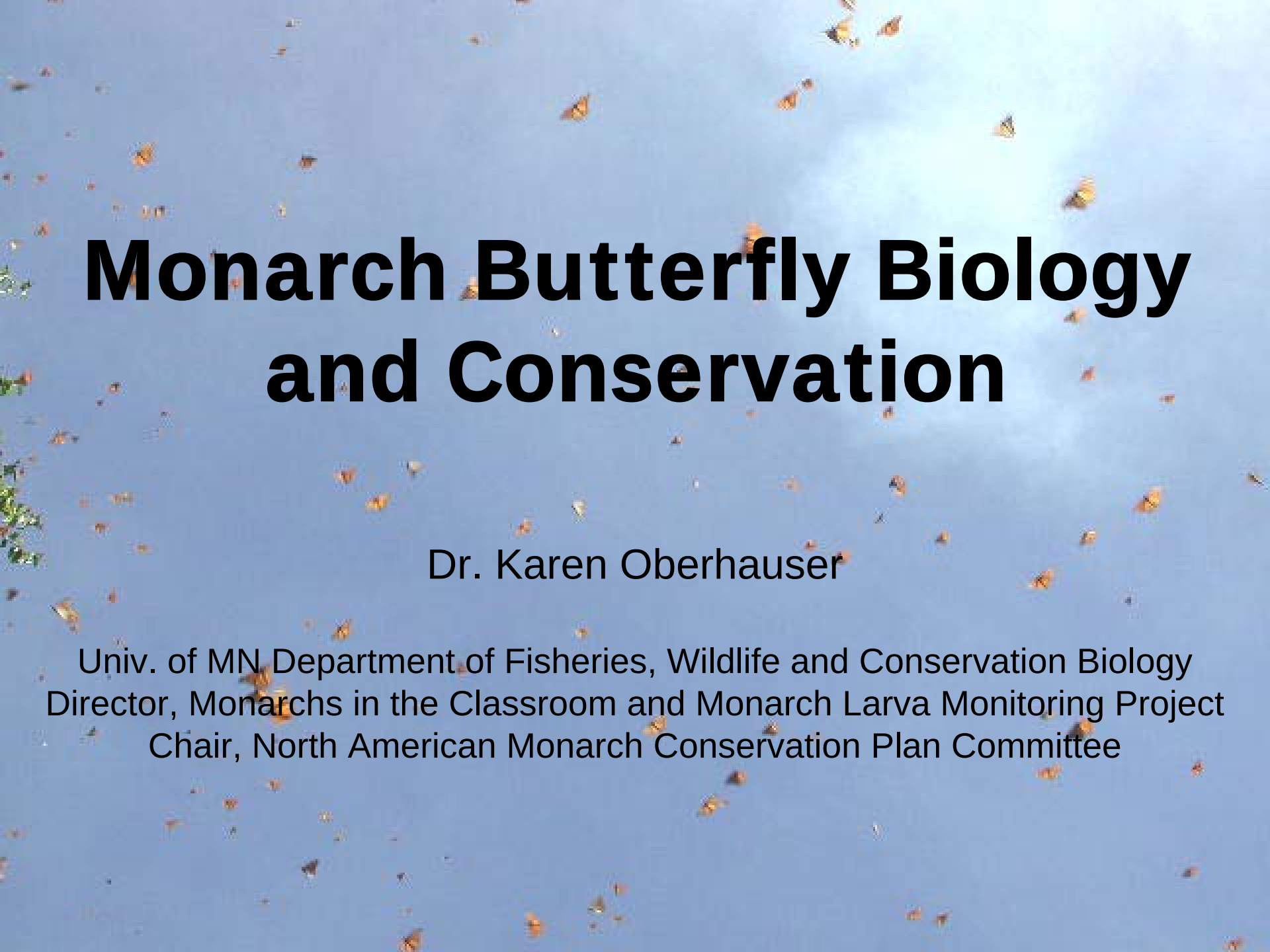

Monarch Butterfly Biology and Conservation

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Director, Monarchs in the Classroom and Monarch Larva Monitoring Project
Chair, North American Monarch Conservation Plan Committee

Conservation requires knowing:

- **What** organisms **need**
- **How** those needs are met
- **Why** those needs aren't being met
- **What** we can do to assure that those needs continue to be met

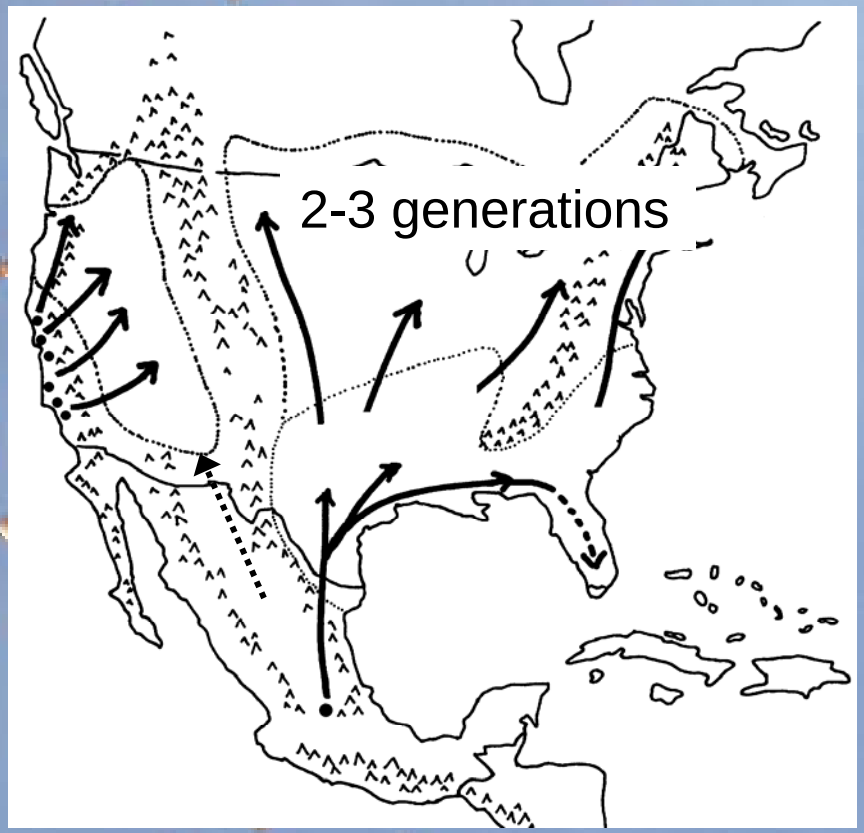
Conservation requires action.

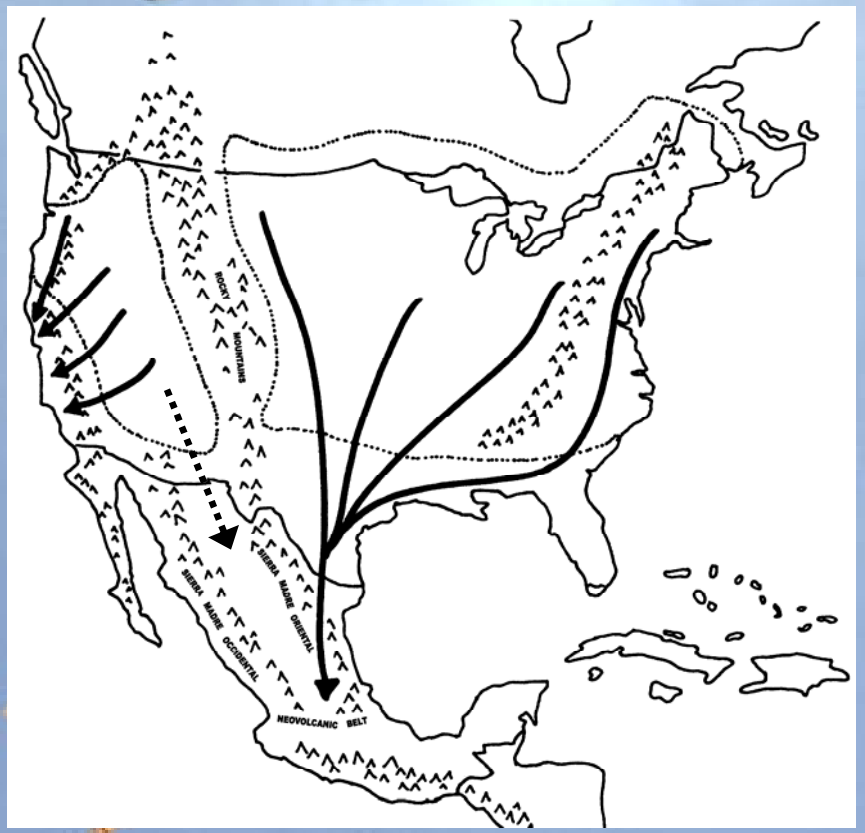
Monarch Conservation: Temporal and Spatial Considerations

- Stages of annual cycle
  - Breeding
  - Migrating south
  - Wintering in central México (Michoacan and México) and coastal California
  - Migrating north
- Monarchs utilize a broad geographic range during this cycle

Annual Cycle

(focus on Eastern Migratory Population)





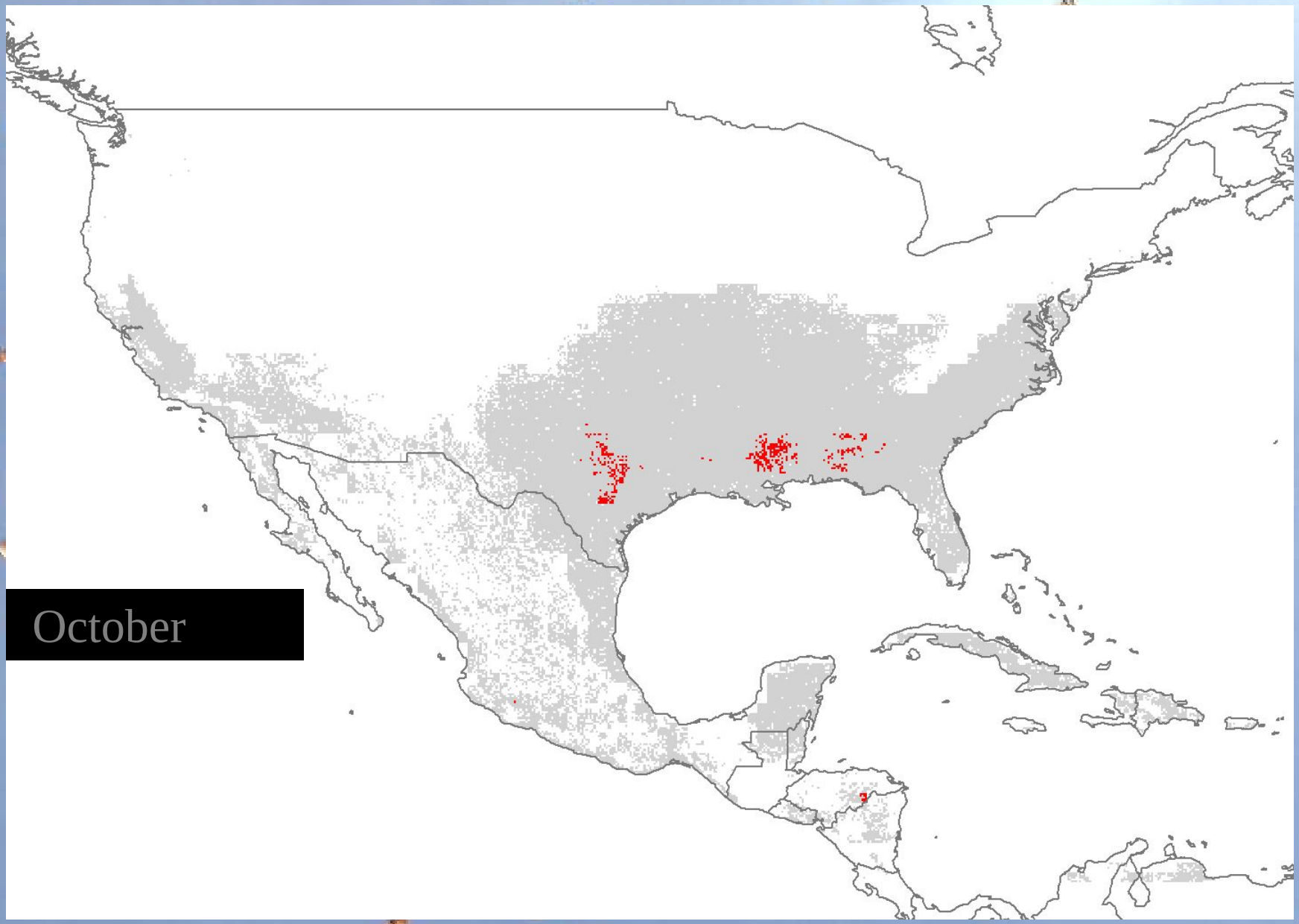
Stage 1: Breeding





Climate effects

- Monarchs follow a specific climatic niche during their breeding generations
- Driven by climatic effects on insect and host plant growth and development

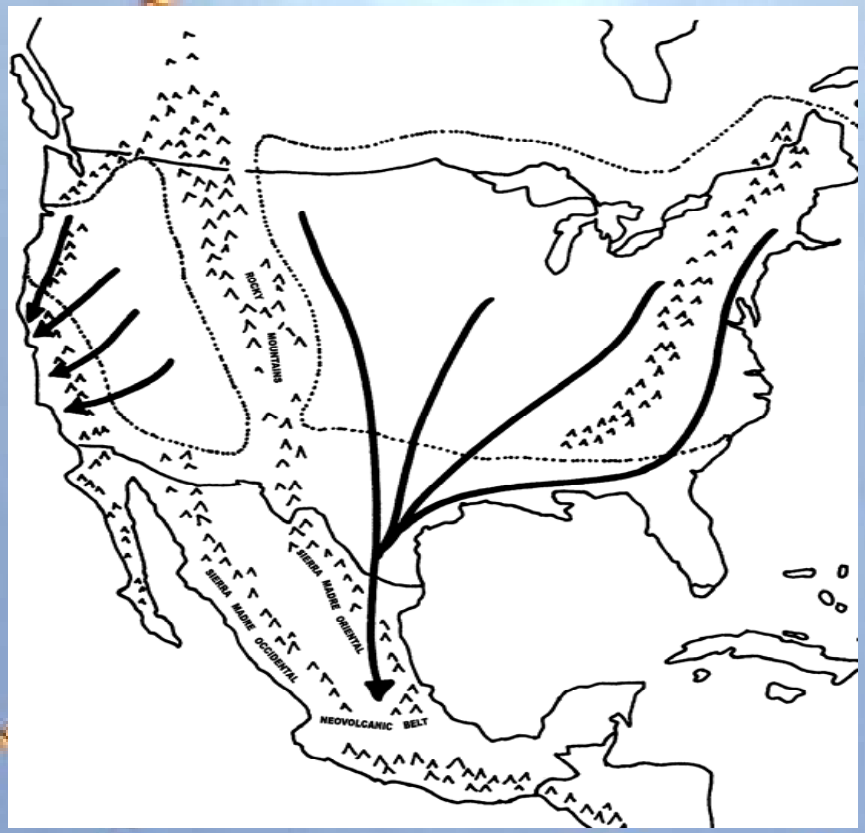

October

Monarch needs during breeding phase

- Host plants, nectar plants
  - Habitat loss (suburban sprawl, agricultural practices, loss of CRP land)
  - Habitat degradation (pesticide use, fragmentation)
- Suitable climatic conditions
  - Climate change

Stage 2: Fall Migration

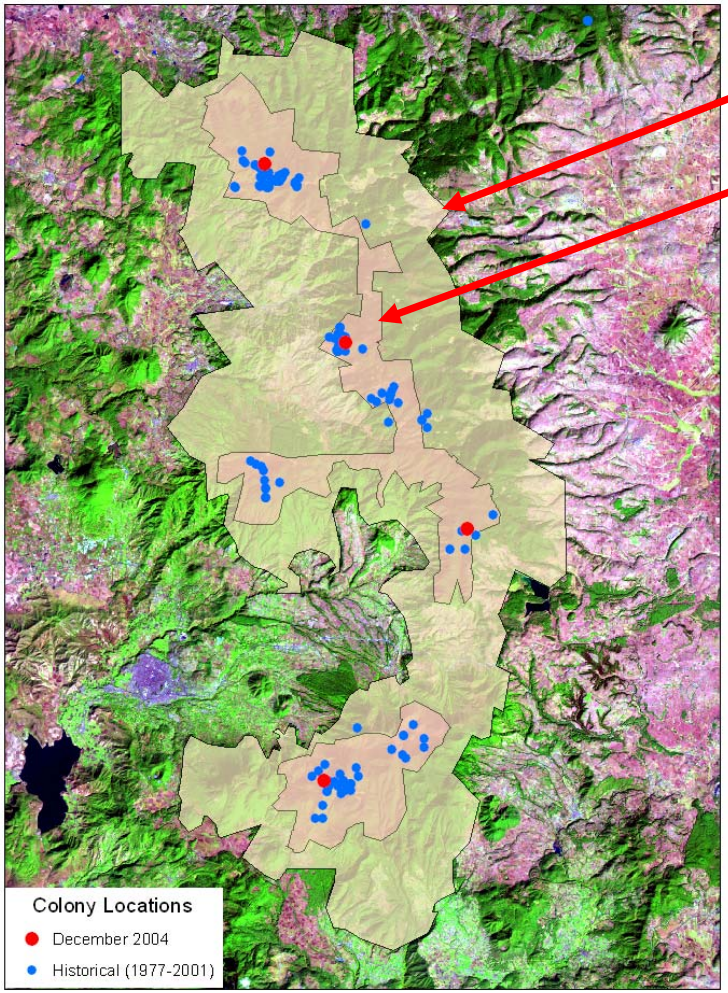
- Adult diapause
- Late August – early November, up to ~4800 km
- Gain lipids during trip
- Flight conditions
  - Daytime
  - Over ~13° C
  - Wind and precipitation can help or hinder



Monarch needs during fall migration

- Nectar
  - Habitat loss/degradation
  - Herbicides
- Roosting and stop-over sites
  - Habitat loss/degradation
- Safe flight paths
  - Roads?
- Climatic conditions for flight, diapause, lipid conservation

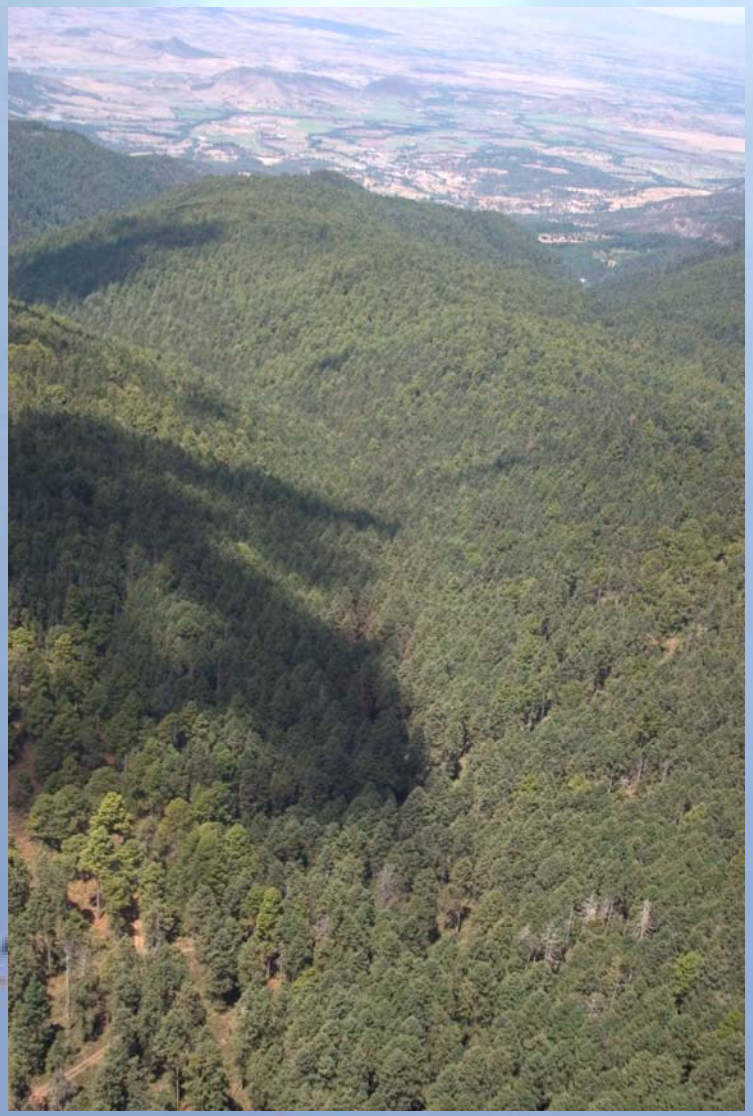
Stage 3: Overwintering

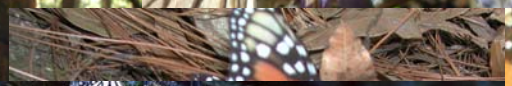


- 2000 Buffer zone
- 2000 Core zone

Image courtesy of Slayback et al. 2005

Views of Chincua, 1997 and 2004





Winter Behaviors

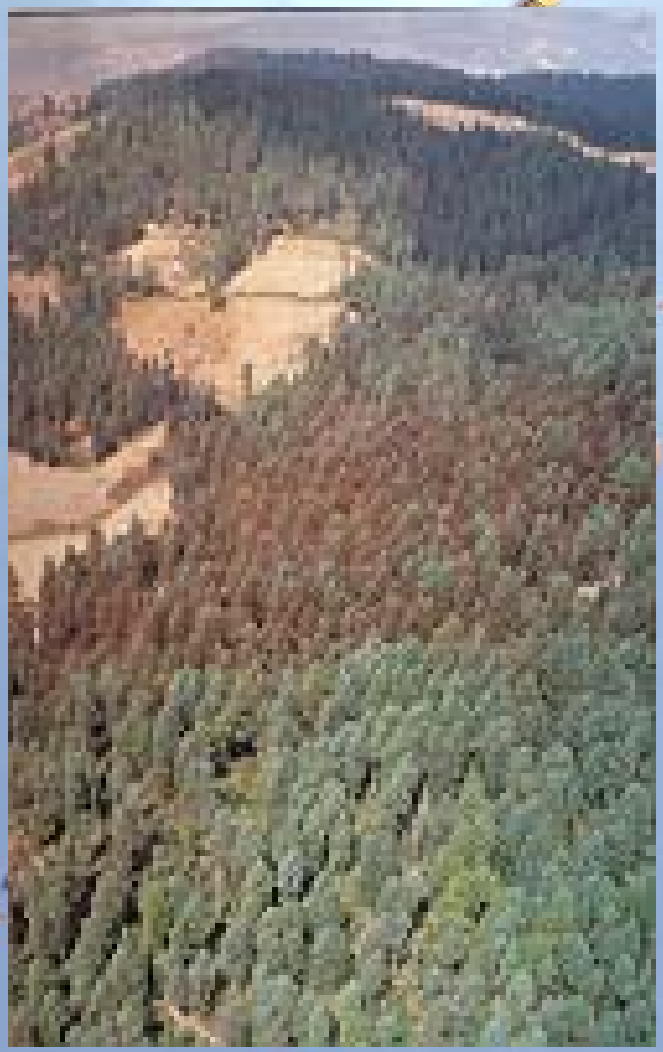
- Drinking
- Nectaring
- Mating
- Predation

Monarch needs during the winter

- Stay alive
  - Starvation: maintain lipids
  - Dessication
  - Predation
  - Freezing
- Maintain diapause

Monarch needs during the winter

- Climatic conditions
  - Activity levels, lipid use
  - Maintaining diapause
  - Freezing
  - Dessication
- Intact forest
  - Roosting trees (structure)
  - Suitable climatic conditions
  - Protection from predation (edge effects)
- Minimal disturbance

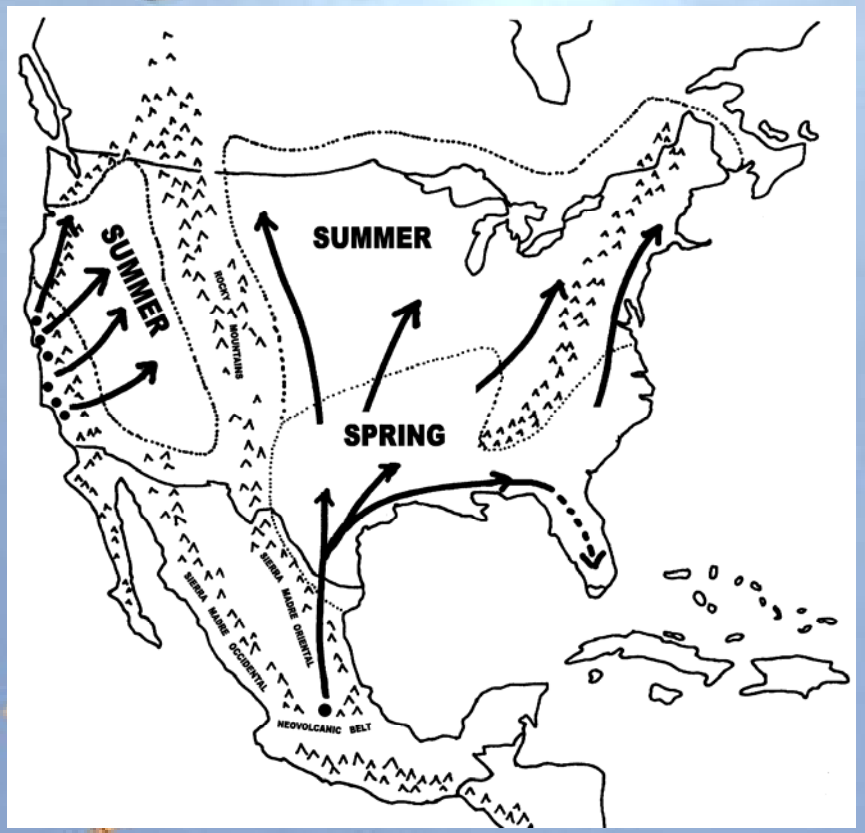


Threats to monarch needs during the winter

- Climate change
- Deforestation
- Other Disturbance
  - Fire
  - Tourists
  - Insect pests (confounded by climate change)

Stage 4: Spring Migration

- Spring migrants are reproductive
- Mid-March through early June
- Two generations
- Spring conditions in south are key



Spring Migration Needs

- Combination of migration and breeding
  - Sufficient host and nectar plants
  - Suitable climate
  - Safe flight paths

Actions to promote conservation

- Education
- Government and NGO action
  - North American Monarch Conservation Plan
  - Sister Protected Areas
  - Monarch Butterfly Biosphere Reserve
  - Monarch Butterfly Sanctuary Foundation
  - Alternare
  - Michoacan Reforestation Fund
- Research

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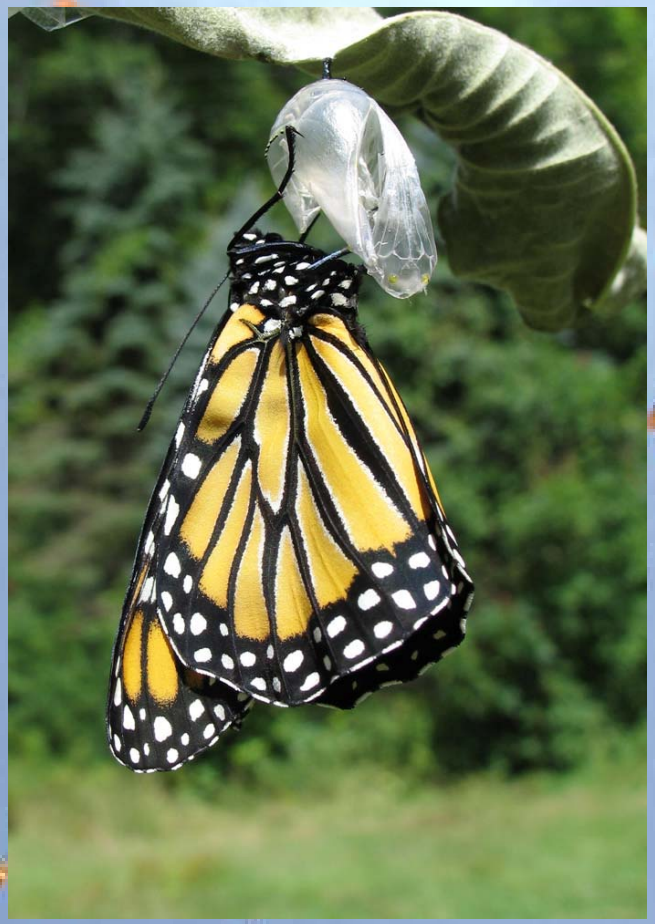
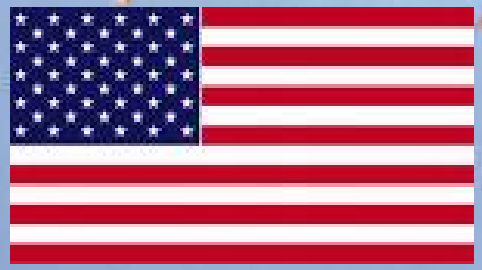
Overarching Goal

- To maintain the North American monarch population and its migratory phenomenon by managing threats to monarchs' breeding, migrating and wintering habitats within the context of social and economic issues



Planning Committee
(3 Representatives per Country)

- Canada
  - Environment Canada
  - Canadian Museum of Nature
  - Non-government / Community
- USA
  - US Fish and Wildlife Service
  - Texas Parks and Wildlife
  - Academia / Non-government
- Mexico
  - Monarch Butterfly Biosphere Reserve
  - Michoacan Forestry Commission
  - World Wildlife Fund Mexico



Links to existing efforts

- Trilateral / CEC Monarch Butterfly Sister Protected Area (SPA) Network
- Canadian Monarch Management Plan
- North American Pollinator Protection Campaign - Monarch Task Force
- Conservation and education programs addressing a spectrum of issues (government, NGO and academia)
- Monitoring programs
- Research programs

Progress to Date

- Committee formed during Monarch Flyway Conservation Workshop, Mission TX, 6-7 Dec 2006
- First committee meeting in Morelia Mich, 14-16 March 2007, to develop first draft of plan
- Second meeting in Quebec City, 13 May 2007 to continue plan development

Conservation Plan Components

1. Biological Monitoring (habitat, monarch populations) to understand populations drivers and support conservation decisions
2. Education / Public Outreach
3. Habitat protection, restoration and enhancement

Examples of Specific Objectives

1. Biological Monitoring (habitat, monarch populations)
   - Develop a shared monitoring toolkit with standard protocols
   - Assess available breeding and migratory habitat with associated land use changes


Abundance at any stage in cycle is affected by many factors

Natural enemies

January storms in Central Mexico

Land use change

Breeding Population in Upper Midwestern US

Dry conditions in Texas in April

Pesticide Use

Host plant abundance

Human-induced climate change

Competition from other herbivores

Understanding Monarch Population Dynamics Requires:

- Broad temporal and spatial scales
- Variety of research approaches

Monitoring Programs Address these Needs

Citizen and Scientist Monitoring

- During all stages of annual cycle
  - Journey North (www.learner.org)
  - Monarch Watch (www.monarchwatch.org)
  - 4th of July Butterfly Count (www.naba.org)
  - Monarch Larva Monitoring Project (www.mlmp.org)
  - Texas Monarch Watch (www.tpwd.state.tx.us)
  - Monarch Alert Project (www.bio.calpoly.edu/Biosci/MonarchAlert)
- Need coordinated efforts

Examples of Specific Objectives

2. Education / Public Outreach
   - Increase awareness of conservation needs and threats to the monarch and its migratory route

Examples of Specific Objectives

3. Habitat protection, restoration and enhancement
   - Important during all stages of the annual cycle
   - Wintering habitat is Achilles Heel of annual cycle

The Monarch as a Symbol

- Exists in mosaic of rare and pristine, and common and disturbed habitats shared with a myriad of other species
- Incredibly interesting and charismatic organism from which we still have a lot to learn
- An unmatched biological phenomenon