Adaptation and Change with Global Warming

The Emerging Spatial World-Structure and Transportation Impacts

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Introduction

- Climate change is traditionally linked with transportation
  - Consumption of fossil fuels
  - Contribution of greenhouse gas emissions
- Much research on these topics
  - Reducing fuel consumption and impacts
  - Technical aspects: road design, vulnerabilities, etc.
- This paper takes a different approach
  - Explores consequences of global warming on transportation at a global scale

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Introduction

- Global warming generally:
  - Hot and dry regions: Warmer and drier
    - Worse off ?
  - Cold regions: Warmer and wetter
    - Better off ? Perhaps in some respects
  - Arctic: projected to become much warmer
    - 7-13°F (4-7°C) warmer predicted this century
    - Retreat of ice: A runaway process

Valsson and Ulfarsson, 2009

Introduction

- Spatial Structure of Earth
  - Today: Ribbon around the globe
  - In the future: Evolution towards a semi-globe with Polar ice retreat
  - The Arctic at the center!
- Resource and Transport Consequences
  - Arctic resources: Mining, oil/gas extraction
  - Arctic shipping routes
- Geopolitical Importance of the Arctic

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The Emerging Spatial World-Structure

- The spatial structure of Earth is now a ribbon
- Habitation and economic activity falls mostly within the ribbon
- This ribbon is expanding towards the Poles with technology and retreat of Polar ice

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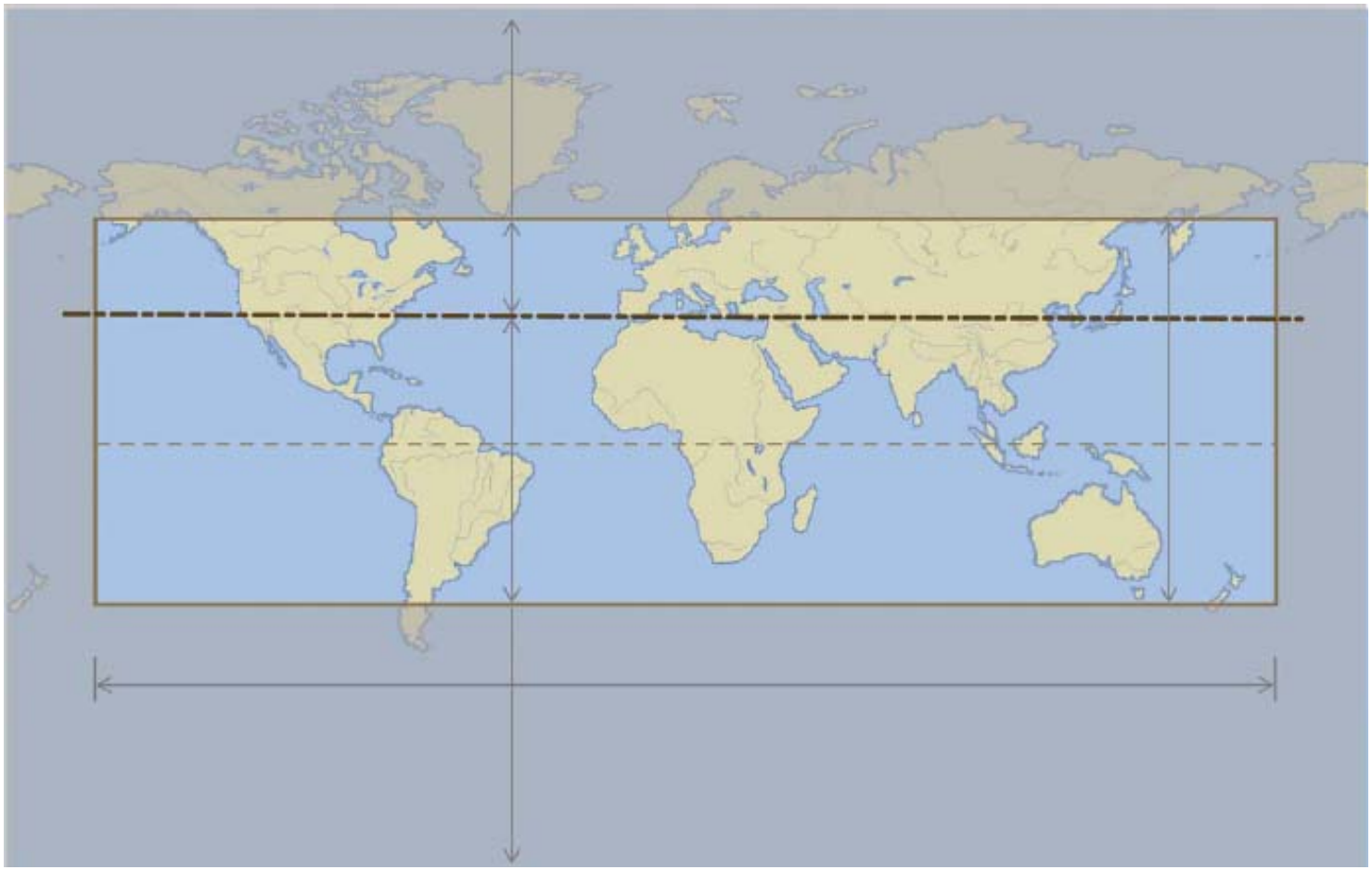
Earth's Ribbon of Major Habitation



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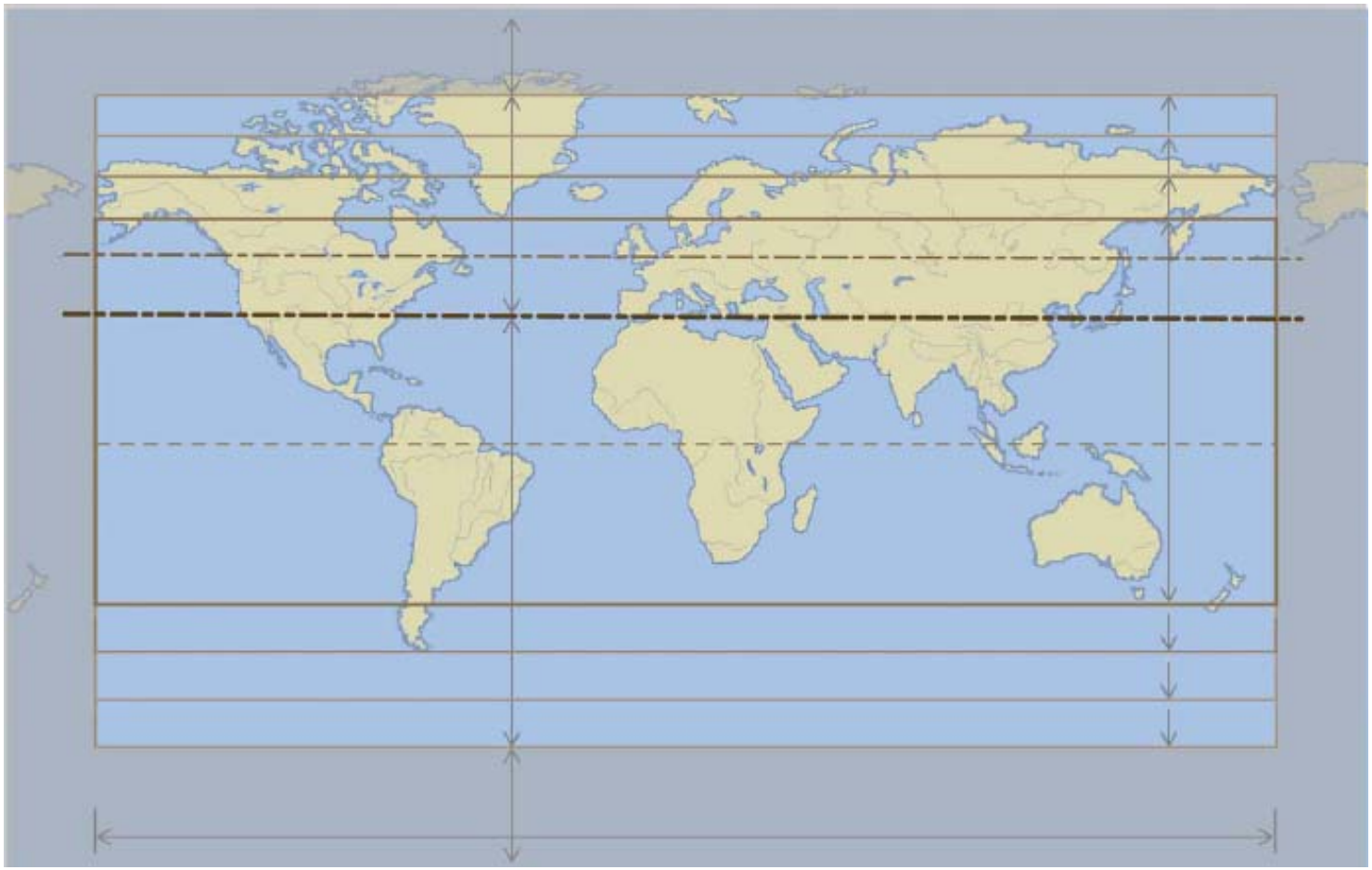
Expanding Ribbon of Major Habitation with Global Warming



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Realities of the Ribbon Map

- The Arctic is an outer fringe
  - In effect, the Arctic is forgotten
- The ribbon distorts the spatial reality of the globe
  - The main land mass of Earth is in the northern hemisphere
  - Northernmost areas come together in the Arctic

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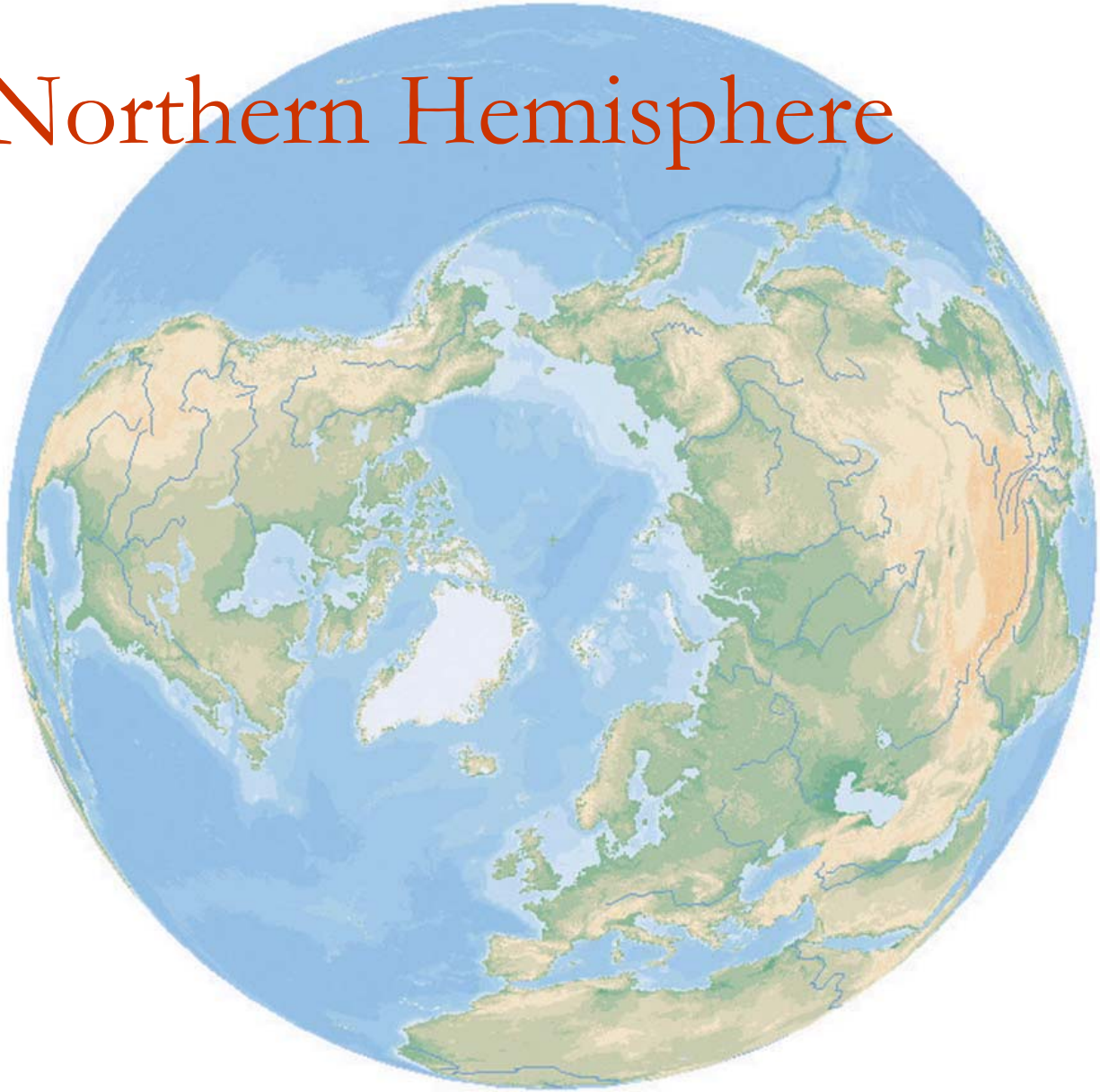
The Northern Hemisphere



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Northward Expansion

- With global warming there will be a gradual spreading of people, development, bio- and climate zones northward

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Arctic Migration and Settlement

Towards the Semi-Globe

- Added usefulness and importance of the Arctic
- Continued global warming: Desertification around the equator
- The spatial world view of the ribbon may shift towards a semi-globe

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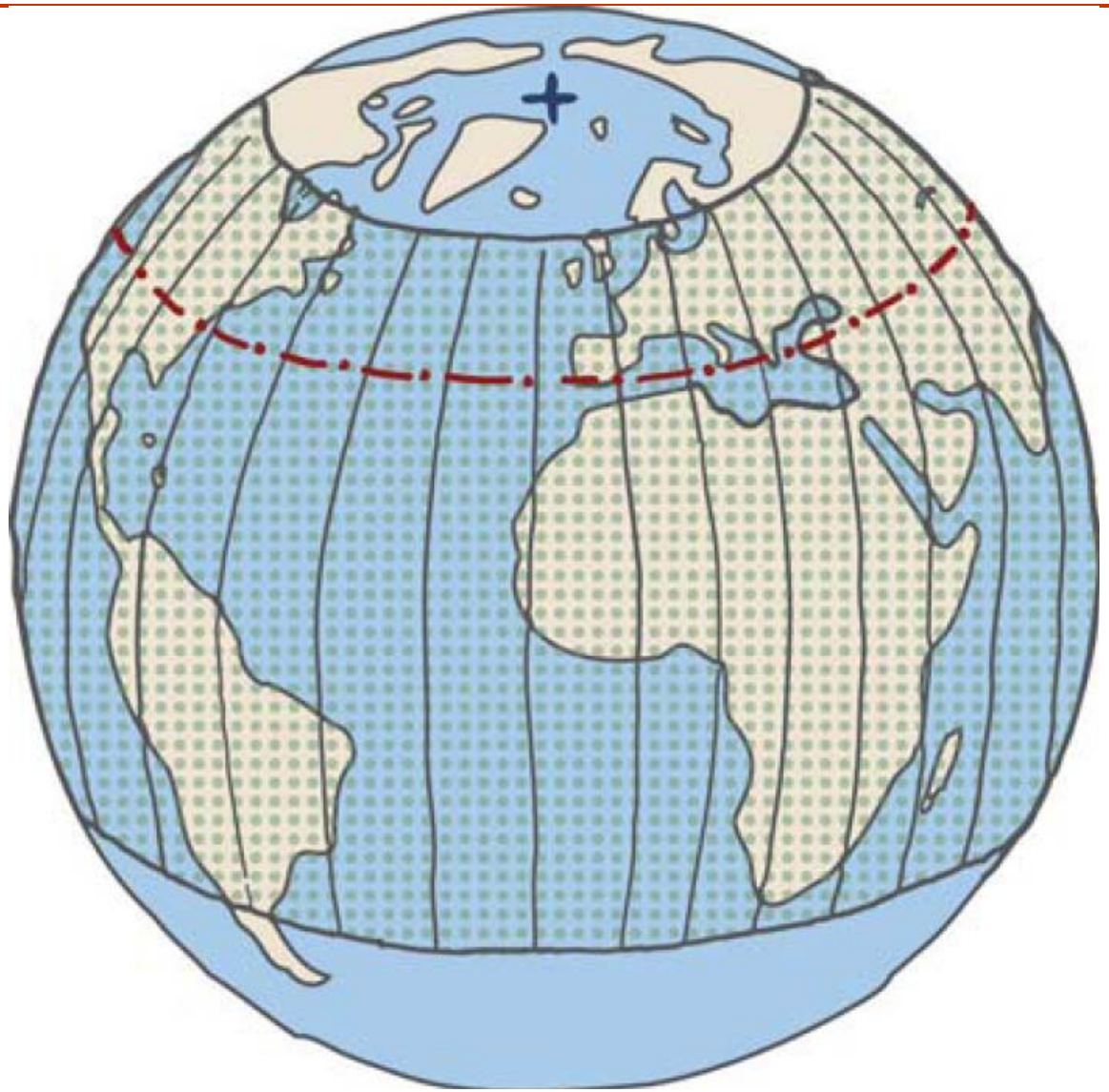
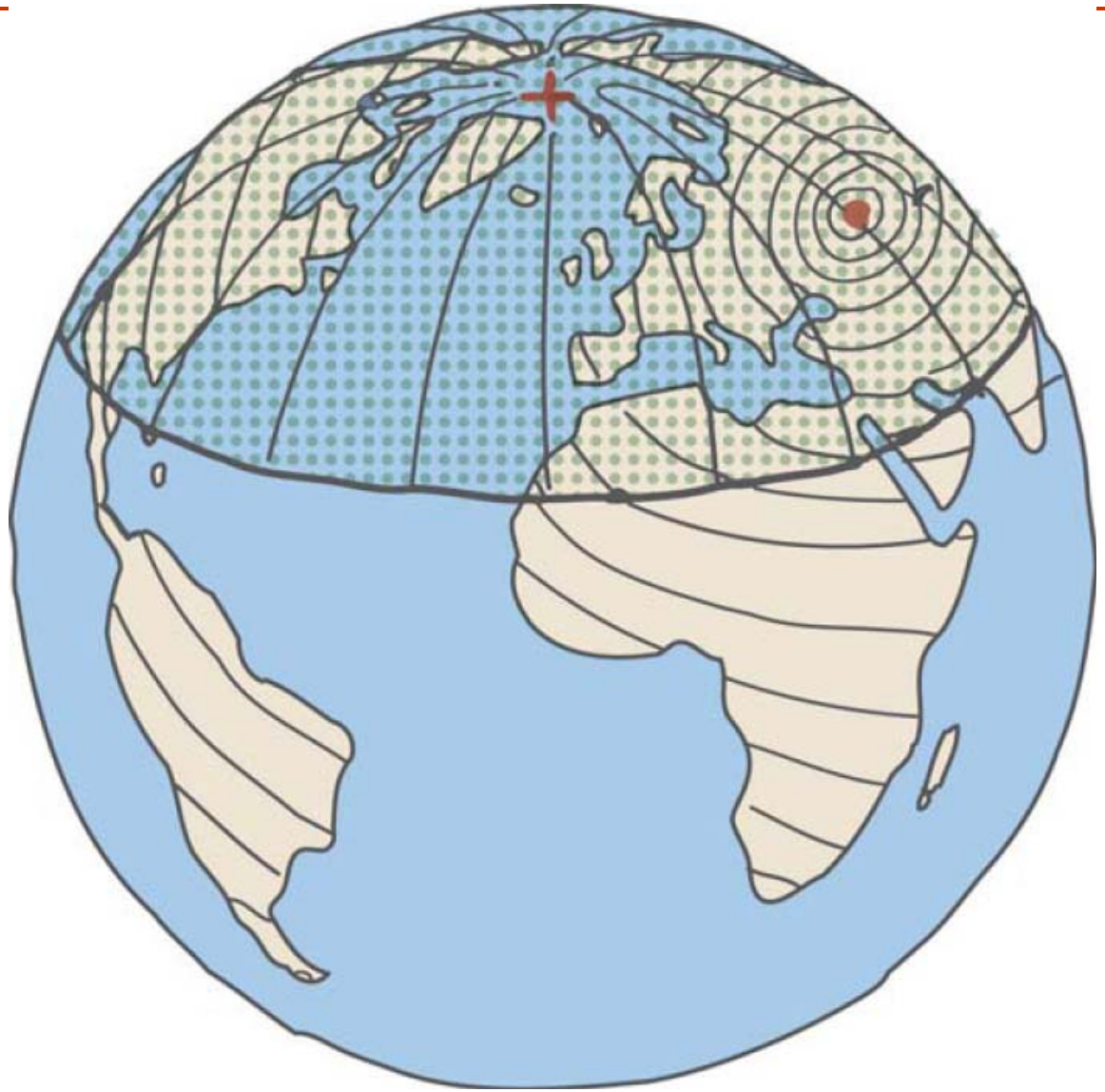
World of the Ribbon



World of the Semi-Globe



Arctic Resource Development

- Consequence of Polar ice retreat: Arctic resource development and extraction
  - Fossil fuels, Minerals, Agriculture, Fishing
  - Access of ships to the Arctic Ocean and northern shores of e.g. Alaska, Canada, Russia
- The Arctic countries have formed the Arctic Council
  - Conflict about access to the Arctic and its resources will surely arise
  - Both between nations and with special interest groups

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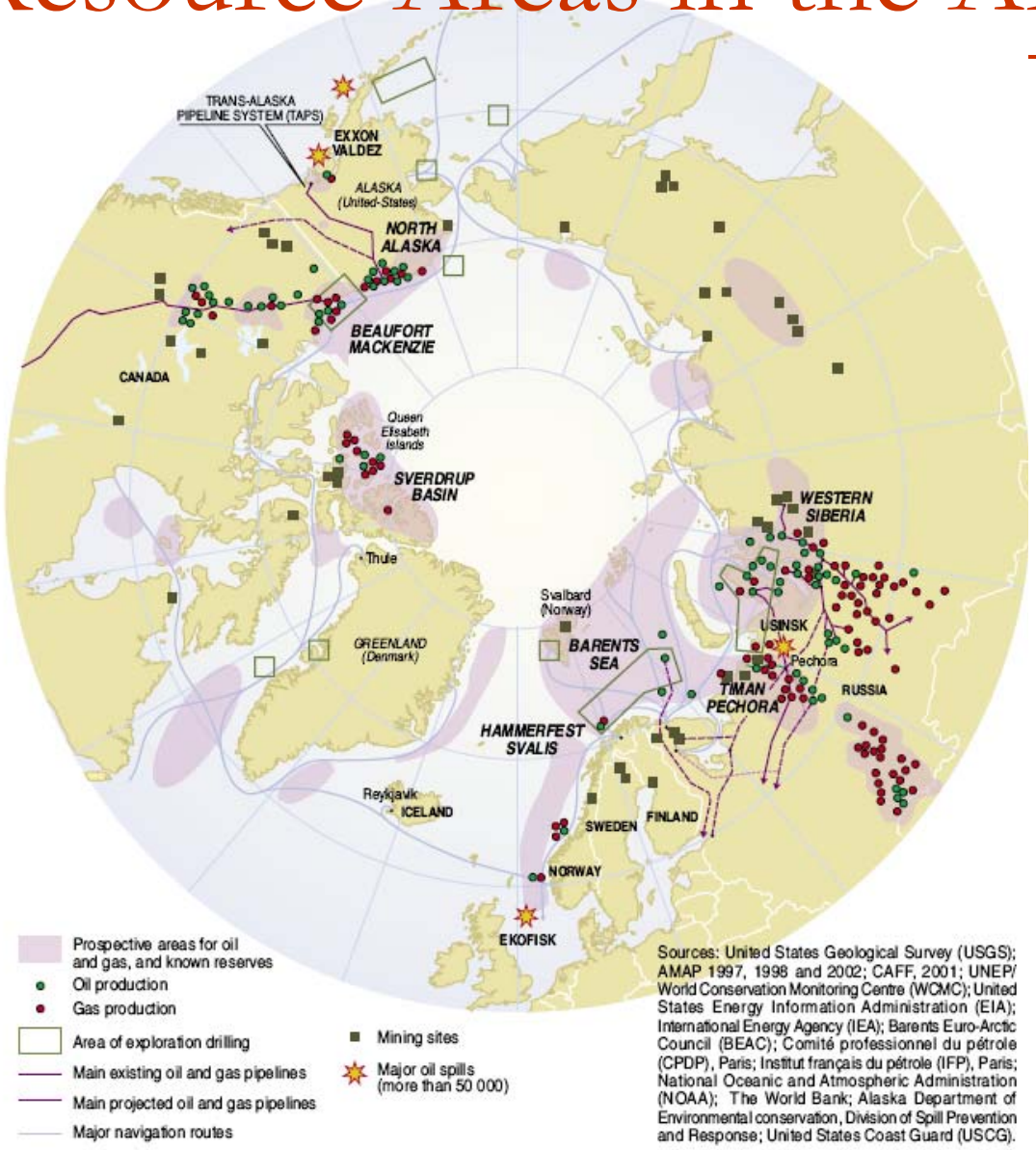
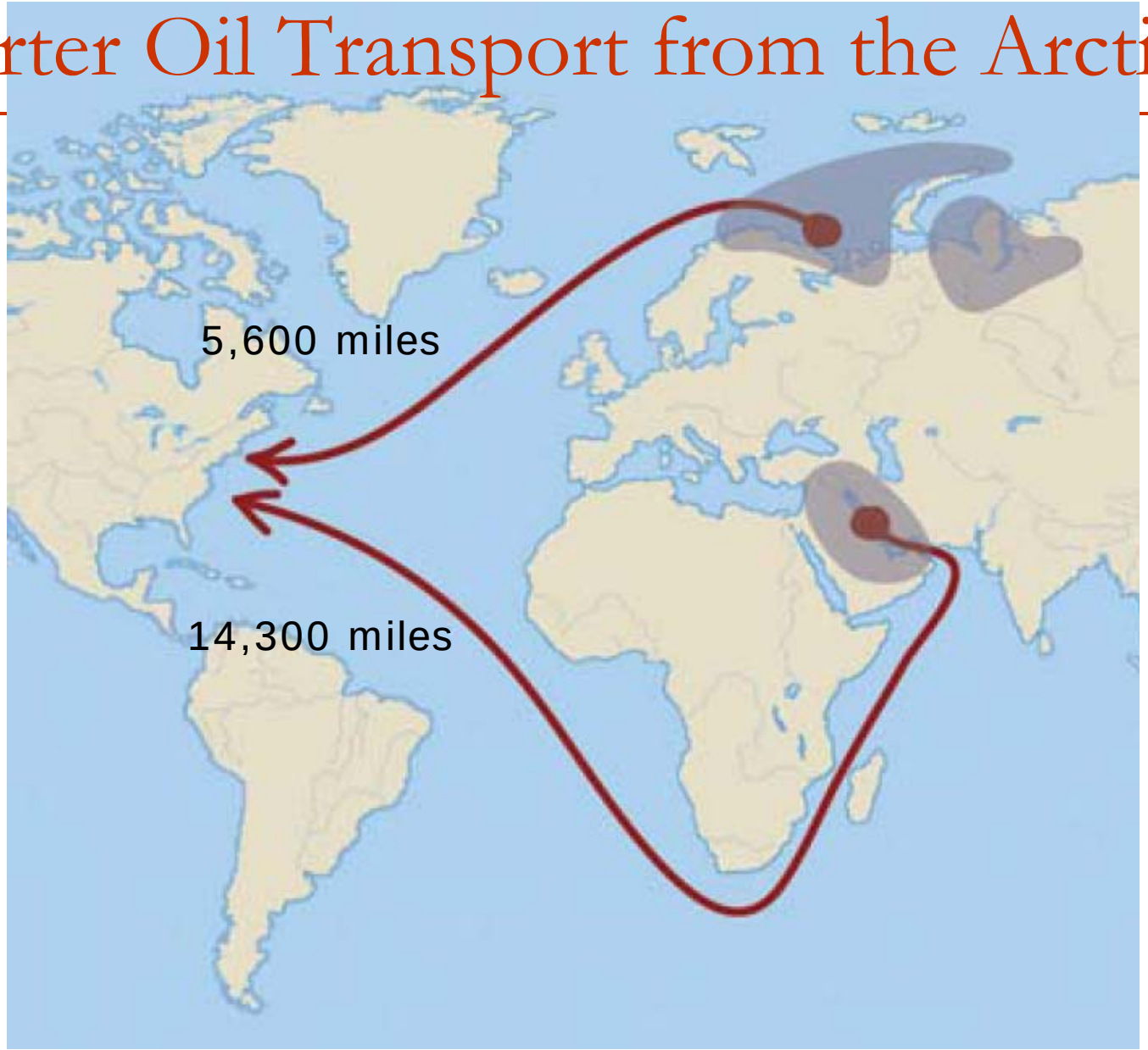
Fuel Resource Areas in the Arctic



Shorter Oil Transport from the Arctic



Global Transportation Changes

- Reduced Arctic sea ice opens shipping routes
- Will require reinforced ships during this century
  - Despite the few ice free summer months, due to seasonal ice and icebergs
- The Arctic has no size limitations as the Suez and Panama Canals
- Transshipment harbors are already moving towards implementation

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Global Transportation Changes

- Cargo can be transferred from regular vessels to reinforced vessels at transshipment harbors
  - Enables economies of scale and increased usage of Arctic ocean routes
- New global circles of transportation
  - Equalizes locations on transport routes
  - Provides alternatives in times of conflict

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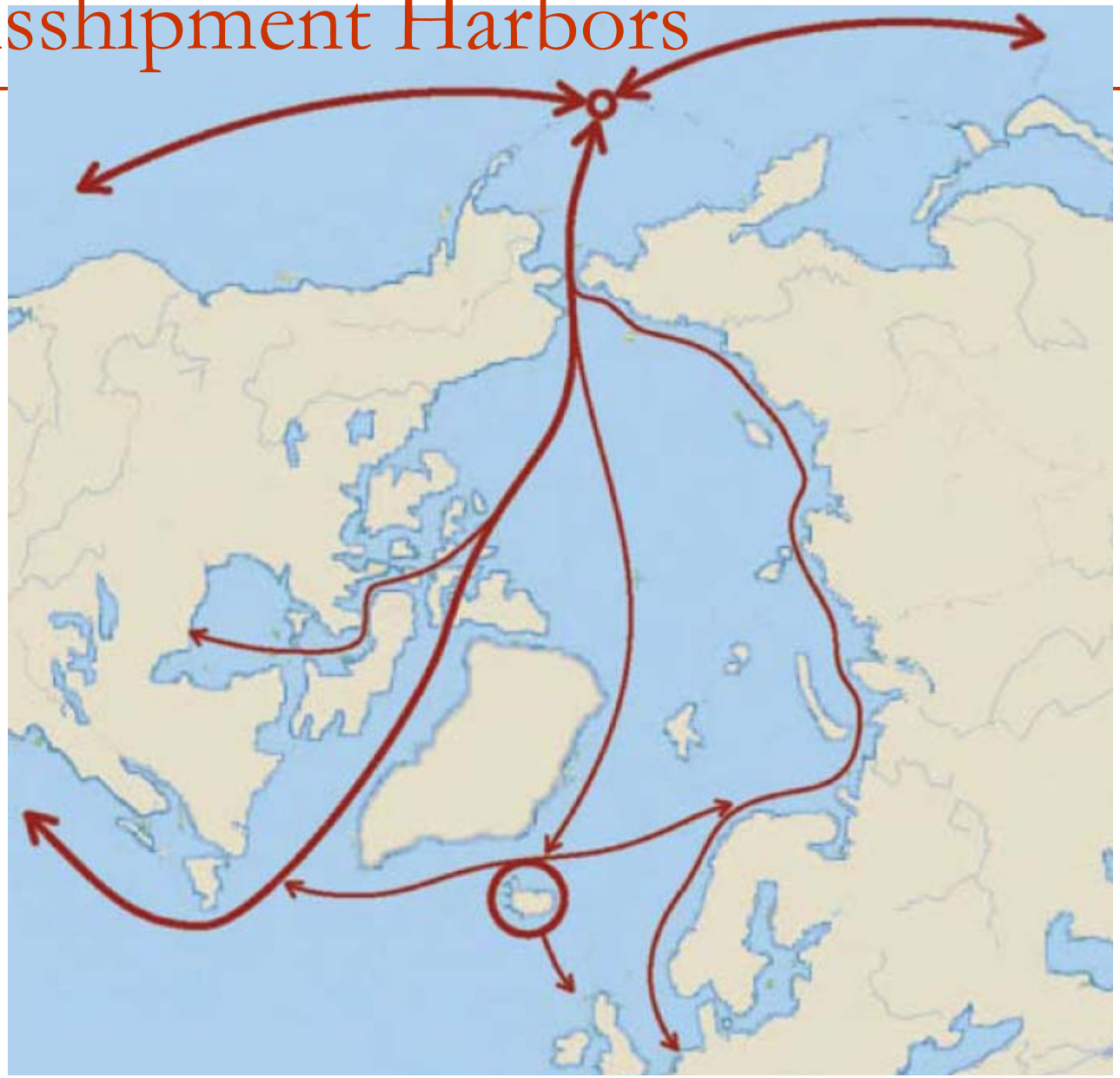
Potential Arctic Shipping Routes and Transshipment Harbors



Shortening of Shipping Distances

	Shanghai	Yokohama
	Nautical Miles	*Nautical Miles*
Halifax via Arctic Ocean	10,091	9,051
Halifax via Panama Canal	10,904	10,020
Halifax via Suez Canal	11,818	12,517
Halifax via Cape of Good Hope	15,998	16,028

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New Global Shipping Circles

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Conclusions

- Opportunities and challenges that come with global scale transportation changes
  - Shorter distances benefit global trade
  - New routes: Europe – North America – Asia
    - US East coast – West coast routes
- North-West Passage in Arctic Ocean
  - Neutralizes Panama Canal size limitation
  - Adds safety in times of conflict
  - Canada adding patrol ships to Arctic
  - Shipping circles around northern continents

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Conclusions

- Global shipping circles
  - Equalize national position on shipping routes
  - Avoids today's "cul-de-sac" nature of routes
  - Impacts geopolitical position and economic role of nations
- Immigration pressures and increasing stress on fragile Arctic ecosystems and native ways of life

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Conclusions

- The world system of the ribbon map may be replaced by a semi-global system of the northern hemisphere
- New topological position for all nations
- A shift in world system on the scale of the move from the flat Earth to the globe

- Additional Reference:
  - Valsson, T. *How the World will Change – with Global Warming*. University of Iceland Press, 2006, 168 p. www.hi.is/~tv

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