Conservation as a public health strategy for climate change preparedness

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CEO Canadian Wildlife Health Cooperative
Professor – Western College of Veterinary Medicine
Clinical Professor- School of Population and Public Health
Start by reframing the determinants of health

Nature is not a hazard

- Environmental determinants of health are fundamental positive contributions to our health

https://www.pinterest.ca/pin/495396027732592544/
My Proposition

• Health equity is a cornerstone of climate change resilience
  • But, the determinants of equity are more than the social determinants of health

• Climate change health equity needs to be inter-generational
  • Climate change impacts have been coming for 100 years and will take longer to abate

• Intergenerational health equity requires a sustainable, resilient biosphere
  • Cannot be achieved without interspecies health equity
Climate change health equity

• all species, across multiple generations, can reach their full health potential and should not be disadvantaged from attaining it because of climate change

• the fair and equitable distribution of resources needed for health and sustainability that balances the needs of today with the needs of tomorrow by investing in and maintaining social and ecological services
The biosphere is the foundation for the social determinants of health

Millennium Ecosystem Assessment

Focus: Consequences of Ecosystem Change for Human Well-being

Ecosystem Services
- Provisioning
  - Food
  - Freshwater
  - Wood and fiber
  - Fuel
- Regulating
  - Climate regulation
  - Flood regulation
  - Disease regulation
  - Water purification
- Supporting
  - Nutrient cycling
  - Soil formation
  - Primary production
- Cultural
  - Aesthetic
  - Spiritual
  - Educational
  - Recreational

Constituents of well-being
- Security
  - Personal safety
  - Secure resource access
  - Security from disasters
- Basic material for good life
  - Adequate livelihood
  - Sufficient nutritious food
  - Shelter
  - Access to goods
- Health
  - Strength
  - Feeling well
  - Access to clean air and water
- Good social relations
  - Social cohesion
  - Mutual respect
  - Ability to help others

Freedom of choice and action
Opportunity to be able to achieve what an individual values doing and being
“The overall guiding principle [in health promotion policy] for the world, nations, regions and communities alike, is the need to encourage reciprocal maintenance—to take care of each other, our communities and our natural environment.”

—Ottawa Charter (1986)
Conservation is a state of harmony between men and land.

- Aldo Leopold

©www.famouscelebrityquotes.org
The conceptual bond

• Public health
  • Preventing disease, prolonging life and promoting health through the organized effort of society

• Conservation biology
  • Preventing the loss, protecting and restoring biodiversity by managing physical, ecological and social factors
Biodiversity

• all the variety of life that can be found on Earth as well as to the communities that they form and the habitats in which they live

• not only the sum of all ecosystems, species and genetic material but the variability within and among them
Climate change is a shared threat

- Healthscape concept
  - Shared space when people, animals and environments interact

- Climate change works at the healthscape rather than community level

- Critical inter-dependencies
  - Ex. “The Narrows”
Intermissions – Climate change and health across sectors

CLIMATE CHANGE?

WHAT ME WORRY?

STOP CLIMATE SCIENCE DENIAL

https://www.pinterest.ca/knutsroenlund/green-stuff/
Public health priorities

PHAC Sustainable Development Strategy
• to reduce the vulnerability of individuals, communities, and regions to climate change impacts which can adversely affect health
  • to reduce infectious disease emergence and other climate change risks through evidence-based information

Chief Medical Health Officer
• Public health must strive to prevent and adapt to current as well as anticipated and unforeseen threats and identify the most vulnerable populations
### Impact of climate change on livestock production

| Water | Change in quantity and timing of precipitation affects  
<table>
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<tr>
<td>- reduced quantity</td>
<td>- Dry areas will get drier and wet ones wetter</td>
</tr>
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</table>
| Feed | Land use and systems changes  
| - reduced quality and quantity | Decline in productivity of rangelands, crops, forages  
| | Quality of plant material deteriorates  
| | Reduced feed intake |
| Changes in the incidence of infectious diseases | Changes in the patterns and range of infectious diseases  
| | Loss of disease resistant breeds  
| | Increased heat stress, deterioration of immunity |
How We're Endangering Animals

Climate Change

Humans affect climate change by adding greenhouse gases to the atmosphere, which raise the planet's temperature, consequently melting ice caps, raising sea levels and warming oceans. Climate change also creates droughts, which threaten animals' food and fresh water sources. The largest man-made contributions to climate change come from running factories and power plants, heating and cooling homes, and driving automobiles.

Only About 350 North American Right Whales Still Exist

With rising ocean temperatures killing off their food, these whales can no longer properly bulk up for pregnancy.

90% of Loggerhead Turtles are Female

Changes in temperature have affected nesting conditions, skewering their gender ratio.

Penguin Populations Have Declined About 60%

Since the 1960s, Antarctic penguins have been vanishing due to a loss of habitat resulting from melting sea ice.

Polar Bears Are 10 Percent Thinner Than 30 Years Ago

Rising temperatures are melting sea ice, leaving hungry polar bears with less hunting grounds.
IMPACTS OF CLIMATE CHANGE ON CANADA'S FORESTS

CLIMATE CHANGE
- Temperature and precipitation change
- Changing weather patterns

PHYSICAL IMPACTS
- Forest productivity
- Forest fires
- Pests and diseases
- Composition, distribution and structure of ecosystems
- Extreme weather events

ECONOMIC AND SOCIAL IMPACTS
- Timber supply
- Macroeconomic impacts
- Change in global timber markets
- Human health impacts
- Non-market values

Impacts quantified in our analysis

SOURCE: ADAPTED FROM WILLIAMSON ET AL. (2009)

What can we do?

Resilient

Options to adapt

Low vulnerability

Buffer harms
Green infrastructure buffers against extreme events

http://www.newterrain.us/green-infrastructure/green-infrastructures-maintenance-opportunity/
Protection from Extreme Events


http://www.fishingcatcambodia.org/tag/mangrove-conservation/
Benefits of Urban Trees

Research has linked the presence of urban trees to...

- **Reducing Rates** of cardiac disease, strokes, and asthma due to improved air quality
- **Cooling** city streets by 2-4°F, reducing deaths from heat and cutting energy use
- **Filtering** up to a third of fine particle pollutants within 300 yards of a tree
- **Protecting Biodiversity** including habitat for migrating birds and pollinators
- **Reducing Obesity Levels** by increasing physical activity including walking and cycling
- **Managing Stormwater**, keeping pollutants out of waterways, and reducing urban flooding
- **Increasing** neighborhood property values
- **Reducing Stress** by helping interrupt thought patterns that lead to anxiety and depression
Buffer climate change

Natural forests capture CO₂; deforestation releases CO₂

INTACT FOREST ECOSYSTEMS
capture carbon in vegetation and soil

CLEARING AND BURNING FORESTS
releases carbon that had been stored in vegetation and soil

REGROWING FORESTS
capture and accumulate carbon slowly over decades

CONVERSION
to pasture, agriculture, and urban areas produces ongoing emissions

https://www.cgdev.org/blog/tropical-forests-offer-24%E2%80%9330-percent-potential-climate-mitigation
Storms and water quality

Clean water

- The continued loss of forests and the destruction of watersheds reduce the quality and availability of water supplied to household use and agriculture.

Remember Toxoplasma, Victoria, watersheds, rain and pooping cougars.
Vulnerability and Biodiversity
The propensity to be adversely affected.
*exposure and sensitivity to hazards and lack of capacity to cope and adapt*
Reducing exposure through early warning

Disease emergence

The ‘sexy’ case
Signals of exposure

- Is it there (*exposure assessment*)
  - Detect hazards in a shared environment
  - Where is it
- Can it hurt us (*probability and magnitude of harm*)
  - Biological evidence of harm
- Evidence to action
  - Sick animals can inspire action in advance of human harm
    - best use has been contaminants
    - Most action today = zoonooses
Beyond zoonoses

Mercury in Canada’s North and East: The Grasshopper Effect also known as Global Distillation

As air masses warm again they transport contaminants which eventually enter and condense in the colder polar region ecosystems.

Air cools and contaminants condense at the mid-latitudes - these and regionally deposited contaminants then evaporate and are transported north.

Air rises at the hotter equatorial regions carrying contaminants further north.

Biomagnification

http://www.blue-growth.org/Plastics_Waste_Toxins_Pollution/Biomagnification_Bio_Accumulation.htm
We suck at prediction

• Missed Zika
• SARS 100x less than predicted
• Credibility lost over calls for avian influenza pandemics
• Never even imagined Mad Cow
• Despite billions invested

You have been warned!

...again and again and again

Apocalyptic Attention Deficit Disorder

https://escapetoreality.org/2017/05/25/the-market-for-bad-predictions/
Why prediction is tough.
Complex dynamic systems
We expect the pathogen to be the clue
If we can’t predict can we be surprised less often?

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
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<tbody>
<tr>
<td>Rare event with serious serious consequences</td>
<td>Post-tsunami nuclear accident in Japan</td>
</tr>
<tr>
<td>Common event we didn’t recognize as a warning signal</td>
<td>Translocated pathogens – 1st cases not seen as a warning (ex. West Nile virus)</td>
</tr>
<tr>
<td>Unexpected consequences</td>
<td>Moving New York’s garbage to Ohio made rabies jump borders</td>
</tr>
<tr>
<td>Knowable consequence from an unexpected source</td>
<td>Feeding cows to cows lead to mad cows</td>
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# Strategies to reduce surprise

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<tr>
<th>Category of Surprise</th>
<th>Response</th>
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<td>Knowable in retrospect but <strong>elude detection</strong></td>
<td><strong>Is a harm possible?</strong></td>
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<tr>
<td></td>
<td>• Connect specialized pools of knowledge to see hazards sooner</td>
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<td>• Track changing exposures</td>
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<tr>
<td></td>
<td>• Track clues of harm in other contexts</td>
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<td><strong>Fail to recognize</strong> actionable signal or not able to <strong>respond</strong> despite warning</td>
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<td><strong>Unanticipated</strong> consequences of socio-ecological interactions</td>
<td><strong>Can they deal with it?</strong></td>
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<td>• Track changing sensitivities due to changing determinants of health and cumulative effects</td>
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<td>Previously <strong>inconceivable</strong> events</td>
<td>• Assess capacity to cope</td>
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<td>- Better sharing and integration via health intelligence</td>
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<td>- Public health observatories</td>
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<td>- Looking for upstream clues of changing resilience options</td>
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**Wildlife as biosentinels of vulnerability – more than exposure information**

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<th>PUBLIC HEALTH CONCERNS</th>
<th>WILDLIFE INFORMATION</th>
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<tr>
<td>Vector-borne disease</td>
<td>Document pathogen &amp; vector distribution; reveal changes in pathogen/vector lifecycles; establish host effects</td>
</tr>
<tr>
<td>Food &amp; water safety &amp; security</td>
<td>Identify infectious and non-infectious hazards, biosentinels of effects of hazards; maintain accessible country foods and commercial seafood</td>
</tr>
<tr>
<td>Mental health &amp; social cohesion</td>
<td>+ve mental health value of nature; cultural importance of wildlife; contributions to income and traditional food security</td>
</tr>
<tr>
<td>Indirect effects related to physical infrastructure</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Effects of extreme heat</td>
<td>Not applicable</td>
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Nature has major impacts on climate change vulnerability

Vulnerability = Potential Impact - Adaptive Capacity

Potential Impact = Exposure x Sensitivity

Social determinants of health
Food security
Water safety
Salmon, climate change and us

Social harms

- Living and working conditions
- Unemployment
- Housing
- Care services
- Income and education
- Agriculture and food production
- Work environment
- Culture and environment
- Individual lifestyle factors
- Age, sex, and constitutional factors

I love my job

Source: healthywildlife.ca
Remember when the cod disappeared

- Occupational risks
- Alcoholism
- Family violence
- Mental health
Its happening in the North now

Contributions

- Food
- Income
- Culture

Threats

- Food Safety
- Food
- Declines

Inuit in Canada: Poverty

Annual income in Canada’s Inuit regions

- Household food insecurity by province & territory

- Inuit unemployment

In 2005, rates of unemployment for Inuit people were nearly four times higher than for non-Aboriginals in Canada.

Population size

- 1975
- 1989
- 2004
Sensitivity and exposures will be changed concurrently

Environmental hazard exposure
- New infections cycles
- Release of pollutants
- Both affect conservation, food safety and confidence in the safety of nature

Social determinants of sensitivity
- Less accessible country food = lower food security
- Less hunting tourism revenue = lower income
- Less opportunity for traditional cultural activities

Post et al., 2013. Science
Climate change action need to be tailored to what makes a community vulnerable.
Reciprocal care for resilience
None of us are independent of the Earth

- Some communities have more regular, direct and daily dependencies
  - Rural and remote communities
    - Food security
    - Aboriginal health
    - Connections to the land a defining feature

- But the needs for daily living come from nature
Seafood feeds most of the world’s poor – how to adapt?

Major challenges to fishing communities posed by climate change:

- Relocation of resources and replacement with less commercially valuable species requires diversification of fishing operations and markets.
- Changes in the timing of fish spawning and recruitment will need adjustments to management interventions.
- In areas where production is already limited by temperature (e.g. tropics) traditional productive areas may be reduced. Dependent communities will need to diversify their livelihoods.
- Increases in the frequency and severity of storms may affect infrastructure, both at sea and on shore.
- The impact of ocean acidification may be locally significant, for example in activities dependent on coral reefs.

All fishing policies must address these issues and help fishing communities adapt to the changes they are experiencing as a result of climate change. FAO, member countries and partners must work together to strengthen the resilience of fishing communities in areas most affected by climate change.
WELL MANAGED MARINE PROTECTED AREAS SUPPORT FISHERIES

MPAs IMPROVE THE HEALTH OF OCEANS BY:

- Protecting and Restoring Marine Habitats
- Increasing Resilience to Environmental Changes
- Protecting Species and Rebuilding Fish Stocks

MPA

KEY PRINCIPLES FOR MPAs TO WORK:

- Well Designed Networks of MPAs
- Enforced and Complied With
- Local Community Engagement
- Part of an Integrated Management Plan
- Sustainably Financed

MPAs SUPPORT LIVELIHOODS

In Apo Islands, Philippines, fishers have doubled their catch rate 10 years after the MPA was created. As a result, they go out to sea less, saving on fuel and time.

A global review shows that well-managed MPAs can substantially increase fish size, density, biomass and species richness.

MPAs CAN PUMP FISH INTO ADJACENT AREAS

As fish populations recover within MPAs, juveniles and adults can spill over across the boundaries and replenish fishing grounds.

EXAMPLE: APO ISLAND PROTECTED AREA, PHILIPPINES

Surgeonfish and jackfish represent 40-75% of local fishery yields. Since the MPA established, their population has tripled... resulting in an increase in catch per unit effort of +50%.

MPAs CAN EXPORT LARVAE INTO ADJACENT AREAS

Larger fish inside MPAs produce disproportionately more eggs and larvae. Some larvae then drift to fished areas.

EXAMPLE: GREAT BARRIER REEF PROTECTED AREA, AUSTRALIA

The coral trout and the striped snapper are exploited locally. Local MPAs produce a 50% of total juvenile recruitment in nearby fished areas.

Globally, WWF works to support Marine Protected Areas and ensure they contribute to securing food and livelihoods for people while conserving critical habitat and species.

www.panda.org/mpa
Biodiversity gives options to adapt for food security

Adaptation will be key

**CROPS**
Temperate regions will benefit more from adaptation than tropical regions
- Switching to varieties tolerant to heat, drought or salinity
- Optimising irrigation
- Managing soil nutrients and erosion

**LIVESTOCK**
Key adaptations for small-scale producers include:
- Matching animal numbers to changes in pastures
- More farms that mix crops and livestock
- Controlling the spread of pests, weeds and diseases

**FISHERIES**
Key adaptations for small-scale fisheries include:
- Switching to more abundant species
- Restoring degraded habitats and breeding sites like mangroves
- Strengthening infrastructure such as ports and landing sites
Capacity to Cope
The capacity of social, economic and environmental systems to cope with a hazardous event or disturbance

The 3rd Pillar
We need options to Act

https://www.researchgate.net/publication/277132841_National_RD_Priorities_Climate_Change_Impacts/figures?lo=1
Raw material for Freedom of Choice

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Freedom of choice and action
Opportunity to be able to achieve what an individual values doing and being

Source: Millennium Ecosystem Assessment

Arrow's color: Low, Medium, High
Potential for mediation by socioeconomic factors

Arrow's width: Weak, Medium, Strong
Intensity of linkages between ecosystem services and human well-being
The diversity in biodiversity

**IMPORTANCE OF BIODIVERSITY**

- Genetic diversity
- Protect freshwater resources
- Speed recovery from natural disasters
- Maintaining balance of the ecosystem
- Sustainability and growth

- Provision of food security
  - Adaptation to different habitats
  - Provision of biological resources
  - Promote soils formation and protection
  - Maintain food chain in the nature

by Marjess Hamocha-Daniels
Role for public health advocacy for nature

http://www.alternativesjournal.ca/energy-and-resources/biodiversity-protects
Building climate change health equity requires reciprocal care of us and nature

How can public health build intergenerational health equity without paying attention to nature?

http://nccdh.ca/blog/entry/who-is-using-the-public-health-roles-for-health-equity-action
WE ARE NATURE

Close-up of a small leaf
Blood vessels of a human heart
River network of the Amazon
Thank-you
Questions?
cstephen@cwhc-rcsf.ca