Communicating Uncertainty

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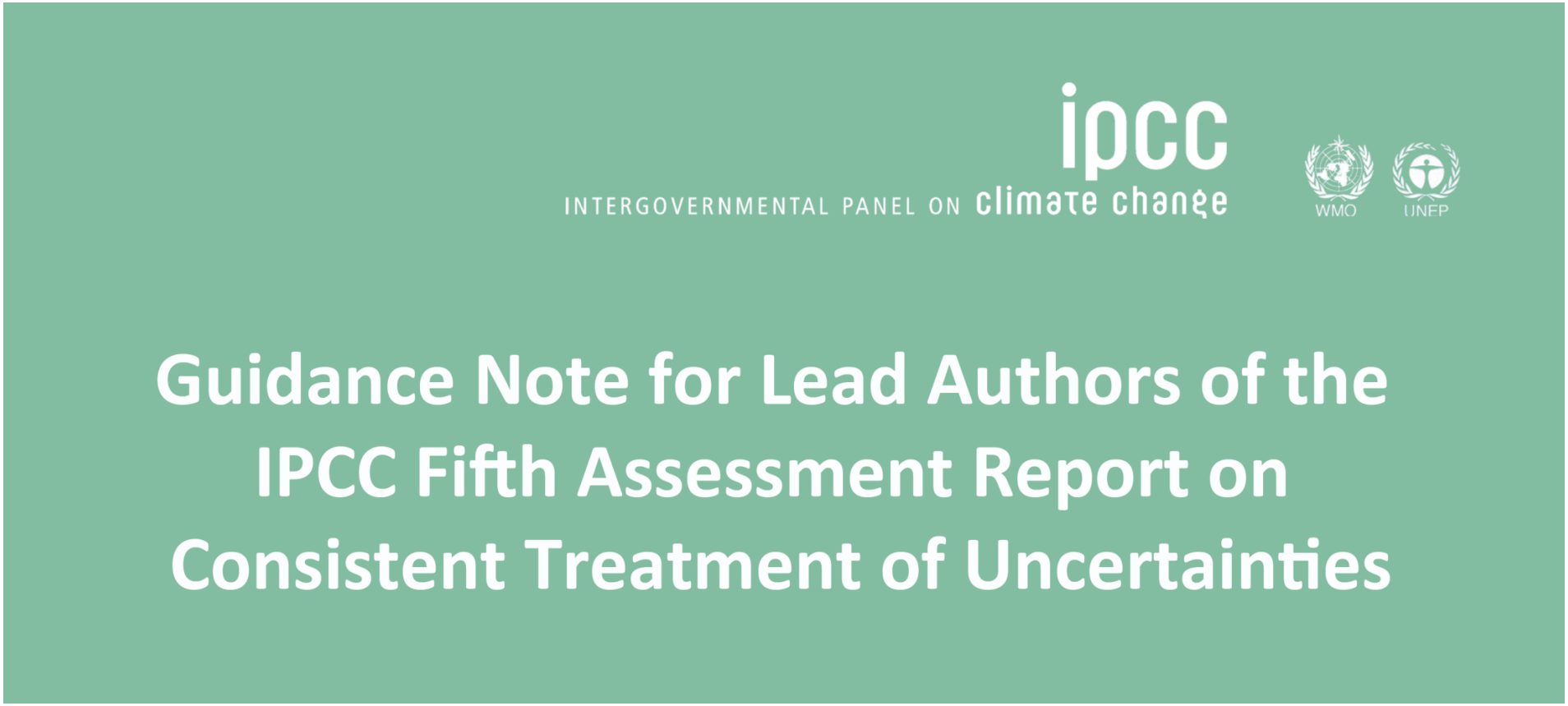


http://www.ipcc-wg2.gov/meetings/CGCs/Uncertainties-GN_IPCCbrochure_lo.pdf

Degree of Certainty for Findings: Process Overview

- **First step is an evaluation of evidence and agreement**
  - Provides basis for any key findings
  - Traceable account
- **Two metrics based on this evaluation**
  - Level of *confidence* in the validity of a finding
    - Qualitative
  - *Quantified measures of uncertainty* in a finding
    - Expressed probabilistically

Evaluation of Evidence and Agreement

Evidence

- Type (e.g., mechanistic understanding, theory, data, models, expert judgment)
- Amount
- Quality
- Consistency

Agreement

- Measure of the consensus across the scientific community
- Not just consensus across an author team

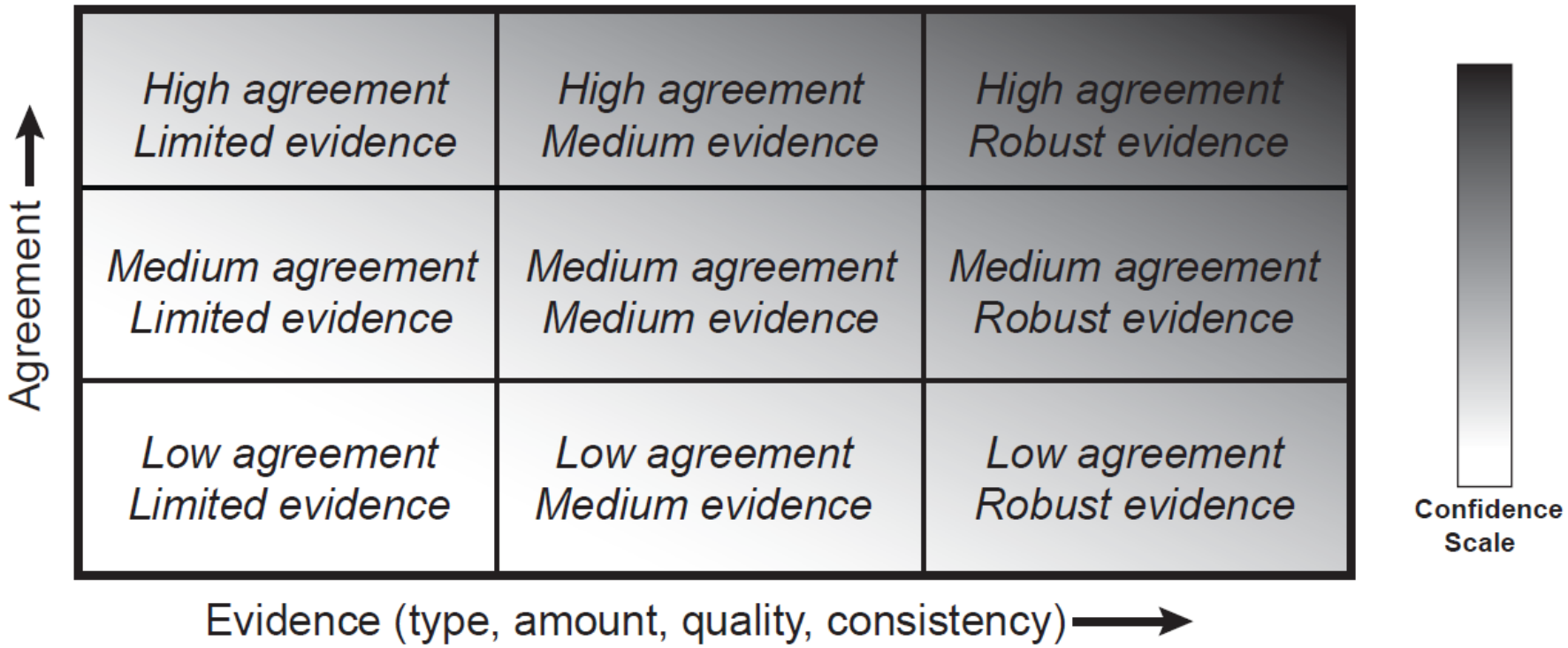
Summary Terms for Evaluation

- **Evidence: “limited,” “medium,” “robust”**

- **Agreement: “low,” “medium,” “high”**

Confidence

- **Confidence synthesizes evaluation of evidence and agreement into a judgment about the validity of a finding.**

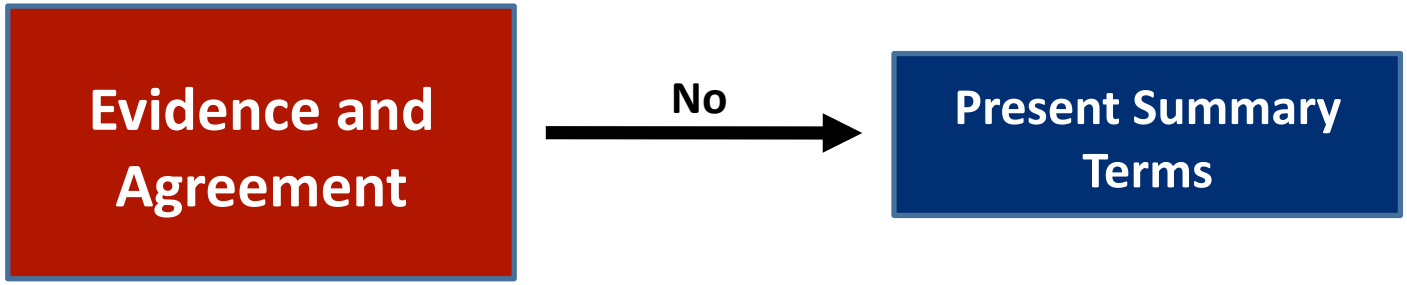


Levels of Confidence

- **Confidence synthesizes evaluation of evidence and agreement into a judgment about the validity of a finding**

“Very high”
“High”
“Medium”
“Low”
“Very low”

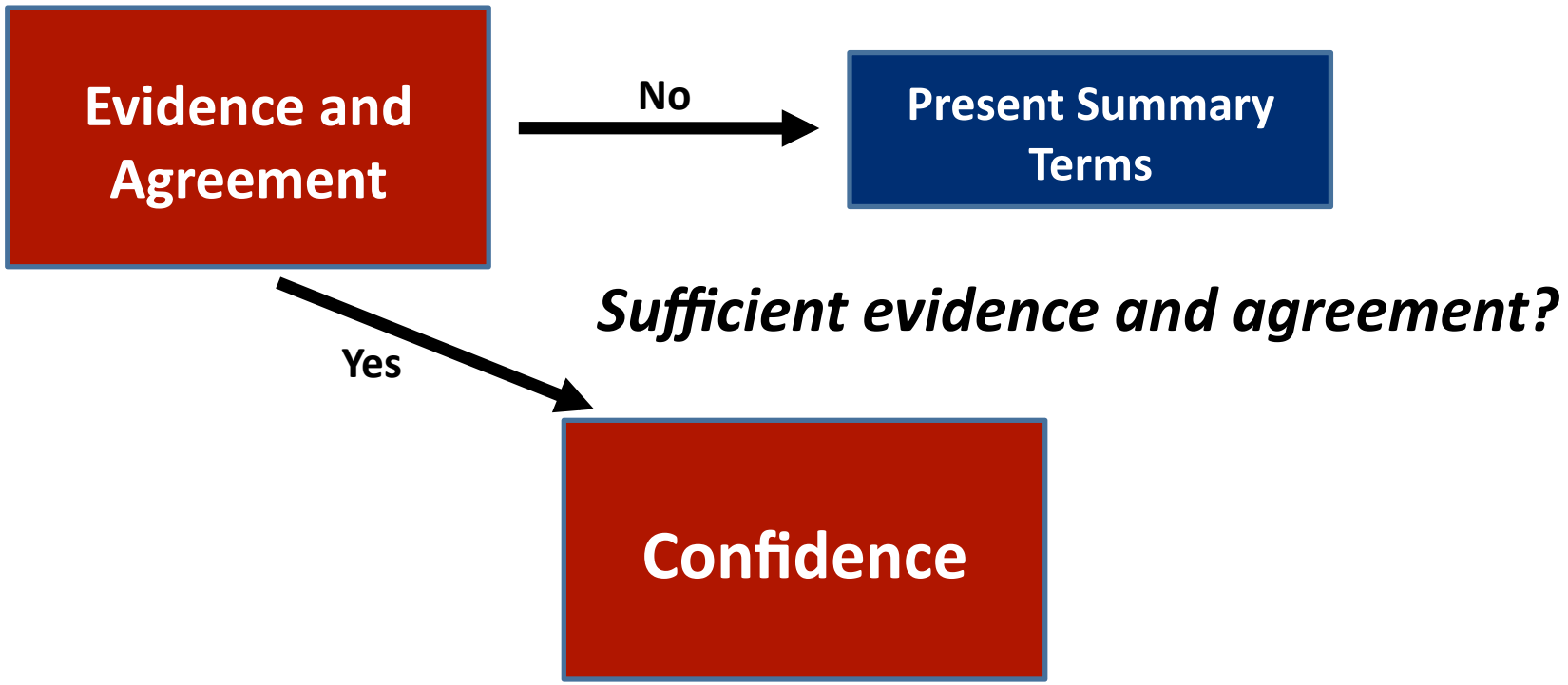
Degree of Certainty for Findings: Process



Sufficient evidence and agreement?

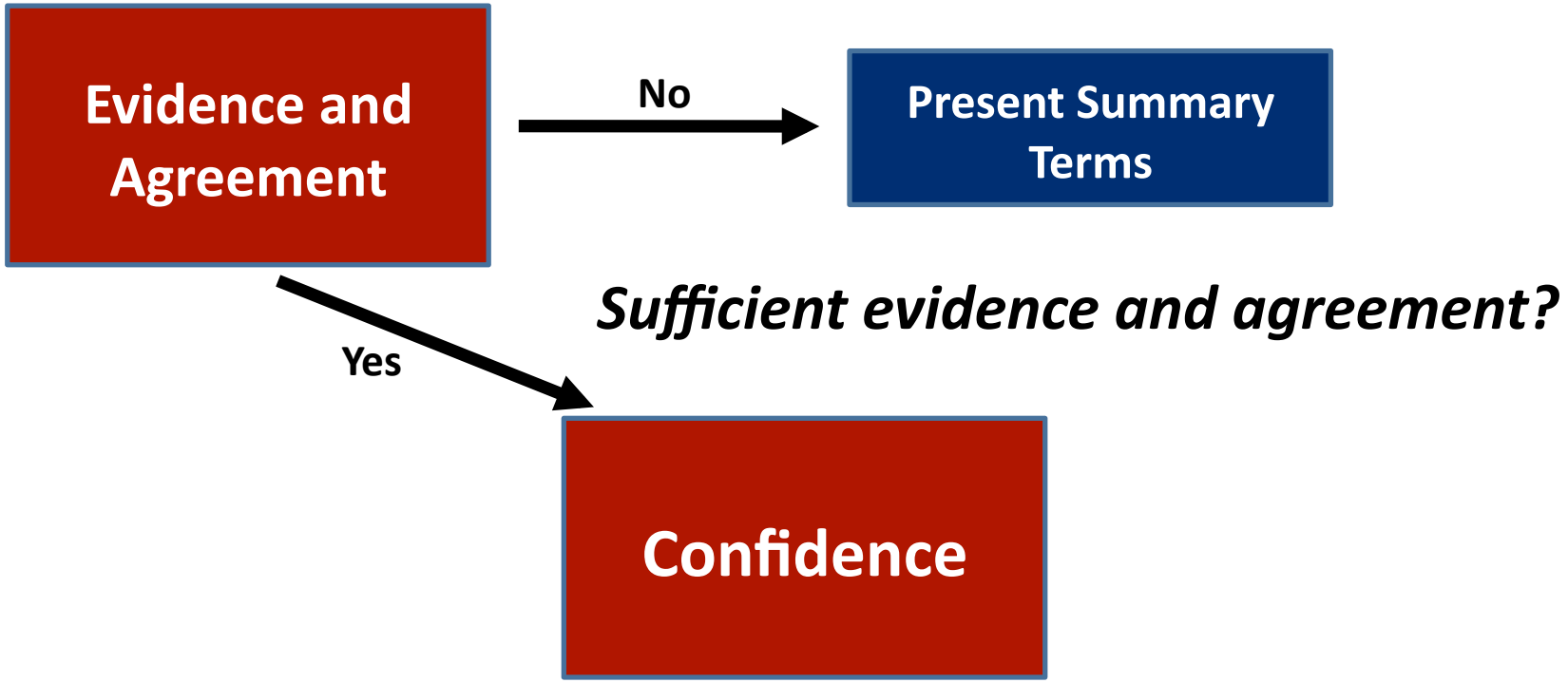
- **Hypothetical Example: The observed increases in economic losses from all weather-related disasters cannot be conclusively linked to climate change given *medium evidence* and *low agreement*.**

Degree of Certainty for Findings: Process



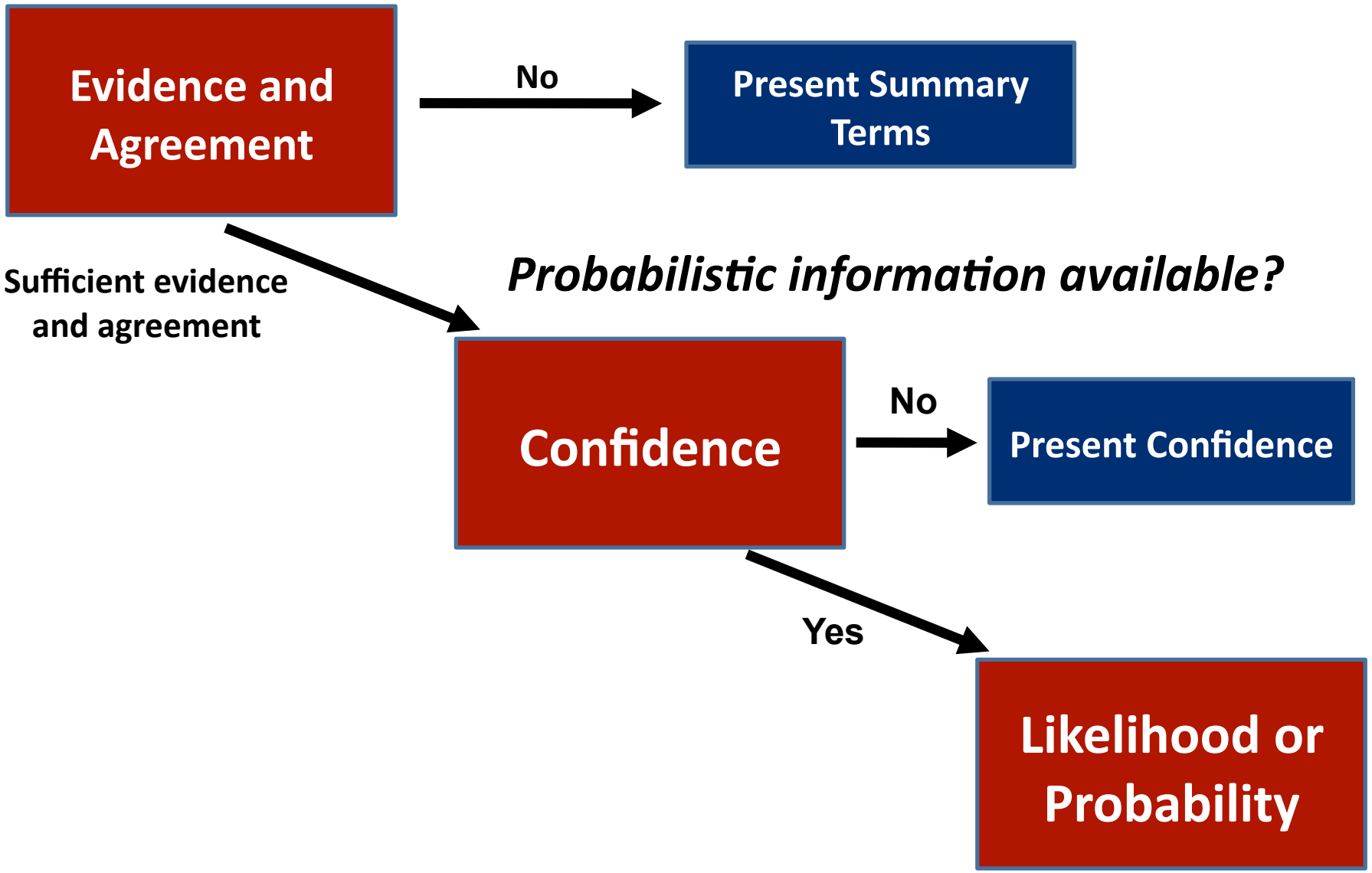
- **Hypothetical Example: There is *medium confidence* that climate change has altered the distribution of infectious disease vectors, including mosquitoes, rodents, and molluscs.**

Degree of Certainty for Findings: Process



- **Hypothetical Example: There is *high confidence* that anthropogenic warming over the last three decades has had a discernible influence on many physical and biological systems, given consistency between observed and modeled changes at global and regional levels.**

Degree of Certainty for Findings: Process



Probabilistic estimate

- **Likelihood expresses a probabilistic estimate of the occurrence of a single event or of an outcome lying in a given range.**

Term	Likelihood of the outcome
Virtually certain	99-100% probability
Very likely	90-100% probability
Likely	66-100% probability
About as likely as not	33 to 66% probability
Unlikely	0-33% probability
Very unlikely	0-10% probability
Exceptionally unlikely	0-1% probability

- **Use more precise probability ranges when appropriate.**

Probabilistic estimate

- **Hypothetical Example: By 2080, without planned adaptation, it is *likely* that 1.1 to 3.2 billion people will be experiencing water scarcity under the A2 scenario.**

Term	Likelihood of the outcome
Virtually certain	99-100% probability
Very likely	90-100% probability
Likely	66-100% probability
About as likely as not	33 to 66% probability
Unlikely	0-33% probability
Very unlikely	0-10% probability
Exceptionally unlikely	0-1% probability

Probabilistic estimate

- **Hypothetical Example: Areas affected by drought are *likely* to increase over the 21st century, under the range of RCP climate projections. There is *high confidence* that an increase in areas affected by drought would decrease cereal grain production in those areas.**

Term	Likelihood of the outcome
Virtually certain	99-100% probability
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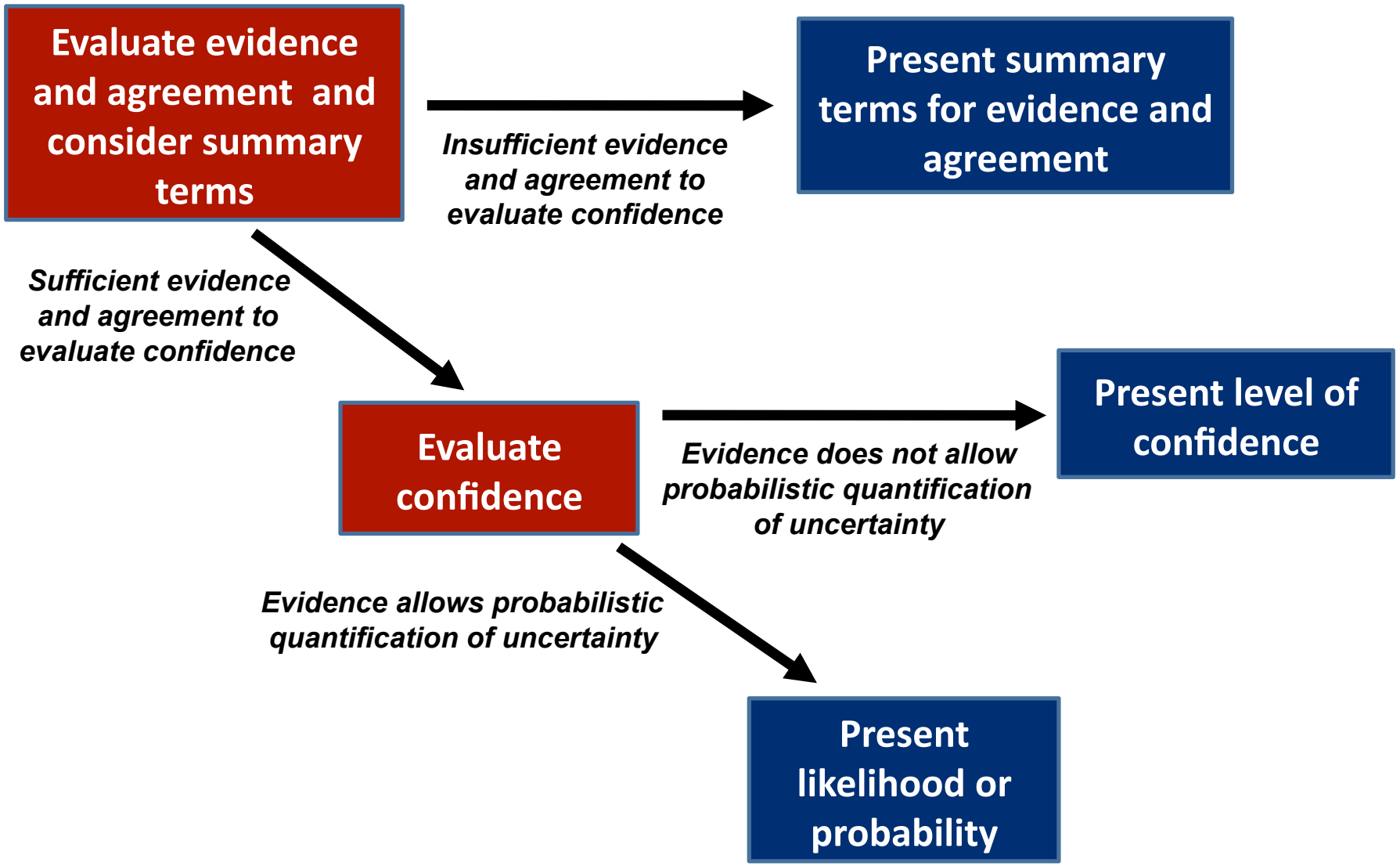

International Agency for Research on Cancer

- Founded in 1965 to provide government authorities with expert, independent, scientific opinion on the causes of human cancer
- Examine all relevant information in order "to assess the strength of the available evidence that an agent could alter the age-specific incidence of cancer in humans"
- Evaluations of IARC working groups are scientific judgments of the evidence for or against carcinogenicity based on the available data
- IARC Monographs are used by national and international authorities in risk assessments, to formulate decisions concerning preventive measures, to provide effective cancer control programs, and to decide among alternative options for public health decisions
  - No recommendations are made with regard to regulation or legislation
- Process similar to IPCC

IARC Standard Terms for Evaluation of Strength of Evidence

- There is *sufficient evidence of carcinogenicity* in humans when a causal relationship has been established between exposure to the agent and human cancer; chance, bias, and confounding can be ruled out with reasonable confidence.
- There is *limited evidence of carcinogenicity* when a positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.
- There is *inadequate evidence of carcinogenicity* when available studies are of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.
- There is *evidence suggesting lack of carcinogenicity* when there are several adequate studies covering the full range of levels of exposure that humans are known to encounter that are consistent in not showing a positive association between exposure to the agent and any studied cancer at any observed level of exposure. The results from these studies alone or combined should have narrow confidence intervals, and bias and confounding should be ruled out with reasonable confidence.

IARC Summary Evaluation Categories

- Group 1: The agent is *carcinogenic to humans*.
  - This category is used when there is *sufficient evidence of carcinogenicity* in humans.
- *Group 2A: The agent is probably carcinogenic to humans*.
  - This category is used when there is *limited evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals.
- *Group 2B: The agent is possibly carcinogenic to humans*.
  - This category is used for agents for which there is *limited evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals
- Group 3: The agent is *not classifiable as to its carcinogenicity to humans*.
- Group 4: The agent is *probably not carcinogenic to humans*.


ARE YOUR PROJECTIONS REALISTIC OR OPTIMISTIC?
THEY'RE HALFWAY BETWEEN A LUCID DREAM AND A NEAR-DEATH HALLUCINATION.
I'LL CALL THEM "MOST LIKELY."
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