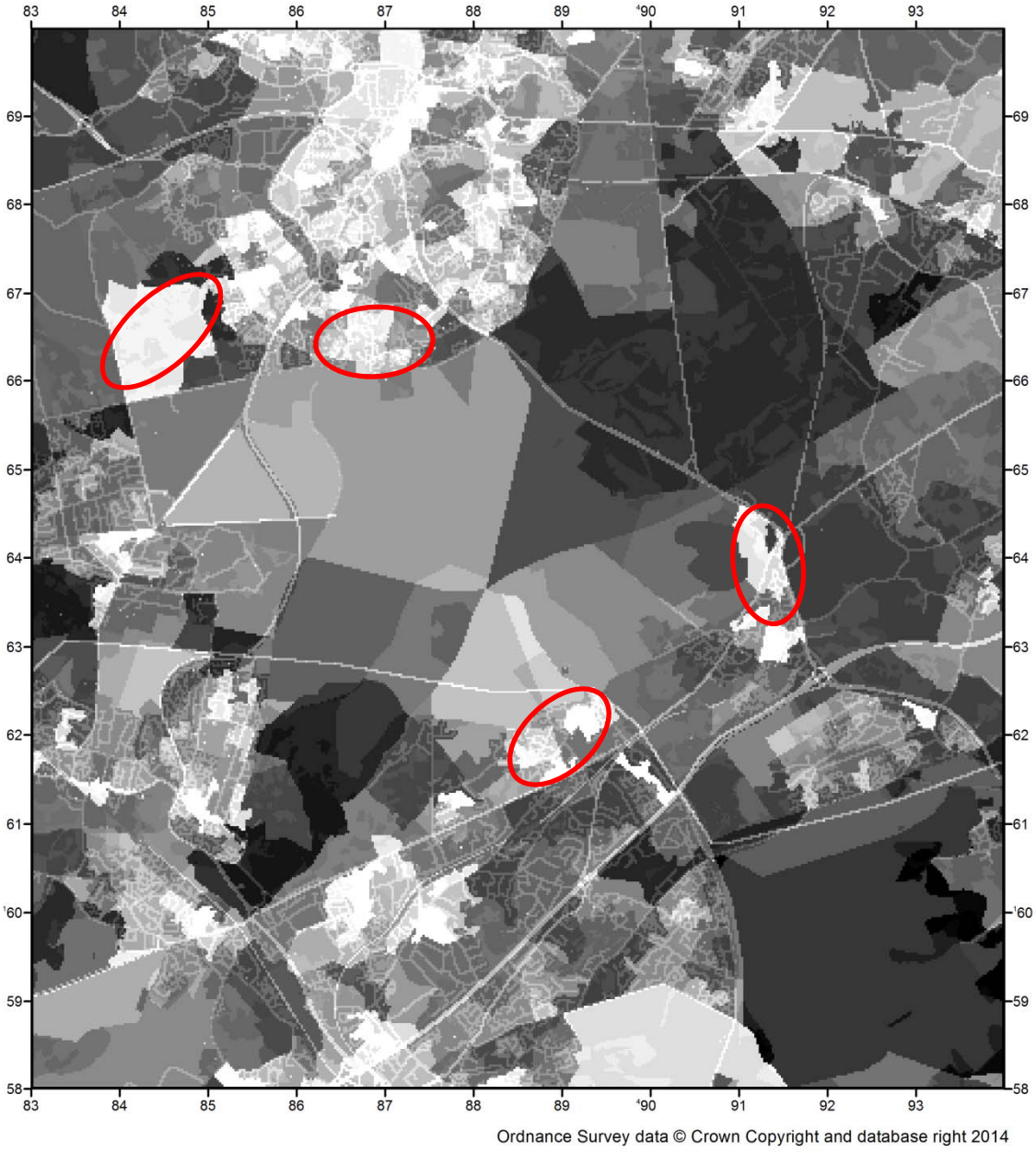
“Weights”

5 Health & well-being
3 Property & infrastructure
1 Ecosystems services



Red elipses show target areas for Forestry Commission





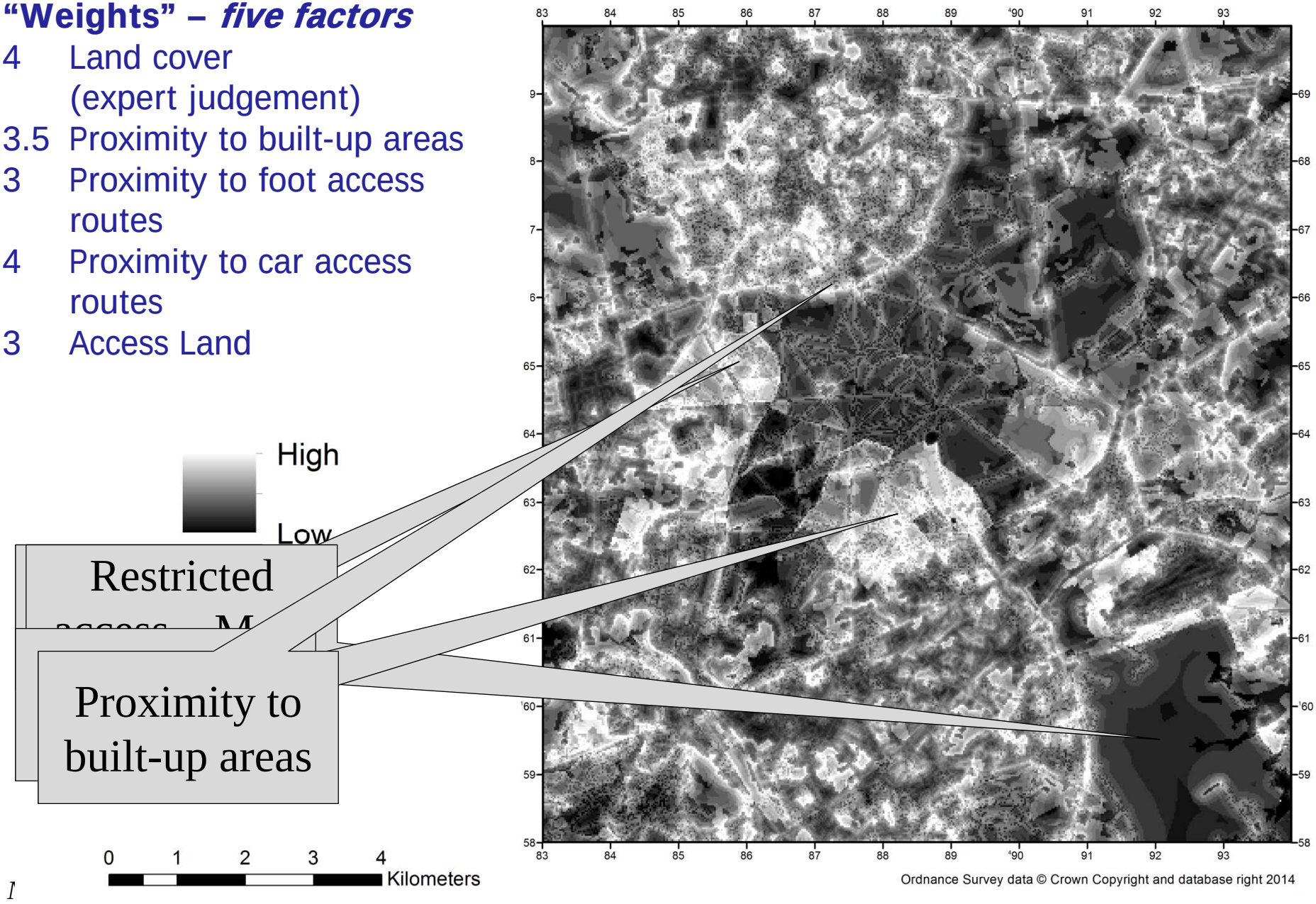
Who does bear the costs of wildfire?
Swinley in practice

- ½ recovered from Central Government (*Bellwin grant*)
- ⅛ borne by local emergency services
- ¼ by road users (cars, buses, LGV's and HGV's)
- $^{1}/_{7}$ by land-owners

Outputs: Risk of Ignition map to target fire prevention

"Weights" – *five factors*

4 Land cover (expert judgement)
3.5 Proximity to built-up areas
3 Proximity to foot access routes
4 Proximity to car access routes
3 Access Land



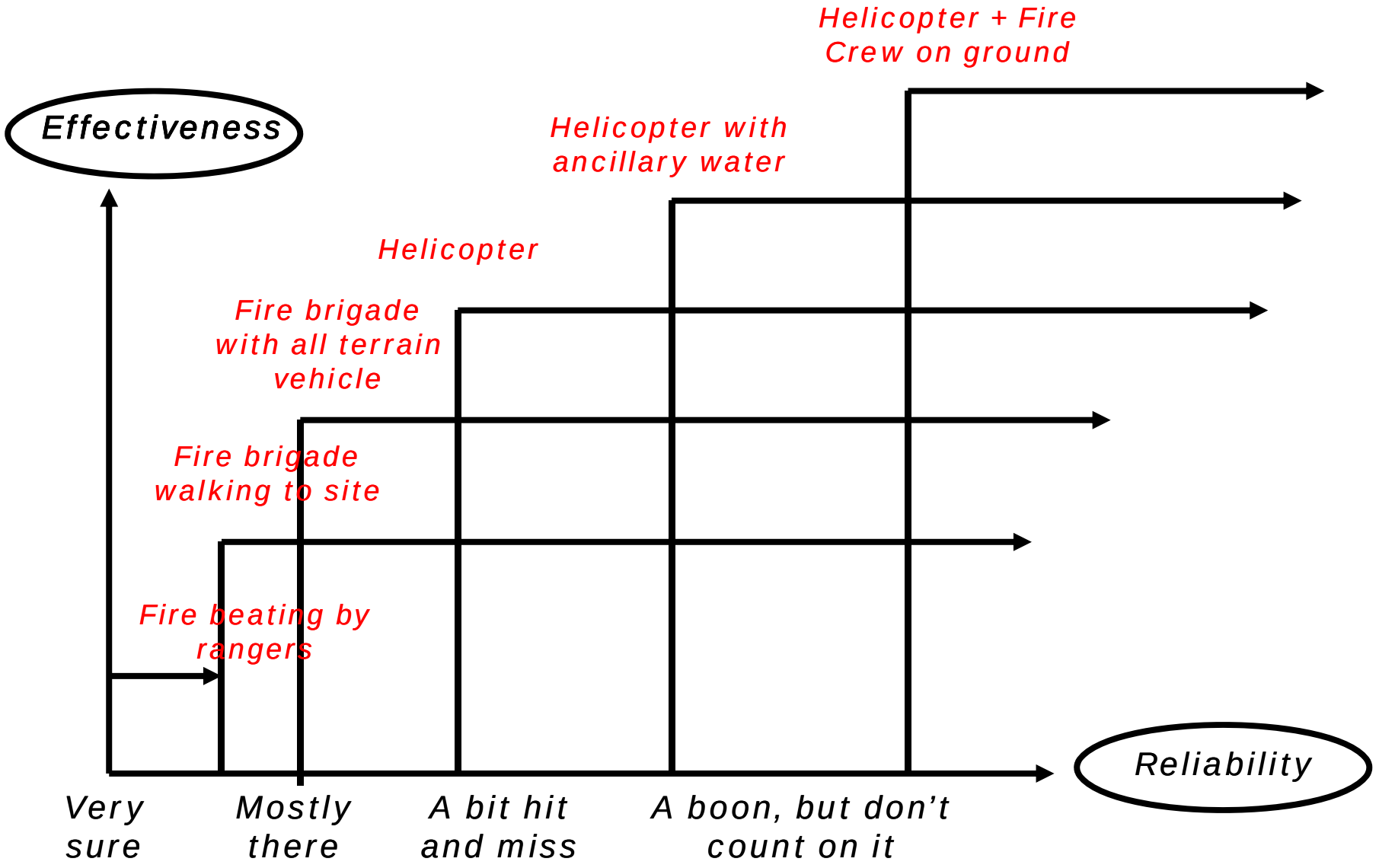
Wildfires, Peak District and W. Yorkshire

	One day	Major incident
Duration (average time: report to close)	4 hours	3 days
Size (average)	15 hectares	350 hectares (also deep burns)
Total appliance hours (average)	15 hours	130 hours
Typical cost to Fire and Rescue Service (average)	£15,000	£210,000 and Helicopter call-out, Property damage

Source: Analysis of 14 fire reports from Fire Services and Rangers, interviews with members of the Fire Operations Group and visits to fire sites. Funded by PDNP.

Note: Limited sample size and limited data availability. Outlier case omitted

Reliability/Effectiveness Trade off – Moorland Fire Fighting



Swinley 2 Avoided?

“Quick-thinking firefighters praised after Swinley Forest blaze”, 11 Sep 2013

“Five crews battled the forest fire for three hours amid fears the blaze could have led to a repeat of the devastating fire of two years

Quick-thinking firefighters halted a woodland blaze before it could repeat scenes of the ferocious fire that tore through Swinley Forest two years ago.”

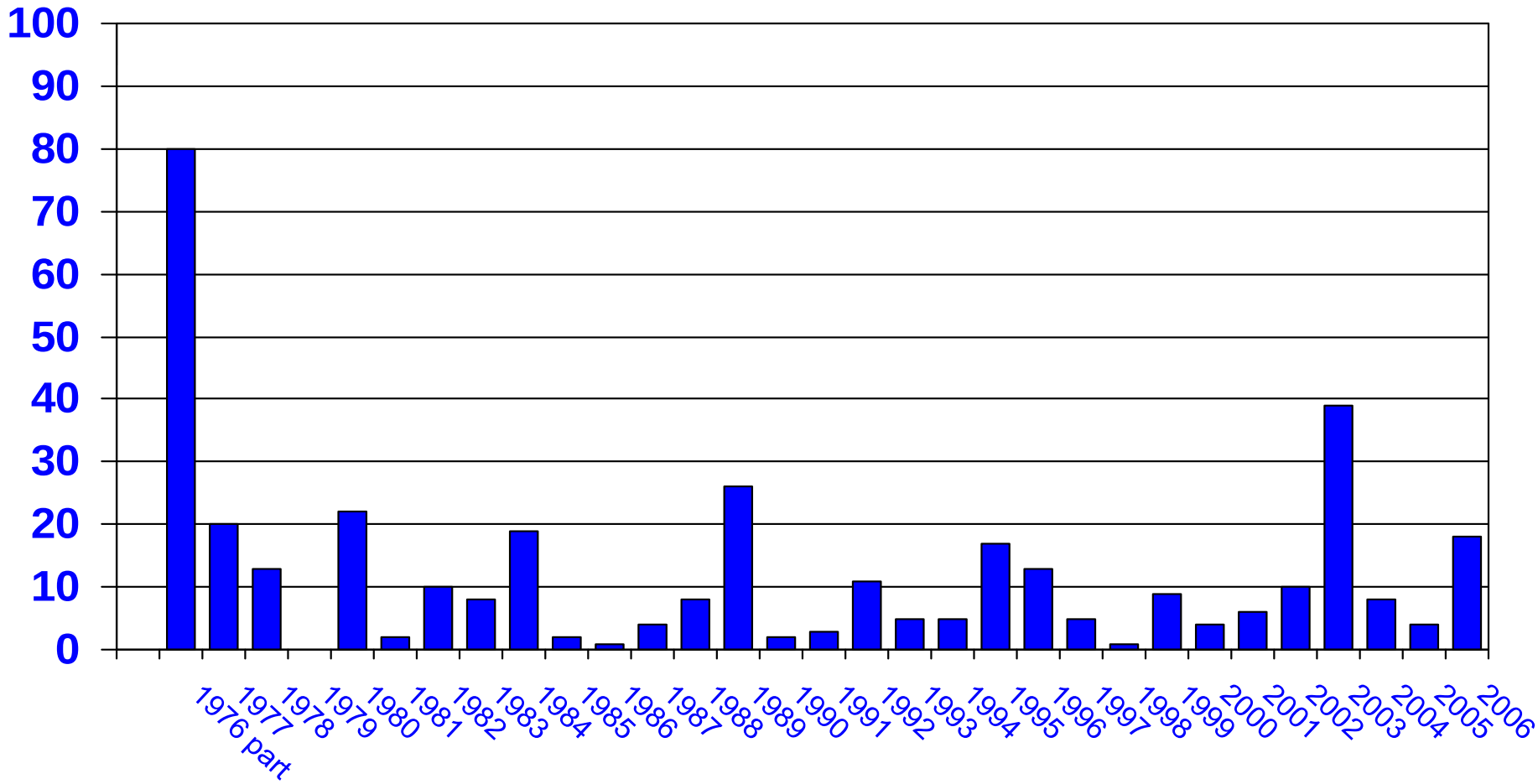
A return period for UK wildfires?

- Is there a return period for UK wildfires of 15 years ?
- Evidence from Peak District 2009-2013; one third of fires in four months out of 29 years (Summer 1976 and Spring 2003)

When do fires occur ?

Number reported wildfires per year – *Peak District*

mid 1976 to end 2006



Swinley - a rare event ?

- Is there a return period for UK wildfires of 15 years ?
- Maybe just 1 in 3,615 fires this severe – *or worse* – in the Swinley 10 km X 11 km study area in 15 years*

  given current suppression and land management practices
- Probability of 0.004 in any given year of a fire escaping initial suppression – a 0.4% chance of a major incident in the Swinley study area > £1 million

* (i.e.964/4 X 15 = 3,615)

Social costs of Wildfire –
conclusions and implications

- Optimal to focus on strong initial attack to avoid prolonged event
- Firefighting and road disruption the big cost items
- Cost to ecosystem relatively small? (*unless* peat)
- Reduce suppression costs through better risk management beforehand
- Most wildfires in the area are far smaller than this, but there is an 0.4% chance of an incident as severe as Swinley or worse in the study area in any year