

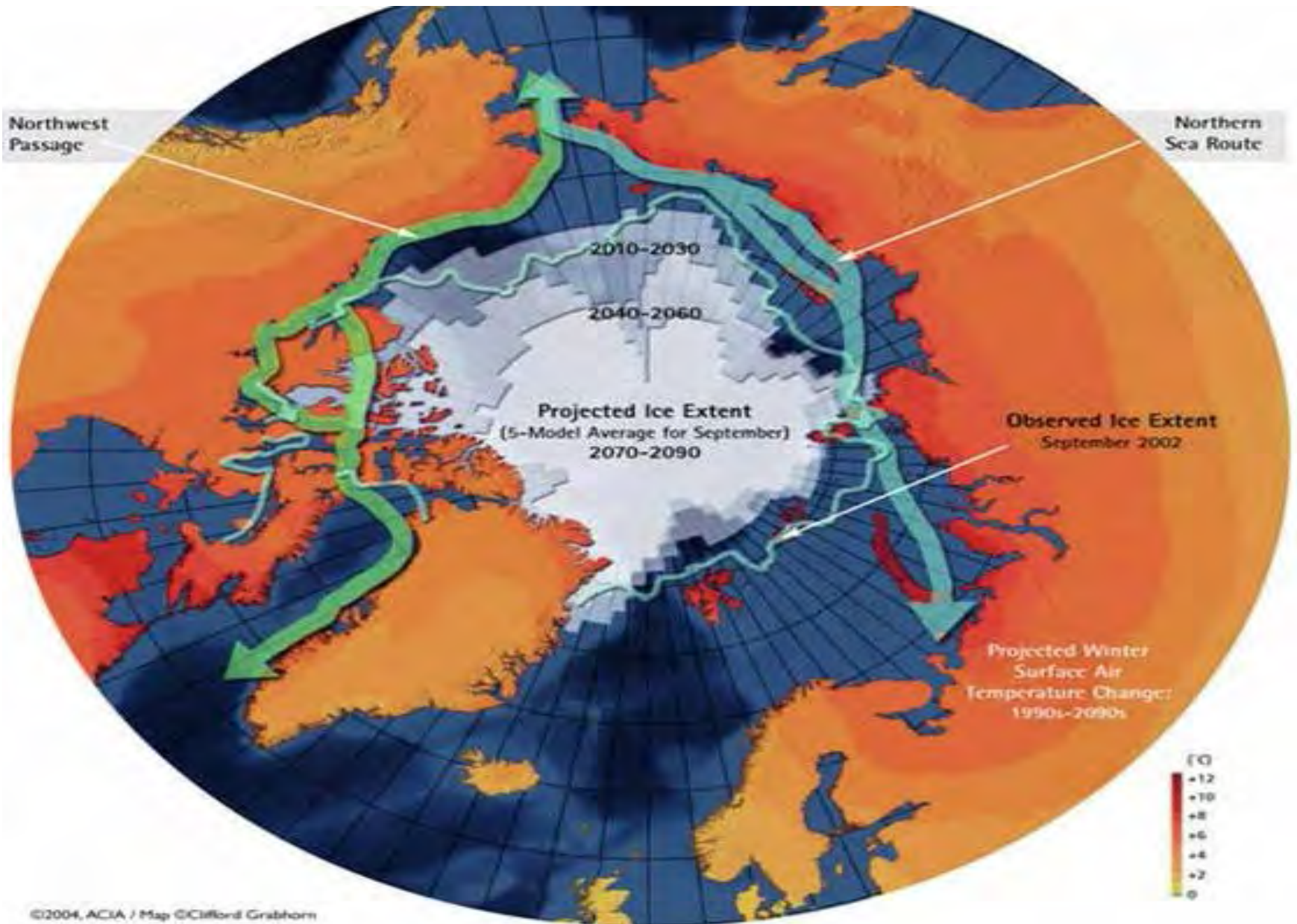


SCENARIOS OF CLIMATE CHANGE AND SHIPPING IMPACTS IN ARCTIC WATERS

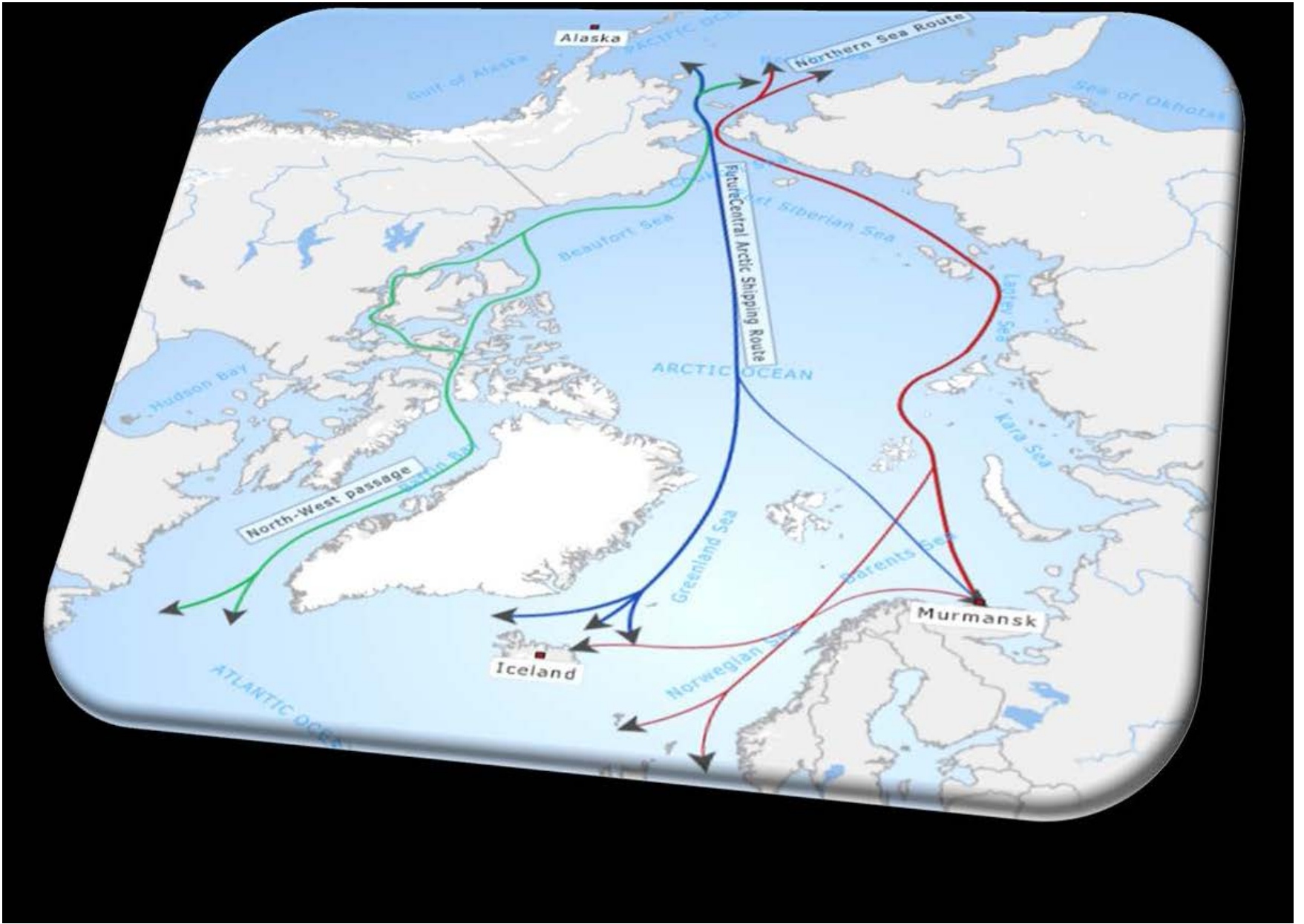
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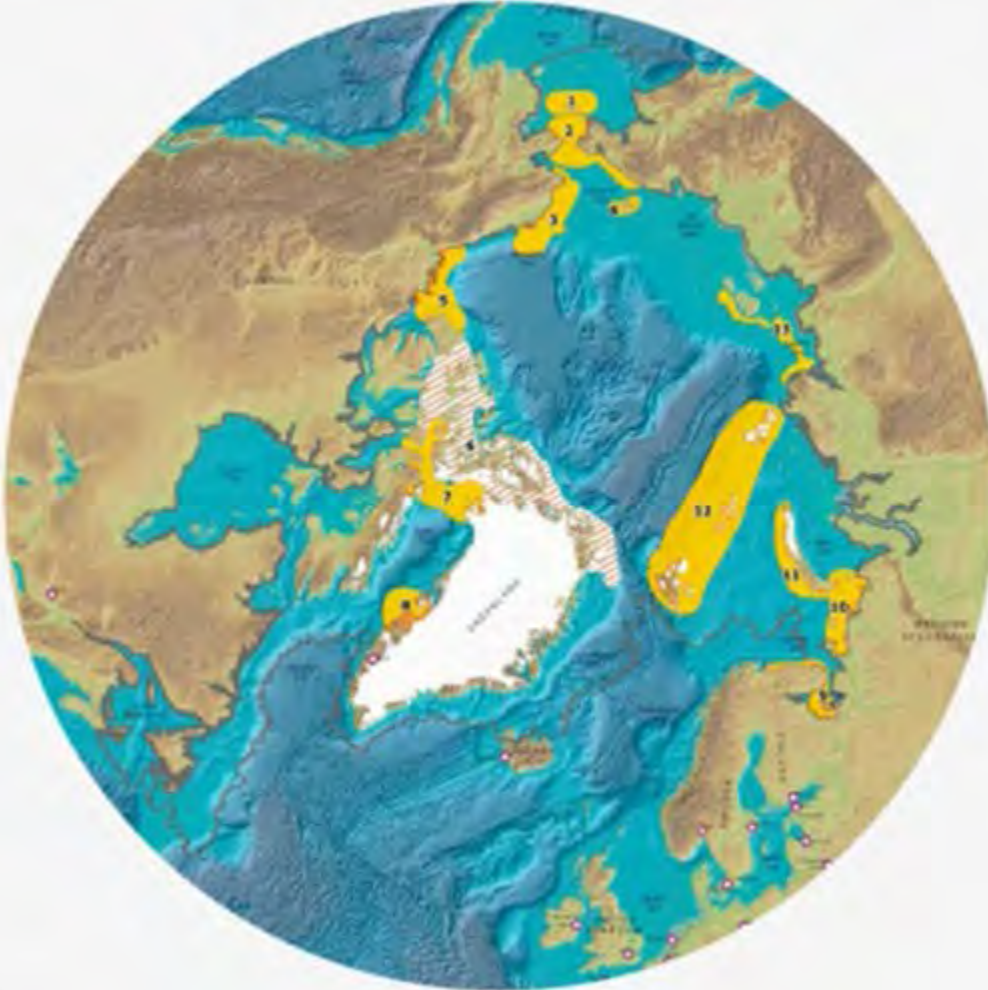




POSSIBLE IMPACTS OF SHIPPING



AREAS WITH VULNERABLE SPECIES AND HABITATS



Super EBSA Overview

1. St. Lawrence Island
2. Bering Strait
3. Chuckchi Beaufort Coast
4. Wrangel Island
5. Beaufort Sea Coast/ Cape Bathurst
6. Polar Pack (projected)
7. North Water Polynya/ Lancaster Sound
8. Disco Bay/ Store Hellekiskebanke
9. White Sea/ Barents Sea Coast
10. Pechora Sea/ Kara Gate
11. Novaya Zemlya
12. High Arctic Islands and Shelf
13. Great Siberian Polynya

SHIPPING AND BALLAST WATER

BALLAST WATER:

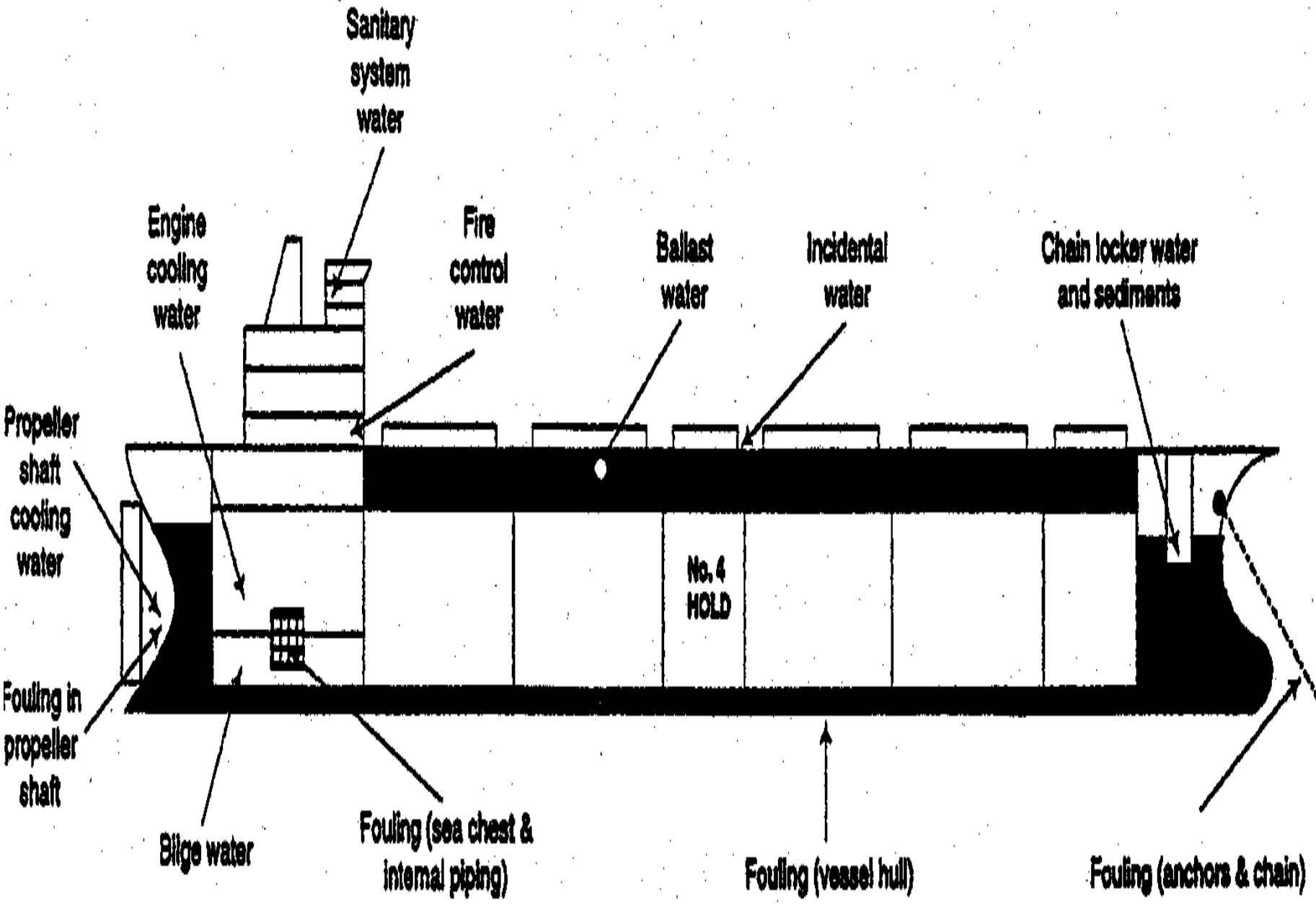
WATER TAKEN ON BOARD A SHIP TO CONTROL TRIM, CARGO, DRAGHT, STABILITY AND STRESS OF THE SHIP

POSSIBLE IMPACTS:

- *ALIEN BIO-ORGANISMS CAN REDUCE NATIVE BIO-DIVERSITY*
- *ALTER HABITAT*
- *CHANGE THE FOOD-WEBS*
- *CREATE ALGAE BLOOMS*

SPECIAL VULNERABILITY IN THE ARCTIC:

- *BIO-DIVERSITY OF SPECIES IS FUNDAMENTAL TO THE LIFE SUPPORT OF THE RESIDENTS*
- *BIO-DIVERSITY IN THE ARCTIC ARE ALSO IMPORTANT FOR MIGRATION AND BIO-DIVERSITY OF THE MORE SOUTHERN LATITUDES*



Physical solid-liquid separation

Treatment:

- Hydrocyclone
- Surface filtration

Chemical enhancement:

- Coagulation/
Flocculation



Disinfection

Chemical treatment:

- Chlorination
- Electrochlorination or electrolysis
- Ozonation
- Peracetic acid
- SeaKleen
- Chlorine dioxide

Residual control:

- Chemical reduction (sulphite/bisulphite)

Physical enhancement:

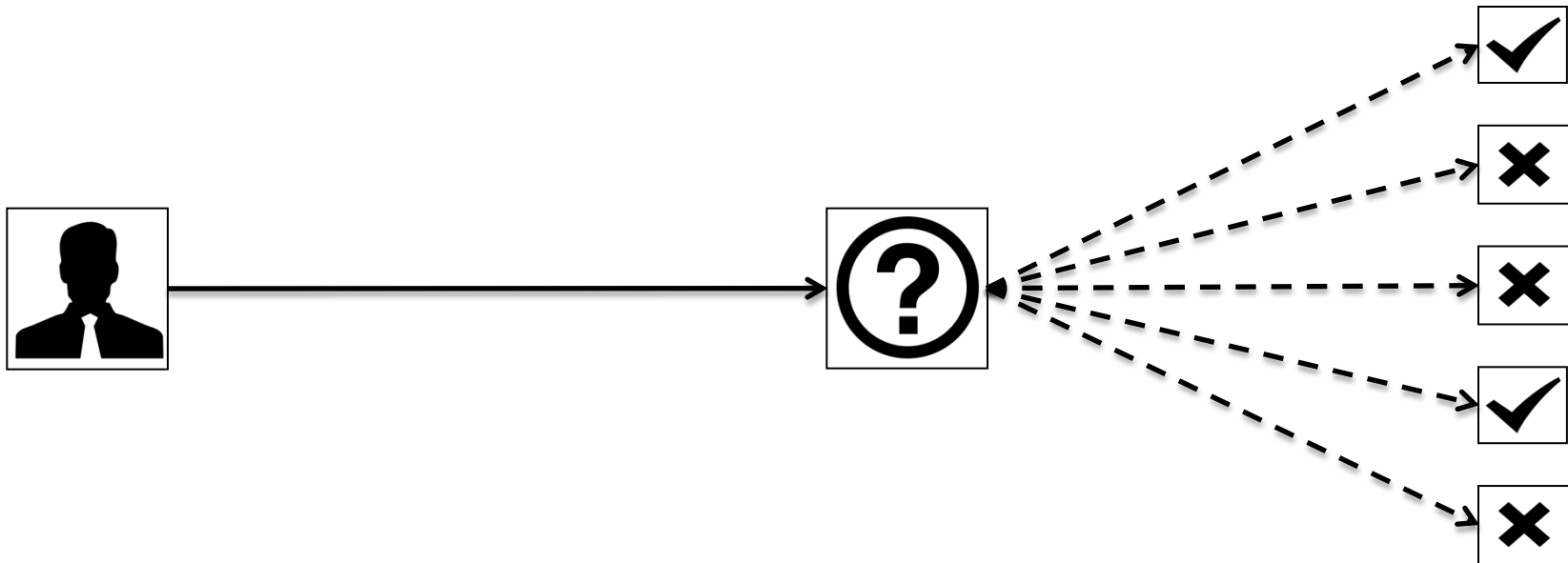
- Ultrasonic treatment
- Cavitation

OR

Physical

- UV irradiation
- UV + TiO₂
- Deoxygenation
- Gas injection
- Ultrasonic treatment
- Cavitation

Strategic Foresight

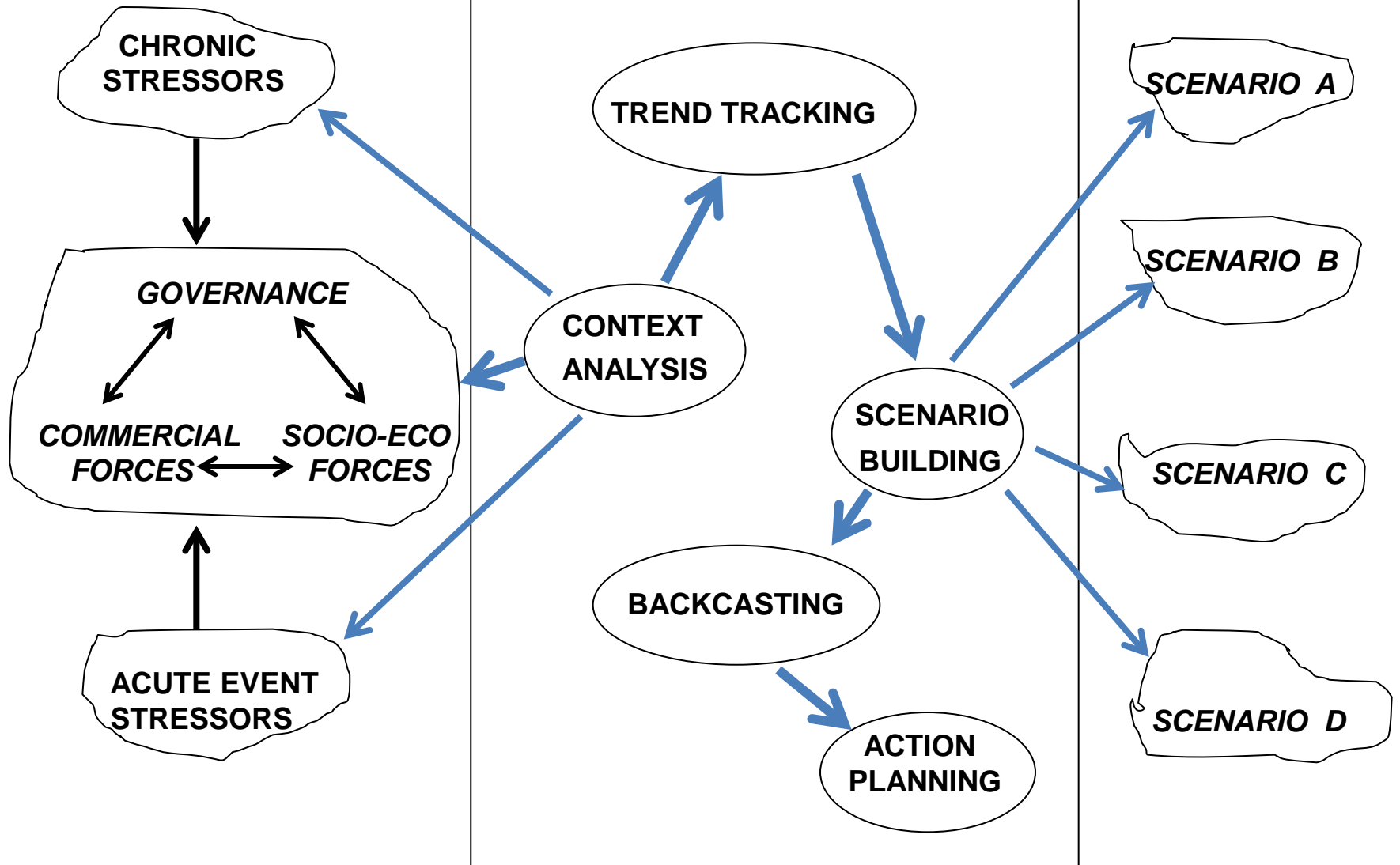


“Foresight is the ability to see how the future might unfold” – (Peter & Jarratt, 2014)

**CURRENT VULNERABILITY /
RESILIENCE STATUS**

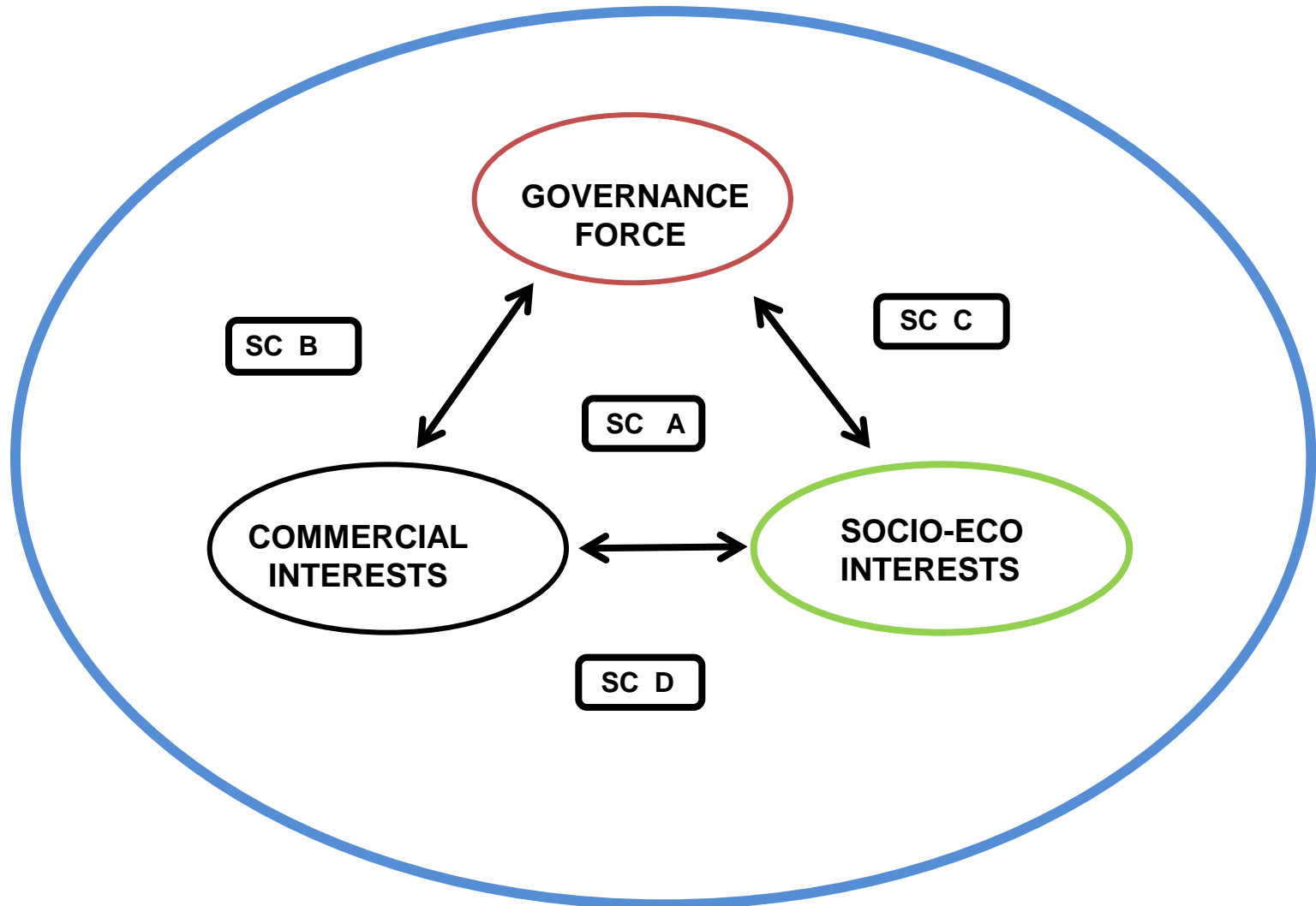
**FORESIGHT OF CLIMATE CHANGE
ADAPTIONS AND TRANSFORMATIONS**

**FUTURE POSSIBLE
VULNERABILITIES /
RESILIENCES**





POSSIBLE SCENARIO VARIATIONS



SCENARIO A: UNITED ARCTIC GOVERNANCE

COALITIONS

- **GLOBAL COALITION**
↓
• **ARCTIC COUNCIL**
- **STATES**
+
COMPANIES
+
NGOs
- **ARCTIC STATES**
+
NON-ARCTIC STATES

GOVERNANCE SYSTEM

- **BALANCED MANDATORY POLAR CODE**
- **UNIFORM MONITORING SYSTEMS**
- **MODERATE INTERNATIONAL POLICE FORCE**
- **MODERATE UNIFORM SANCTION SYSTEM**

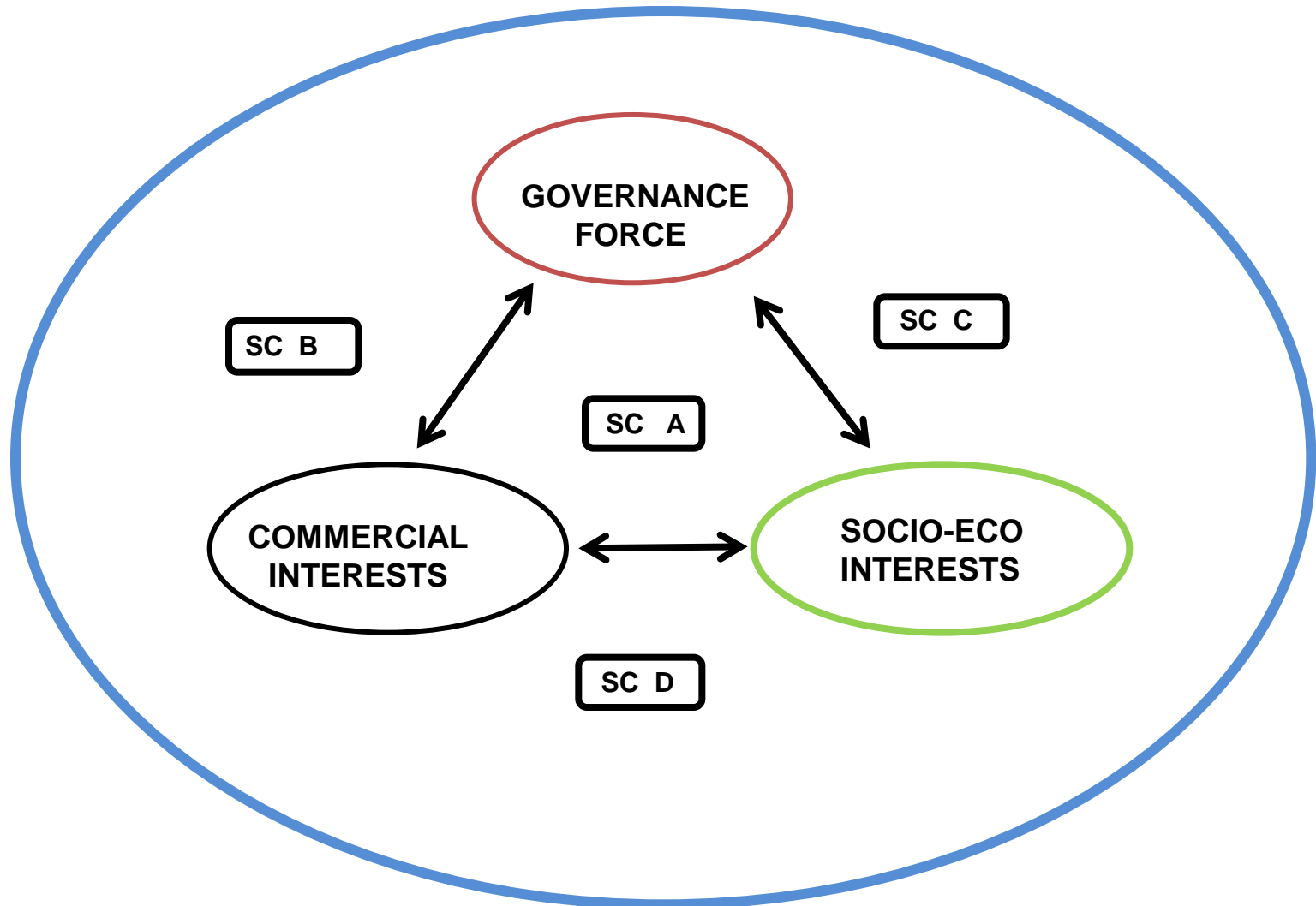
COMMERCIAL PRIORITIES

- **BALANCED EXPLOITATION / PROTECTION**
- **UNIFORM REGULATIONS / SANCTIONS**
- **SIMILAR COSTS**
- **INTERNATIONAL SECURITY**
- **BWMT: MODERATE COSTS + MAX. SECURITY + MIN. HARMS**

SOCIO-ECO PRIORITIES






- **PROTECTION OF THE MOST SENSITIVE ARCTIC AREAS**
- **USE OF STILL LESS POLLUTING FUELS AND WASTE SYSTEMS**
- **INNOVATIVE ACCIDENT PREVENTION SYSTEMS**
- **SUSTAINABLE SHIPPING TECHNOLOGIES ADAPTED TO ARCTIC AREAS**

POSSIBLE SCENARIO VARIATIONS





SCENARIO B: COMMERCIAL GOVERNANCE

COALITIONS AND ANTI-COALITIONS

- **EASTERN**

WESTERN
- **STATES**

COMPANIES

NGOs
- **EASTERN RESEARCHERS**
 
WESTERN RESEARCHERS

GOVERNANCE SYSTEM

- **EASTERN POLAR CODE**
 
WESTERN POLAR CODE
- **DIFFERENT MONITORING SYSTEMS**
- **DIFFERENT AND INEFFECTIVE SANCTION SYSTEMS**
- **WEAK POLICE FORCES**

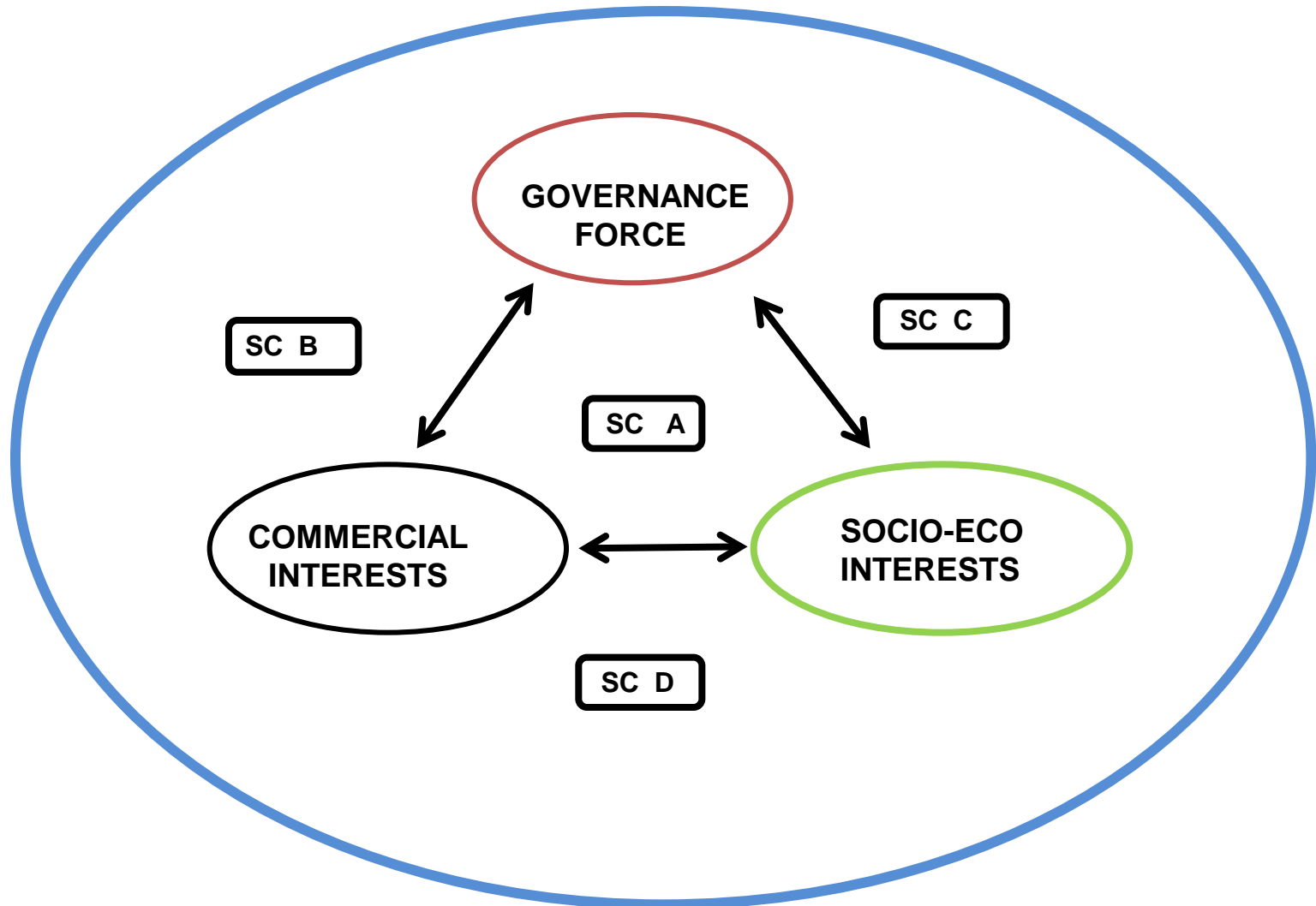
COMMERCIAL PRIORITIES

- **STRONG ARCTIC EXPLOITATION**
- **EAST / WEST PROTECTIONISM**
- **EFFECTIVE LOGISTICS**
- **LOWEST POSSIBLE COSTS**
- **MIN. REGULATIONS**
- **BWMT: LOWEST COSTS VOLUNTARY**

SOCIO-ECO PRIORITIES

- **COSTS OVER HARMS**
- **MIN. PROTECTIVE REGULATIONS**
- **UNLIMITED EXPLOITATION OF ARCTIC RESOURCES**
- **ATTEMPTS TO "GREEN WASHING"**

POSSIBLE SCENARIO VARIATIONS



SCENARIO C: SOCIO-ECOLOGICAL GOVERNANCE

COALITIONS AND ANTI-COALITIONS

- *ARCTIC STATES*
↓
ARCTIC COUNCIL
- *ARCTIC STATES*
+
NGOs
+
RESEARCHERS
- *ARCTIC STATES*
+
NON-ARCTIC STATES

GOVERNANCE SYSTEM

- *SOCIO-ECO MANDATORY POLAR CODE*
- *STRONG MONITORING SYSTEM*
- *STRONG POLICE FORCE*
- *STRONG SANCTION SYSTEM*

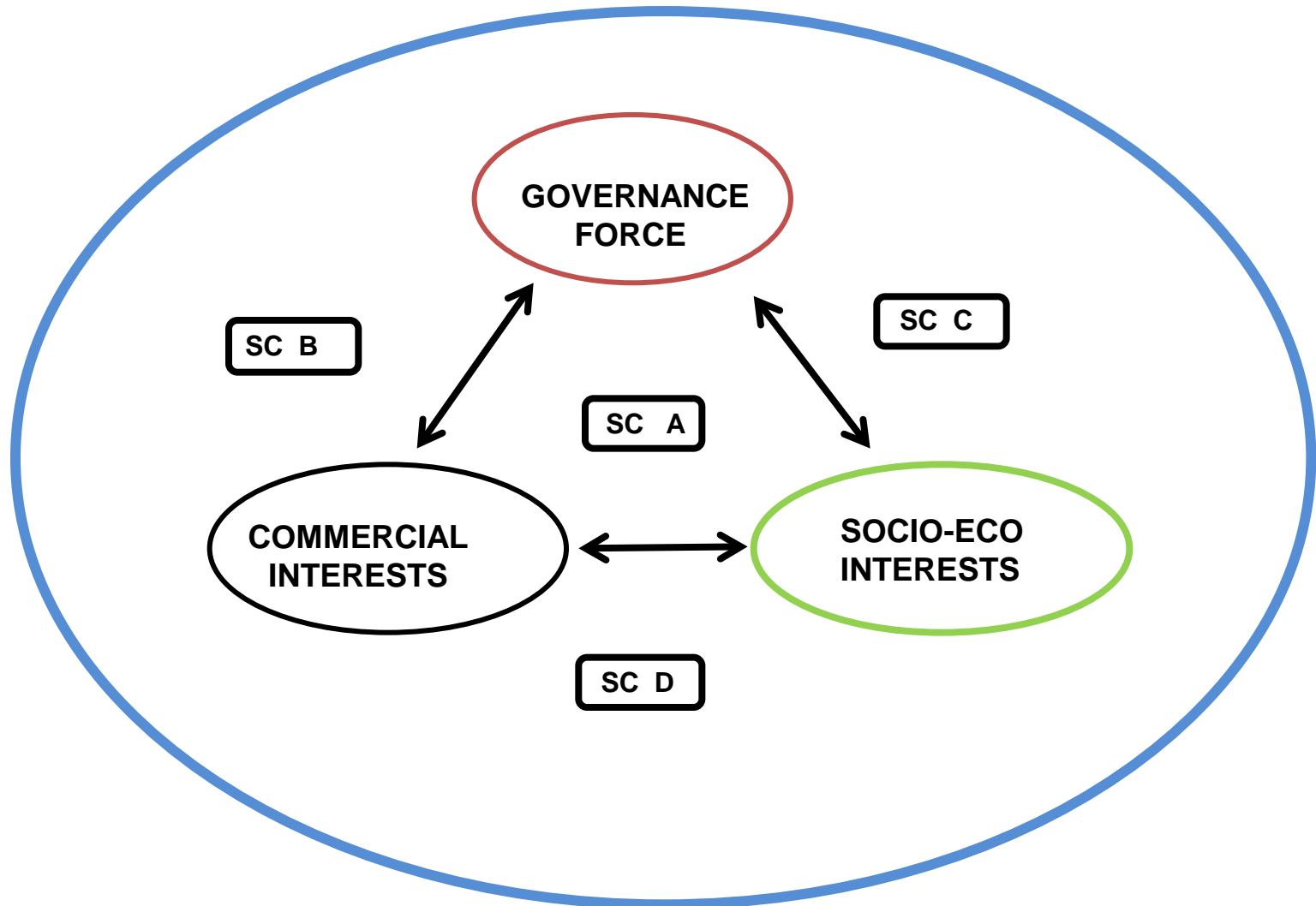
COMMERCIAL PRIORITIES

- *MINIMIZING HARMS*
- *UNIFORM REGULATIONS / SANCTIONS*
- *SIMILAR COSTS*
- *INTERNATIONAL SECURITY*
- *BWMS:*
MAX. SECURITY + MIN. HARMS

SOCIO-ECO PRIORITIES

- *PROTECTION OF ALL SENSITIVE ARCTIC AREAS*
- *"ZERO" GOALS*
- *USE OF FOSSIL-FREE FUELS*
- *ACCIDENT PREVENTION SYSTEMS*
- *SUSTAINABLE LIFE-CYCLES FOR ARCTIC ACTIVITIES*

POSSIBLE SCENARIO VARIATIONS



SCENARIO D: ARCTIC CARTELS

COALITIONS AND ANTI - COALITIONS

- *GREEN CARTELS*
+
MODERATE NGOs
- *GREEN CARTELS*
X
BLACK CARTELS
- *MODERATE NGOs*
X
RADICAL NGOS

GOVERNANCE SYSTEM

- *NATIONAL*
- *WEAK MONITORING*
- *WEAK POLICE FORCE*
- *WEAK SANCTION SYSTEM*

COMMERCIAL PRIORITIES

- *RESOURCE EXPLOITATION*
- *EFFECTIVE LOGISTICS*
- *LOW COSTS*
- *PRIVATE SECURITY SYSTEMS*
- *BWMT - GREEN: MINIMIZING HARM + SECURITY*
- *BWMS - BLACK: COSTS + SECURITY*

SOCIO-ECO PRIORITIES

GREEN CARTELS:

- *MINIMIZING HARMS*
- *"ZERO" GOAL*
- *BALANCED EXPLOITATION*

BLACK CARTELS:

- *COSTS OVER HARMS*
- *"FREE CHOICE"*
- *UNLIMITED EXPLOITATION*

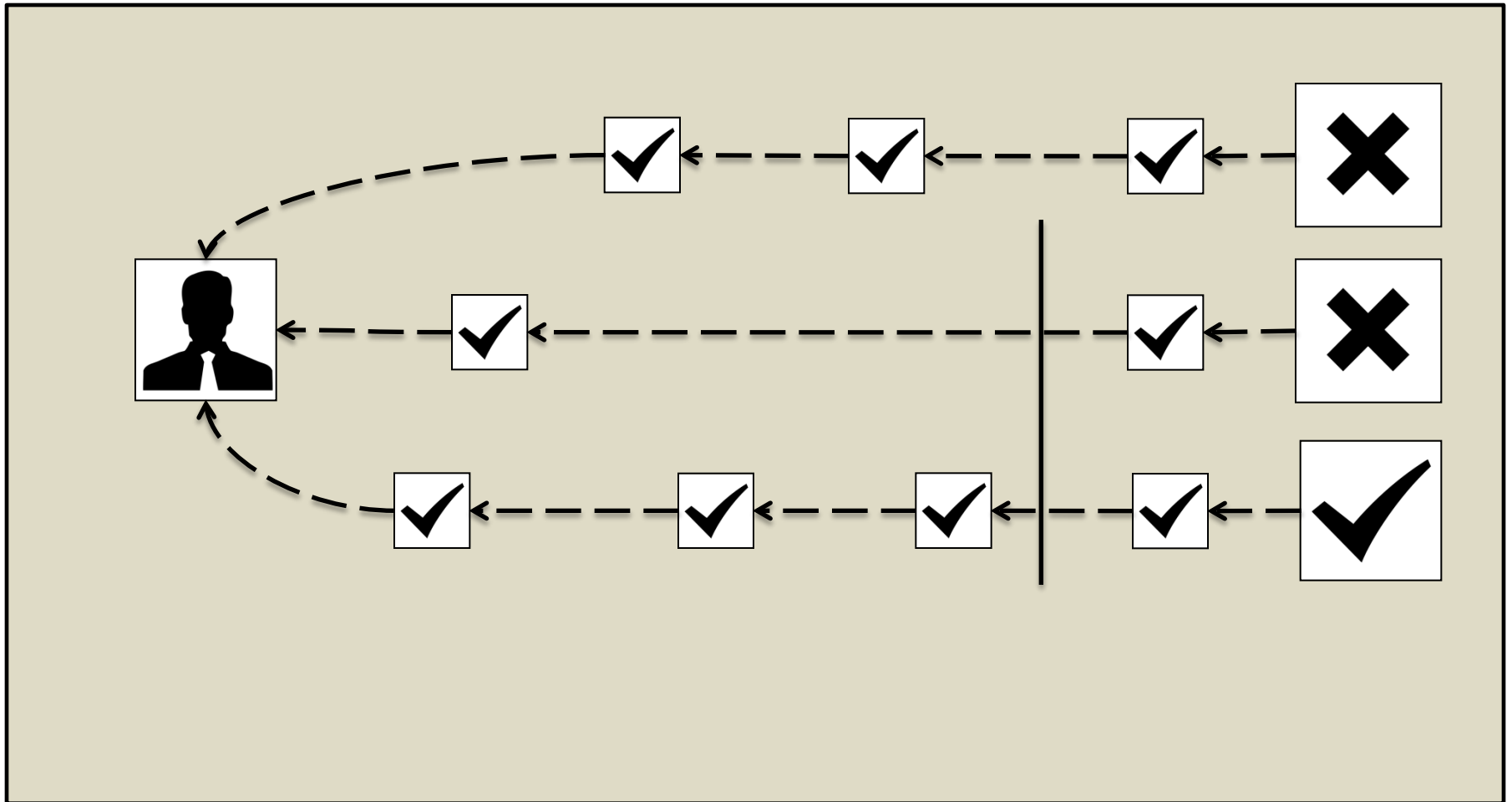


Back-Casting

Current situation

Short Term

Future



BACKCASTING STEPS

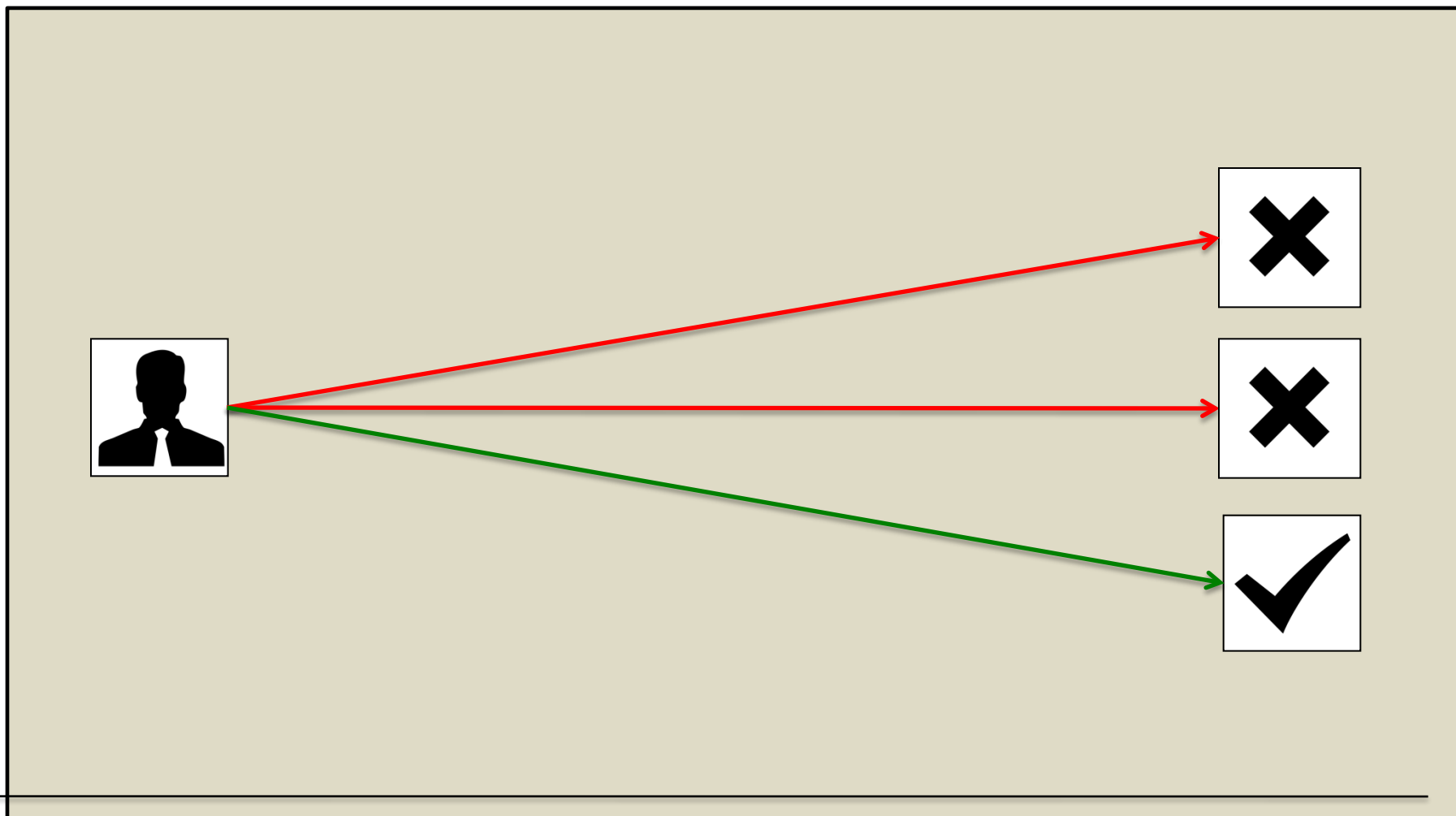
- *IDENTIFICATION OF CHANGE DIMENSIONS*
- *IDENTIFICATION OF CHANGE AGENTS*
- *COMBINATION OF EVENTS TO SEQUENCES OF CHANGE*
- *IDENTIFICATION OF POSSIBLE RELATIONSHIPS*
- *POSSIBLE CONSTRAINTS*
- *POSSIBLE SIDE-EFFECTS (NOT INTENDED BUT POSSIBLE)*

Action Planning

Current situation

Short Term

Long Term



ACTION PLANNING

- *THE GENERAL OBJECTIVE?*
- *PRECISELY DEFINED SUB-GOALS?*
- *MILESTONES IN REACHING THE GOALS?*
- *NEDEED RESOURCES?*
- *HOW TO OBTAIN RESOURCES?*
- *EXPECTED RESULTS?*
- *POSSIBLE CONSTRAINTS?*
- *STRATEGIES TO HANDLE THE CONSTRAINTS?*

**CURRENT VULNERABILITY /
RESILIENCE STATUS**

**FORESIGHT OF CLIMATE CHANGE
ADAPTIONS AND TRANSFORMATIONS**

**FUTURE POSSIBLE
VULNERABILITIES /
RESILIENCES**

