

Effects of Climate Change on Wildlife Health:  
A Case Study on Evidence of Exposure to Vector-borne  
Diseases in Snowshoe Hares (*Lepus americanus*)  
Captured in Northern Michigan, USA

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April 30, 2024

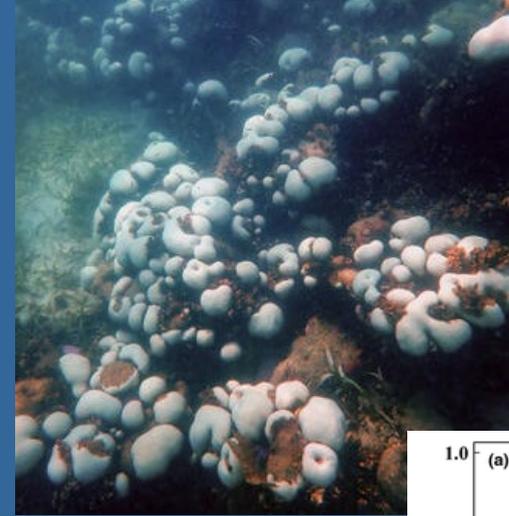
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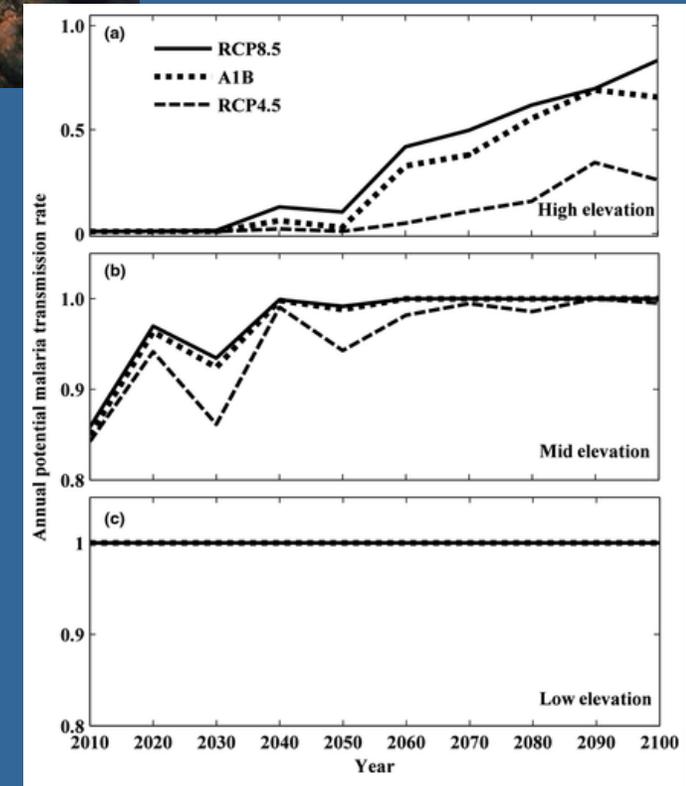
Dan Grear Ecologist, Melissa Lund Technician USGS NWHC

# Climate Change Effects on Wildlife

- Alteration of critical habitats
- Changes in animal density or distribution
- Limitation of food resources direct or indirect (phenology)
- Changes in survival or distribution of intermediate hosts and disease vectors



USGS

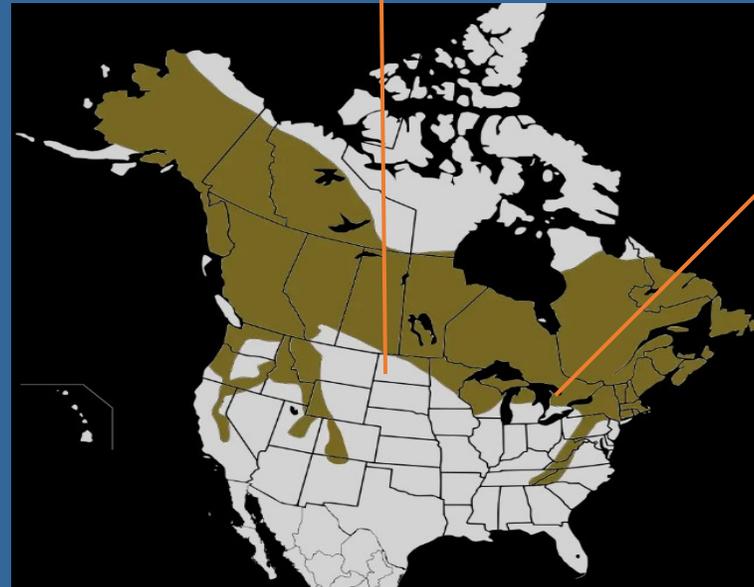


Liao, W et al. Global Change Biol.  
<https://doi.org/10.1111/gcb.13005>

# Anishinaabe Nations – Snowshoe Hares

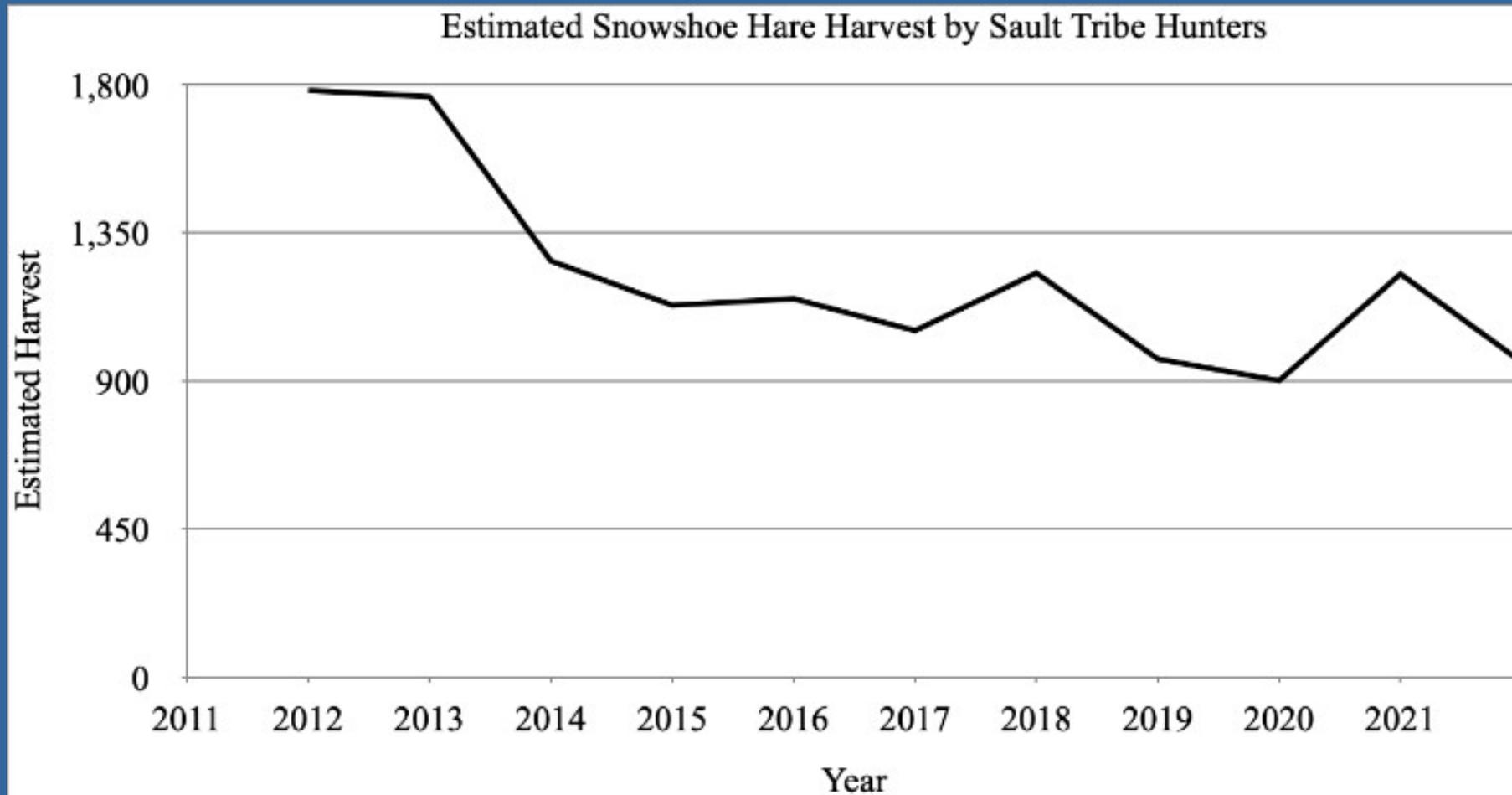


<https://www.thecanadianencyclopedia.ca/en/article/anishinaabe>



Distribution of  
Snowshoe hares in  
North America

# Estimated Snowshoe Hare Harvest by Sault Tribal Hunters 2011 - 2021



# Snowshoe Hare Vulnerability Assessment Eastern Upper Peninsula, Michigan, 2014



- Inland Fish and Wildlife Department  
Sault Ste. Marie Tribe of Chippewa  
Indians
- Applied Forest and Wildlife Ecology  
Lab Michigan St. University
- Michigan DNR
- USDA Forest Service

# Vulnerability Assessment to Climate Change

**Tool:** System for Assessing Vulnerability of a Species (SAVS)  
to Climate Change USDA Forest Service

## Assessment:

Adaptive Capacity

Exposure

Sensitivity

## Vulnerability Response Criteria

Habitat

Physiology

Phenology

Biologic Interactions

**Purpose:** To develop a Tribal adaptive management plan



CT.gov



US NPS

# Assessment Results

- Snowshoe hare are moderately to highly susceptible to climate change through the 21<sup>st</sup> Century
- Most vulnerable categories:
  - Habitat – tree species used for cover or food are expected to decline, scrub/shrub habitat preferred
  - Biotic interactions – Emerging diseases, competitors



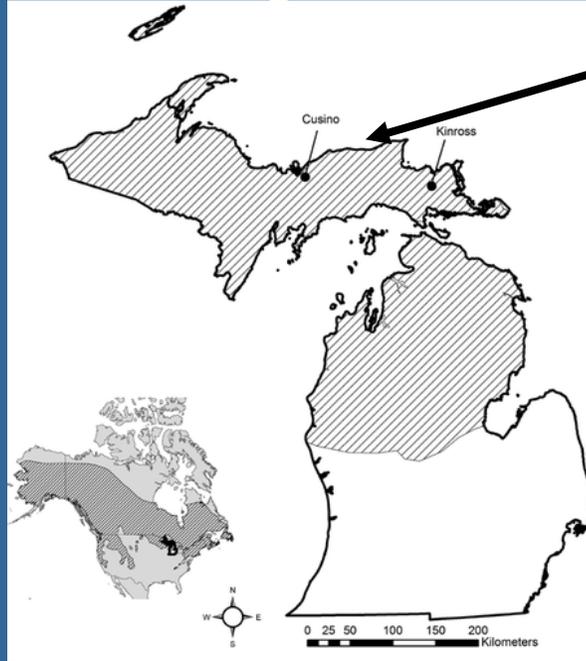
E. Clark STCE

# Snowshoe Hares Field Study in the Eastern UP of Michigan

Goals:

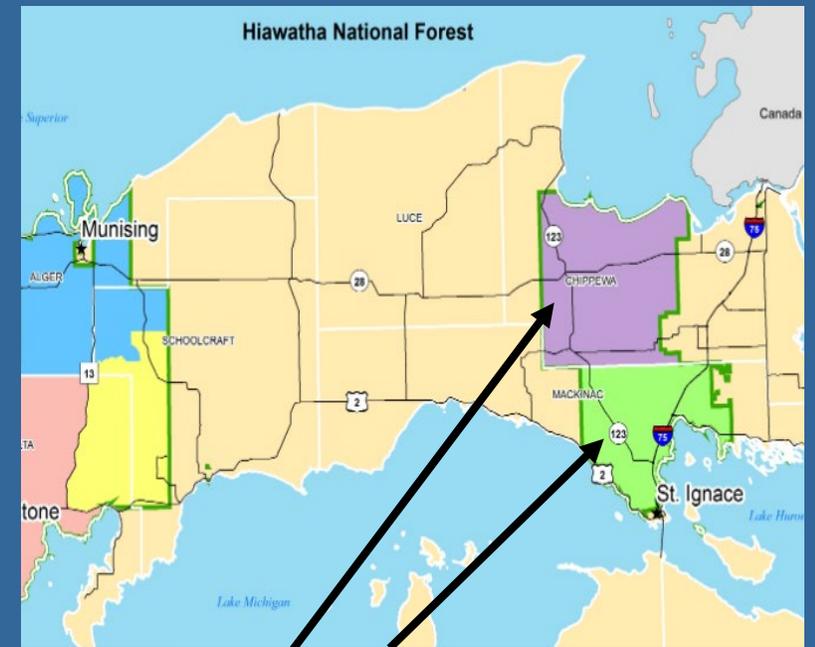
Baseline:

- Spatially-explicit SSH density predictions
- Disease exposure



MI Upper  
Peninsula

Burt, DM et al. Wildl. Soc.  
Bull. DOI: 10.1002/wsb.630



Study Sites: USDA US  
Forest Service Map

# Snowshoe Hares Vector-Borne Serosurvey



Phys.org

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Dan Gear Ecologist, Melissa Lund Technician USGS NWHC

*J Wildl Dis* (2024) 60 (2): 375–387.

# Serosurvey Results of Vector-borne Agents in 47 Snowshoe Hares Captured in UP of Michigan (2016–17)

| Agent                         | Screen Pos. | Confirm Pos. |  |
|-------------------------------|-------------|--------------|--|
| Snowshoe hare virus           | 24          | 24           |  |
| Jamestown Canyon virus        | 3           | 1            | Additionally:<br>With the exception<br>of Silverwater<br>virus all are known<br>zoonotic<br>disease agents |
| Silverwater virus             | 1           | 1            |  |
| LaCrosse encephalitis virus   | 0           |              |  |
| West Nile virus               | 2           | 0            |  |
| <i>Borrelia burgdorferi</i>   | 0           |              |  |
| Powassan virus                | 0           |              |  |
| <i>Francisella tularensis</i> | 0           |              |  |

# SSH seropositive hares found on ELT 70 - 80

Among SSH Positive hares:

Positive association with:

- Increased weight (age)
- ELT70: cedar, mixed swamp conifers, tamarack and balsam fir
- ELT80: forested wetlands black spruce and tamarack



Eric Clark Wildlife Program  
SSMT Chippewa Indians

# Serosurvey Conclusions

Difficult to determine in a 2-year study whether climate change is affecting the exposure of SSH to vector-borne diseases in the UP of Michigan

Sets a bench-mark for future study

Studies of this type are critical for determining the longer-term effects of climate change on wildlife health

For example, long term data sets of the range of SSH in WI found contraction of the range in 2014 as compared to the range in 1980 by an average of 29 km.

**2014 range of SSH (gray)**  
**range contraction**  
**since 1980 (red)**



*Wilson et al. Conserv Lett 2019*

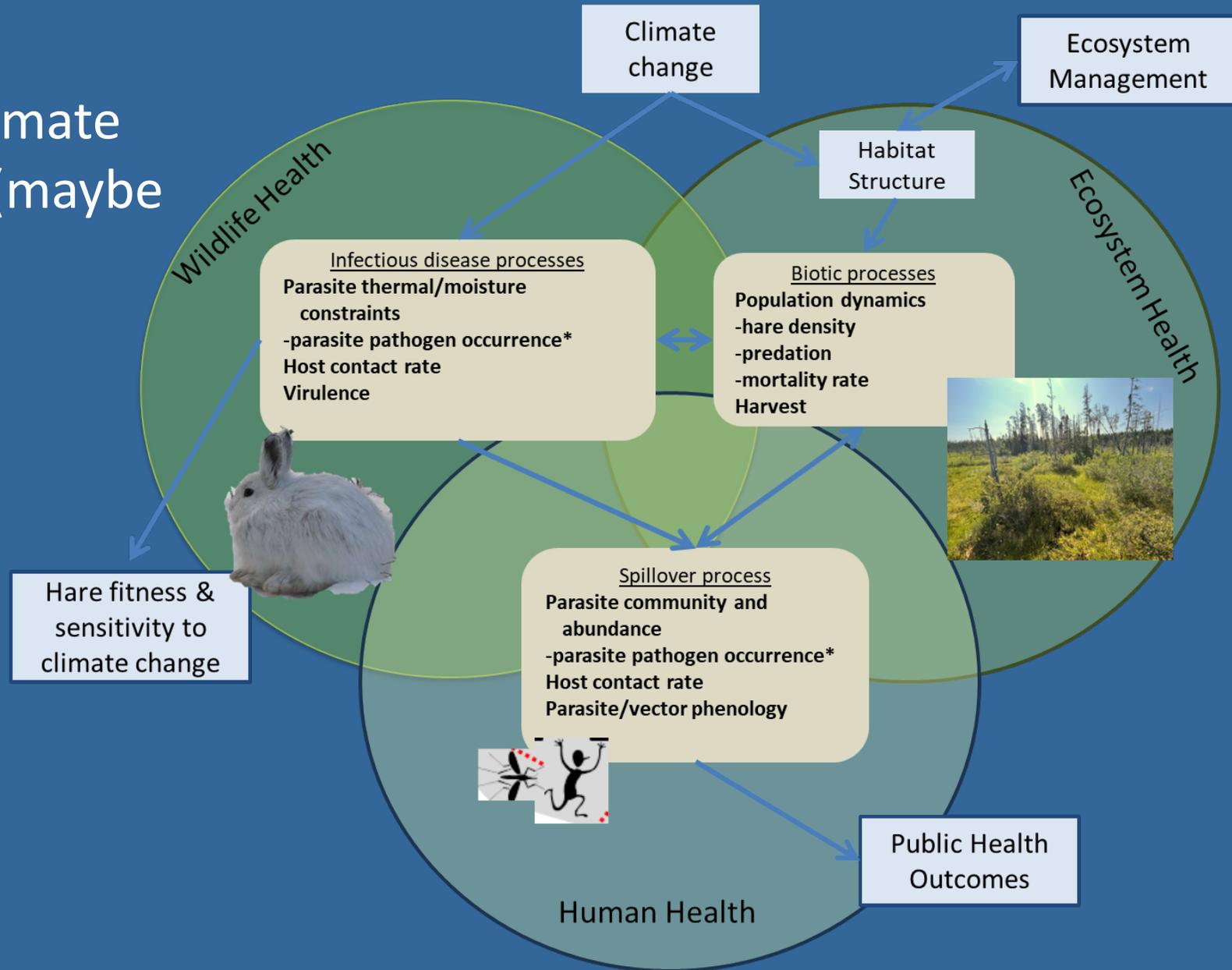


*Sultaire et al.*  
*Proc. Royal Soc. B, 2016*

# Outcomes and Directions

## One-Health Objectives

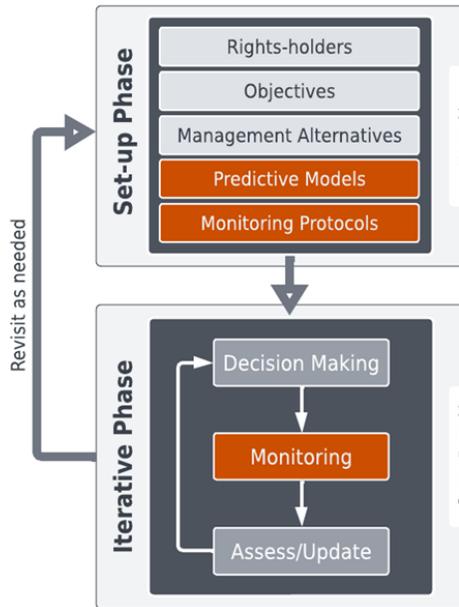
- Vectors will respond to climate change faster than hosts (maybe pathogens too)



# Outcomes and Directions

Bridge for multi-agency & sector objectives

- Sault tribe: resilience of culturally and recreationally important species
- USGS: applying expertise to provide new information to support and manage wildlife health
- USFS: manage multi-stressor response to sustainable forest management – climate, habitat, disease – with forest co-stewards



The banner features a circular logo on the left with a rainbow border and four quadrants containing animal icons: a bear, a moose, a rabbit, and a sturgeon. The central text reads *Win Awenen Nisitotung* in a large, elegant font. Below this, it says 'April 12, 2023', 'Sucker Moon • Namebin Giizis', and 'Vol. 44 • No. 4'. On the right is a circular seal for the Sault Ste. Marie Tribe of Chippewa Indians, celebrating 50 years of federal recognition (1972-2022) with a crane in the center. At the bottom, a black bar contains the text 'Bahweting Bidajimowin • Official newspaper of the Sault Ste. Marie Tribe of Chippewa Indians'.

## Sault Tribe partners with Hiawatha Forest

Thank you!