



Twenty Years of Monarch Outreach, Conservation and Research at the Montreal Insectarium

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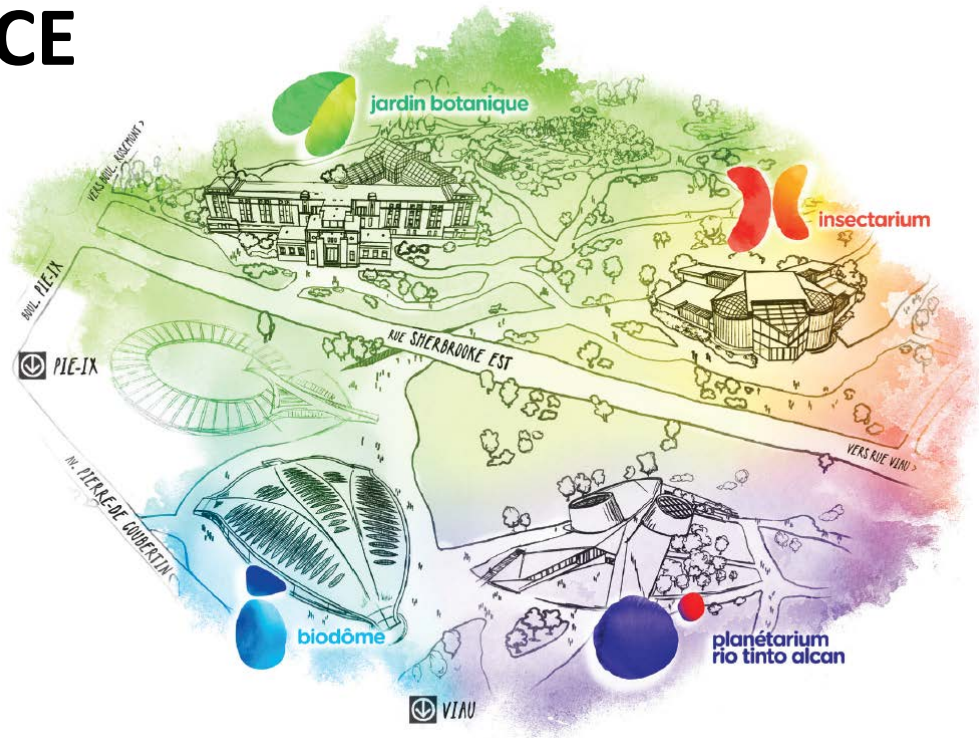
Educational Program Coordinator



The biggest museum complex dedicated to science and nature in Canada

Today the Montréal SPACE FOR LIFE is:

- 1.7 million visitors every year
- 22 million Web pages consulted



The Insectarium

- 1st museum entirely dedicated to insects in North-America
- 350 000 Visitors/year
- 25 years of entomology
- 250 000 live and naturalized specimens
- 30,000 young people who participate every year in monarch butterfly outreach and conservation activities

THE INSECTARIUM'S METAMORPHOSIS 2018-2019

A MAJOR TRANSFORMATION

- Live new sensorial experiences
- Reconciliation of humans/insects bonds
- Essential emotional bonds for our future as humans and of our planet



espace
pour la
vie **insectarium**
montréal



Insectarium's Monarch Programs

**mon
jardin**
espace
pour la
vie montréal



oasis pour les **monarques**



Monarch Odyssey



[Home](#) [Discover eButterfly](#) [Submit Observ](#)

Monarch Without Borders



Monarch Oasis Gardens

- Citizens can build their Oasis in 5 steps
- 300 participants in Southern Québec
- Link with eButterfly and other Monarch outreach programs



Monarch Odyssey

- 1000 tagged and released each year every August week-end
- Live participating audience



Citizen Science: eButterfly

➤ Anchored on 150y of museum data

- CBIF, Peabody, Private Collections, IMCQ
- Problem: Almost no data since 1998
- Consolidation – centralisation of biodiversity information data

➤ Global Change – A matter of scale

- Deal with problematics /test hypotheses at scales no single research team can address
- Changes are happening too fast – need everyone involved!



Goal: gather research grade butterfly survey data across the continent

Museum Data



+

Observation/survey Data



eButterfly – The Tool

- Online relational database (Darwin Core)
- Online web data entry portal
- Virtual collection
- Quality control system
 - Scientific comity
 - Regional experts vet records
- User accounts
 - Personal DBs
 - Species Lists
 - Virtual collections




eButterfly Data Submission

3 Step checklist survey system

1. Enter Location
2. Enter survey type + date + effort + distance covered party size
3. Submit species list (# of ind + determination)

[Home](#) / [Explore data](#) / [Observation list](#)

Observation List

<div> ✓ Pending ⚠ In Review ✓ Verified 🔍 Detail </div>					
EB-ID ↕	Species ↕	Location	Date ↕	Observer	
EB-100983 	1 Mourning Cloak	Nepean - Greenbelt trail 24 - South of Robertson Road 45.309002,-75.853901 Ontario	2015-04-03	Rick Cavašin	✓
EB-100982	2 Silver-spotted Skipper	testsite 54.050222,-112.5052097 Alberta	2015-03-22	samboo zhang	✓
EB-100981	1 Arctic Skipper	Chemin de la Pointe à la Piquette	2015	Maxim Larivière	⚠

Filter

EB-ID

Location

Provinces / States

Family

English Name

Latin Name

French Name

Start date

eButterfly – Vetting Protocol

[Home](#) / [Regional Expert Panel](#) / [Verify Observations](#)

Verify Observations List

👍 Pending ✅ Verified 👁 Detail 🗑 Delete						
<input type="checkbox"/> EB-ID	Species	Location	Date	Observer	Status	
<input type="checkbox"/> EB-100974	3 Black Dash Change Determination	987 Wellington Street West, Ottawa, ON, Canada,45.405682,-75.722968,	2015- 03-23	samboo zhang	Pending	👁
<input type="checkbox"/> EB-100967	2 Obscure Skipper Change Determination	Robinson Preserve, Bradenton,27.513812,-82.664984,	2015- 02-23	Peter Hall	Pending	👁 ✉
<input type="checkbox"/> EB-100965	3 Silver- bordered Fritillary Change Determination	Algonquin PP east - Barron Canyon Road at Lake Travers,45.9435,-78.0508,	2014- 06-03	Peter Hall	Pending	👁 ✉
<input type="checkbox"/> EB-100964	1 Giant Sulphur Change Determination	Algonquin PP east - Barron Canyon Road at Lake Travers,45.9435,-78.0508,	2014- 06-03	Peter Hall	Pending	👁 ✉
<input type="checkbox"/> EB-100968	5 Grizzled Skipper	Mont-Groulx nr. Boissinot 51.617962 -68.105517	2014- 07-07	Maxim Larrivée	Pending	👁

Verify

Validity
 Reason
 Notes
 Final ☐

Verify

Assign to other Experts

Assign

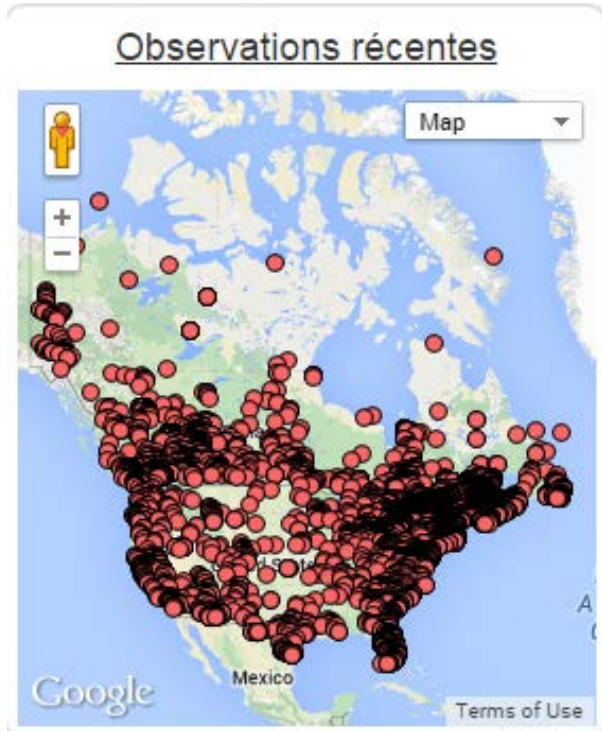
Filter

EB-ID

Location

Provinces /

eButterfly In Numbers



Recent Stats

	Month	Year	Total
Locations	116	304	13787
Checklists	128	413	31456
Species	119	227	627
Users	11	158	3196

- 111 000 new observations shared since 2012 – Doubling each year
- 20 000h + of butterfly surveying since 2012
- Nearly 4500 Monarch observations

The keys to long term success

[Home](#) / [My eButterfly](#)

My eButterfly



My Life List: **184** Species

My Stats

	Life	Year (2015)	Month (April)
Species	184	0	0
Checklists	484	0	0
Observations	2988	0	0









My Favorite Locations

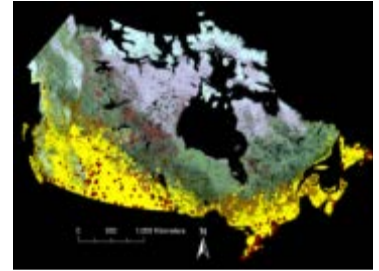
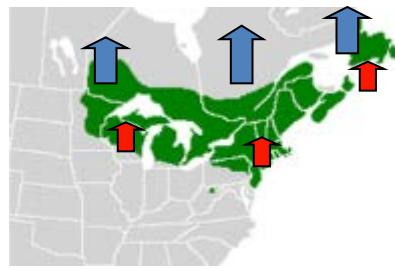
[Add Location](#)

	Species	Checklists	Observations	
My house	33	31	109	
Insectarium	34	48	194	

My Lists

 **Max Larrivée**

-  [My Inbox](#)
-  [My Locations](#)
-  [My Checklists](#)
-  [My Observations](#)
-  [My Photos](#)
-  [My Sharing Request](#)
-  [My Comments](#)
-  [Export My Data](#)



Research: Biodiversity Entomology, Global Change, Web 2.0



Mecanistic models to evaluate northern edge shifts

(Leroux, et al. Ecol. Appl. 2013)

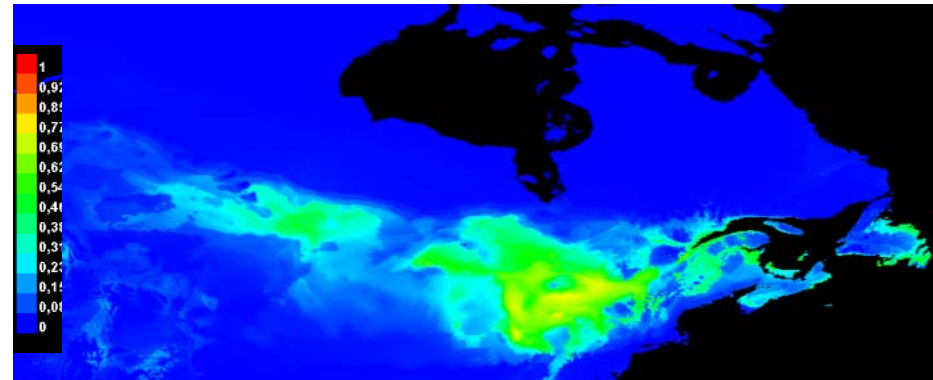
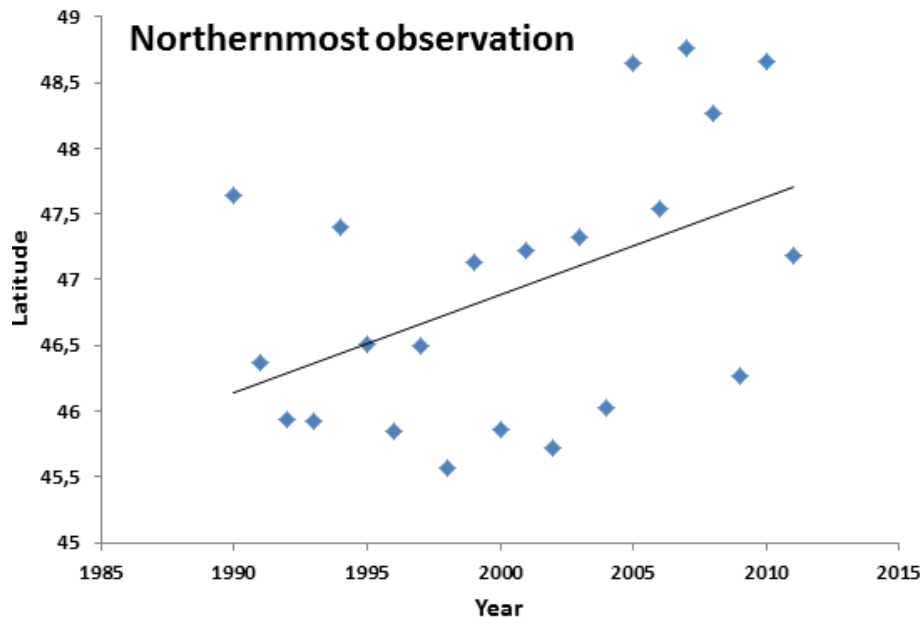
- 1) Speed of the niche displacement to the north
- 2) Mean population growth + Dispersal capacity

$$q > 2\sqrt{Dr} \quad D < \frac{q^2}{4r}$$



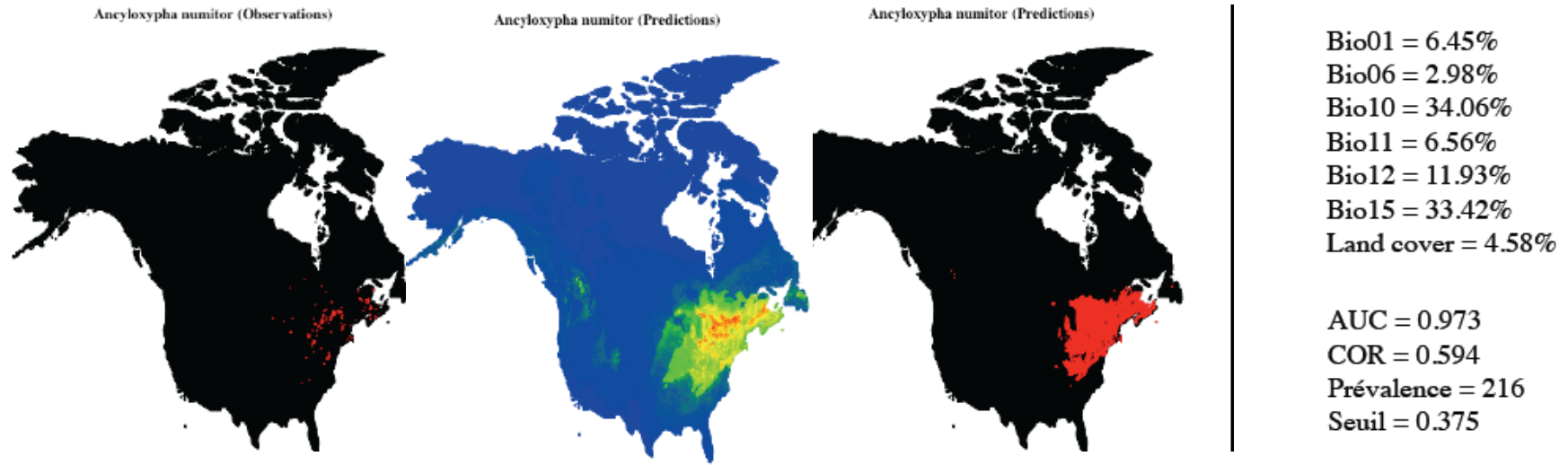
Monarchs and Climate change impacts

- Northern range expansion/range shift
- Migration to nowhere?



Auto-Calibrating Range Predictions

(Larrivée et al. en prép)



- 1) R Loop connected to eButterfly's database
- 2) Run's Maxent Species Distribution Model for all species with with 50+ spatially independent occurrences
- 3) Re-Runs a new SDM when 20 new occurrences are submitted to the database



Determination of the quantity and quality of Monarch breeding habitat in Canada

(Larrivée, Kerr, Galpern and Berteau)

Goal: Maximize breeding success of migratorial Monarchs in Canada

Question: Is milkweed availability a limiting factor for monarch's breeding success in Canada?

Issue: Currently no data available to answer this question



Proposed Monarch Research and Monitoring for Canada

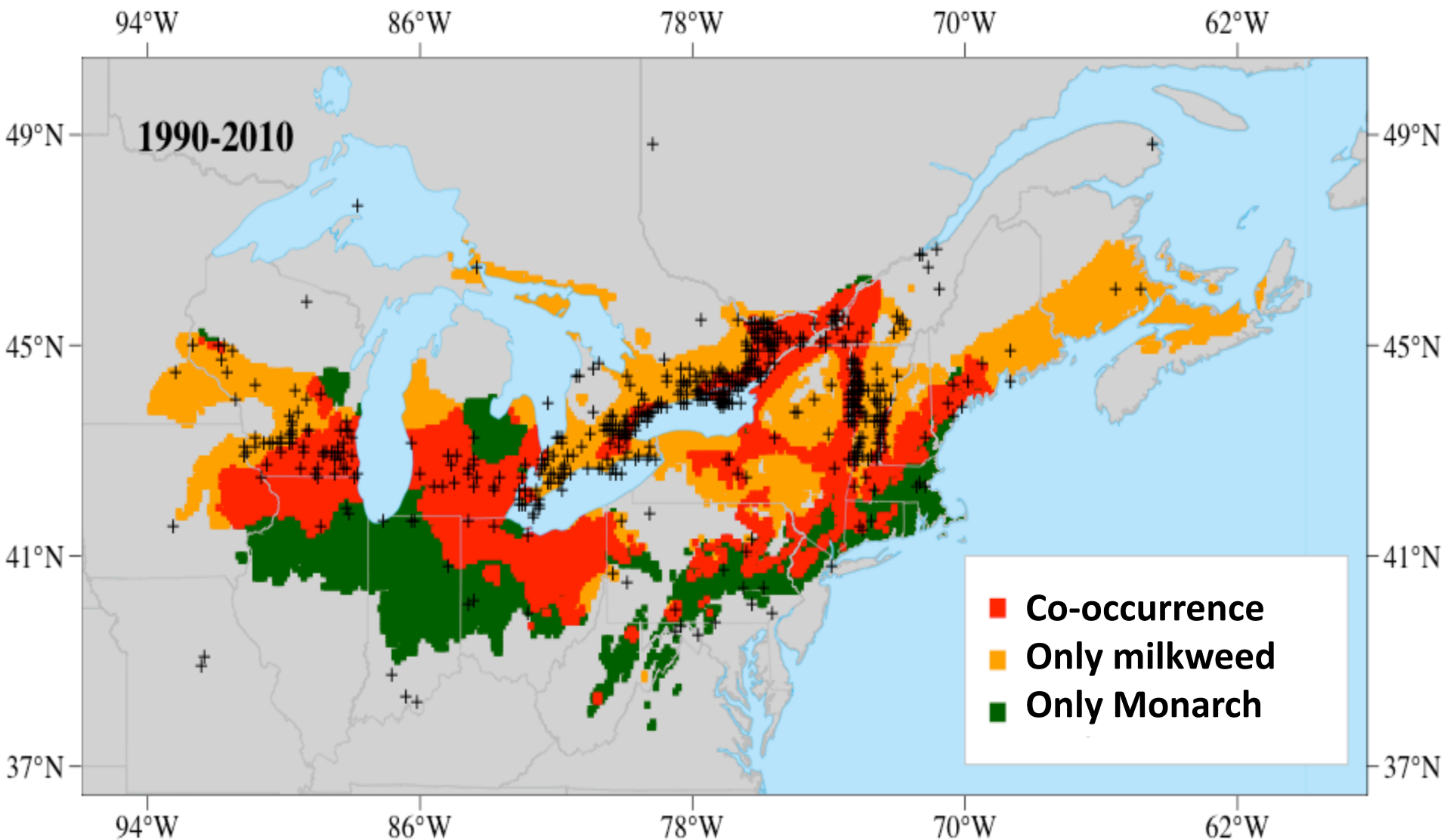
3 Step proposition:

- 1) **Determine realize and potential summer breeding territory in Canada**
- 2) **Map the current distribution of potential high quality monarch habitat in Canada**
- 3) **On the ground validation through “supervised” citizen science efforts**



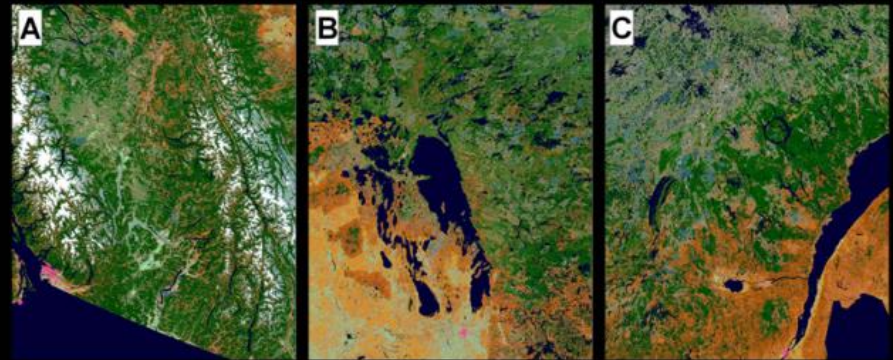
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montréal

Step 1: Determine current milkweed and monarch distribution in Canada



Step 2: National and regional scale trend analyses of land cover

Land Cover
Map Of Canada 2005



Legend

1. Evergreen needleleaf forest / Close Canopy
2. Deciduous broadleaf forest / Close Canopy
3. Mixed evergreen-deciduous forest / Mature to Old Closed Canopy
4. Mixed evergreen-deciduous forest / Young Closed Canopy
5. Mixed evergreen-deciduous forest / Closed Canopy
6. Evergreen needleleaf forest / Medium crown density / Moss-Shrub Understory
7. Evergreen needleleaf forest / Medium crown density / Lichen-Shrub Understory
8. Evergreen needleleaf forest / Low crown density / Shrub-Moss Understory
9. Evergreen needleleaf forest / Low crown density / Lichen (Rock) Understory
10. Evergreen needleleaf forest / Low crown density / Poorly Drained
11. Deciduous broadleaf forest / Low to Medium Density
12. Deciduous broadleaf forest / Young Regenerating
13. Mixed evergreen-deciduous forest / Mixed coniferous / Low to Medium Density
14. Mixed evergreen-deciduous forest / Mixed deciduous / Low to Medium Density
15. Mixed evergreen-deciduous forest / Mixed deciduous / Low Regenerating Young Mixed Cover
16. Shrubland / High-Low Shrub Dominated
17. Herbaceous vegetation / Temperate or subpolar grassland / Grassland, Prairie Region
18. Herbaceous vegetation / Temperate or subpolar grassland Herb-Shrub-Bare Cover
19. Herbaceous vegetation / Saturated temperate or subpolar grassland / Wetland
20. Herbaceous vegetation / Temperate or subpolar grassland with a sparse tree layer / Coniferous sparse
21. Herbaceous vegetation / Short sod polar grassland / Herb-Shrub
22. Herbaceous vegetation / Polar grassland with sparse shrub layer / Shrub-Herb-Lichen-Bare
23. Herbaceous vegetation / Polar grassland with sparse shrub layer / Herb-Shrub poorly drained
24. Herbaceous vegetation / Polar grassland with sparse dwarf-shrub layer / Lichen-Shrub-Herb, Bare Soil
25. Herbaceous vegetation / Polar grassland with sparse dwarf-shrub layer / Low vegetation cover
26. Annual graminoid or forb vegetation / Cropland-Woodland
27. Annual graminoid or forb vegetation / Temperate or subpolar annual grassland or forb vegetation / High Biomass Cropland
28. Annual graminoid or forb vegetation / Temperate or subpolar annual grassland or forb vegetation / Medium Biomass Cropland
29. Annual graminoid or forb vegetation / Temperate or subpolar annual grassland or forb vegetation / Low Biomass Cropland
30. Nonvascular Dominated / Temperate or subpolar lichen vegetation / Lichen Barren
31. Nonvascular Dominated / Temperate or subpolar lichen vegetation / Lichen-sedges, moss low shrub wetland
32. Nonvascular Dominated / Temperate or subpolar lichen vegetation / Lichen-spruce bog
33. Vegetation Not Dominated / Consolidated rock sparse vegetation / Rock Outcrops
34. Recent Burns
35. Old Burns
36. Urban and Built-Up
37. Water Bodies
38. Mixes of Water and Land
39. Snow/Ice

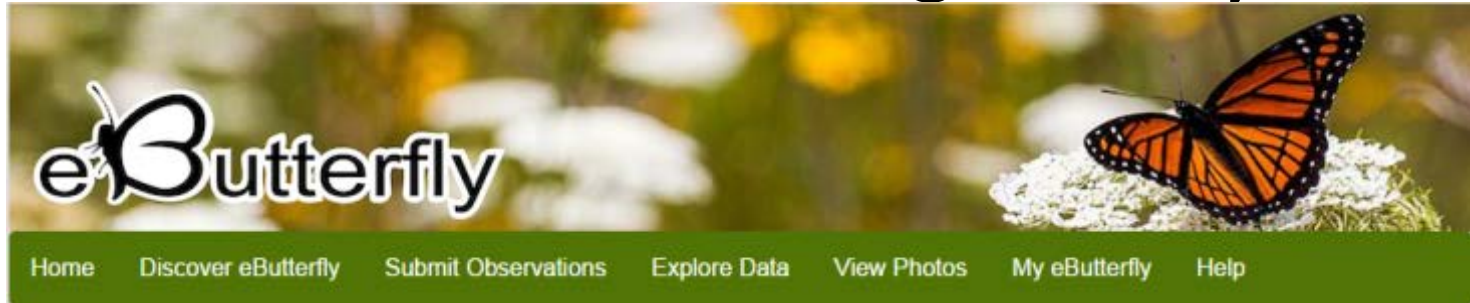
0 300 600 1,200 1,800 2,400
Kilometers



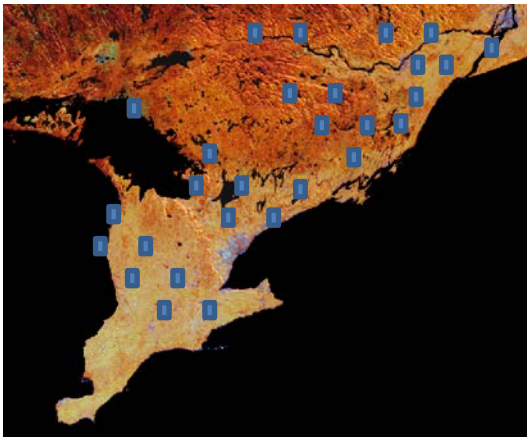
<https://www.nrcan.gc.ca/earth-sciences/land-surface-vegetation/land-cover/north-american-landcover/9146>



Step 3: Incorporate citizen scientists to conduct monarch monitoring surveys



Monarch Larva Monitoring



Mike Dunn 2004



Key Outcomes

- 1) Up to date realized and potential Monarch breeding range predictions and consolidated milkweed and monarch occurrence database
- 2) Estimate of the current distribution of potential high quality reproductive habitat for monarchs in Canada cross referenced with national and regional scale trend analyses of land cover
- 3) Mobilization of thousands of Canadians towards the conservation of the Migratorial Monarch population



Remerciements

- The eButterfly crew: Sambo, Kent, Katy, Apple
- All the passionate lepidopterists out there and eButterfly users and very importantly our regional experts
- Our scientific and administrative panels
- Environment Canada
- The organizing committee
- Our partners and member organizations





Thank you! Questions?

Outreach program synergy

Monarchs Without Borders



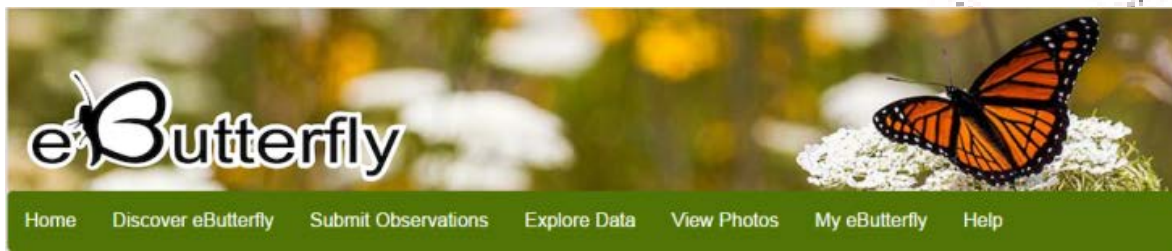
Monarch oasis



Monarch Larva
Monitoring Project



Got-milkweed – D. Suzuki



Monarch conservation plan

Increase synergy btw monarch outreach programs

- a. Many programs out there, few talking to each other, sharing and consolidating information
- b. Partnerships between monarch gardens/way stations and citizen science databases

Monarch oasis



Got-milkweed – D. Suzuki

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Step 3: On the ground validation and monitoring

- Determine realized and potential breeding habitat
- Use recent summer monarch occurrences (eButterfly + ON atlas) to ID potential breeding hotspots
- Combine ranges of expected milkweed and monarch distribution, with land cover change detection
- Gather georeferenced Monarch and milkweed density data using eButterfly and the MLMP protocol



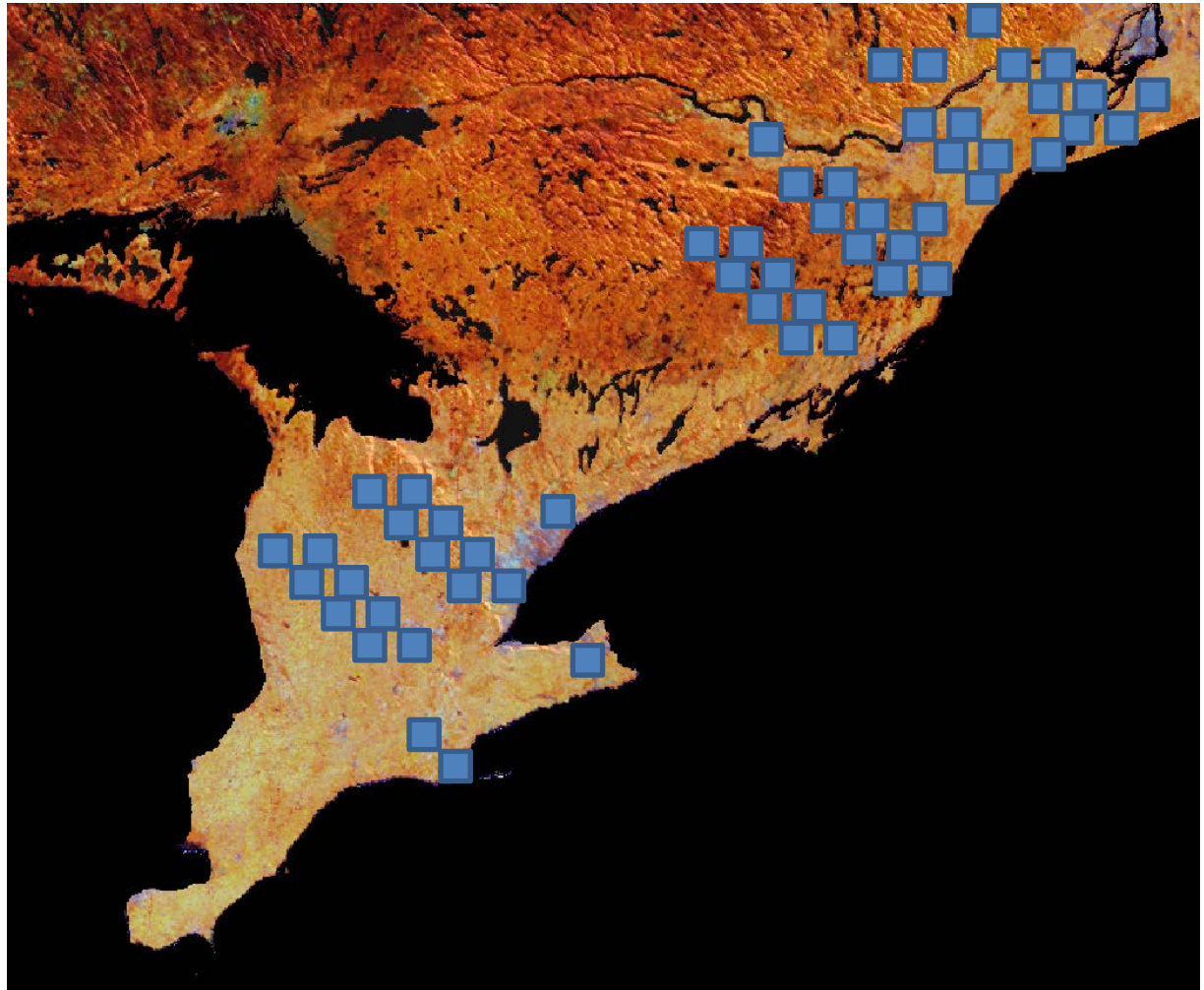
Step 3: On the ground validation and monitoring

Determine realized and potential breeding habitat

Use recent summer monarch occurrences (eButterfly + ON atlas) to ID potential breeding hotspots

By combining ranges of expected milkweed and monarch distribution, with land cover change detection

Gather openly accessible georeferenced Monarch and milkweed density data



Education, Outreach, Conservation, Research



A unique and sought after museum expertise

Minnesota • New York • Beijing • Shanghai

Hong Kong • Taïpei