CLIMATE ADAPTATION

Climate Change

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Presentation outline

- Key drivers of fire regimes
- Future fire regimes
- Uncertainty cascade
- Forecasts/scenarios/unknowables
- Impacts on fire regimes
- Impacts on fire weather severity
- Policy-making under climate change
- Scenario planning
- Concluding remarks

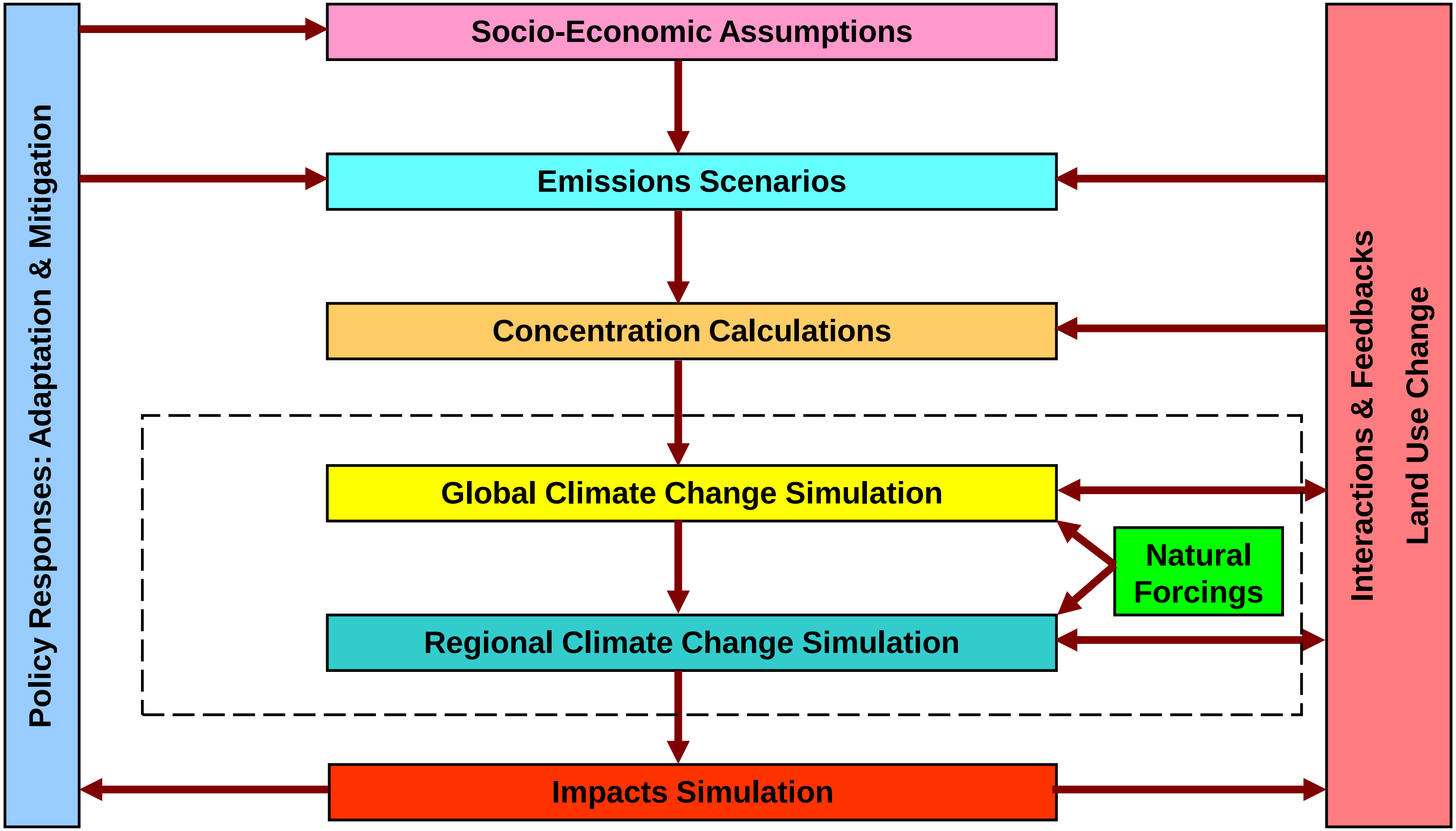
Key drivers of fire regimes

- The ‘4 switch’ model
  - Rate of vegetation (and hence fuel) growth
  - Rate at which fuels dry
  - Occurrence of suitable weather for fire spread (very high maximum temperatures, strong winds, low relative humidity)
  - Source of ignition (natural or human)
- Each switch needs to be ‘on’ for fire propagation
- Fire regimes in different regions constrained by different switches
- Climate change is expected to affect all four drivers
- Climate change research has largely focused on projected changes to severity of fire weather

Future fire regimes

- Changes to fire weather
  - Temperature extremes (and heat waves)
  - Rainfall (wet- and dry-spell lengths)
  - Relative humidity and wind speed
- Changes to fuel moisture and decomposition (predisposition to fire)
- Increases in atmospheric CO_2
  - Increased vegetation production and hence fuel loads
  - Effects may be offset or overwhelmed by drought and rainfall decline
  - Outcome is highly uncertain
- Changes to land-use and hence fuel loads
- Invasion and spread of exotic weeds and grasses – fuel loads
- Changes to frequency of natural ignition

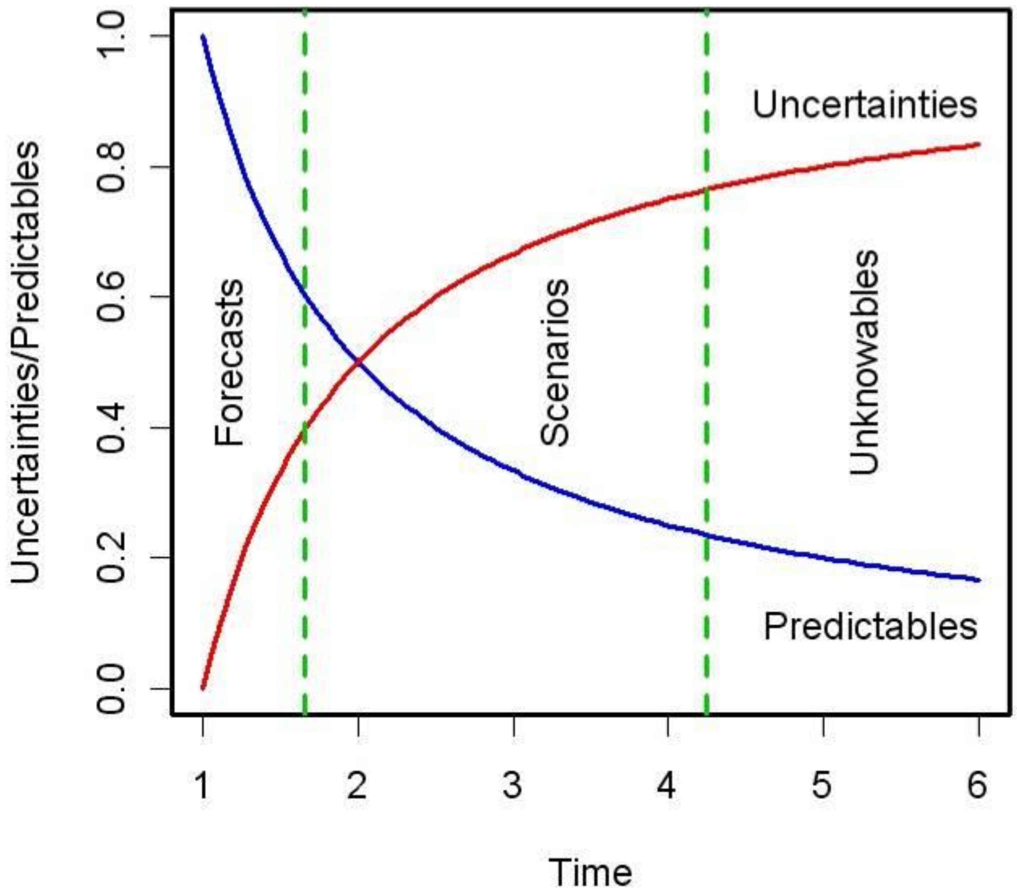
The uncertainty cascade



(Adapted from *Mearns et al*., 2001)

Forecasts/scenarios/unknowables

(Adapted from *Postma & Liebl*, 2005)



Prediction: **a selected picture of the future**

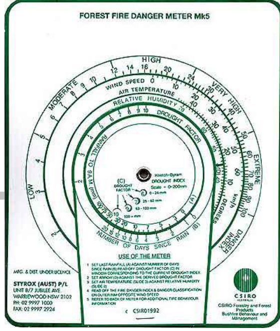
Forecast: **most likely picture of the future**

Scenario: **a series of events that could lead from the present to a plausible but not assured future situation**

Impacts on fire regimes

- Uncertain, but has potential to alter regimes
- Will vary at landscape scales and regionally
  - Some regions constrained by fuel availability (tropical north)
  - Other regions by periods of suitable weather (temperate south)
  - Warmer and drier southern Australia – increased risk of severe fire weather
  - Little (no?) research on how climate change could affect incidence of lightning fires in Australia
- Prescribed burning
  - Altered window of opportunity for safe application (temporal shift and narrowing)
  - Diminished effectiveness
- Reducing risk to property, people and biodiversity will be challenging

Impacts on fire weather severity



- Assessments usually based on Forest or Grassland Fire Danger Indices
- In SE Australia, severity has increased by 10 to 40% (2001 to 2007 versus 1980 to 2000)
- Increases in fire danger have been detected in other regions (SA, western NSW, northern Tasmania)
- Projections for SE Australia (using different models and emissions scenarios)
  - 5 to 65% increase by 2020
  - 100 to 300% by 2050
  - Fire seasons likely to become longer

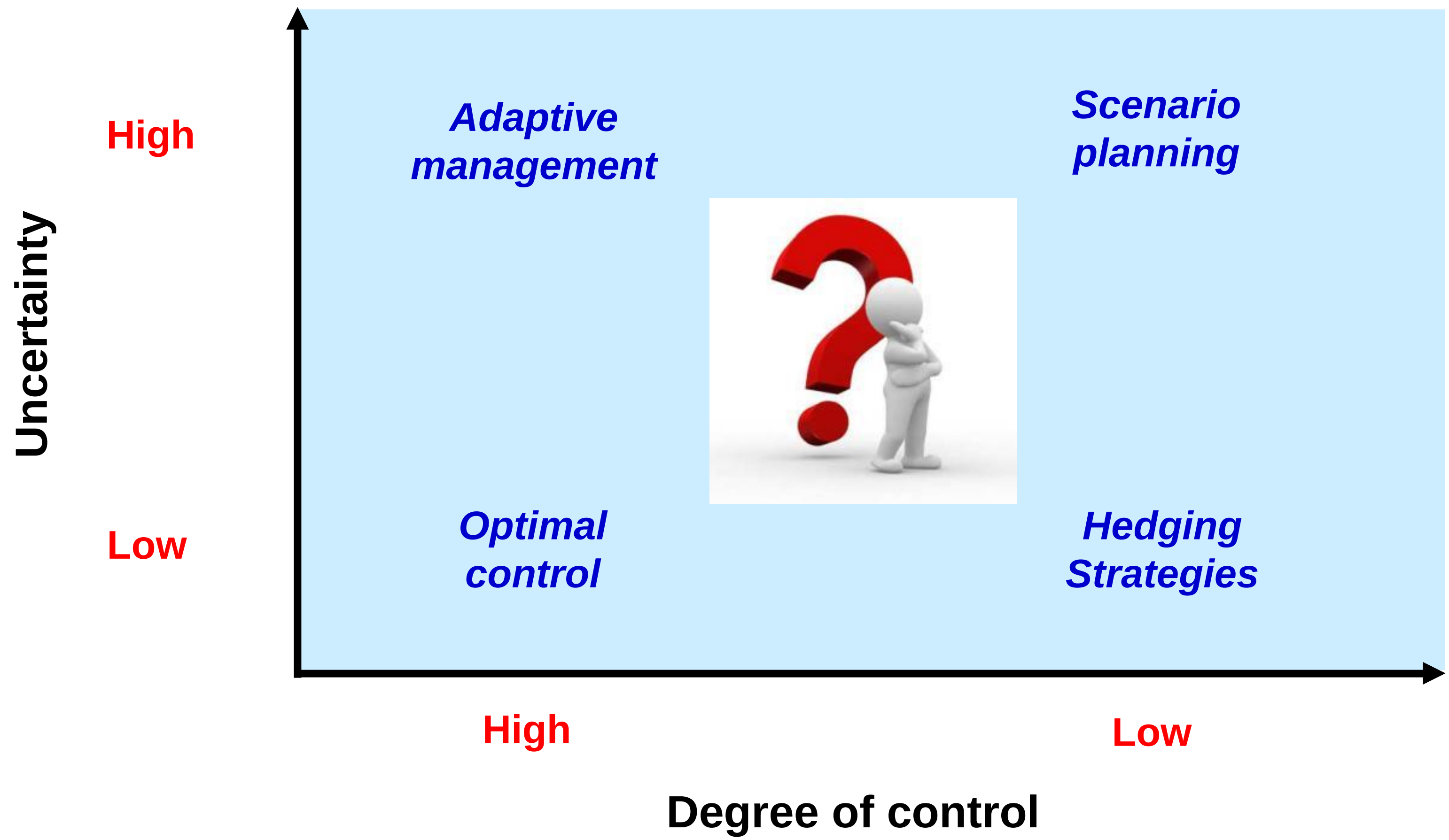
New lightning-fire research (ACCSP and WAWCP)

- Dry lightning is most common, natural ignition source
- Lightning fires tend cluster temporally
- Changes in frequency and seasonality?
- Characterisation of atmospheric forcing
  - Intense frontal systems (fire propagation)
  - Heat waves (fuel curing)

- Landscape factors – topography, soil type, etc
- Formal linkage between atmospheric forcing, landscape and lightning strike occurrence – statistical downscaling
  - Multi-decadal variability (Reanalyses)
  - Operational forecasting applications – ignition and fire spread
  - New climate change projections (IPCC AR5)

Policy-making under climate uncertainty

(Adapted from *Peterson et al,* 2003)



Scenario planning

- Evolving climate change projections
- Future GHG emissions and GCM development are likely to evolve irregularly in coming decades
- Recognises imperfect
  - Knowledge of relevant processes
  - Data, methods and models
- Advantages
  - Avoids emphasis on most likely scenario
  - Reveals vulnerabilities; particularly to high impact, low probability events
  - Identifies need for contingency plans
  - Focuses attention on key decision points (triggers for action)
  - Builds adaptive capacity

Concluding remarks

- Need to increase our understanding of
  - Observed trends and decadal variability
- Impacts of climate change on
  - Fire frequency and intensity (ignition and atmospheric forcing)
  - Biodiversity – vegetation structure and composition, and ‘critters’
  - Property and inappropriate human behaviour (arson, carelessness)
  - Community response and resilience
- Uncertainty and surprise are inevitable; risk is <u>certain</u>
- Risk and adaptation assessments that include all four ‘switches’
- Preparedness, not prediction – robust adaptation strategies
- Risk reduction – many implications for planners and land managers

References

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