
# Adaptation to Climate Change

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**December 8, 2006**

- Impacts on Humans
- What Others are Doing

# Arctic Council

Eight Arctic Nation Forum and Permanent Participants

- Russia, Sweden, Finland, Norway, Denmark (Greenland), Iceland, Canada and USA
- ICC, Arctic Athabascan, Gwichin, Aleut, Saami, Raipon
- Relevant Working Groups:
  - Arctic Monitoring and Assessment Program (AMAP)
  - Sustainable Development Working Group (SDWG)
  - Conservation of Flora and Fauna (CAFF)

# Arctic Council Reports 2004

# The Main Key Finding

"The Arctic is extremely vulnerable to observed and projected climate change and its impacts. The Arctic is now experiencing some of the most rapid and severe climate change on earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, many of which have already begun." -- ACIA, 2004

# “Yelling ‘FIRE’ on a Hot Planet”

- “Polar bears are drowning; an American city is under water; ice sheets are crumbling.”
- “Are humans like frogs in a simmering pot, unaware that temperatures have reached a boiling point; or has global warming been spun into an ‘alarmist gale’?...”
- “There is enough static in the air to simultaneously confuse, alarm and paralyze the public”

Andrew Revkin

NY Times

April 2006

- Adaptation is different from mitigation, but not mutually exclusive
- Vulnerability, Resilience and Adaptation
- Climate change is at the local level, adaptation must happen at the local level
- Use of local knowledge is essential
- CC happening  in the context of other social economic, political and environmental changes (multiple stressors)

SLiCA
Survey of Living Conditions in the Arctic

# Survey of Living Conditions in the Arctic

| Inuit Settlement Region | Inuit Adults | Sample Size | Response Rate | Maximum estimated sampling error (plus or minus %s) |
|---|---|---|---|---|
| Alaska | 11,000 | 700 | 84% | 4% |
| Chukotka | 14,000 | 600 | 85% | 4% |
| Canada | 22,000 | 4,700 | 83% | 1% |
| Greenland | 35,000 | 1,200 | 82% | 3% |
| Inuit Settlement Regions | 82,000 | 7,200 | 83% | 1% |

The aims of SLiCA are to:

- Measure living conditions in a way relevant to Arctic residents
- Document and compare the present state of living conditions among the indigenous peoples of the Arctic
- Improve the understanding of living conditions to the benefit of Arctic residents

Arctic Council, will be released
in April 2007
ISER is lead in USA

# AHDR/SLICA Findings

Well-being is closely related to:

job opportunities

locally available fish and game

a sense of local control

# SLICA Workshop

- April workshop(Anchorage) will be organized around the six dimensions of living conditions identified in the Arctic Human Development Report (AHDR 2004):
- 1. Fate control
- 2. Cultural Integrity
- 3. Closeness to nature
- 4. Education
- 5. Material Well-being
- 6. Health/Demography
- SLICA results under these topics will include over 1,000 tables.

# Human Health Effects

- Accidents/Injury from changing weather (ice,storms,avalanche)
- Extreme Events – Wild fires, Storms, Insects
- UV radiation – Sunburns, Rashes, Skin Cancer, Eye problems(cataracts)
- Food Safety
- Less Frostbite and Cold Exposure

# Human Health Effects

- Changes in diet due to changes in supply of traditional food
- Safe Water/Sanitation possibly impacted
- Spread of new infectious diseases or disease vectors (West Nile, avian, etc.)
- Social and mental stress of change
- Extreme events vs. chronic

Expert Sources: Jim Berner, Alan Parkinson and Avian flu experts

# What Others Are Doing

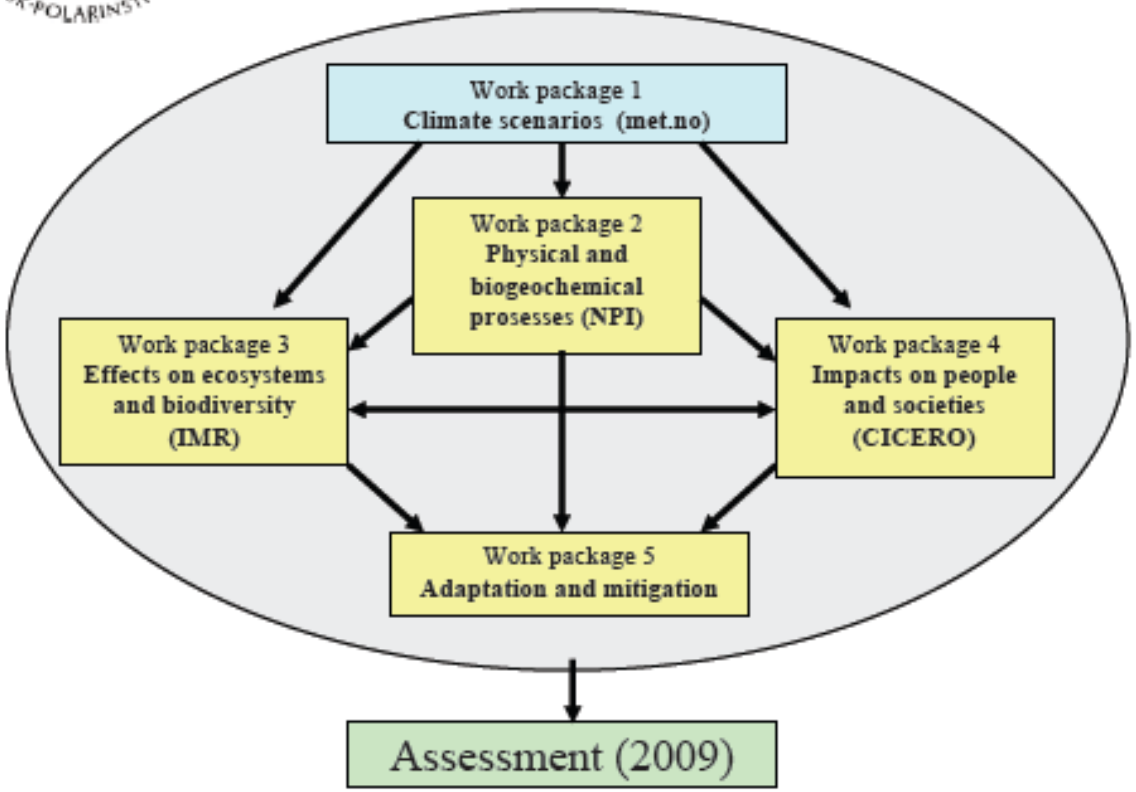
- Norway
- Finland
- Canada
- Arctic Council

# NorACIA
# Norwegian Arctic Climate Impact Assessment

Magnar Bjerga

Norwegian Polar Institute

# NorACIA Assessment (2006-2009)



# Time schedule

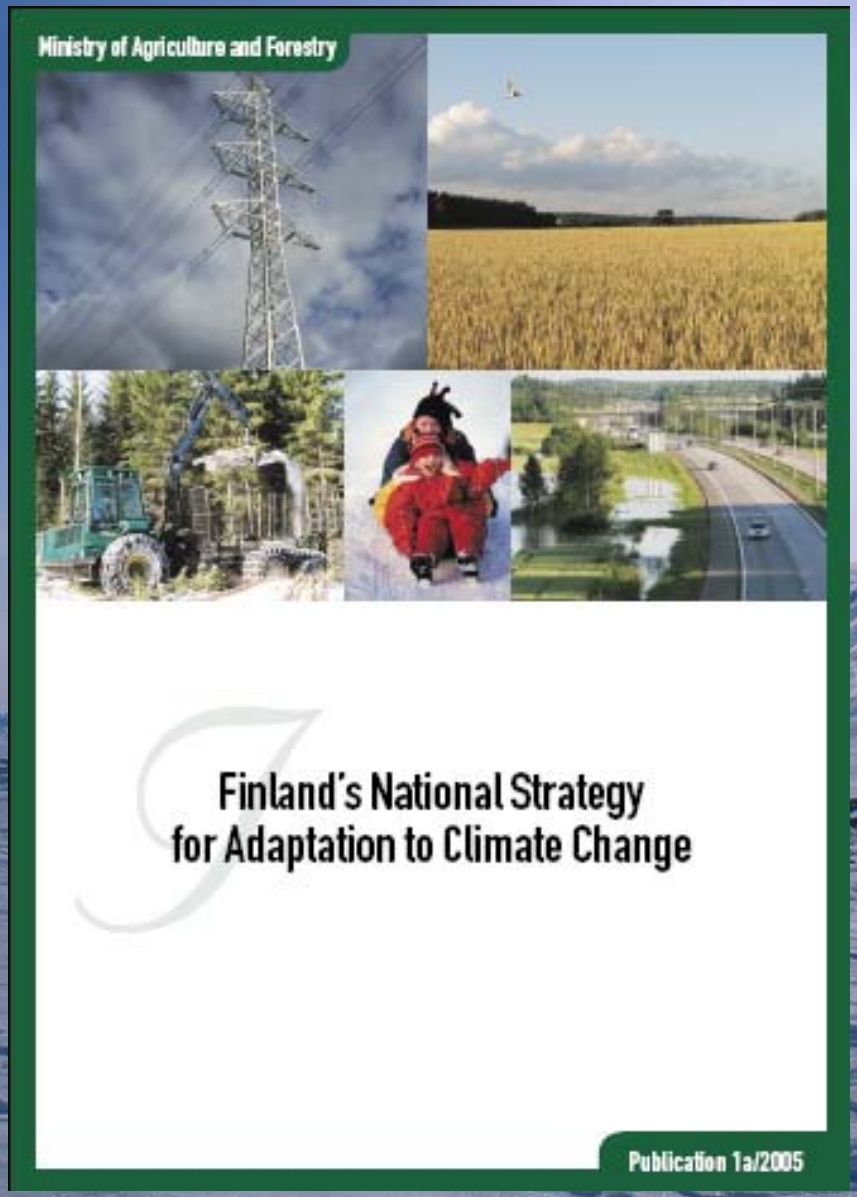
- **May 2006:** Kick-off meeting NorACIA Assessment
- **May 2007:** Consortium meeting. What can be expected deliverances before the end of the Norwegian Chairmanship of the Arctic Council?
- **2007:** Kick off meeting for the ”Adaptation and mitigation”-work package
- **Autumn 2008:** Report to Arctic Council (preliminary report)
- **Autumn 2009:** NorACIA assessment is handed over to the Norwegian Ministry of Enviornment

# Future workshops – preliminary schedule

- Nov 2006: Climate change scenarios
- Mar 2007: Extreme climate and weather events
- May 2007: Local adaptation planning
- Jun 2007: Nature management in a changing climate
- Nov 2007: Feedback mechanism in climate change systems
- Feb 2008: Pollution and climate change
- Jun 2008: Climate change and traditional knowlegde
- Nov 2008: Nordic/international cooperation
- Mar 2009: Climate change and health
- Nov 2009: Conference presenting NorACIA Assessment

# Finland's National Strategy

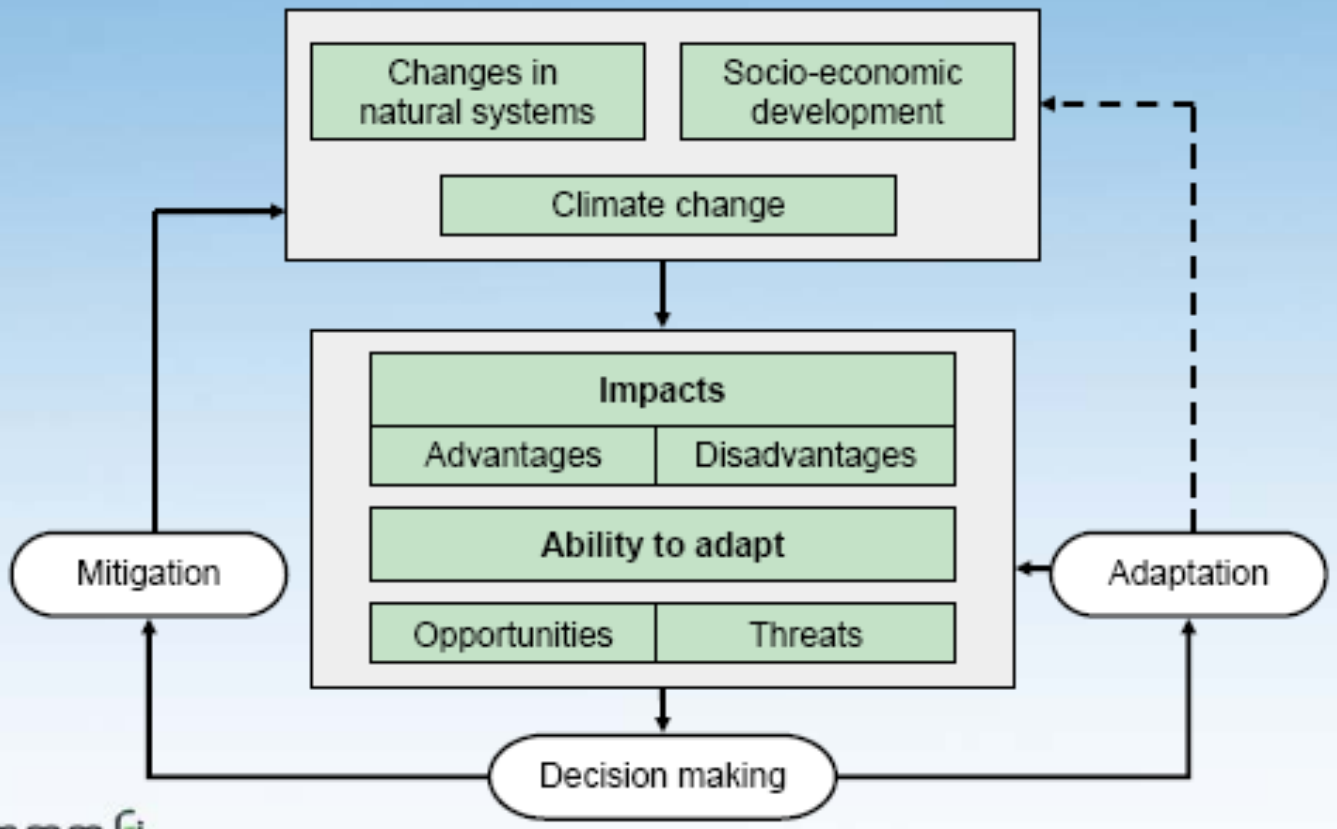
Pirkko Heikinheimo
Ministry of the Environment
Finland


Ministry of Agriculture and Forestry
Finland's National Strategy
for Adaptation to Climate Change
Publication 1a/2005

# Adaptation Strategy By Sector 2005

- 280 page document (Current to 2080)
- Describe Climate Change and Impact
- Assess current adaptor capacity, vulnerability and opportunity
- Present actions that should be taken immediately and policy for future action

# Framework



# Sectors

- Natural resources:

  agriculture and food production, forestry, fisheries, game husbandry, reindeer husbandry, water resources
- Biodiversity
- Industry, energy
- Transport
- Land use, building
- Health
- Tourism, recreation
- Insurance



mmm.fi

*Table 3.2. Summary of the anticipated impacts of climate change on forestry in Finland. The impacts are not commensurable, in other words, the number of the listed advantages and disadvantages cannot be used to conclude which ones are quantitatively more significant. Some of the impacts are clear advantages or drawbacks but the direction of some impacts is still unclear or the direction of the impact depends on the intensity of climate change.*

| Disadvantage | Direction of the impact unclear or simultaneous disadvantage and advantage | Advantage |
|---|---|---|
| – Increased risk of nutrient leaching<br>– Increased risk of wind damage and weakened anchoring of trees to the soil as ground frost declines<br>– The combined impacts of air pollutants (ozone) and UV radiation on ecosystems will become intensified due to climate change<br>– The risk of pests and forest pathogens will increase<br>– Potentially reduced ground frost will make forest harvesting more difficult<br>– Longer thaw period in spring will impose additional demands on machine capacity and wood storage<br>– The quality of coniferous wood may suffer | • The proportions of tree species will change<br>• The tree line will move farther north | + Increases in carbon dioxide concentration, temperature and precipitation will add to the productivity of the boreal belt<br>+ Felling opportunities will increase<br>+ Plants will have access to more nutrients<br>+ The seed yield of trees will improve and natural regeneration in Vaccinium site types in Northern Finland will become easier. |

*Table 4.2. Adaptation of forest management actions to climate change on the basis of current knowledge.*

| Forest management action | Adaptation to climate change |
|---|---|
| Improvement | • Adaptation of artificial regeneration materials to a changing climate by means of forest tree improvement aimed at increased reliability of cultivation<br>• Origins resistant to damage |
| Natural regeneration | • The natural adaptation potential of trees is available |
| Artificial regeneration | • Use of artificial regeneration if the aim is to favour conifers<br>• Enables the use of seed orchard seeds and clones bred for better adaptation |
| Seedling stand management | • Tending of seedling stands may have to be carried out earlier |
| Thinning | • Suitable intervals and strengths of thinning<br>• Regular forest management prevents damage by insects, fungal diseases, storms and snow |
| Turnover time | • Increased growth allows for a shorter turnover time |
| Forest drainage | • Reassessment of the need for ditch cleaning and supplementary ditching |

*Table 4.3. Summary of indicative adaptation measures to climate change in forestry and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.*

| | | Anticipatory | Reactive |
|---|---|---|---|
| Public | Administration and planning | • Inclusion of climate change aspects in the National Forest Programme*<br>• Revision of forest management recommendations to correspond to climate change**<br>• Protection of gene pools of forest trees* | |
| | Research and information | • Development of forest management adapting to climate change and mitigating it*<br>• Development of a system for anticipating and monitoring damage* | |
| | Economic-technical measures | • Development of harvesting*<br>• Tree improvement*<br>• Control of pests and diseases***<br>• Maintenance of forest roads* | • Rapid harvesting of wind damage in order to prevent consequential damage**<br>• Selection of the origin of artificial regeneration material** |
| | Normative framework | • Assessment of the needs for change in forest legislation in changing climatic conditions**/***<br>• Potential bans on wood imports from areas most badly contaminated by pests*** | |
| Private | | • Preparation of forest plans on the basis of new management recommendations**/*** | • Rapid harvesting of wind damage in order to prevent consequential damage** |

# Canada's Strategy

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Director, Environment and Renewable Resources

Indian and Northern Affairs Canada | Affaires indiennes et du Nord Canada

# From ACIA a Canadian Strategy : Ten Measures

1. Assess critical economic, social, environmental and security risks in the North, and establish northern needs and priorities for information and action
2. Assess risks for community infrastructure in the North, develop mitigation options and action plans, and incorporate climate considerations in future infrastructure planning
3. Work with renewable and non-renewable resource sectors to share information, identify issues, and plan for adaptation in operations and emergencies
4. Assess major emergency preparedness and security issues, policies, legislation and capability to monitor and control increased traffic in the North
5. Work with Aboriginal leaders and organizations to develop options and plans for addressing the cultural and social impacts of climate change

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# From ACIA to Building a Canadian Strategy : Ten Measures

6. Review existing northern policy and legislation, including land claims and implementation plans, as well as the northern dimensions of international initiatives, to identify major policy gaps and options for addressing climate change adaptation
7. Develop a plan for science in the North, including both focussed short-term studies and longer-term observational needs and improve the outreach networks for dissemination of this information within and outside the North
8. Work with key education institutions domestically, and the University of the Arctic internationally, to develop a climate change curricula in order to build northern capacity
9. Establish a coordinated, partnership management approach to climate change action in the North, and an envelope for funding specific priorities
10. Assess population health vulnerabilities to climate change across various regions of the North and identify effective solutions to manage health risks, including cross-sectoral interventions

# Expert Opinion : Key Risks Identified

- Food security
- Loss of traditional ways of life
- Infrastructure – structural integrity and location
- Access to natural resources
- Risks to traditional economies
- Risks to health and safety
- Making decisions with lack of information

| Risk | Likelihood | Impact | Risk Level | *Scorecard* |
|---|---|---|---|---|
| Infrastructure - structural integrity | 4 | 4 | 16 | *A* |
| **Infrastructure – new design to accommodate** | **5** | **4** | **20** | *B* |
| Infrastructure – location | 3 | 3 | 9 | *C* |
| Natural resources – challenges to management | 4 | 4 | 16 | *D* |
| Natural resources – challenges to policies | 2 | 4 | 8 | *E* |
| **Natural resources – access to resources** | **5** | **4** | **20** | *F* |
| Economies – individuals' choices | 5 | 3 | 15 | *H* |
| Economies – communities' choices | 4 | 3 | 12 | *I* |
| **Economies – traditional economies** | **5** | **4** | **20** | *J* |
| **Food security** | **5** | **5** | **25** | *L* |
| **Health risks** | **4** | **5** | **20** | *M* |
| Reduced resiliency of people to change | 4 | 4 | 16 | *N* |
| **Losing traditional ways of life** | **5** | **5** | **25** | *O* |
| **Making decision with imperfect information** | **5** | **4** | **20** | *P* |
| Loss of risk reduction measures/capacity | 2 | 3 | 6 | *Q* |
| **Permafrost melting (regional differences)** | **5** | **4** | **20** | *R* |

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# Canada is Assessing its Vulnerability: The 2007 Assessment

- Scientifically objective assessment of existing knowledge of the risks and opportunities that climate change presents to Canadians
- Moving forward - focus on adaptation and adaptation decision-making while informing mitigation issues
  - Understanding ability to adapt and limits to adaptation
  - Understand significance of rate of change
- Emphasize what we DO KNOW, as well as identifying knowledge gaps
- Policy relevant but not policy prescriptive.
- Complement global perspective of IPCC 4AR

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# Framework for Regional Chapters

1 – Synthesis
2 – Regional description
3 – Climatic trends and projected futures
4 – Relevant socio-economic trends and projected futures
5 – Sensitivities to current climate, including observed impacts
6 – Key vulnerabilities to climate change
7 – Key uncertainties and knowledge gaps
Case studies to illustrate key points
- adaptive capacity
- community level initiatives

**KEY LIMITATION** – published length 40-50 pages

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## Cross-cutting Themes

- **Public Safety and Security - extreme events and natural hazards**
- **Economic Sustainability / Development – natural resource sectors**
- **Human health**
- **Cultural impacts**
- **Security and sovereignty**
- **Ecosystem and species sustainability (including biodiversity and protected areas)**

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# Key Northern Areas / Issues

- Each section to address:
  - Current status and key vulnerabilities within sector
  - Projected changes in relation to climate
  - Sensitivity, Adaptive Capacity, Options for Adaptation.

- Hydro electric development
- Oil and Gas
- Mining
- Linear Infrastructure
- Shipping and Transport
- Northern Forestry Sector
- Fisheries
- Wildlife
- Aesthetic and Recreational Aspects of Northern environments
- Human Health

# Adaptation to Climate Change is a Priority

*Strengthening the adaptive capacities of Arctic residents, including indigenous peoples and local communities, and identifying the most vulnerable sectors of society*

According to the ACIA report, the consequences of climate change in the Arctic will be dramatic for human life, ecosystems and many sectors of society. Further studies of impacts and means of adaptation are needed in order to address these issues. Work on adaptation strategies and action, such as institutional arrangements, should be initiated. This will contribute to local, innovation Arctic adaptation strategies.

- Programme for the Norwegian chairmanship of the Artic Council 2006-2008

# Selected Projects at UA

- Heterogeneity and Resilience of Human-Rangifer Systems
- Circum-Arctic Rangifer Monitoring and Assessment (CARMA) Network
- Alaska Center for Climate Assessment and Policy
- The Human-Fire Interactions Project
- Humans and Hydrology at High Latitudes
- The Arctic Borderlands Ecological Knowledge Co-op
- Scenarios Network of Alaskan Planning (SNAP)
- Resilience and Adaptation Graduate Program at UAF
- EPSCOR- potential funding

# Sectors/Issues

## Sectors

- **Natural Resources**
  - **Forests**
  - **Fisheries**
  - **Game husbandry**
  - **Agriculture and Food Production**
  - **Water**
  - **Soil**
- **Traditional Way of Life, Economics, Cultures**
- **Biodiversity**
- **Infrastructure**
  - **Transportation**
  - **Buildings**
  - **Sanitation**
  - **Land**
  - **Water**
- **Land Use**
- **Human Health**
- **Tourism/Recreation**
- **Insurance**
- **Major Event Preparedness**

## Issues

- **Melting permafrost**
- **Sea level rise**
- **Coastal erosion**
- **Flooding**
- **Fire activity**
- **Sea ice change**
- **Fish stock changes**
- **Skin Cancer rates/UV**
- **Infectious diseases**

Regional Breakdowns?

# Suggestions

List of who is doing what now

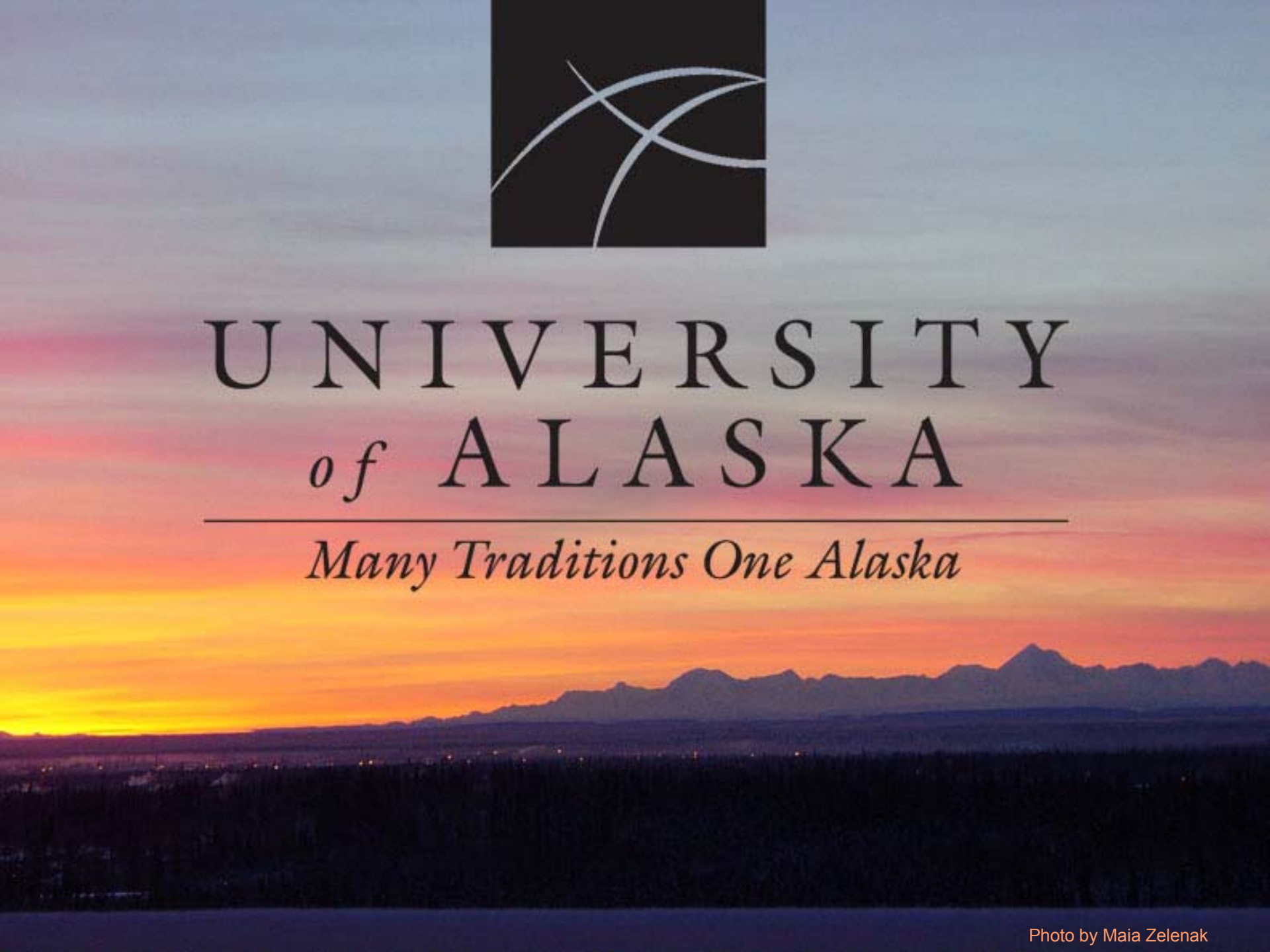
Alaska, Other

Organization of disadvantages/advantages by sector or issue

Focus on adaptation strategies

Best Practices

Enlist help- ISER/Economic modeling, State agencies, sector groups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Many Traditions One Alaska
Photo by Maia Zelenak