Risk Management, Precaution, and Policy Making

Strategies to cope with complexity, uncertainty and ambiguity

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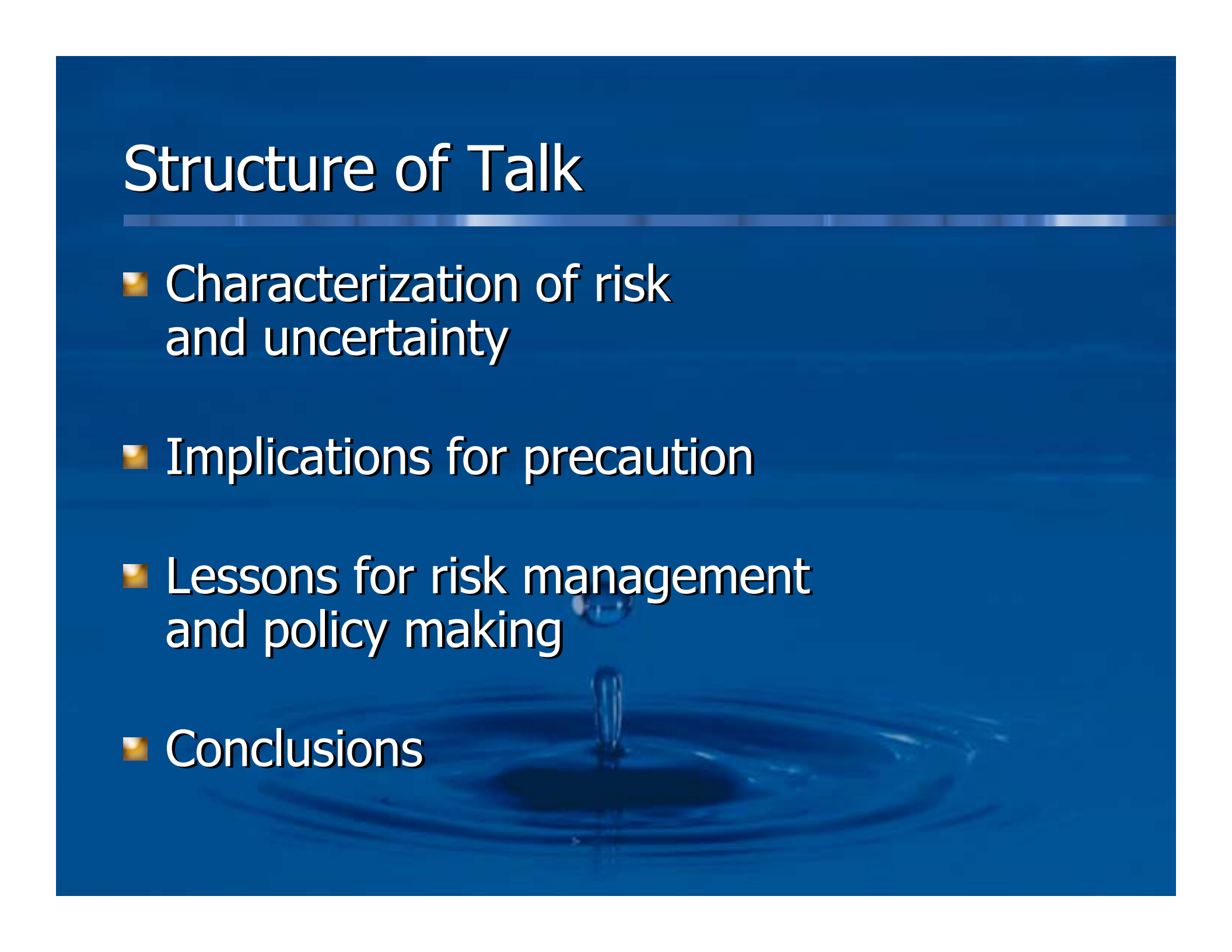
Policy Dilemma in Risk Management

If policy makers define policies according to the risk perceptions and desires of lay people, they actually may tolerate more sacrifices than necessary; if they follow only the advise of the professional experts, they may lose public support.

Structure of Talk

- Characterization of risk and uncertainty
- Implications for precaution
- Lessons for risk management and policy making
- Conclusions



PART I

Characterization of risk
and uncertainty:

Towards a new classification

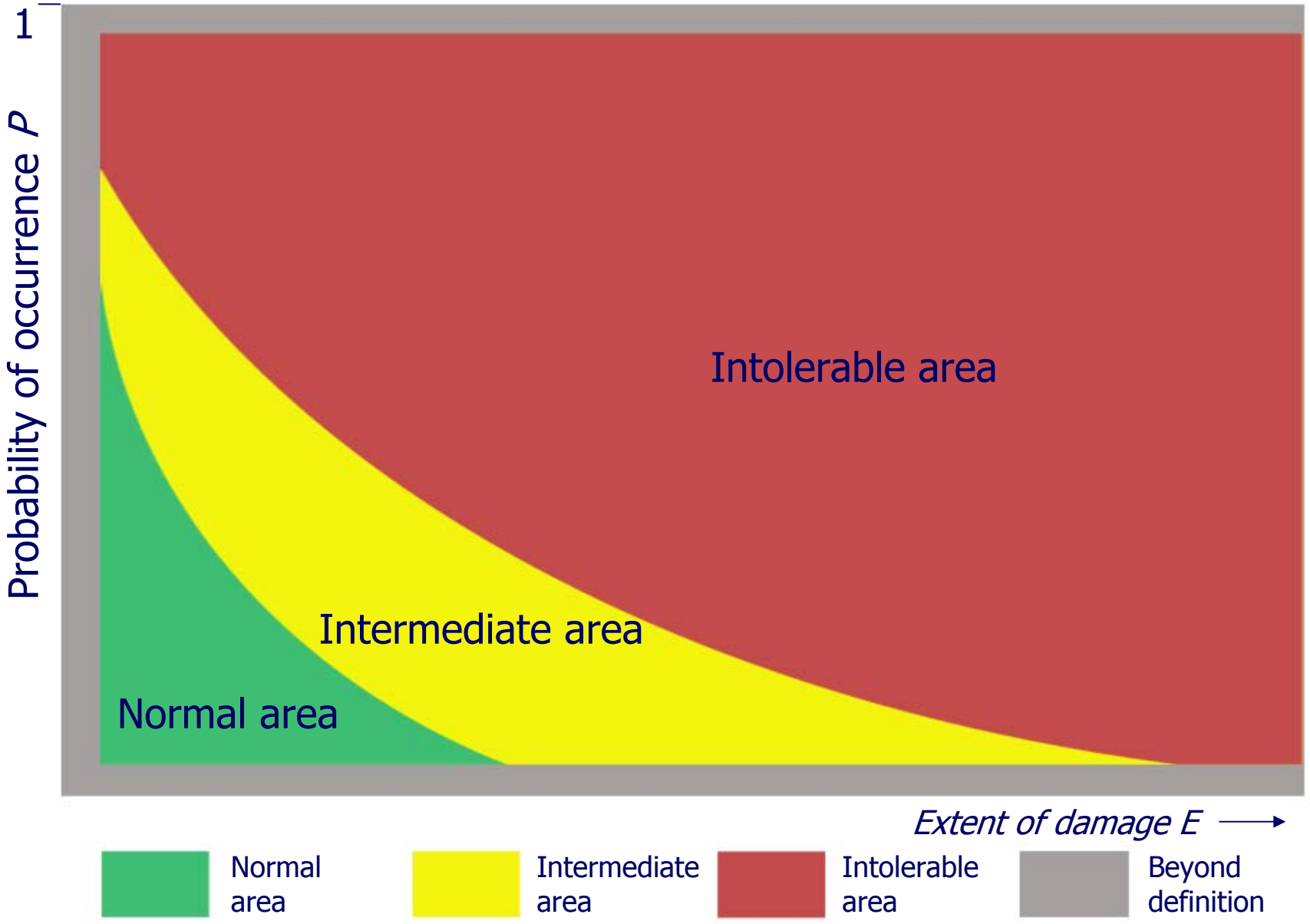
Generic Risk Characteristics
Three challenges of risk management

- Complexity in assessing causal and temporal relationships
- Uncertainty
  - variation among individual targets
  - measurement and inferential errors
  - genuine stochastic relationships
  - system boundaries and ignorance
- Ambiguity in interpreting results

What Matters in Assessing Risks?
Classification of the Global Change Council

Factors that matter:

- Probability
- Potential for harm
- Uncertainty (first order and second order)
- Ubiquity
- Persistence
- Delayed Effects
- Equity Violations
- Potential for Social Mobilization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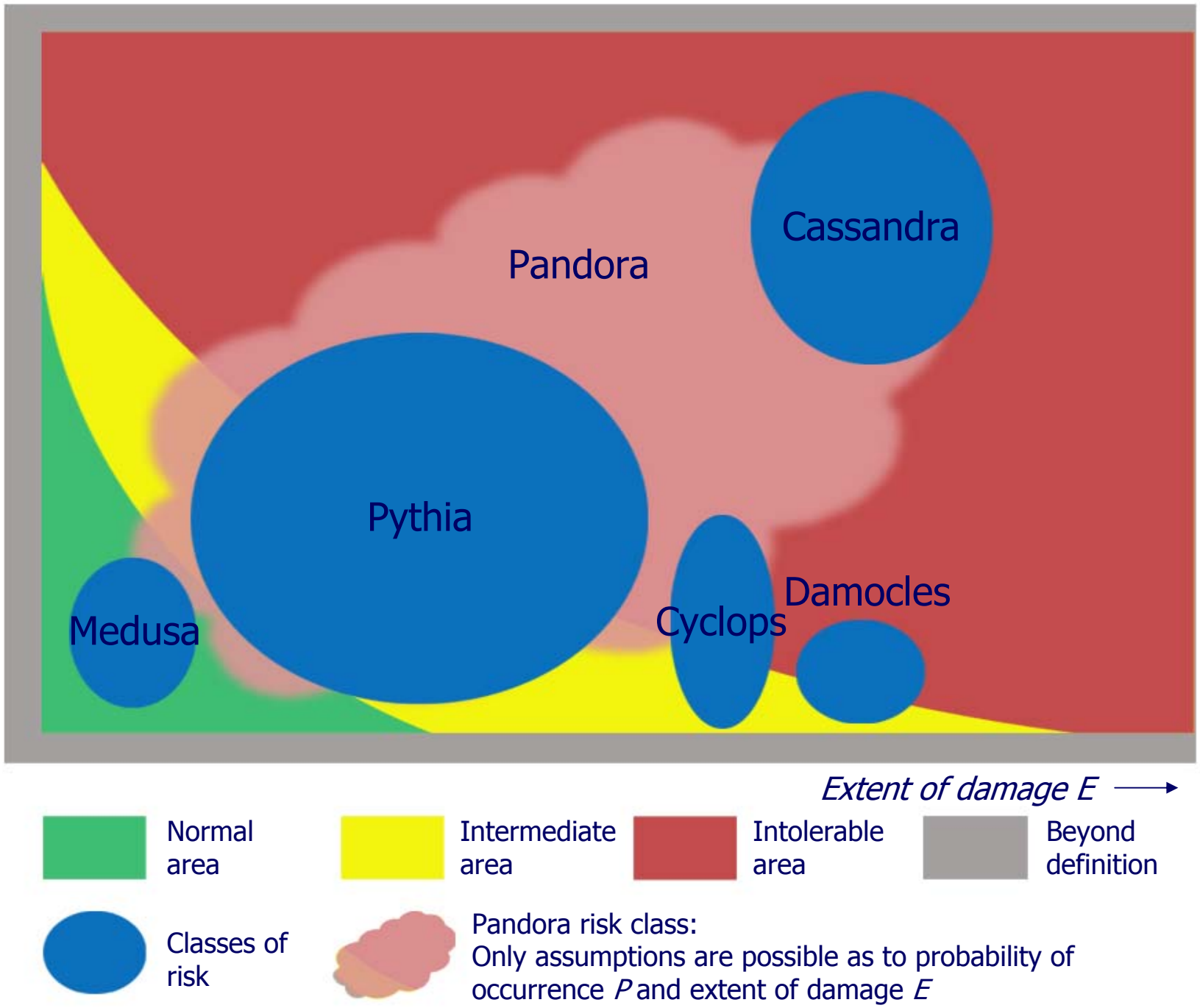
Probability of occurrence P
Intolerable area
Intermediate area
Normal area
Extent of damage E
Normal area
Intermediate area
Intolerable area
Beyond definition


Cassandra
Pandora
Pythia
Medusa
Cyclops
Damocles
Extent of damage E
Normal area
Intermediate area
Intolerable area
Beyond definition
Classes of risk
Pandora risk class:
Only assumptions are possible as to probability of occurrence P and extent of damage E

PART II

The Precautionary Principle

Strategies for dealing with uncertainty and ambiguity

Definitions of Precaution

- General: Acts of caution in the face of uncertainty
- Possibility of regulatory action even if conclusive evidence of harm is missing
- Additional safety margins beyond the No Adverse Effect Level (NOAEL)
- Shift of burden of proof
- Avoidance of irreversible damages

Open Questions

- Problem of arbitrariness
- Problem of predictability of regulatory outcome
- Problem of adjustments over time
- Who can use the discretionary power to what extent?
- What is the role of science, what the role of legal provisions, what the role for subjective interpretation?

Different Concepts of Precaution I

- *Original German Version:* precaution is the space between intervention point and residual risk
  - not related to second-order uncertainty
  - discretion for regulatory action beyond legally prescribed intervention point
- *Assessment based version:* conservative assessments within scientifically (or statistically) determined confidence intervals
  - worst case estimates within reason
  - xy percent of confidence interval
  - safety factor for threshold risk levels

Different Concepts of Precaution II

- *Management based version:* extra degree of safety in the light of ignorance
  - acknowledgement of systems boundaries
  - securing of reversibility of decisions
  - "better safe than sorry" attitude
- *Ambiguity based version:* extra degree of risk reduction in the light of controversy
  - cope with social conflict
  - appeasement policy

Principles of the EU (Communication 2000)

- Sound scientific expertise
- Burden of proof
- Consistence and coherences
- Non-discrimination
- Proportionality
- Cost-Benefit- Analysis
- Predictability for all actors (within reason)

PART III

What does that mean for
risk management and policy making

Towards a rational approach to regulation

Need for different risk management strategies

- dealing with routine, mundane risks
- dealing with complex and sophisticated risks (high degree of modeling necessary)
- dealing with highly uncertain risks (high degree of second order uncertainty)
- dealing with highly controversial risks (high degree of ambiguity)
- dealing with eminent dangers (need for fast responses)

Risk Management Strategies I
Coping with routine and complexity

- **Routine Risk Management**
  - Sufficient knowledge of key parameters
  - Little complexity, clear causal knowledge
  - Standard Assessment
  - Risk-Benefit Analysis
  - Risk-risk-comparisons

- **Risk-Based Management**
  - High complexity
  - Little uncertainty and ambiguity
  - Expanded risk assessment/Knowledge management
  - Risk standards with safety factors
  - Risk-Benefit Comparison

Examples:Risk-Based Management

- Industrial plants with hazardous material
- Large dams
- Bridges and highways
- LNG Terminals
- Weapon complexes
- Dense settlements
- Classic infectious diseases
- Deterministic health risks (threshold)

Risk Management Strategies II
Coping with high uncertainty

- Precaution-Based Management
  - High uncertainty or ignorance
  - Adverse effects plausible
  - Appraisal of uncertainty
  - Goal: avoidance of irreversible effects
  - Instruments:
    - Negotiation between too little and too much precaution
    - classic: ALARA etc.
    - new: containment, diversification, monitoring; substitution

Examples: Precaution-Based Management

- "Green" biotechnology
- Internet sabotage
- New epidemics (new mutations)
- BSE
- Endocrine disruptors
- Extreme weather events due to global climate change

Risk Management Strategies III
Coping with ambiguity and crisis

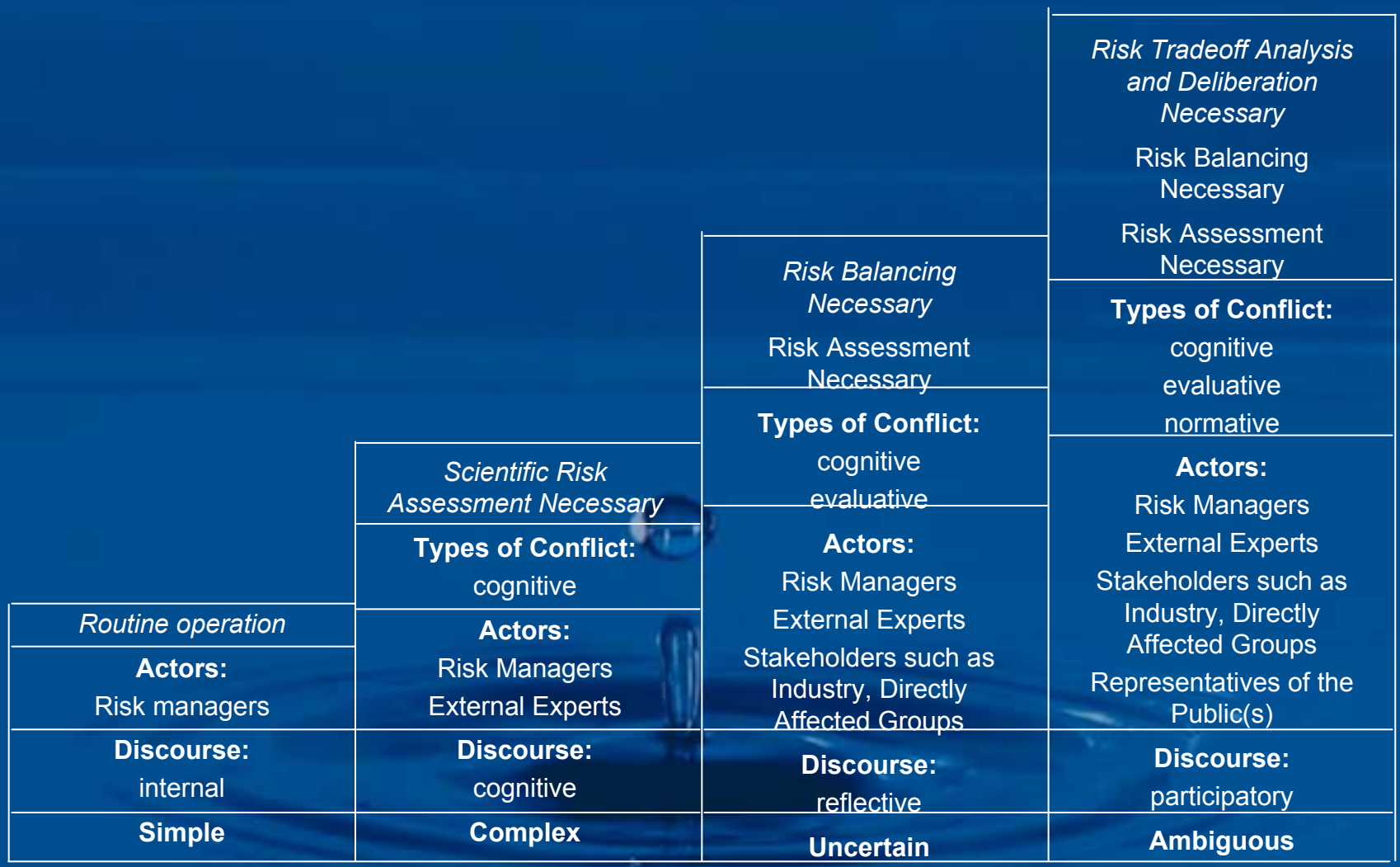
- **Discourse-Based Management**
  - High ambiguity
  - Goal: to find consensus or tolerance
  - Instruments:
    - stakeholder involvement
    - public debate
    - risk communication
- **Prevention (eminent danger)**
  - clearly intolerable risk
  - banning or substitution
  - exception: extreme benefit

Examples: Discourse-Based Management

- "Red" biotechnology and genetic engineering
- "Industrial" food production
- Biochips for human implementation
- Electromagnetic fields
- Globalization of consumer technologies
- Projects of geo-engineering

The Risk Management Escalator

(from simple via complex and uncertain to ambiguous phenomena)



PART IV

Conclusions

Conclusions I

- Precaution is still a fuzzy concept that has different meanings in different concepts
- There is an agreement among all risk professionals that a precautionary approach in risk assessment is prudent
- There is clear disagreement about the role of precaution in risk management
- The most controversial issues are avoidance of arbitrary regulation and dismissal of scientific evidence

Conclusions II

- Five risk management regimes should be used to deal with risks:
  - routine risk management: standard risk assessments
  - *risk-based management:* expanded risk assessments; risk-benefit ratios
  - *precaution-based management:* negotiated safety level under uncertainty; containment
  - *discourse-based management:* more public input and stakeholder involvement;
  - *prevention*: phasing out except for special benefits

Quote:

- What man desires is not knowledge but certainty

  Bertrand Russel

- Policy makers cannot produce certainty but can help people to develop coping mechanisms to deal prudently with the necessary uncertainty that is required for societies to progress