

# Dancing to Learn – Learning to Dance



## STAO2010 Conference

Science Teachers' Association of Ontario



STAO/APSO



**Inclusive Science:**

**Difference, Diversity and Equity**

11-13 November 2010; Toronto, Ontario

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**Canada Research Chair in Integrative Science**

**Professor of Biology, Cape Breton University**

**cheryl\_bartlett@cbu.ca; [www.integrativescience.ca](http://www.integrativescience.ca)**

# Dancing to Learn – Learning to Dance



## STAO2010 Conference

Science Teachers' Association of Ontario



STAO/APSO



## Inclusive Science: Difference, Diversity and Equity

“We dance in order to expand the potential for something to happen.”

Joseph Rael (2009) in *“Sound: Native Teachings + Visionary Art”* (p. 55),  
Council Oak Books, San Francisco



**ABSTRACT:** "Integrative Science" brings together indigenous and western scientific knowledges and ways of knowing for the purposes of science education, research, application, and outreach to Aboriginal youth and community. This talk will share understanding of the issues, challenges, and controversies for science educators.

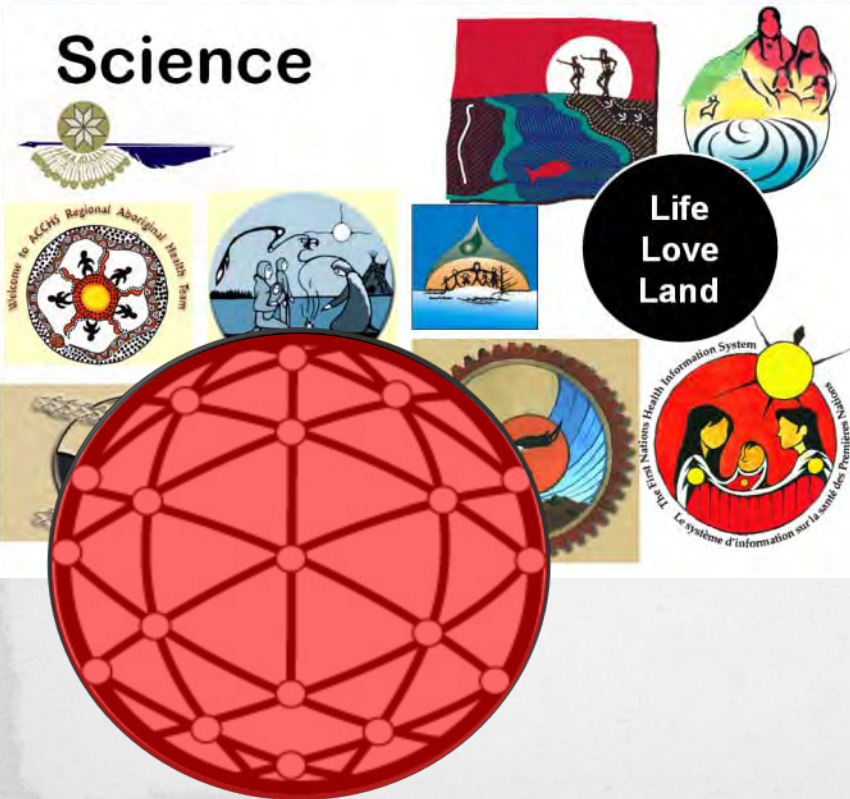


# OUTLINE and ENDING

# INTEGRATIVE SCIENCE: Difference ↔ Equity ↔ Diversity

stories of our interactions with and within nature

Science

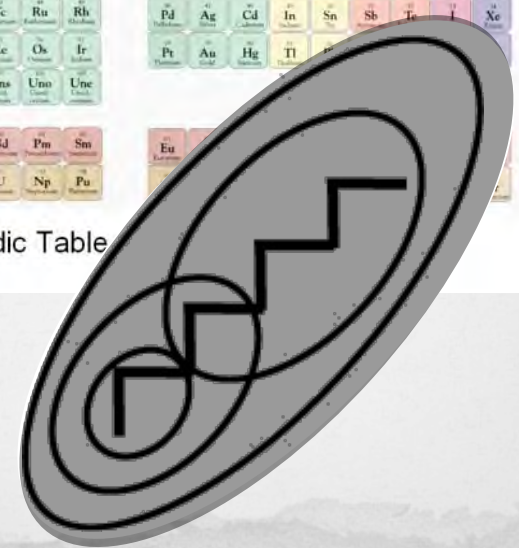


Life  
Love  
Land

stories of our interactions with and within nature

Science

Periodic Table







Canada Research  
Chairs

Chaires de recherche  
du Canada



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

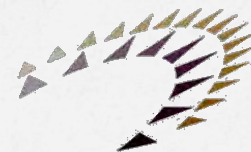
Canada  
Canada

# Thank you / Wela'liog



IAPH

CAPE BRETON  
UNIVERSITY



Canada Foundation  
for Innovation

Fondation canadienne  
pour l'innovation



Membertou  
Elementary

CIHR IRSC

Canadian Institutes of  
Health Research

Instituts de recherche  
en santé du Canada



Mi'kmawey  
Debert  
CULTURAL CENTRE



IWK Health Centre  
Foundation



Mermaid Theatre  
of Nova Scotia



Eskasoni First Nation Detachment  
Royal Canadian Mounted Police  
Gendarmerie royale  
du Canada



Mi'kmaq College Institute  
Mi'kmaq Espi Kina'matno'kuom

The support of various  
partners and funding agencies  
is gratefully acknowledged.

**for 15+ years we have been on a  
Co-Learning Journey  
(wherein we have been our own experimental rats)**





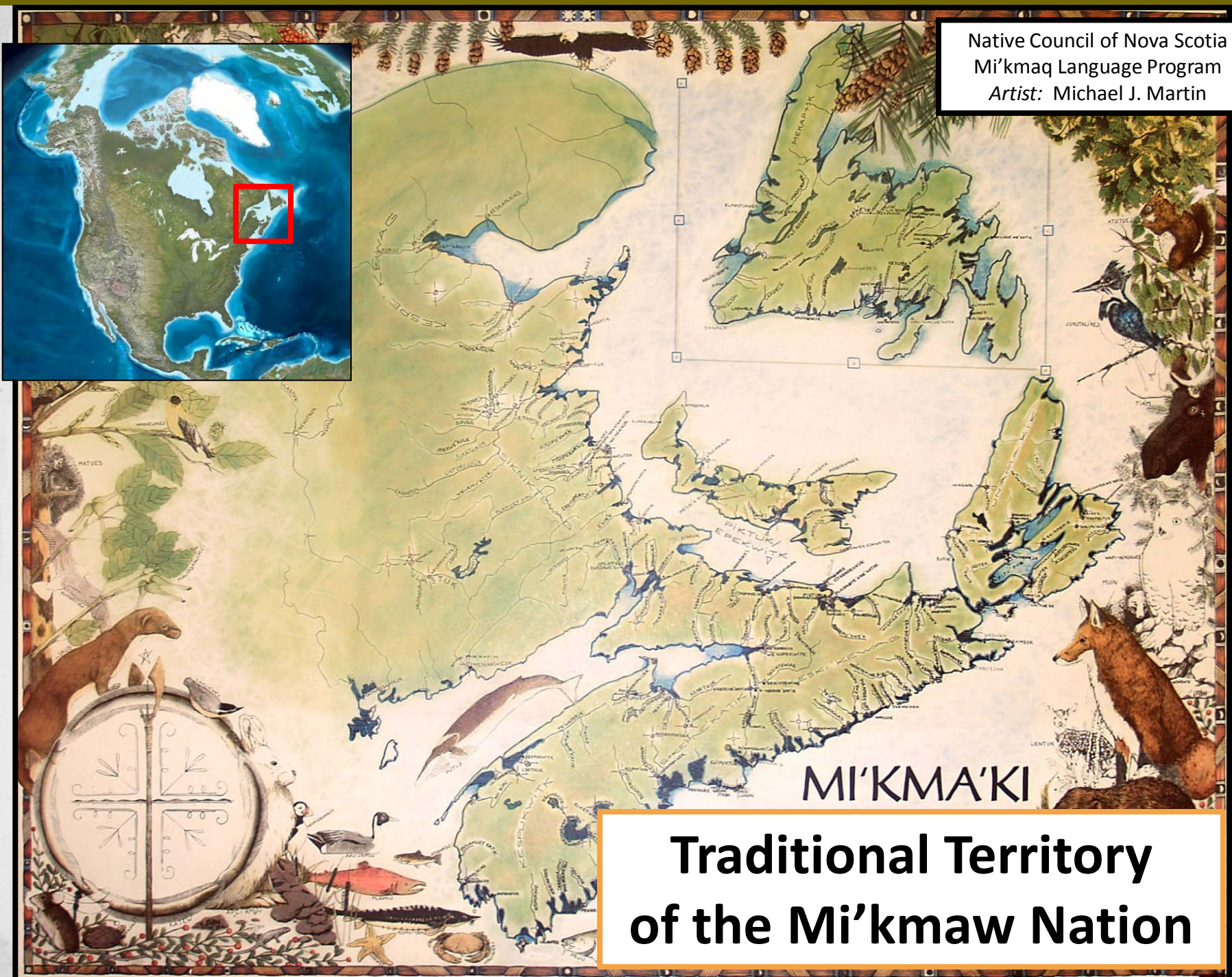


## Mi'kmaw Elders, Students, Research Team, Mother Earth





Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin



**Traditional Territory  
of the Mi'kmaq Nation**



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin



**Island of  
Cape Breton - Unama'ki  
Cape Breton University**

**Halifax**

**MI'KMA'KI**







**Alberta**

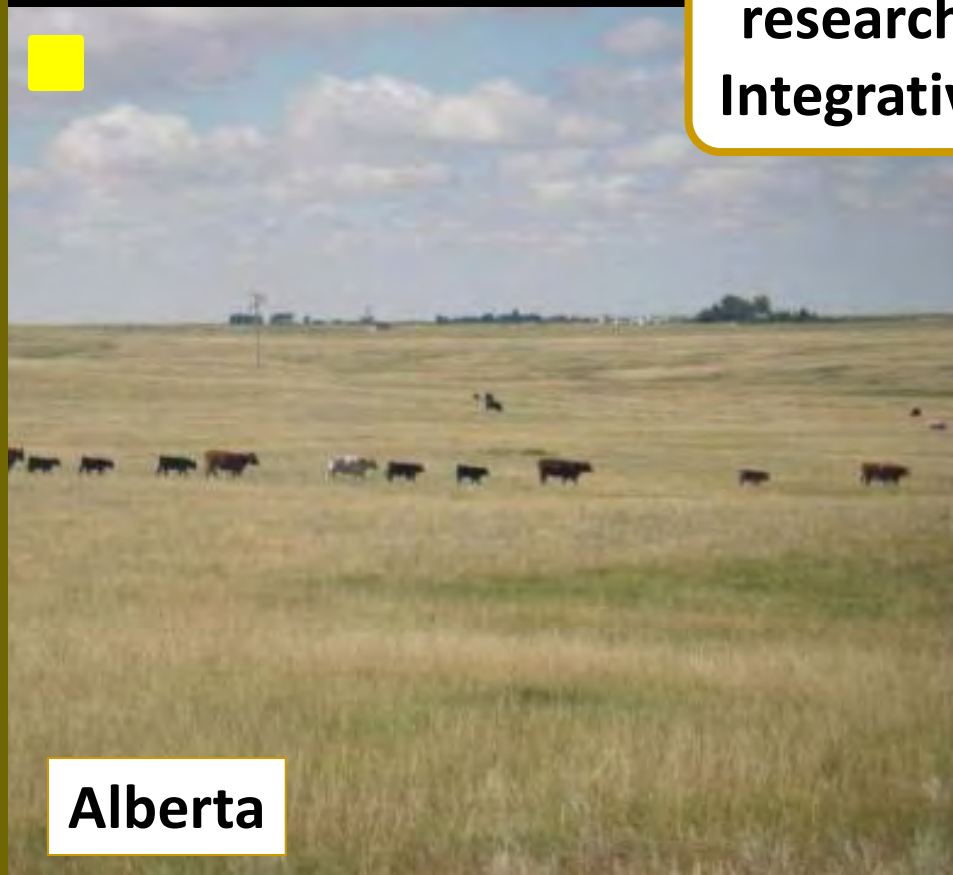
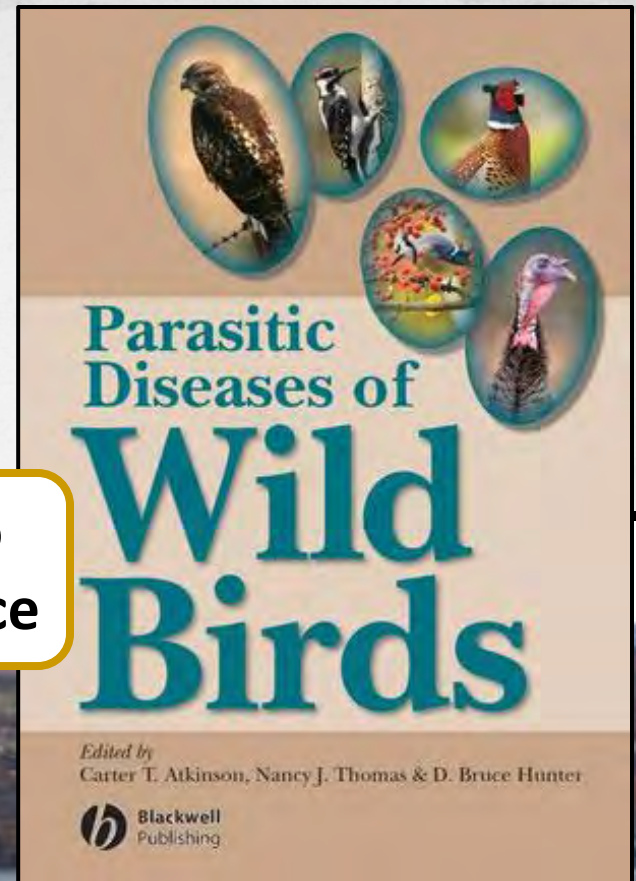


**Nova Scotia**

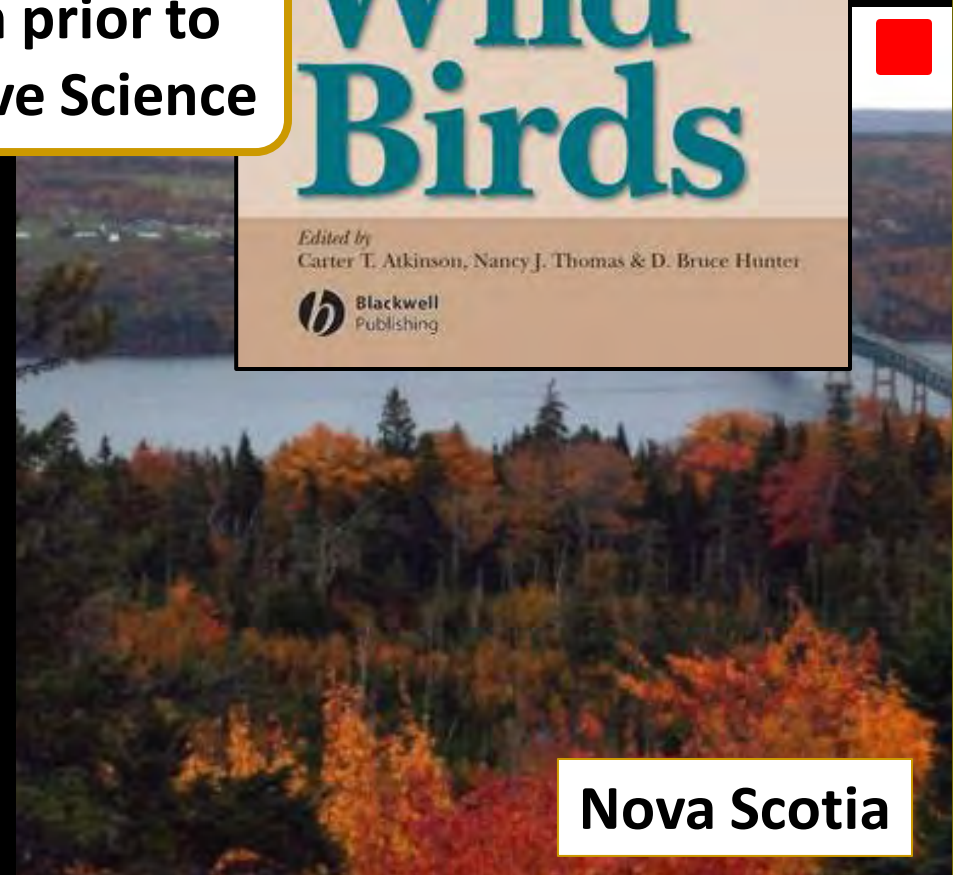




research prior to  
Integrative Science



Alberta



Nova Scotia





research in  
Integrative Science

especially with Mi'kmaw Elders  
Murdena and Albert Marshall

Alberta

Nova Scotia



**The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.**

Gregory Cajete, PhD  
Native American Scientist & Educator, Univ. of New Mexico

**Indigenous**

**Western**

**The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.**

Gregory Cajete, PhD  
Native American Scientist & Educator, Univ. of New Mexico

Indigenous

Western



# Integrative Science

bringing together Indigenous and Western scientific knowledges and ways of knowing

starting in the mid 1990's



Indigenous

Western

# Integrative Science



Indigenous

Western



# Integrative Science



our stories  
our sciences

Indigenous

our worldviews

Western

“bringing our knowledges together”

# Integrative Science

words of Elder Albert Marshall, Mi'kmaw Nation

**“The foundational basis for any relationship  
is an exchange of stories.”**

Indigenous

Western

**“bringing our stories together”**



# Integrative Science

STAO2010: INCLUSIVE SCIENCE



Indigenous

Western

“bringing our stories together”

# Integrative Science

STAO2010: DIFFERENCE

Indigenous

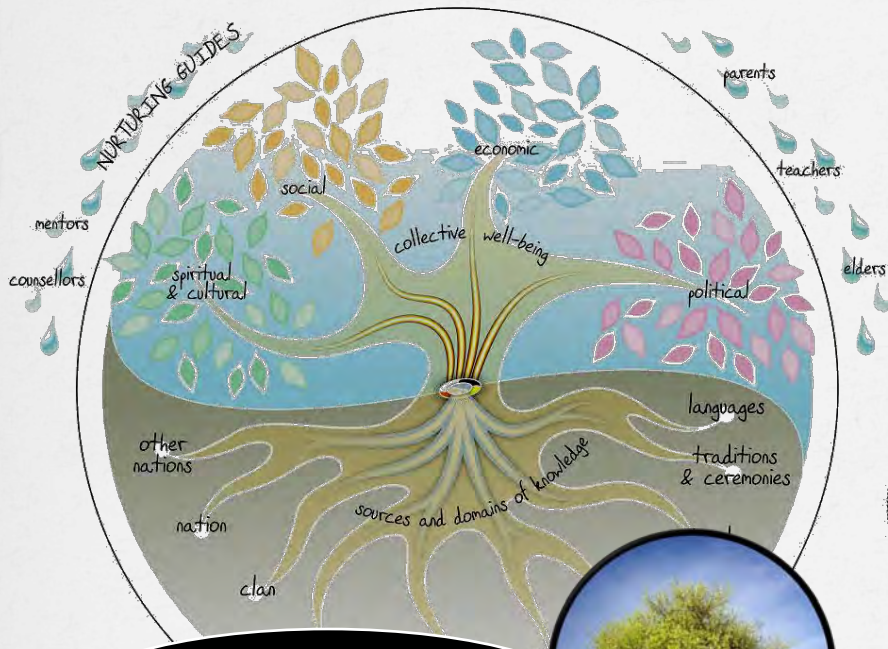
Western

“bringing our stories together”



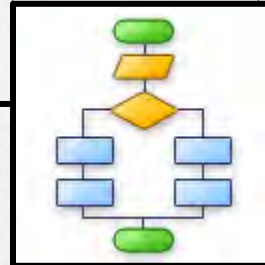
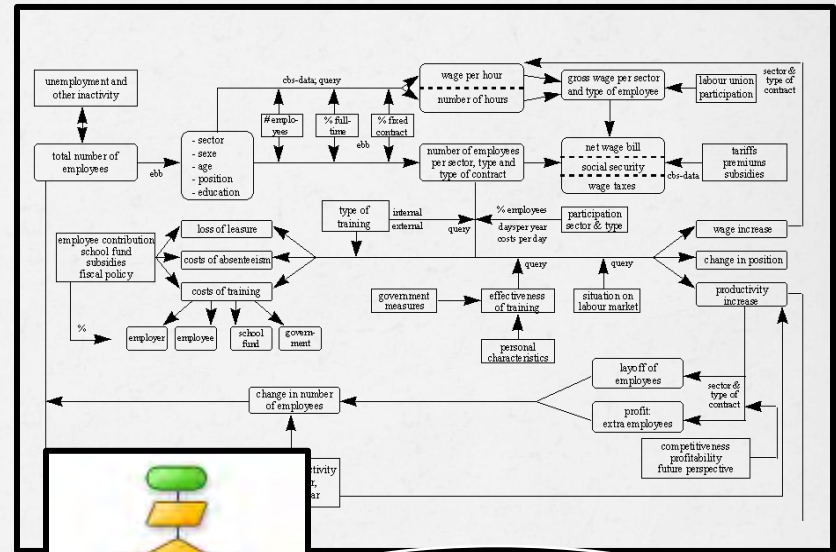
# Integrative Science

## STAO2010: DIFFERENCE



**Indigenous**

([www.ccl-cca.ca/CCL](http://www.ccl-cca.ca/CCL))

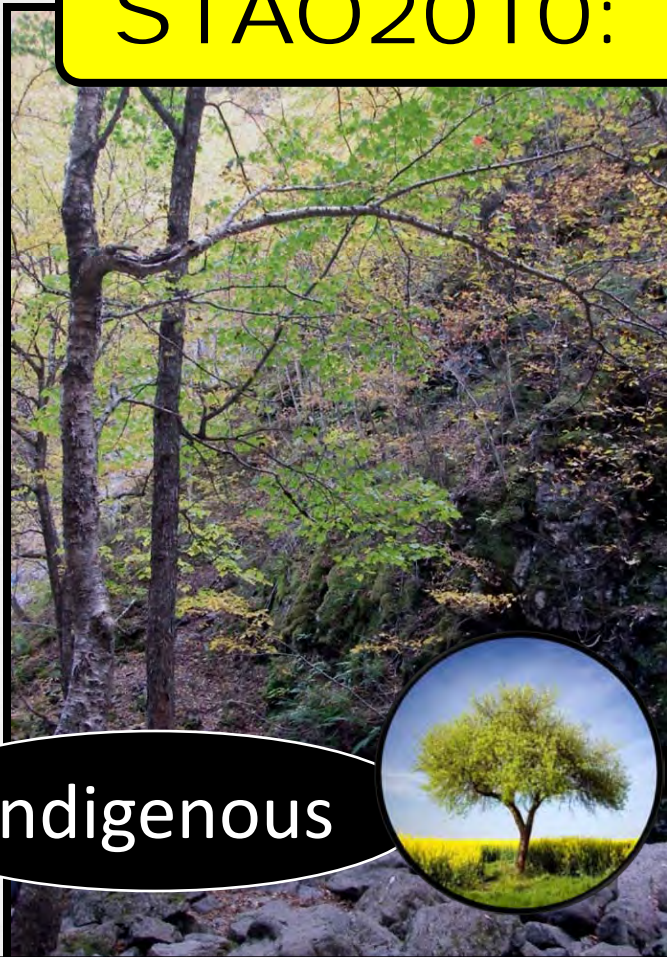


**Western**

# Lifelong Learning Models

# Integrative Science

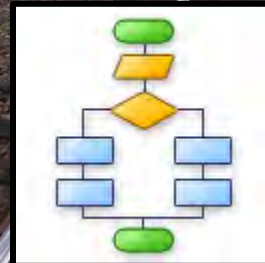
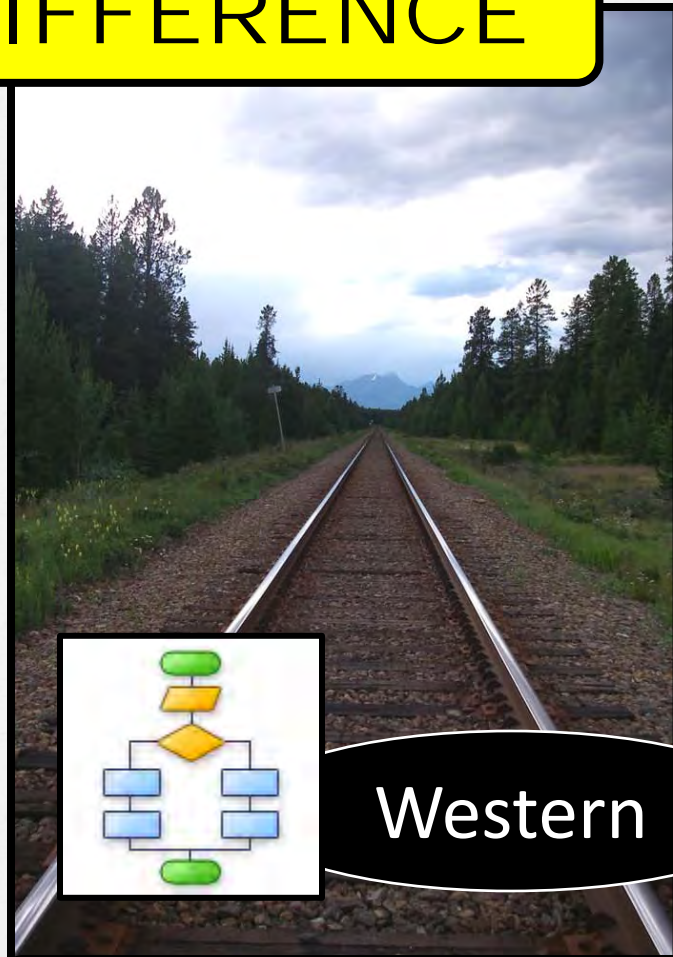
STAO2010: DIFFERENCE



Indigenous



towards resonance of  
understanding within environment



Western

towards construction of  
understanding of environment



# Integrative Science

## STAO2010: DIFFERENCE



*(words of Elder Albert Marshall)*

**“If only we would spend a few moments to determine if there are possibilities for change ... to hear the **STORIES** from cultures other than our own.”**



**“Let us find ways to share our stories.”**

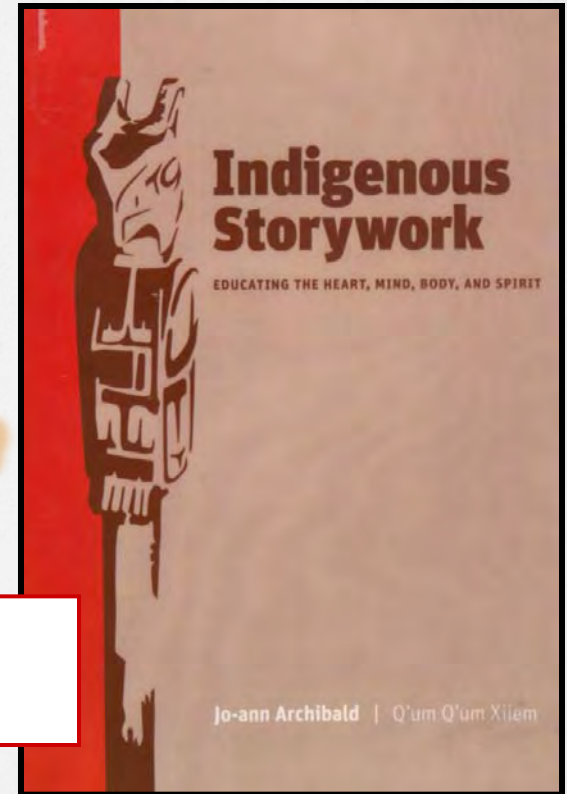
# Integrative Science



## Indigenous Storywork types of stories:

- 1) legends ... *things come to be*
- 2) peoples' experiences

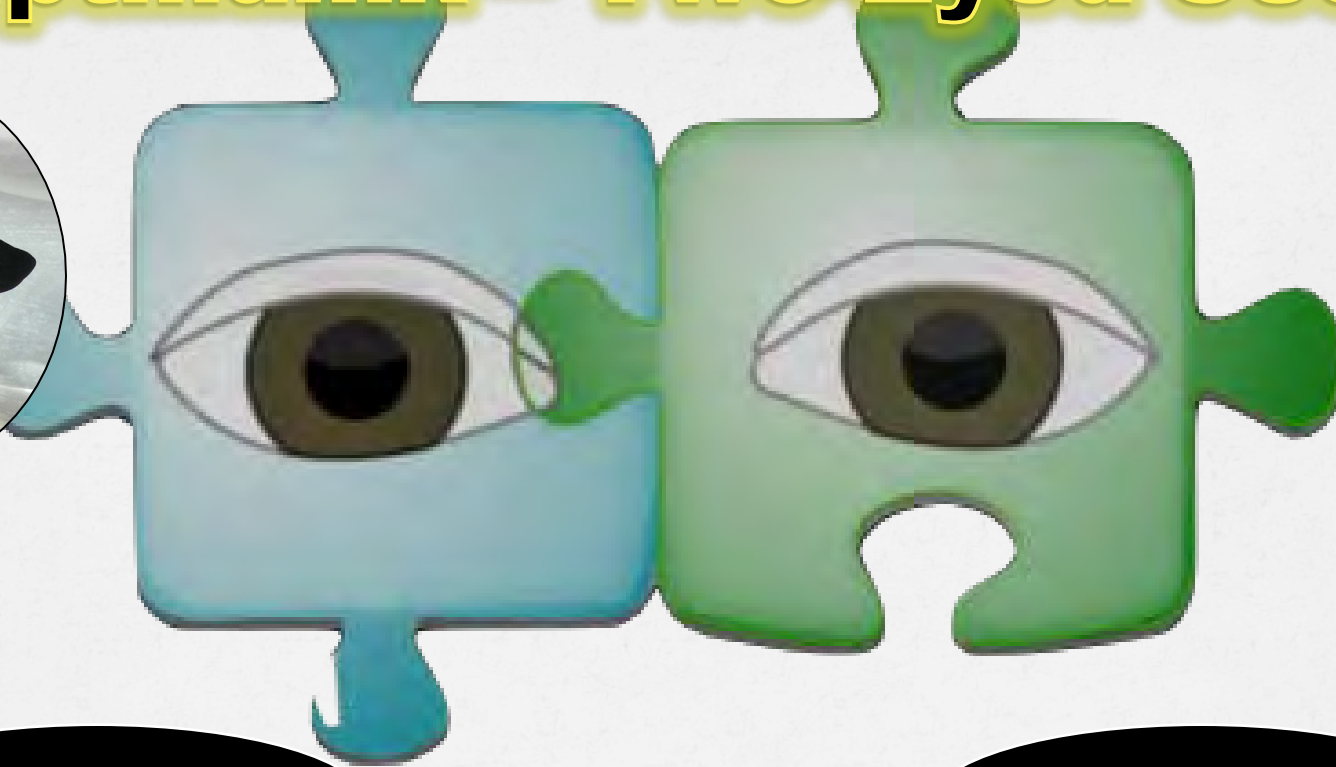
Jo-ann Archibald (2008),  
Indigenous Storywork, UBC Press



“Let us find ways to  
share our stories.”



# Etuaptmumk – Two-Eyed Seeing



**Indigenous**

**Western**

**“Let us find ways to  
share our stories.”**

# **Etuaptmumk – Two-Eyed Seeing**



**LEARN ... to see from one eye with the best in our Indigenous ways of knowing, and from the other eye with the best in the Western (or mainstream) ways of knowing ... and learn to use these eyes together, for the benefit of all.**

*(words of Elder Albert Marshall)*



# **Etuaptmumk – Two-Eyed Seeing**

**We need to consider some philosophical aspects about our stories / sciences / knowledges / worldviews.**





# **Etuaptmumk – Two-Eyed Seeing**

We need to consider some philosophical aspects about our stories / sciences / knowledges / worldviews.

In general, we (scientists) are not very good at this ... it has not been part of our formal educational experience.

## **Dancing to Learn – Learning to Dance CHALLENGES**





# Etuaptmumk – Two-Eyed Seeing

We need to consider some philosophical aspects about our stories / sciences / knowledges / worldviews.

Ermine (2007): Fundamental question of cultural encounters is “How can we reconcile worldviews?” He suggests the implementation of ethical space in which we make “a venue to step out of our allegiances, to detach from the cages of our mental worlds and assume a position where human-to-human dialogue can occur.”

## Dancing to Learn – Learning to Dance CHALLENGES

Ermine, W. 2007. The ethical space of engagement.  
*Indigenous Law Journal* 6(1): 193-203.





# Etuaptmumk – Two-Eyed Seeing

We need to consider some philosophical aspects about our stories / sciences / knowledges / worldviews.

... four “big pattern” considerations ...

Ermine et al. (2004) say implementation of ethical space first requires an affirmation of its existence. Ethical space cannot exist without this affirmation.

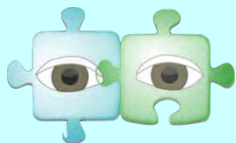
## Dancing to Learn – Learning to Dance CHALLENGES

Ermine, W., Sinclair, R., and Jeffrey, B. 2004.

The ethics of research involving Indigenous peoples. *Report of the Indigenous Peoples' Health Research Centre to the Interagency Advisory Panel on Research Ethics.*







# TWO-EYED SEEING

learning to see with the strengths of each & together

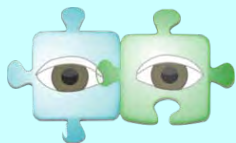
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## OUR OVERALL KNOWLEDGE OBJECTIVES

### BIG QUESTION

**What overall goals  
do we have for  
our ways of knowing?**





# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR OVERALL KNOWLEDGE OBJECTIVES

### BIG UNDERSTANDING ... IN WORDS

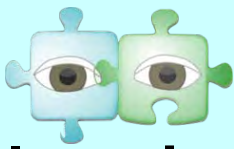
collective, living  
knowledge to enable  
nourishment of one's journey  
within expanding sense of  
"place, emergence and  
participation" for collective  
consciousness and  
interconnectiveness

dynamic, testable,  
published knowledge  
independent of  
personal experience  
that can enable  
prediction and control  
(and "progress")

**towards resonance of  
understanding within environment**

**towards construction of  
understanding of environment**



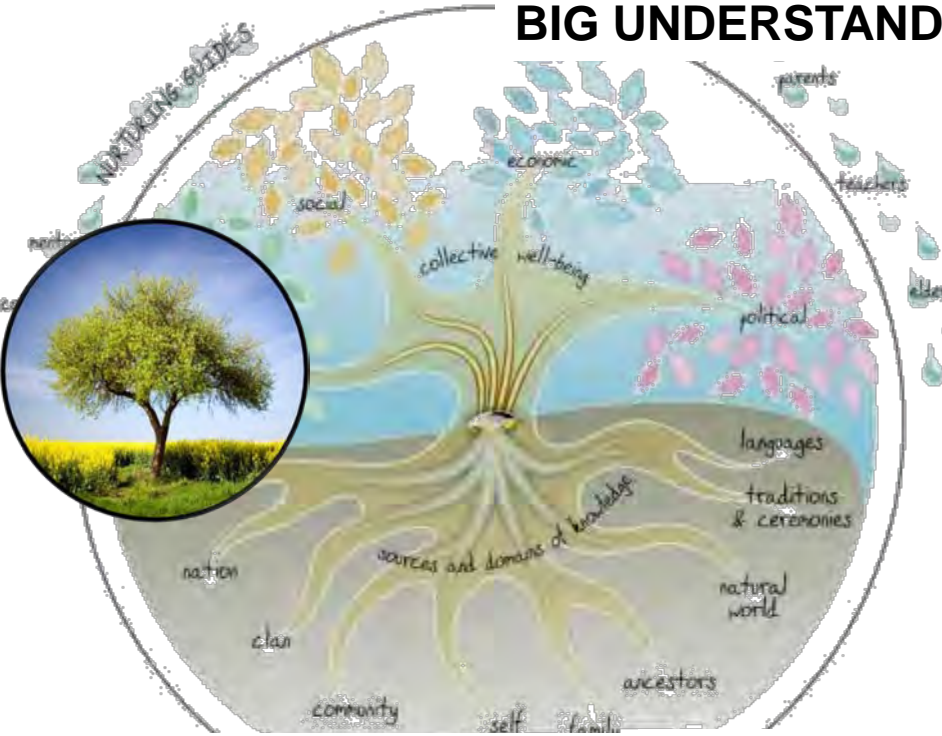


# TWO-EYED SEEING

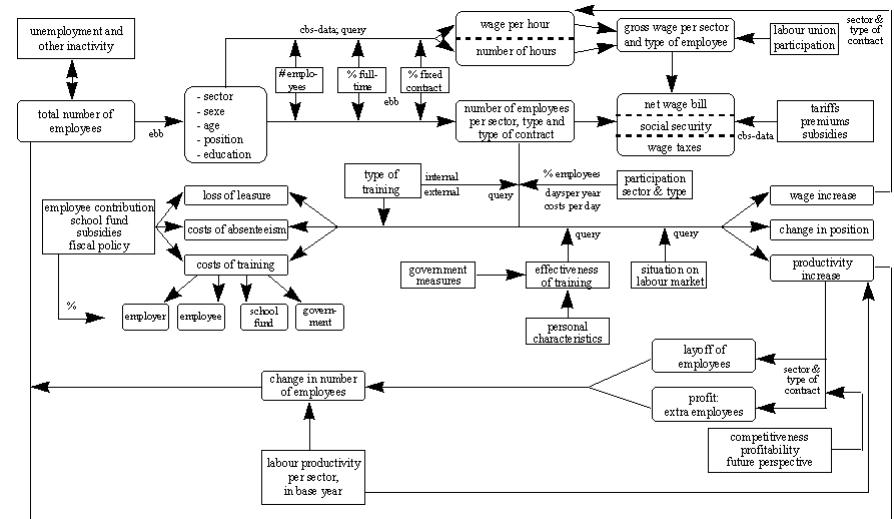
learning to see with the strengths of each & together

## OUR OVERALL KNOWLEDGE OBJECTIVES

### BIG UNDERSTANDING ... IN VISUALS



from: CCL Aboriginal Learning Knowledge Centre ([www.ccl-cca.ca/CCL](http://www.ccl-cca.ca/CCL))



from: [www.leads.ac.uk](http://www.leads.ac.uk)

**towards resonance of understanding within environment**

**towards construction of understanding of environment**

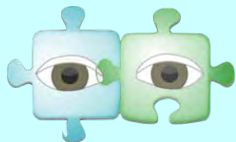


**Shaping our stories ...  
by how we value and share the world.**

**Dancing to Learn – Learning to Dance**







# TWO-EYED SEEING

learning to see with the strengths of each & together

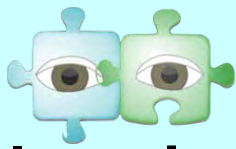
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## OUR WORLD

### BIG QUESTION

**What do we believe  
the world or cosmos to be?  
(ontology)**





# TWO-EYED SEEING

learning to see with the strengths of each & together

---

## OUR WORLD

BIG UNDERSTANDING ... IN WORDS

**interconnective**

beings ...  
interconnective  
and animate:

*spirit +  
energy + matter*

with

**CONSTANT CHANGE**

within balance and wholeness

**parts & wholes**

objects ...  
comprised of parts and  
wholes characterized by  
systems and emergences:

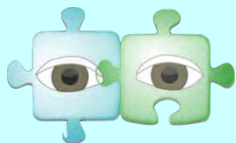
*energy + matter*

with

**EVOLUTION**

with systems and emergences





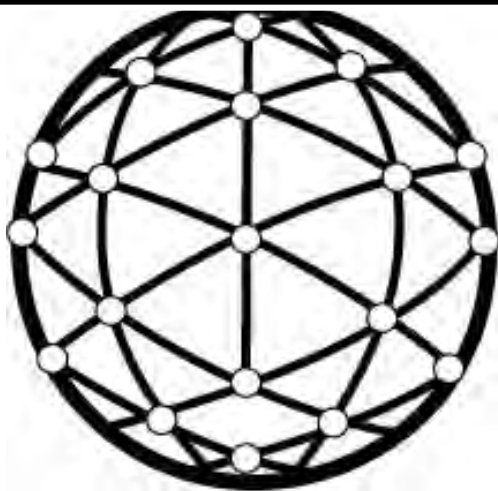
# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR WORLD

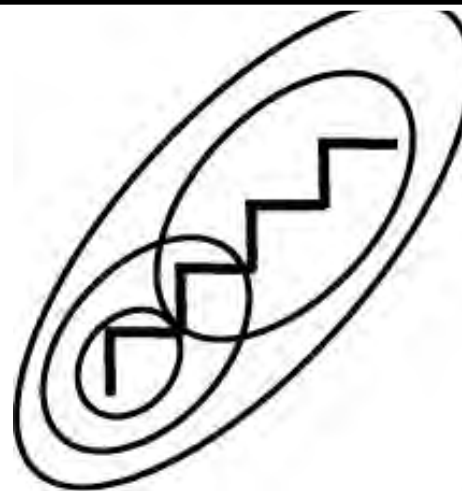
BIG UNDERSTANDING ... IN VISUALS

**interconnective**



**CONSTANT CHANGE**  
within balance and wholeness

**parts & wholes**



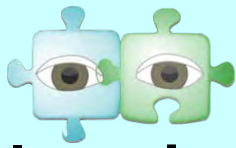
**EVOLUTION**  
with systems and emergences

**Shaping our stories ...  
by how we value and share the world.**

**Dancing to Learn – Learning to Dance**







# TWO-EYED SEEING

learning to see with the strengths of each & together

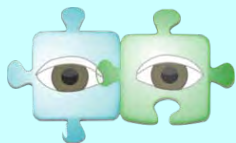
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## OUR KEY CONCEPTS and ACTIONS

### BIG QUESTION

**What do we value as  
“ways of coming to know”  
the cosmos?  
(epistemology)**





# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR KEY CONCEPTS and ACTIONS

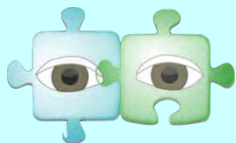
### BIG UNDERSTANDING ... IN WORDS

- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility

- hypothesis  
(making & testing)
- data collection
- data analysis
- model & theory  
construction







# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR KEY CONCEPTS and ACTIONS

### BIG UNDERSTANDING ... IN VISUALS

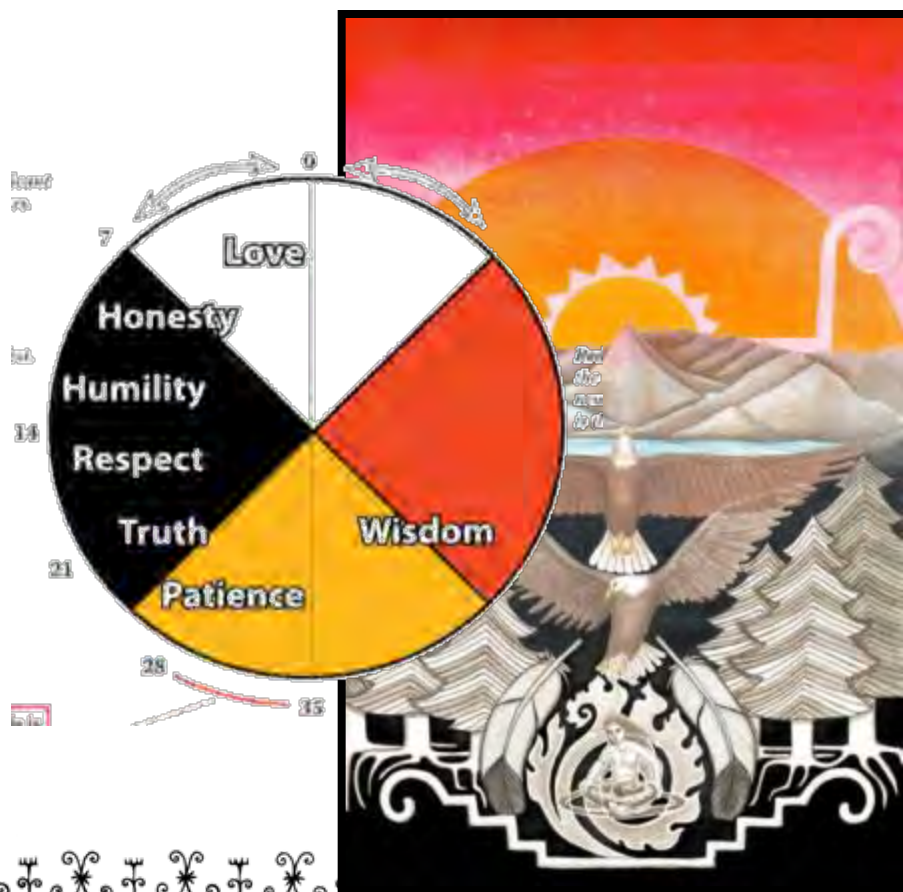


photo credit: NRC

Artist Basma Kavanagh

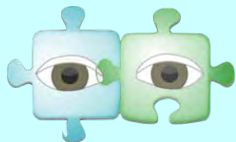


**Shaping our stories ...  
by how we value and share the world.**

**Dancing to Learn – Learning to Dance**







# TWO-EYED SEEING

learning to see with the strengths of each & together

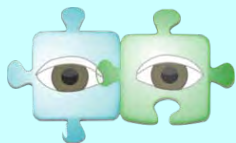
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## OUR LANGUAGES and METHODOLOGIES

### BIG QUESTION

**What can remind us  
of the complexity within  
our ways of knowing?**





# TWO-EYED SEEING

learning to see with the strengths of each & together

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## OUR LANGUAGES and METHODOLOGIES

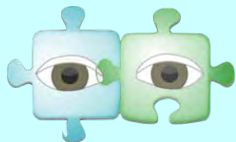
### BIG UNDERSTANDING ... IN WORDS

*weaving* of patterns within nature's patterns via creative relationships and reciprocities among ***love, land, and life (vigour)*** that are constantly reinforced and nourished by Aboriginal languages

*un-weaving* of nature's patterns (especially via analytic logic and the use of instruments) to cognitively reconstruct them, especially using ***mathematical language (rigour)*** and computer models







# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR LANGUAGES and METHODOLOGIES

BIG UNDERSTANDING ... IN WORDS

Life  
Love  
Land

vigour

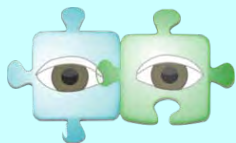
**WEAVING**

Math  
&  
Instruments

rigour

**UN-WEAVING**





# TWO-EYED SEEING

learning to see with the strengths of each & together

## OUR LANGUAGES and METHODOLOGIES

BIG UNDERSTANDING ... IN VISUALS



Life  
Love  
Land

vigour

**WEAVING**



Math  
&  
Instruments

rigour

**UN-WEAVING**





**The four “big pattern” understandings  
are required for Two-Eyed Seeing.**

**Dancing to Learn – Learning to Dance**



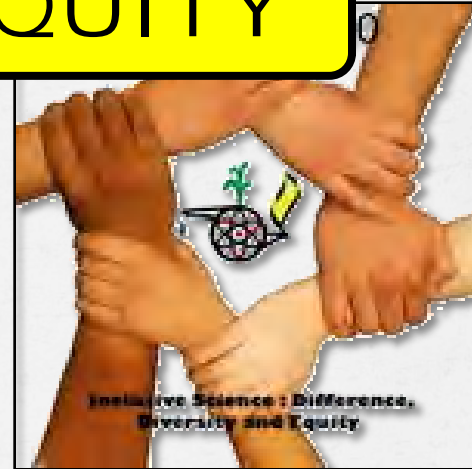


# Dancing to Learn – Learning to Dance

STAO2010: EQUITY



STAO/APSO



## Inclusive Science: Difference, Diversity and Equity

"We dance in order to expand the potential for something to happen."

Joseph Rael (2009) in *"Sound: Native Teachings + Visionary Art"* (p. 55),  
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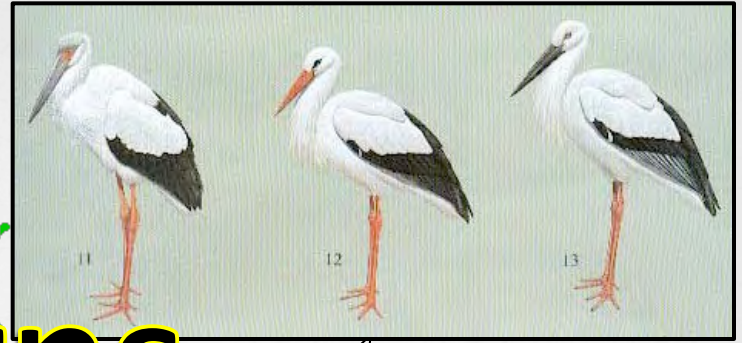
# Integrative Science

STAO2010: EQUITY

# patterns







# patterns

“thing”

difference

pattern

human  
consciousness

variation  
and  
diversity





# Integrative Science

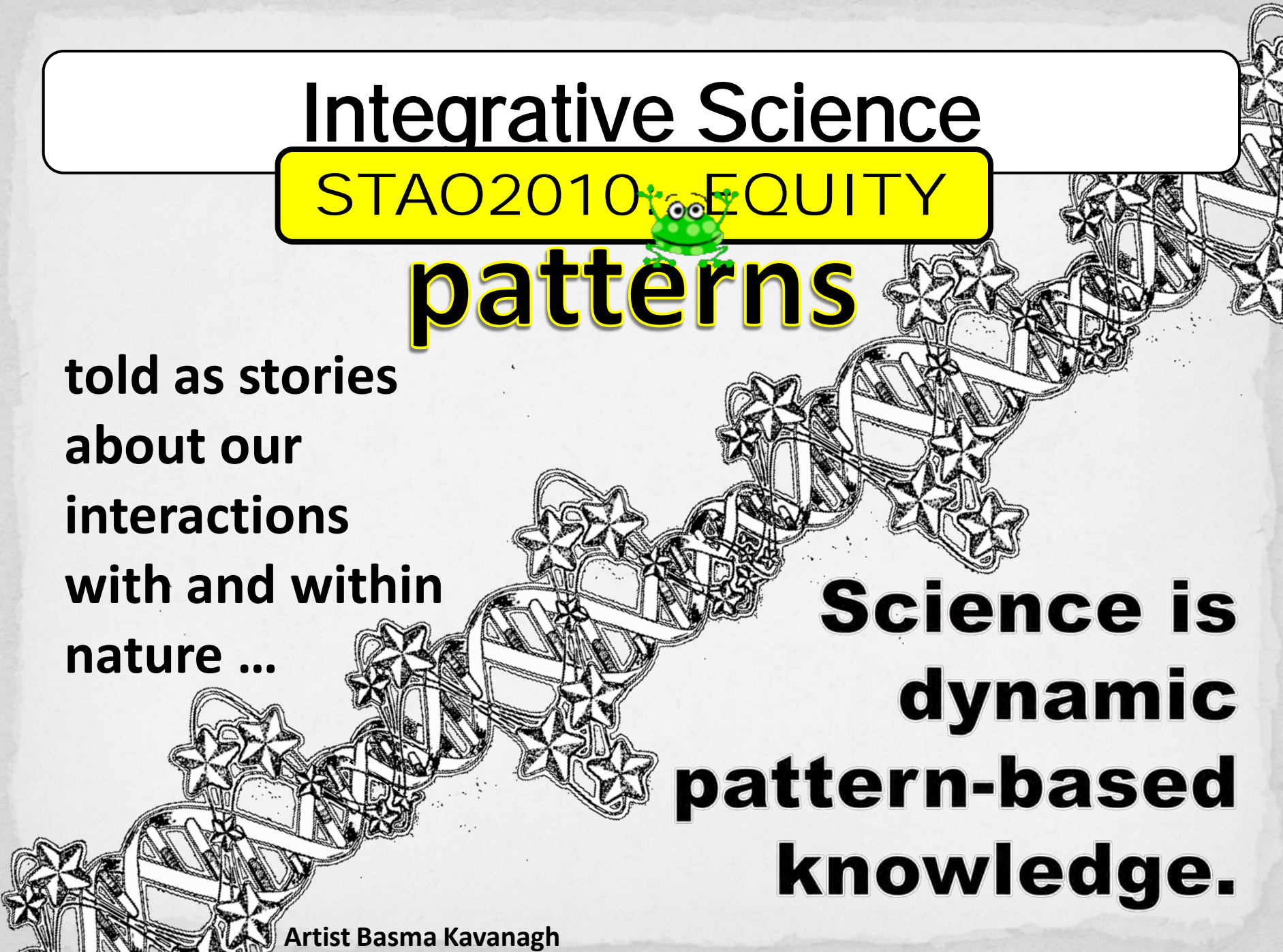
STAO2010: EQUITY

**patterns**

told as stories  
about our  
interactions  
with and within  
nature ...

**Science is  
dynamic  
pattern-based  
knowledge.**

Artist Basma Kavanagh



# Integrative Science

STAO2010: EQUITY

**patterns**

told as stories  
about our  
interactions  
with and within  
nature ...



Artist Basma Kavanagh



# Integrative Science

STAO2010: DIVERSITY


## patterns

told as stories  
about our  
interactions  
with and within  
nature ...

### human pattern smarts

- various ways to connect the dots
- diversity in our stories

Artist Basma Kavanagh

- ◇ numbers (logical-mathematical)
- ◇ language (linguistic)
- ◇ music (musical) 
- ◇ body (body-kinesthetic)
- ◇ spatial (spatial)
- ◇ other people (interpersonal)
- ◇ self (intrapersonal)
- ◇ naturalist (naturalist)
- ◇ spiritual / existential \*

Howard Gardner's "multiple intelligences"


## human pattern smarts

- various ways to connect the dots
- diversity in our stories



Artist Basma Kavanagh

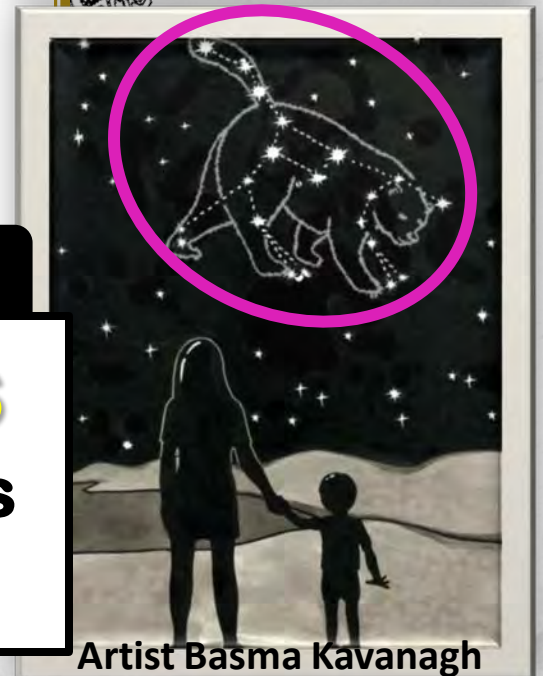
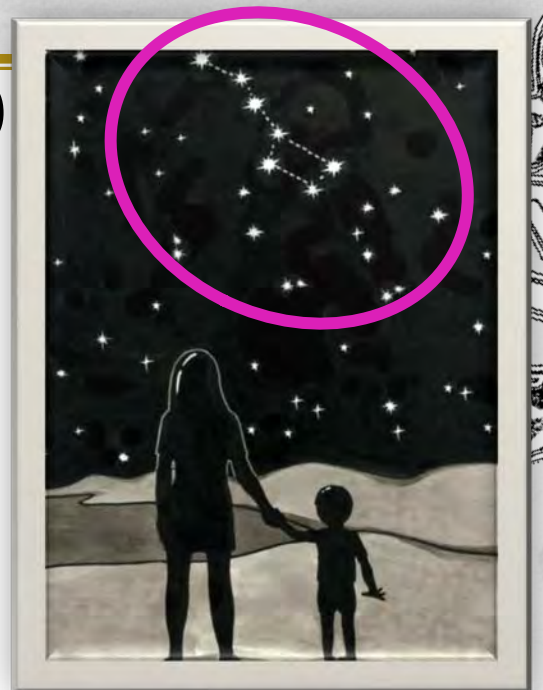


- ◇ numbers (logical-mathematical)
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- ◇ spiritual / existential \*

Howard Gardner's "multiple intelligences"

## human pattern smarts

- various ways to connect the dots
- diversity in our stories



Artist Basma Kavanagh

our science stories ...  
draw upon our "pattern smarts"

word smarts

math smarts

music smarts

nature smarts

picture smarts

body smarts

spirit smarts

people smarts

self smarts



**WHAT STORIES ... depends upon:  
SANCTIONED PERSPECTIVES & INTELLIGENCES**

who we are; where we are; where we were;  
what we know, do and value



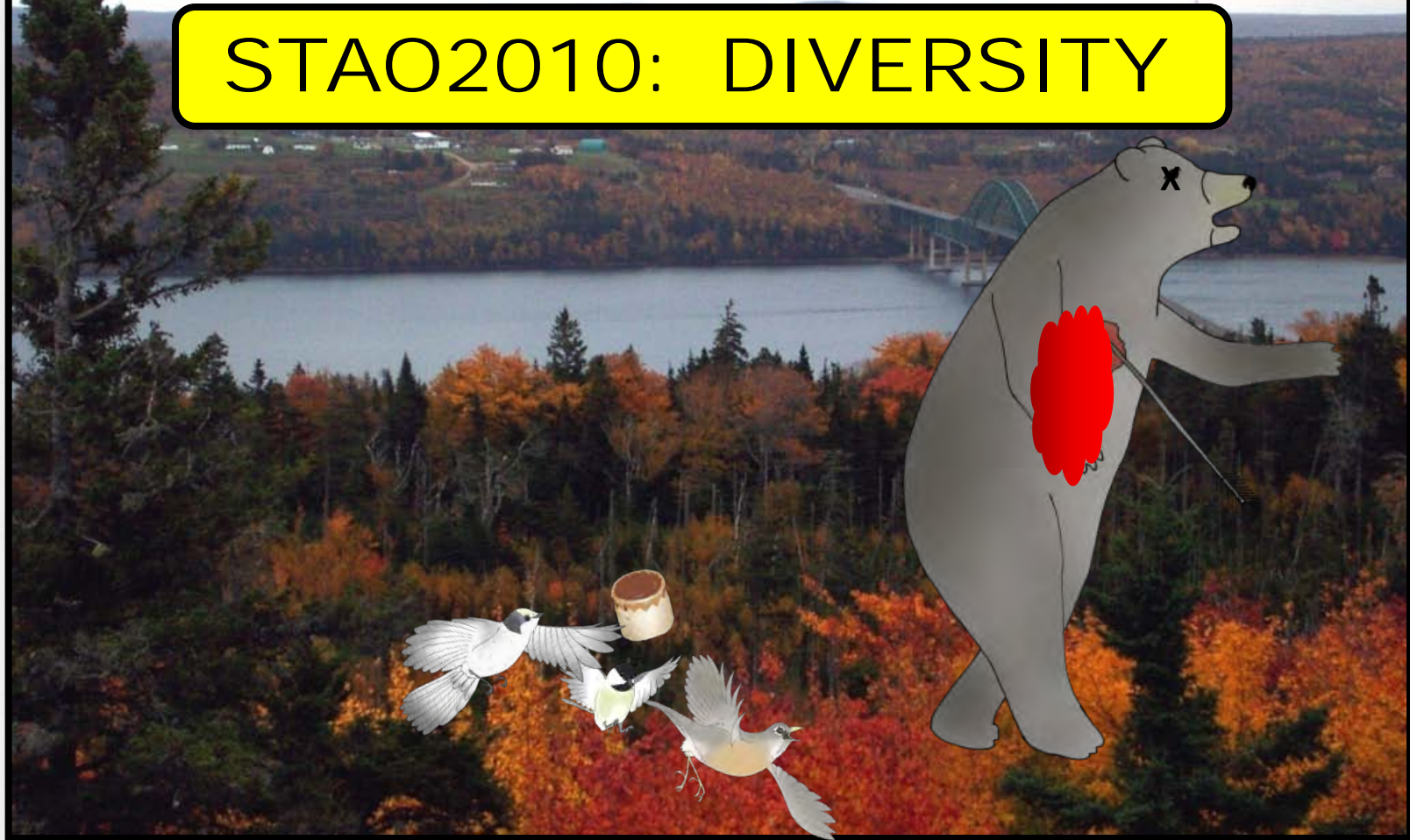


Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

Canada

# STAO2010: DIVERSITY



## Muin and The Seven Bird Hunters



# “Reflections”

artist Gerald Gloade  
Millbrook First Nation





# Patterns in Stars

## “Reflections”

artist Gerald Gloade  
Millbrook First Nation

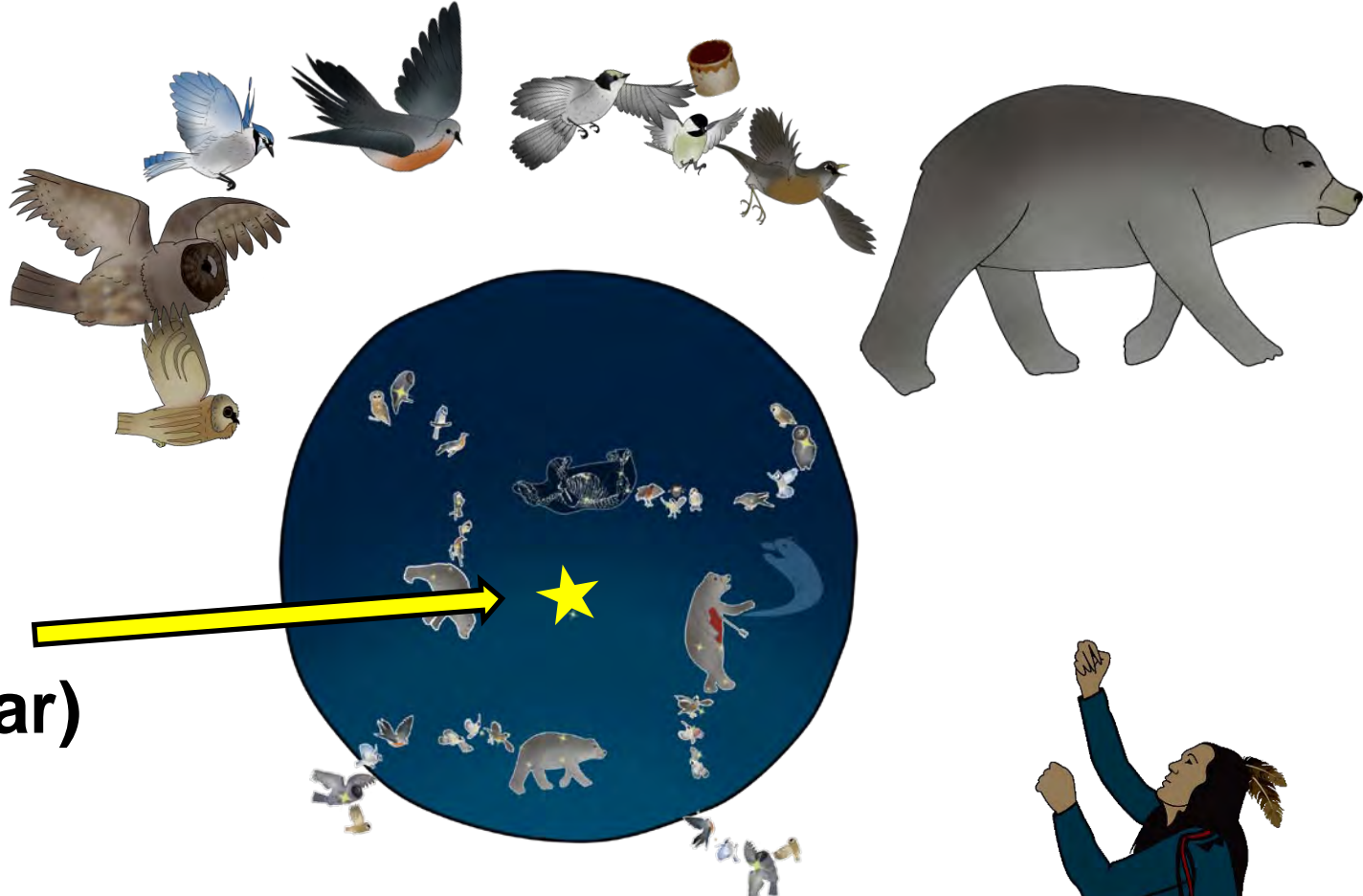
# Patterns on Earth



DVD

image by Kristy Read





**Tatapn  
(North Star)**

**Muin and The Seven Bird Hunters:  
a Mi'kmaw Night Sky Story  
... interconnectiveness of  
space-time-life-knowledge-spirit**



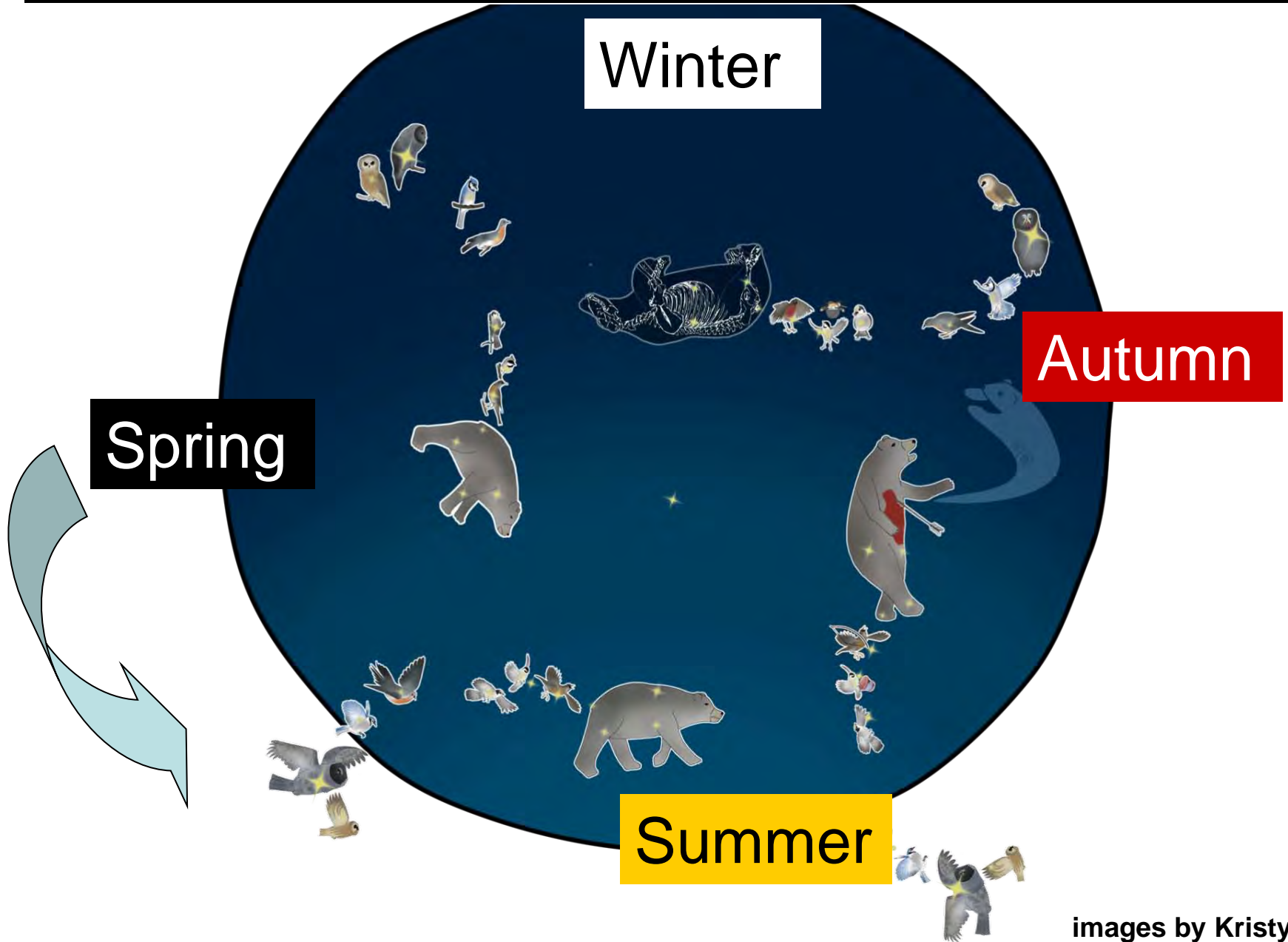


# Muin and The Seven Bird Hunters





# meta pattern of the story over one full year



# Pemi Pungek Mi'kma'ki

Winter

Autumn

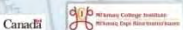
Spring

Summer

This poster is dedicated to all Mi'kmaq Elders.

This poster is one in a series made by the Institute for Integrative Science and Health at Cape Breton University and Mi'kmaq First Nations' Elders of Cape Breton. Integrative Science brings together Indigenous and Western scientific knowledge and ways of knowing for science education.

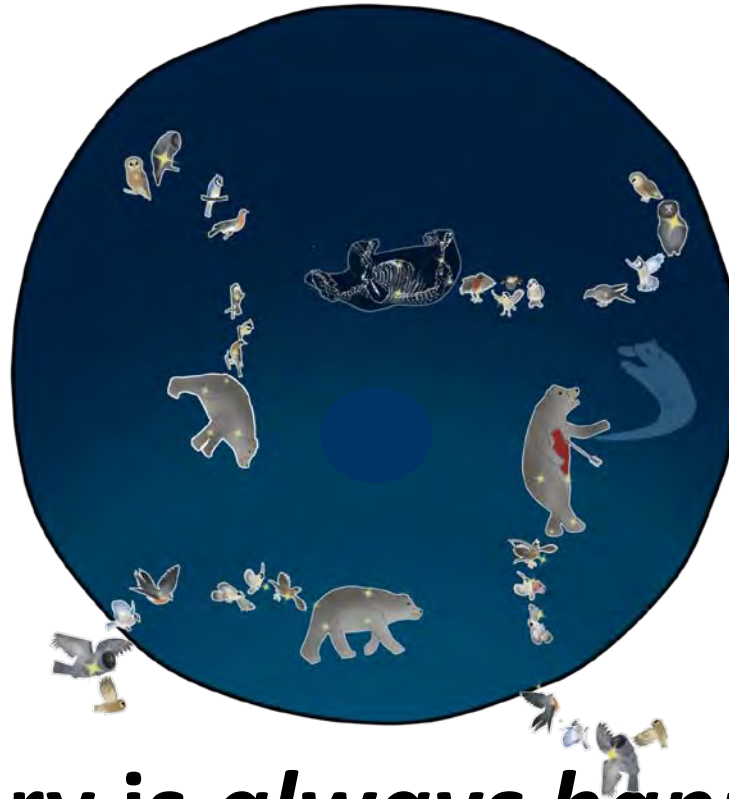
This poster is called Pemi Pungek Mi'kma'ki, which means one continuous year in the Mi'kmaq traditional territory. On the outside, it shows the four seasons and the 12 months of the year. On the inside, it shows the land, water, and sky over a full year. The pictures of plants, animals, and weather show the cycles of changing events in nature. The pictures of people show when to do traditional and modern activities. Read this poster in a circle to see the cycle of the seasons. Spring is on the left, summer is on the bottom, fall is on the right, and winter is at the top.



images by Kristy Read



# MU PESIPKA'SINUK THERE IS NO END



The story is *always happening.*  
It is told in the *present tense.*

**Dancing to Learn – Learning to Dance**





Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin



MI'KMA'KI



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

# Stories

Shaw et al. 2010 in Canadian Journal of Earth Sciences



MI'KMA'KI



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

es



with permission of Artist Gerald Gloade, Millbrook First Nation





with permission of Artist Gerald Gloade, Millbrook First Nation



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

**Kluscap, wanting to take a bath, ordered Beaver to build a dam across the mouth of the bay to hold the ocean water so that there would be lots of water for his bath.**





with permission of Artist Gerald Gloade, Millbrook First Nation



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

**Beaver did as  
Kluscap asked.**

**But Whale was unhappy  
because now the water did  
not flow as before.**

**“Why has the water  
stopped?” Whale cried.**





with permission of Artist Gerald Gloade, Millbrook First Nation



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

**Kluscap hearing him and not wanting Whale to be upset told Beaver to break the dam and release the water. Beaver liked the dam he had made, so he was slow to begin taking it apart.**



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin



**Whale became impatient.  
He wanted the water as it was before.  
Using his great tail, he started breaking the dam apart.**

with permission of Artist Gerald Gloade, Millbrook First Nation





with permission of Artist Gerald Gloade, Millbrook First Nation



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

**The dam broke.**  
And it caused water to  
flow back and forth  
with such force that it  
continues so  
until this day.





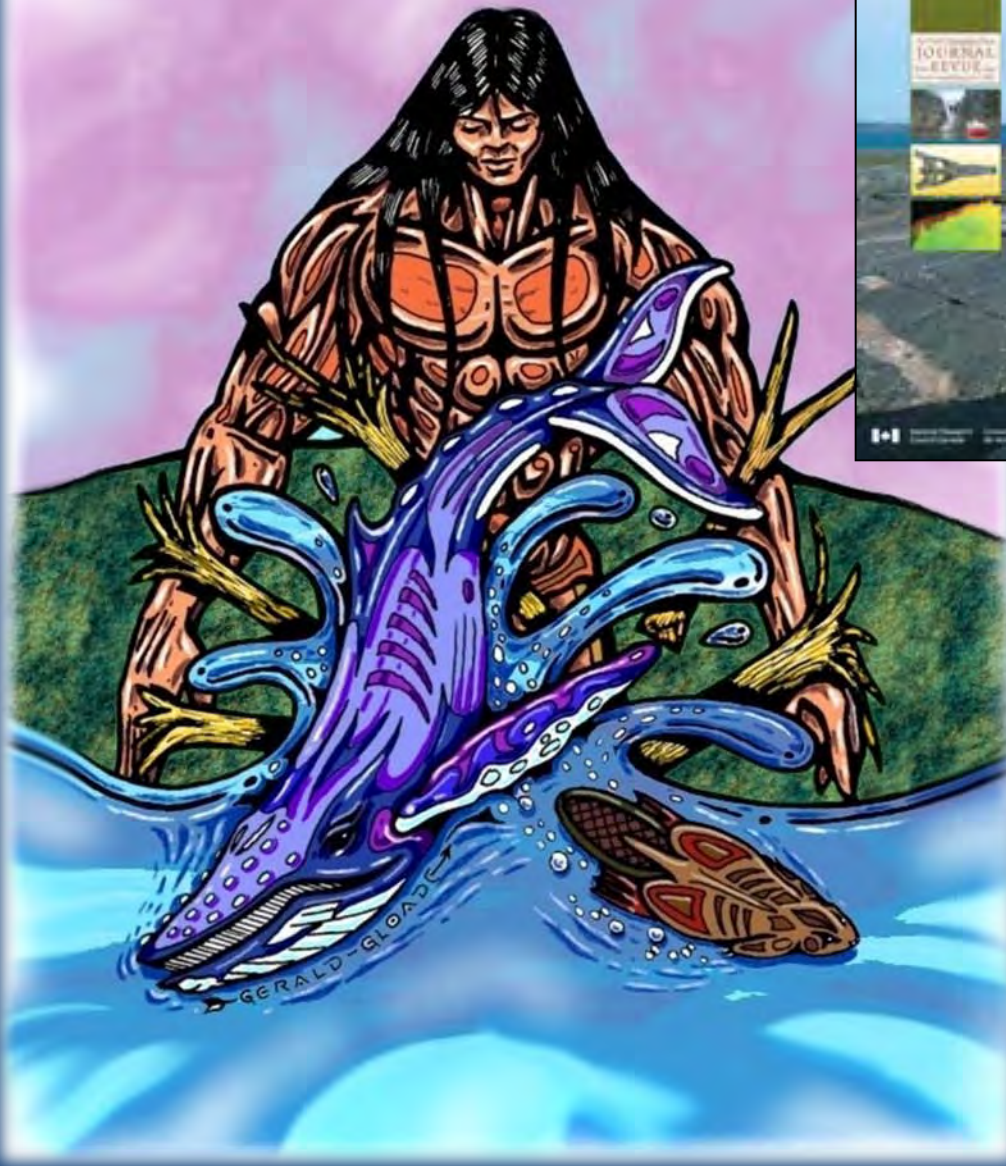
with permission of Artist Gerald Gloade, Millbrook First Nation



2010 ARTICLE in:  
Canadian  
Journal of  
Earth Sciences  
47(8):  
1079–1091

## Catastrophic tidal expansion in the Bay of Fundy, Canada

by: John Shaw, Carl L. Amos,  
David A. Greenberg,  
Charles T. O'Reilly, D. Russell Parrott,  
and Eric Patton



with permission of Artist Gerald Gloade, Millbrook First Nation



We argue that the catastrophic breakdown of the barrier is related in the legend, showing that Aboriginal peoples observed the rapid environmental changes and preserved an oral record for 3400 years.

*last sentence in ABSTRACT for:  
Shaw et al. 2010*



# NRC Press Research Journals

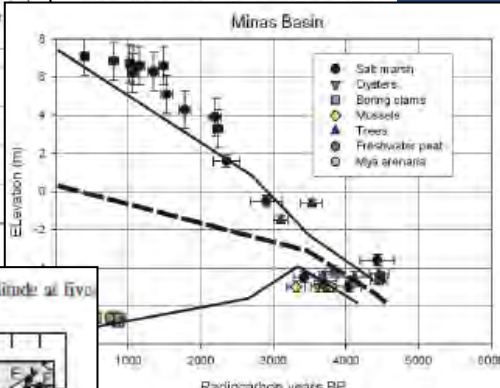
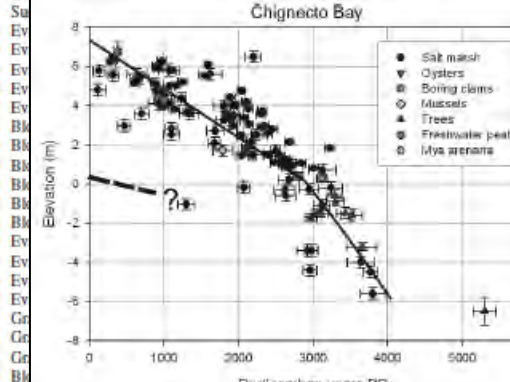
## Canadian Journal of Earth Sciences 47

**Table 1:** Radiocarbon dates

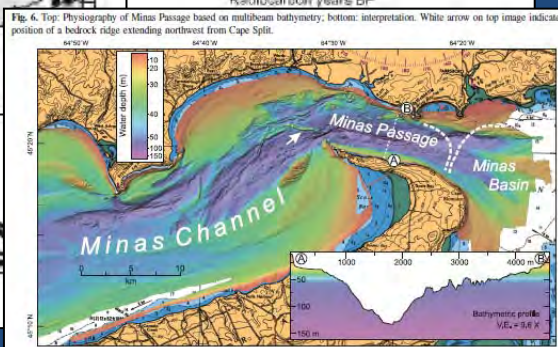
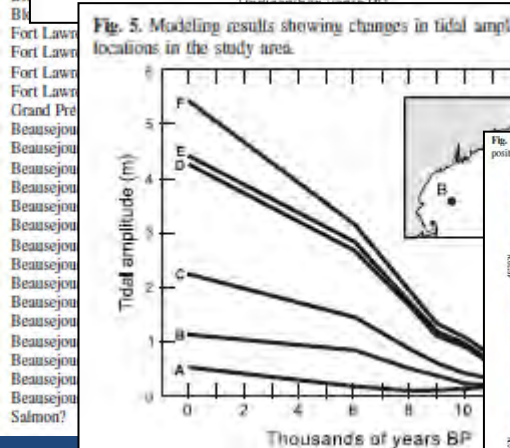
Location	Age (radiocarbon years BP)	Lab No.	Material	Elevation (metres geodetic datum)	References
Kingsport	2905±220	GX-6811	SMP	-0.5000	Scott and Greenberg 1983
Kingsport	4430±235	GX-6810	SMP	-3.6000	Scott and Greenberg 1983
Beausejour	1335±130	GX-8141	SMP	3.6000	Scott and Greenberg 1983
Beausejour	2185±145	GX-8142	SMP	1.5000	Scott and Greenberg 1983
Beausejour	2620±145	GX-8143	SMP	-0.3000	Scott and Greenberg 1983
Beausejour	3800±160	GX-8145	SMP	-5.6000	Scott and Greenberg 1983
Mary's Point	2225±160	GX-8146	SMP	2.5000	Scott and Greenberg 1983
Mary's Point	3130±180	GX-8147	SMP	0.7000	Scott and Greenberg 1983
Mary's Point	3240±160	GX-8148	SMP	-0.2000	Scott and Greenberg 1983
Mary's Point	3640±180	GX-8145	SMP	-4.0000	Scott and Greenberg 1983
Aulac	2500±60	Beta-65696	SMP	1.7000	This paper
Aulac	2100±60	Beta-65695	SMP	1.8300	This paper
Aulac	1240±60	Beta-74550	SMP	4.3500	This paper
Aulac	720±60	Beta-74551	SMP	7.5000	This paper



We argue that the catastrophic breakdown of the barrier is related in the legend,



showing that Aboriginal peoples observed the rapid environmental changes and preserved an oral record for 3400 years.



last sentence in ABSTRACT for: Shaw et al. 2010











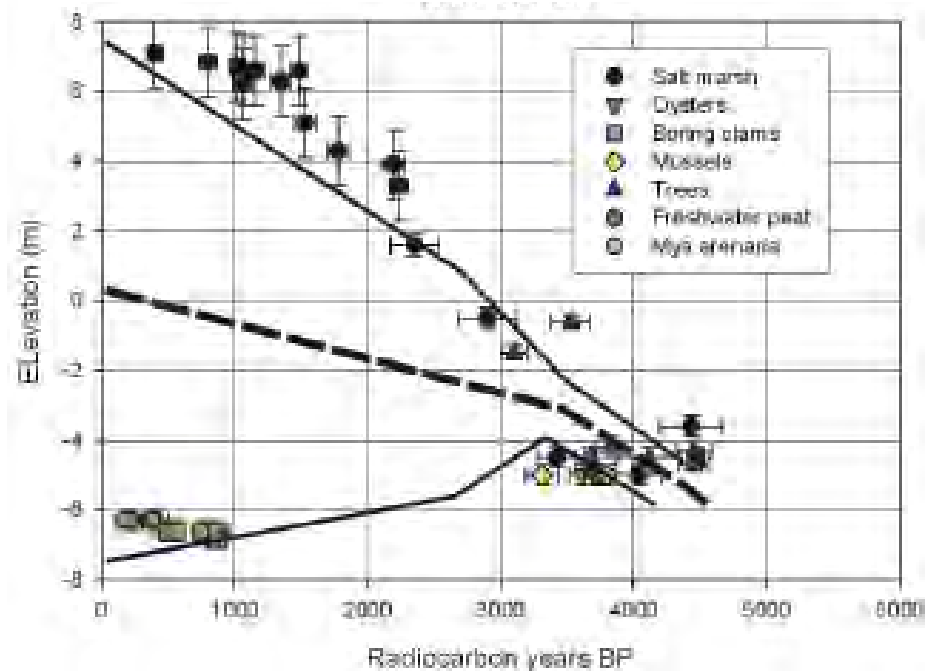
# our science stories



with permission of Artist Gerald Gloade

**towards resonance of  
understanding within environment**

Fig. 4. Palaeoindicator data from Minas Basin.



NRC Press Research Journals  
Shaw et al. 2010; CJES 47: 1086

**towards construction of  
understanding of environment**



# our science stories

**Dancing to Learn – Learning to Dance**





# our science stories

stories of our interactions with and within nature

## Science



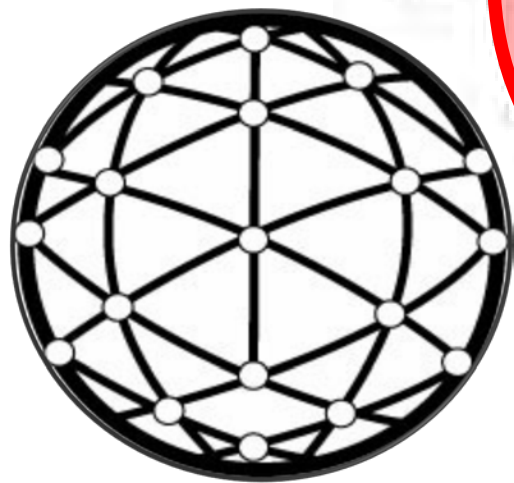
stories of our interactions with and within nature

## Science

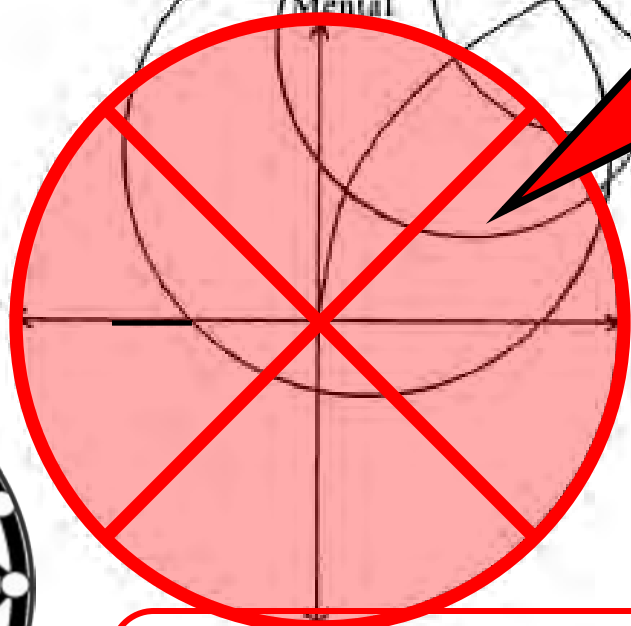
A periodic table of elements. The elements are arranged in rows and columns, with their symbols and names. A large grey oval with a zigzag line is overlaid on the bottom right of the table.

Periodic Table of the Elements

**SCIENCE stories of:  
interconnectiveness**



Physical



Mental

Spiritual

Emotional

Vision



**my world is  
“all my relations” (subjects)**



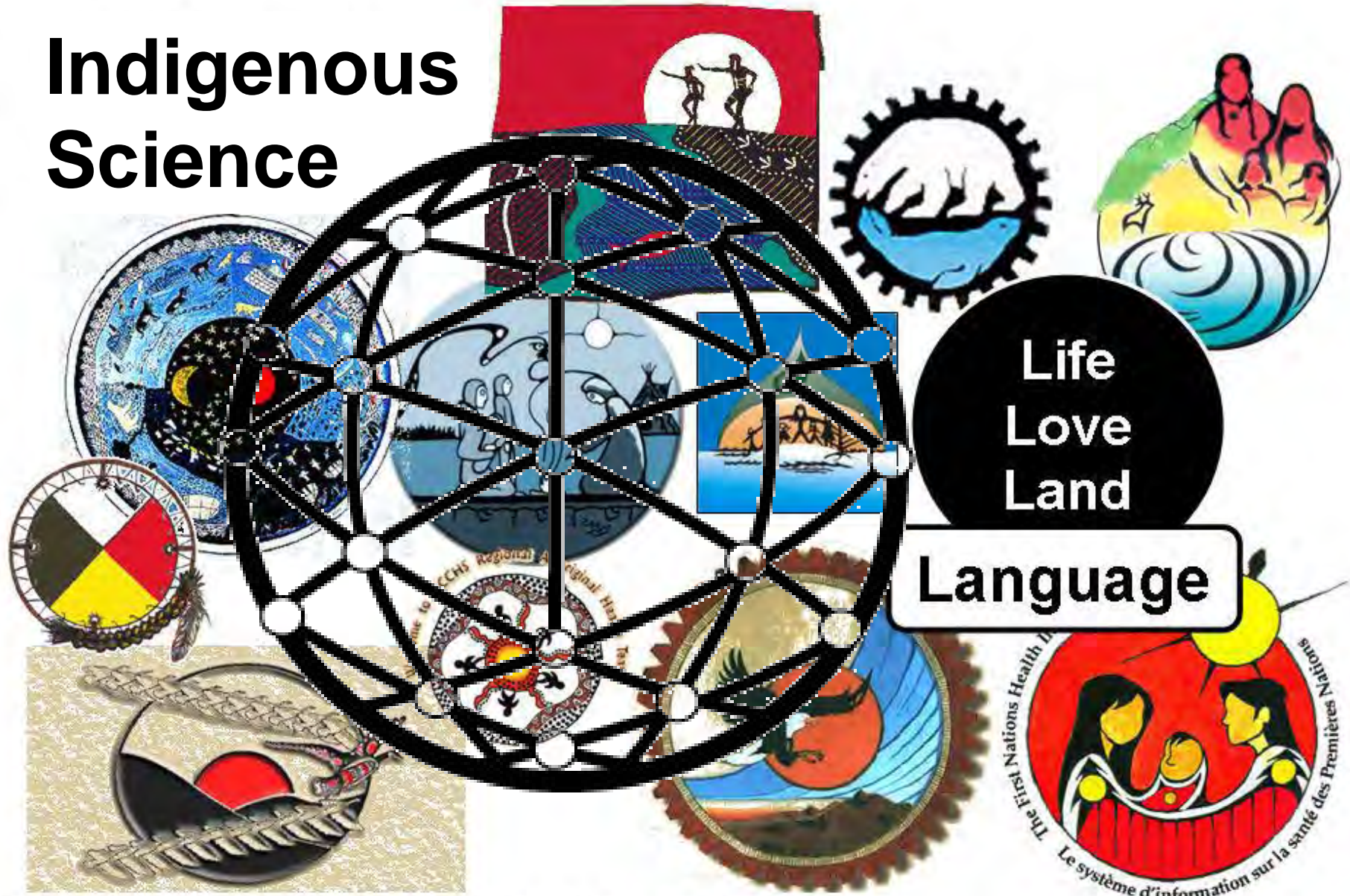
# Indigenous Science



images from: Aboriginal organizations/artists, various sources



# Indigenous Science

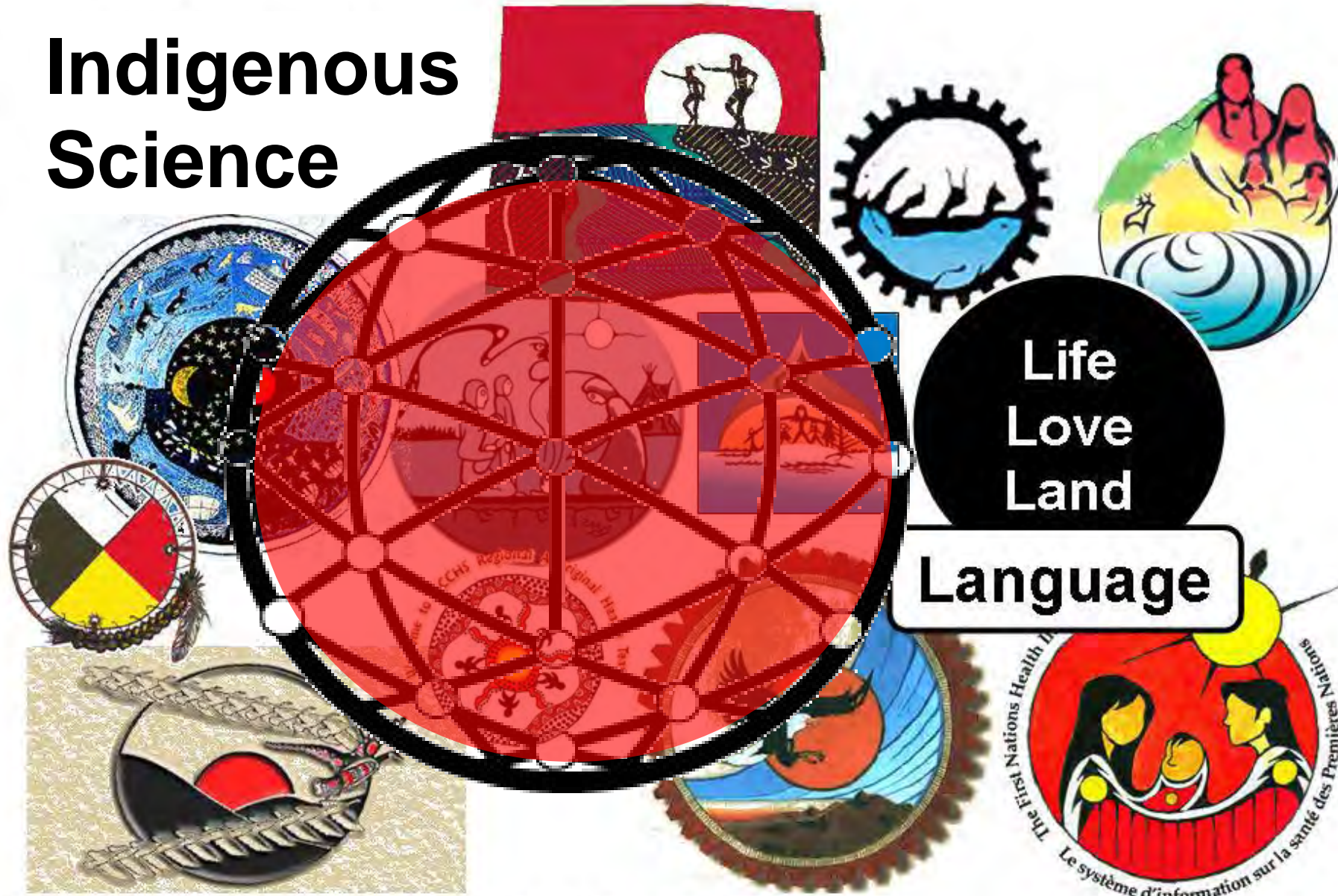


Life  
Love  
Land  
Language

images from: Aboriginal organizations/artists, various sources



# Indigenous Science



Life  
Love  
Land  
Language

images from: Aboriginal organizations/artists, various sources

# science stories that ... draw upon many “**pattern smarts**”

word smarts

math smarts

music smarts

nature smarts

picture smarts

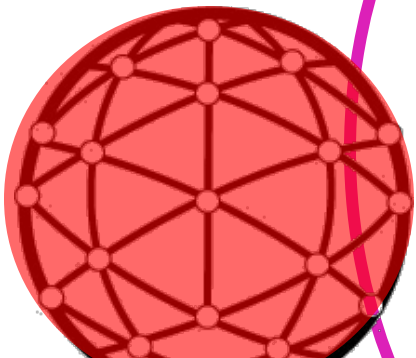
spirit smarts

body smarts

self smarts

people smarts

*Howard Gardner's  
“multiple  
intelligences  
theory”*



stories of our interactions with and within nature

Science



Life  
Love  
Land

**SANCTIONED “SMARTS”:**

**who we are; where we are; where we were;  
what we know, do and value**



# science stories that ... acknowledge few "pattern smarts"

word smarts

math smarts

nature smarts

music smarts

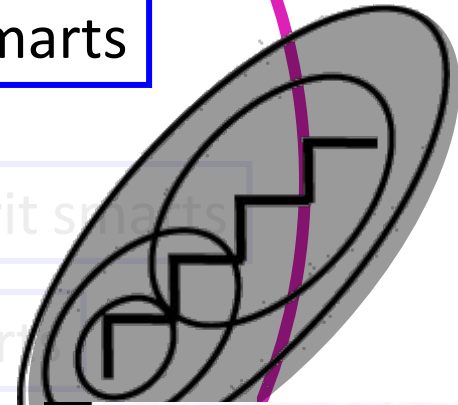
picture smarts

body smarts

people smarts

self smarts

spirit smarts



Howard Gardner's  
"multiple  
intelligences  
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**SANCTIONED "SMARTS":**  
who we are; where we are; where we were;  
what we know, do and value

stories of our interactions with and within nature

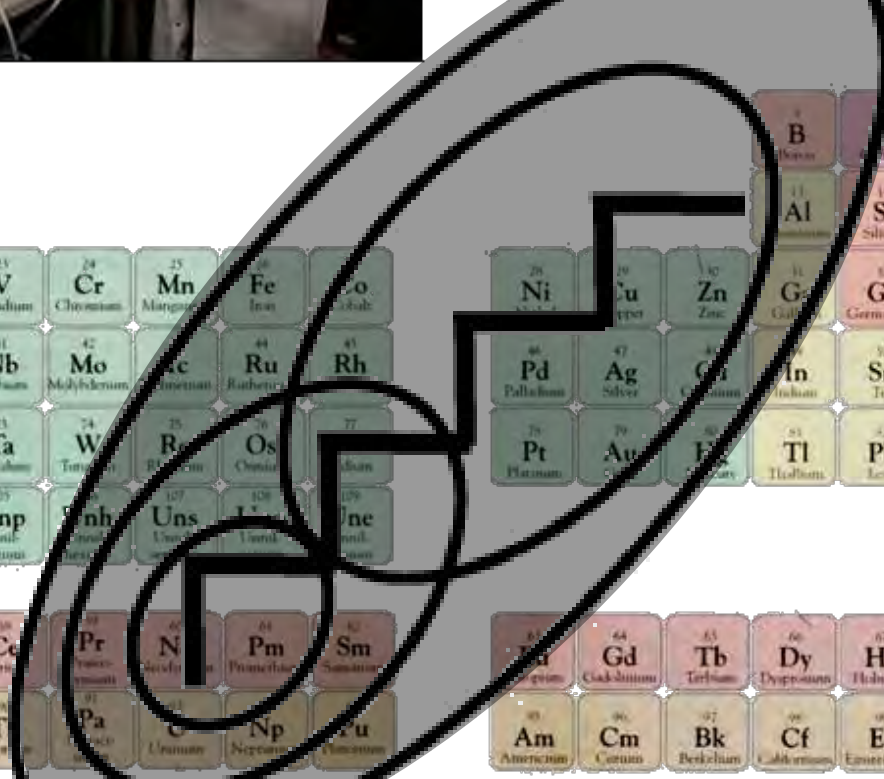
Science

Periodic Table of the Elements

photo credit: NRC



# Western Science



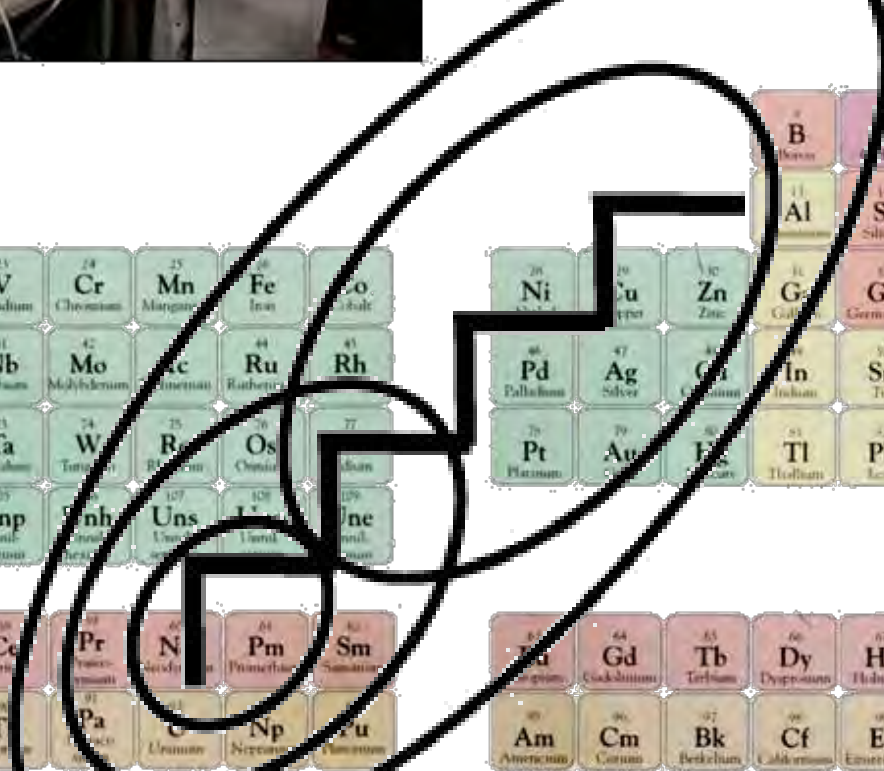
1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Cesium	56 Ba Barium	57-71 Lanthanides	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Unq Unnilquadium	105 Unp Unpentquadium	106 Unh Unhexquadium	107 Uns Unseptquadium	108 Uuo Unoctquadium	109 Uuh Unnonquadium	110 Uuq Unquadquadium	111 Uuh Unhexquadium	112 Uuo Unoctquadium	113 Uut Untrium	114 Uuq Unquadquadium	115 Uup Unpentquadium	116 Uuq Unquadquadium	117 Uuh Unhexquadium	118 Uuo Unoctquadium
			89 La Lanthanum	90 Ce Cerium	91 Pr Praseodymium	92 Nd Neodymium	93 Pm Promethium	94 Sm Samarium	95 Eu Europium	96 Gd Gadolinium	97 Tb Terbium	98 Dy Dysprosium	99 Ho Holmium	100 Er Erbium	101 Tm Thulium	102 Yb Ytterbium	103 Lu Lutetium
			97 Ac Actinium	98 Th Thorium	99 Pa Protactinium	100 U Uranium	101 Np Neptunium	102 Pu Plutonium	103 Am Americium	104 Cm Curium	105 Bk Berkelium	106 Cf Californium	107 Es Einsteinium	108 Fm Fermium	109 Md Mendelevium	110 No Nobelium	111 Lr Lawrencium



photo credit: NRC



# Western Science



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37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
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photo credit: NRC



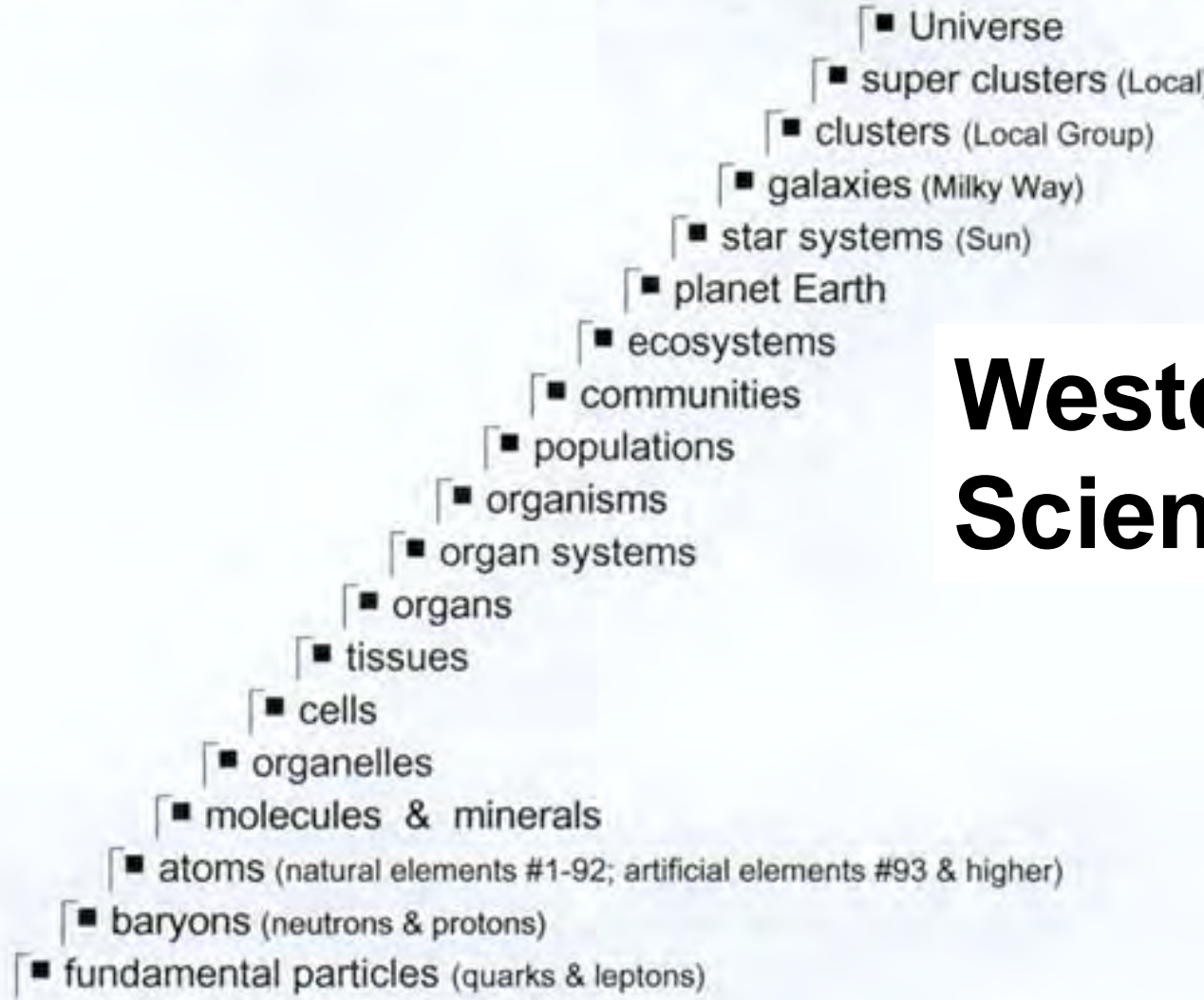
# Western Science

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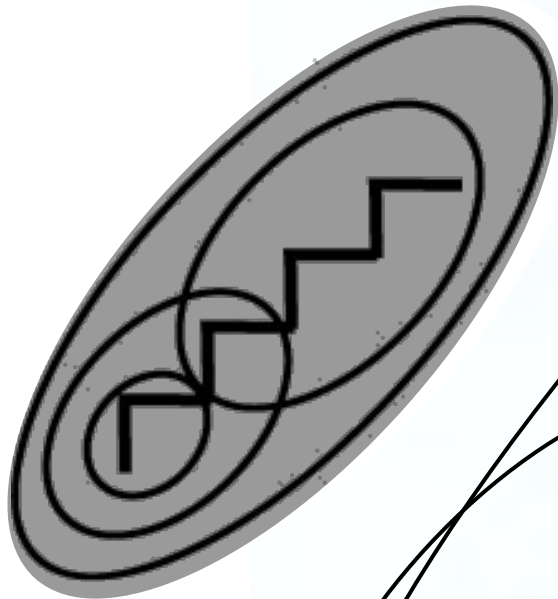
Universe: Visible Matter (levels of organization - biology)



**Western  
Science**

Universe: Visible Matter (levels of organization - biology)

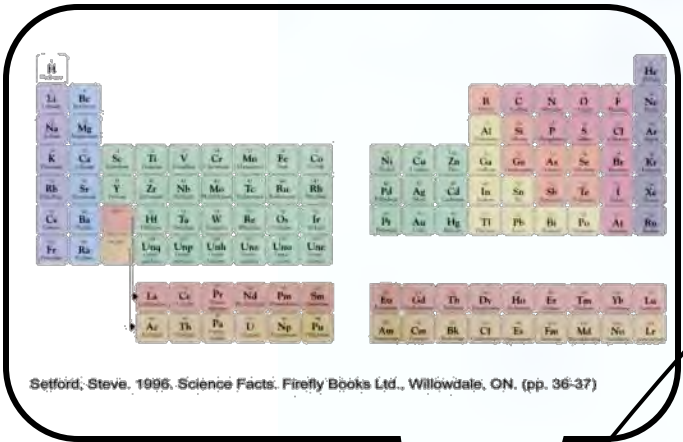
- ▣ Universe
- ▣ super clusters (Local)
- ▣ clusters (Local Group)
- ▣ galaxies (Milky Way)
- ▣ star systems (Sun)
- ▣ planet Earth
- ▣ ecosystems
- ▣ communities
- ▣ populations
- ▣ organisms
- ▣ organ systems
- ▣ organs
- ▣ tissues
- ▣ cells
- ▣ organelles
- ▣ molecules & minerals
- ▣ atoms (natural elements #1-92; artificial elements #93 & higher)
- ▣ baryons (neutrons & protons)
- ▣ fundamental particles (quarks & leptons)



**Western  
Science**



# Universe: Visible Matter (levels of organization - biology)



Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)

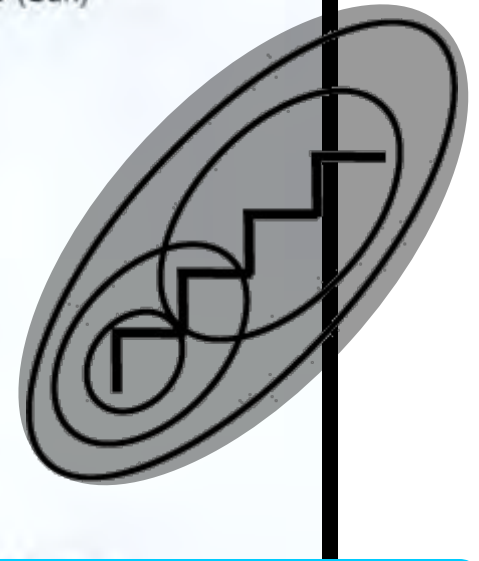
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# Western Science

# Universe: Visible Matter (levels of organization - biology)

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    - baryons (neutrons & protons)
    - fundamental particles (quarks & leptons)



**SCIENCE stories of:**

**parts & wholes**

**my world is many "its" (objects)**





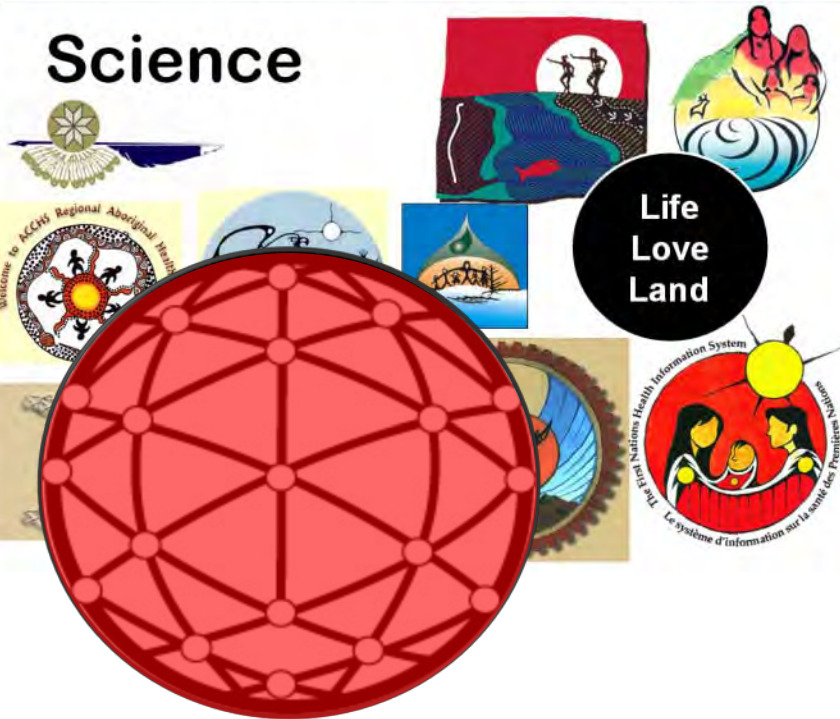
STAO/APSO



# INCLUSIVE SCIENCE: Difference, Diversity, Equity

stories of our interactions with and within nature

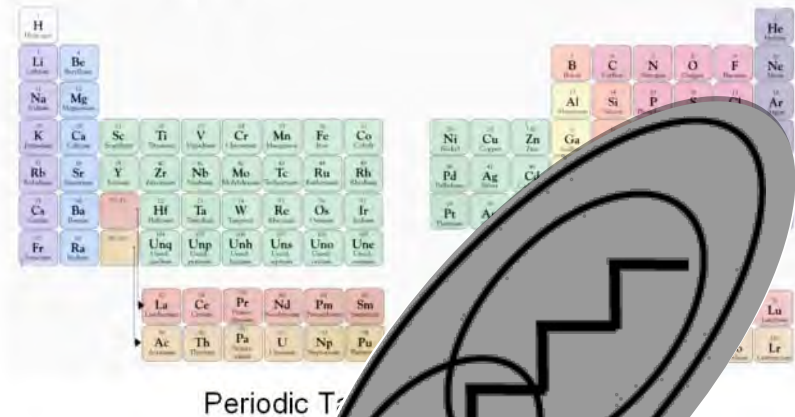
## Science



Life  
Love  
Land

stories of our interactions with and within nature

## Science



Periodic Table

# Wela'lioq / Thank you



with permission of Tuma Young, photographer,  
Eskasoni First Nation





Canada Research  
Chairs

Chaires de recherche  
du Canada



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

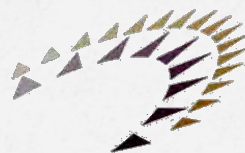
Canada  
Canada

# Thank you / Wela'liog



IAPH

CAPE BRETON  
UNIVERSITY



Canada Foundation  
for Innovation

Fondation canadienne  
pour l'innovation



Membertou  
Elementary

CIHR IRSC

Canadian Institutes of  
Health Research

Instituts de recherche  
en santé du Canada



Mi'kma'wey  
Debert  
CULTURAL CENTRE



Eskasoni First Nation Detachment  
Royal Canadian Mounted Police  
Gendarmerie royale  
du Canada



Mi'kmaq College Institute  
Mi'kmaq Espi Kina'matno'kuom

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partners and funding agencies  
is gratefully acknowledged.