

Encouraging Beneficial Insects in Your Field and Horticultural Operations

Alberta Agriculture & Rural Development
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Science & Horticulture**
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Overview

n Biodiversity

q What is it?

q How many?

n What is an Ecosystem?

q Components

q Processes

n The Landscape

q Characteristics

n Plants

q Exotic versus Native

n Beneficial

q Insects

q What they require

n How can we Preserve our Ecosystems

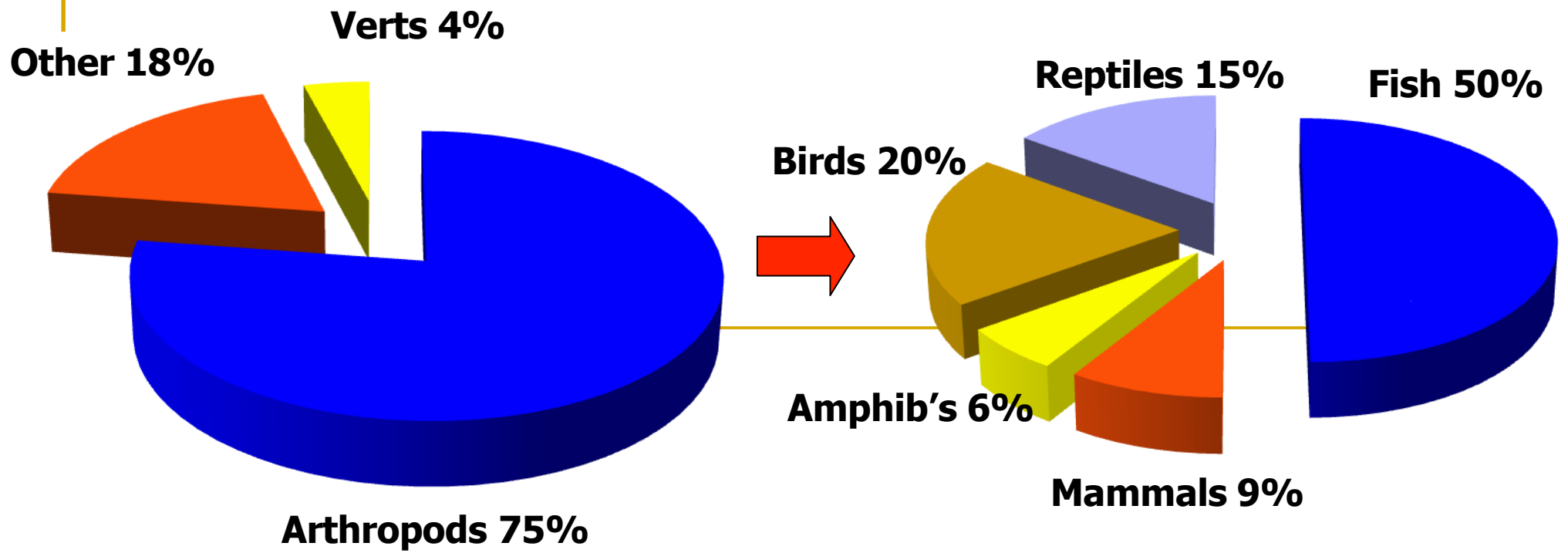
q Plants

q Practices

Biodiversity

- n **Biodiversity** can be measured on many biological levels ranging from genetic diversity within a species to the variety of ecosystems on Earth, but the term most commonly refers to the number of different species in a defined area.
 - n **Biological diversity** - presence of many different types of living organisms.
-

All Species



note: 9% of 4% = 0.36%

Ecology

n Distribution and abundance of living organisms and their interactions with the environment

q Abiotic – nonliving

q Biotic – living

n Ecosystem Services: \$57 Billion/yr

(Losey & Vaughan 2006 Bioscience 56:311-323)

What is an Ecosystem?

- Components

Living

Plants



Animals

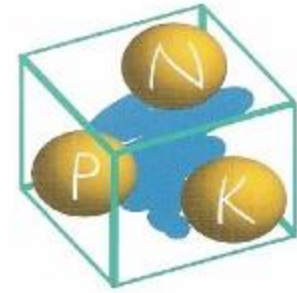


Microbes



Non-living

Nutrients



Water



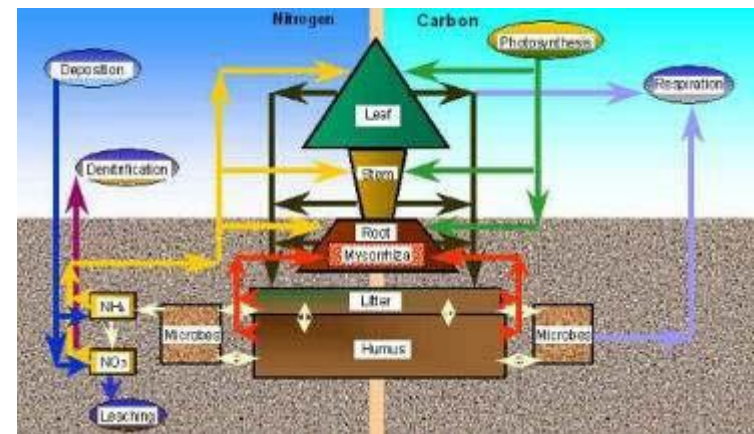
Weather



What is an Ecosystem?

- Processes

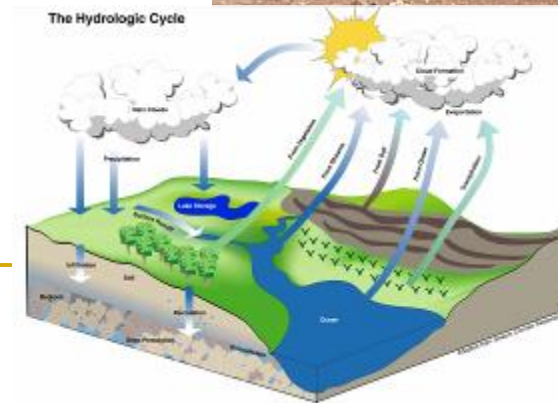
n **Nutrient Cycling**

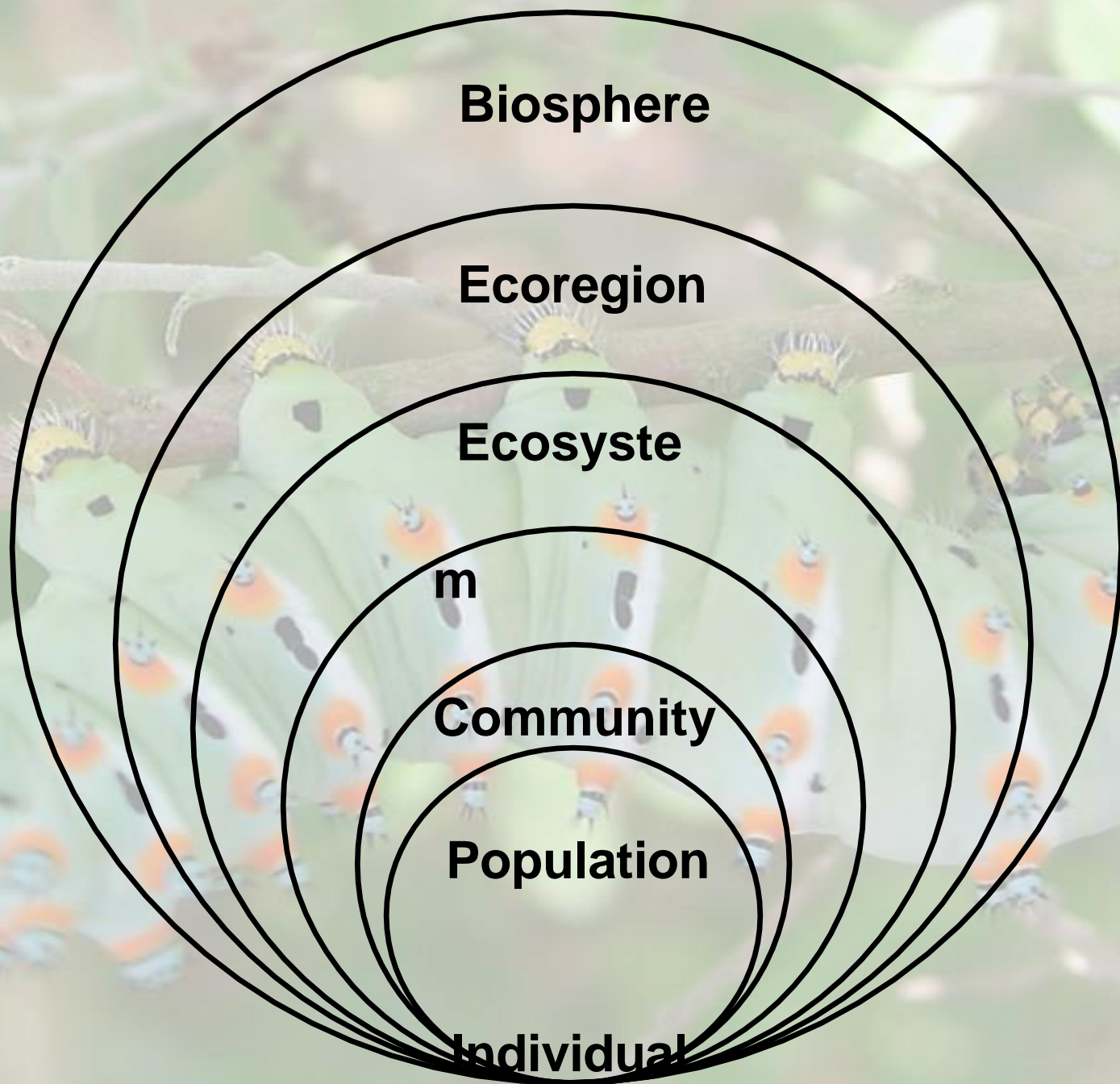


n **Decomposition**



n **Water cycling**





Exotic Plants

Benefits

- q Reliable seed or plant sources
- q Large agronomic database
- q Prolific/sustained floral display
- q Previous success in other locales

Disadvantages

- q Do not enhance native biodiversity
- q Potentially invasive



Native Plants

Benefits

- q Enhance native biodiversity
- q Re-creation of imperiled habitats
- q Less likely to be invasive
- q Adapted to local climate
- q Habitat permanency



Disadvantages

- q Greater initial cost
- q Longer establishment time

Bloom Timing of Native Plants Attractive to Beneficial Insects

Native plant	Natural enemies	Bees	Bloom Period						
			May	Jun	Jul	Aug	Sep	Oct	
wild strawberry	« «	«	■						
golden Alexanders	« « «	« «	■	■					
Canada anemone	« « «	«		■	■				
penstemon	« «	« «		■					
angelica	« « «	«		■					
cow parsnip	« « «	«		■					
sand coreopsis	« « «	«		■	■	■	■		
shrubby cinquefoil	« « «	«		■	■	■	■	■	
Indian hemp	« « «	«		■	■	■	■		
late figwort	« «	« «			■	■	■		
swamp milkweed	« «	« «			■	■	■		
Culver's root	« «	« « «			■	■	■		
yellow coneflower	« « «	« «			■	■	■		
nodding wild onion	«	« «				■	■	■	
meadowsweet	« « «	« «				■	■	■	
yellow giant hyssop	« «	« « «				■	■	■	
horsemint	« « «	« «				■	■	■	■
Missouri ironweed	« «	« «				■	■	■	
cup plant	« « «	« « «				■	■	■	
pale Indian plantain	« «	« «				■	■	■	
boneset	« « «	« «				■	■	■	
blue lobelia	« « «	« « «				■	■	■	
pale-leaved sunflower	« « «	« «				■	■	■	
Riddell's goldenrod	« « «	« « «						■	■
New England aster	« « «	« «						■	■
smooth aster	« «	« «						■	■

KEY

« good

« « better

« « « best

Plants for our climate

Plant	Bloom Colour	Time of Bloom
Pussy Willow	Yellow	Spring
Goldenrod	Yellow	Fall
Penstemon	Pink	Early Summer

Wildflower.org

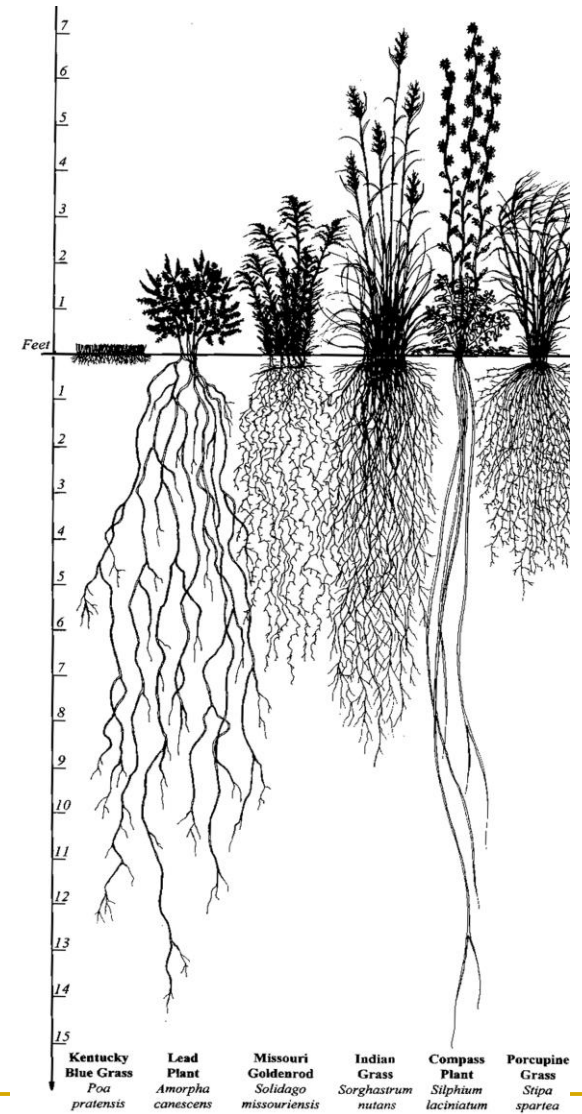
Native grasses

- **Grow in native prairie habitat, where they:**

1. **Provide structural support for wildflowers**

2. **Fill in gaps that wildflowers can't early in establishment, decreasing weed pressure**

3. **Have root systems of different depths that complement wildflowers**



Heidi Natura,
Conservation Research Institute

Habitat Diversity



n Spatial diversity

- q Horizontal diversity - No monoculture
- q Vertical diversity – herbs, forbs, shrubs, trees

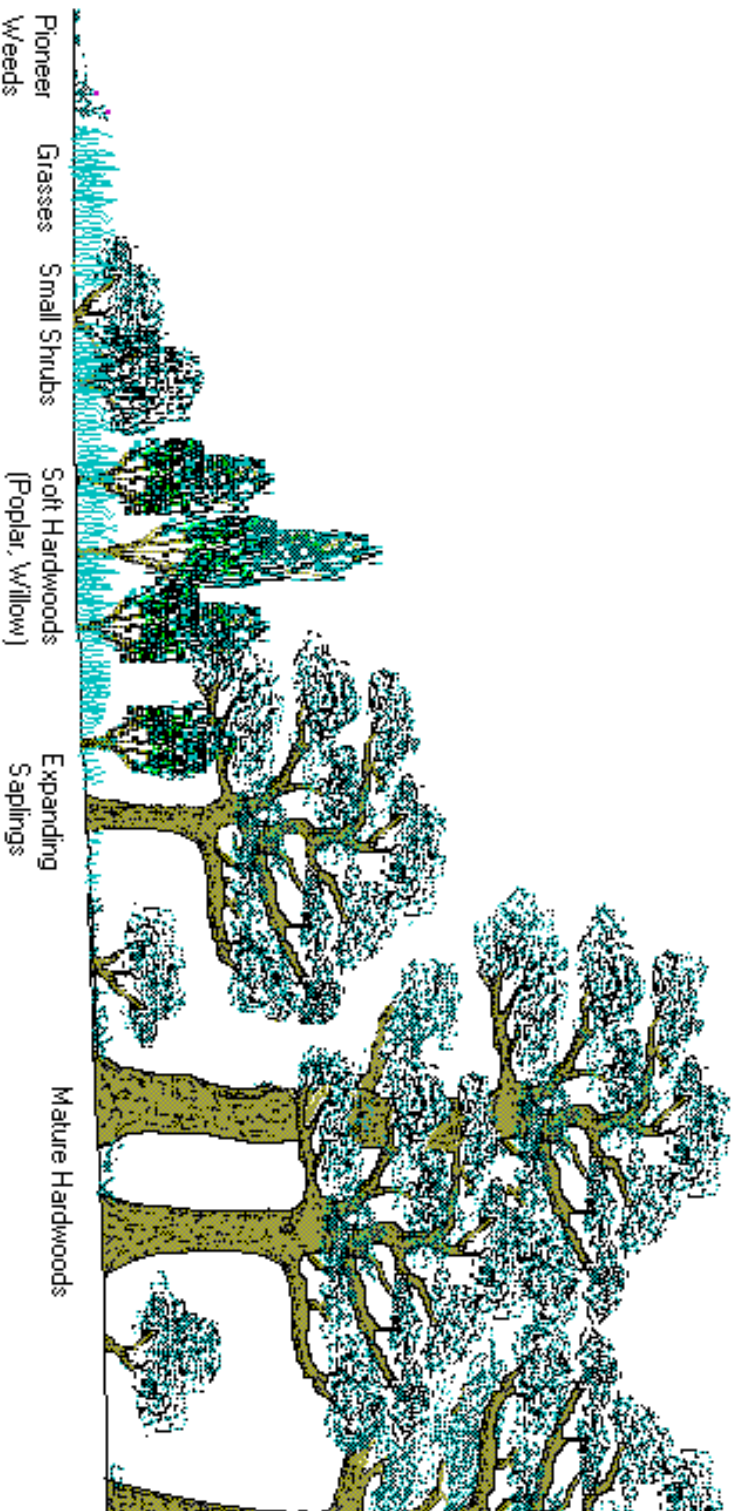
n Biodiversity

- q Alternate hosts
- q Refugia

n Temporal Diversity

- q Flowering plants all season long

n Transition Zones



California Integrated Waste Management Board

Eco-buffers

- n **A variety of trees and shrubs planted to mimic natural hedgerows**
 - n **Rapid establishment**
 - n **Serve a role as mechanical buffer and biodiversity habitat**
 - n **Placed anywhere a shelterbelt is and within the crop as a hedgerow**
-

Eco-buffers

n **30% trees, 70% shrubs and
perennials**

n **Tall Trees**

q **> 15 m**

q **Long-lived**

q **10% of plant material**

n **Nurse Trees**

q **20% of plant material**

q **Short-lived**

q **Pioneer species**

Eco-buffers

n Tall Shrubs

- q 40 % of plant material**
- q Comprise the understory**

n Low Shrubs and Perennials

- q 30 % of plant material**

n Typically planted in a 5 row design but can also be reduced to a 3 row design for tight spaces

- q Tall trees every 6th plant**
-

Eco-buffers

n Connect to existing woodlands or uncultivated areas

n Serve as wildlife

corridor n Source of food

and cover q In season

and over winter

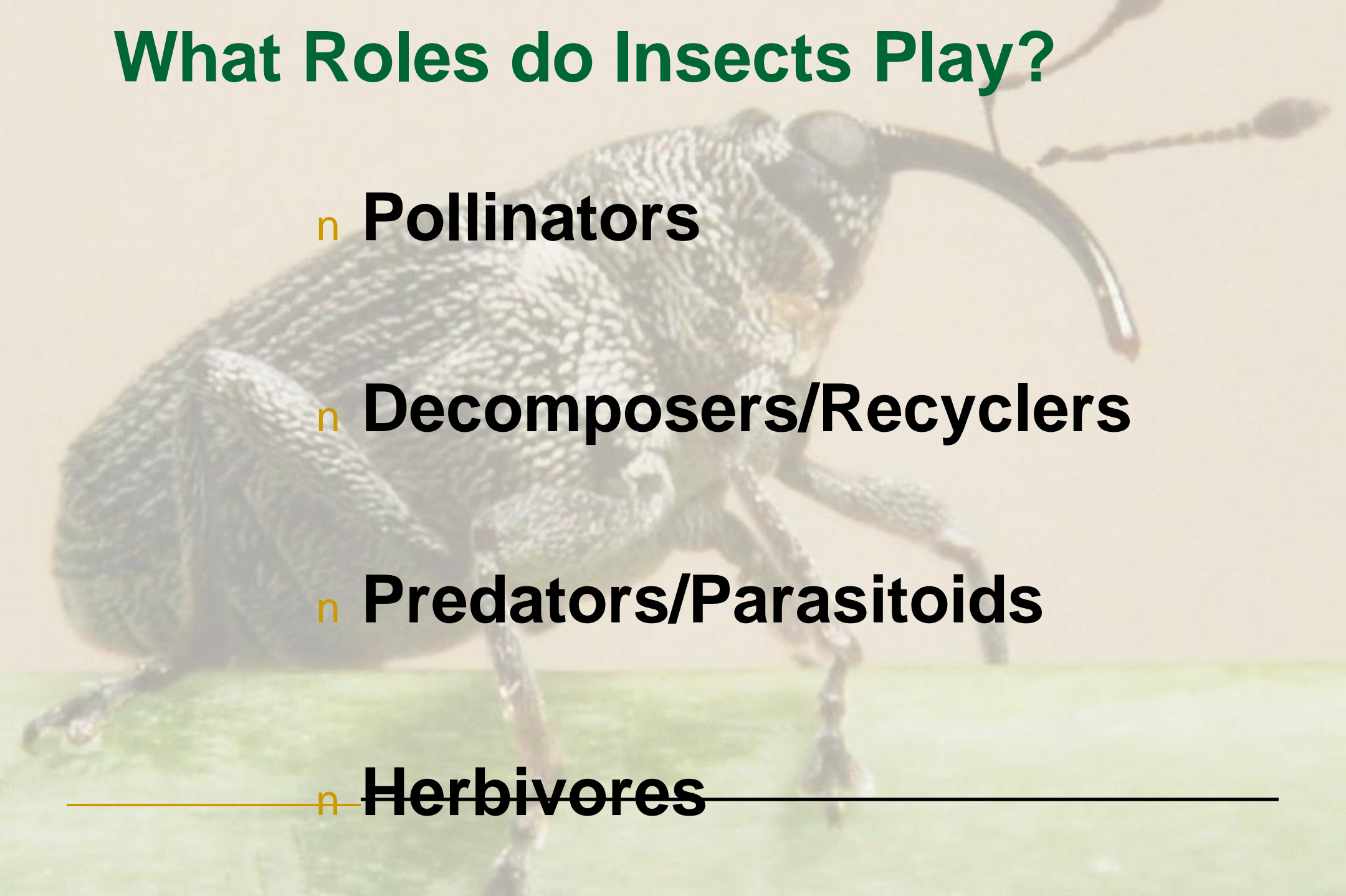
What Roles do Insects Play?

n **Pollinators**

n **Decomposers/Recyclers**

n **Predators/Parasitoids**

~~n **Herbivores**~~







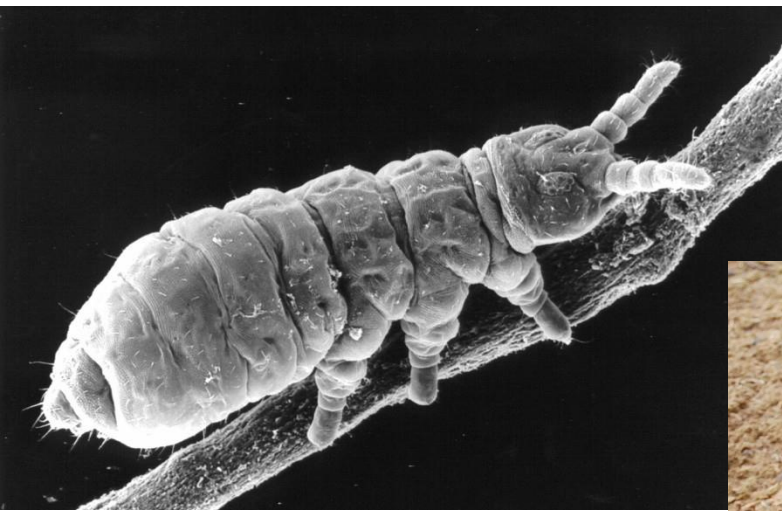








Decomposers/Recyclers



N. Winchester, U. Victoria



Duwwel



Viorika Prikhodko





What is a beneficial insect?

Natural enemies

Predators: both young and adults feed directly on other insects.

Parasitoids: develop on or in one host insect, emerge as adult, eventually killing host.

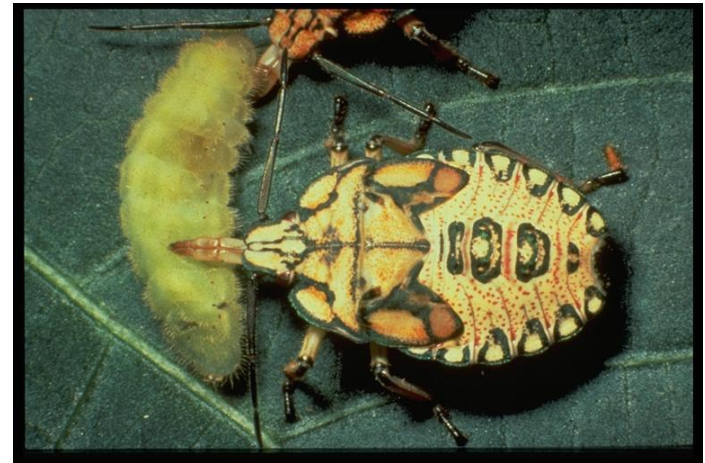


**Order Odonata:
Dragonflies & Damselflies
Nymphs & adults feed on
mosquitoes**





Podisus maculiventris
Pentatomidae
- Prey on caterpillars





Family Nabidae: Damsel Bug
Nymphs and adults feed on small insects



Family Phymatidae: Ambush Bug
Nymphs and adults feed on insects that visit flowers



**Family Anthocoridae:
Minute Pirate Bug
Nymphs and adults feed on small insects**



UGA9005028

Family Lygaeidae:

Big-eyed Bug

Nymphs and adults feed on small insects in turf



Statewide IPM Project



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Lady Beetles

Coccinellidae

- soft-bodied insects



Statewide IPM Project
University of California



Family Carabidae:

Ground Beetles

Larvae & adults feed on worms, slugs, and large insects in the soil and above ground



Family Staphylinidae:

Rove Beetle

Larvae & adults feed on insects in the soil and above ground



**Family Syrphidae:
Flower Fly Larvae and Adult
Larvae feed on soft-bodied insects
Adults are pollinators**



Family Cecidomyiidae: Midges
Larvae feed on soft-bodied
insects
Adults feed on nectar

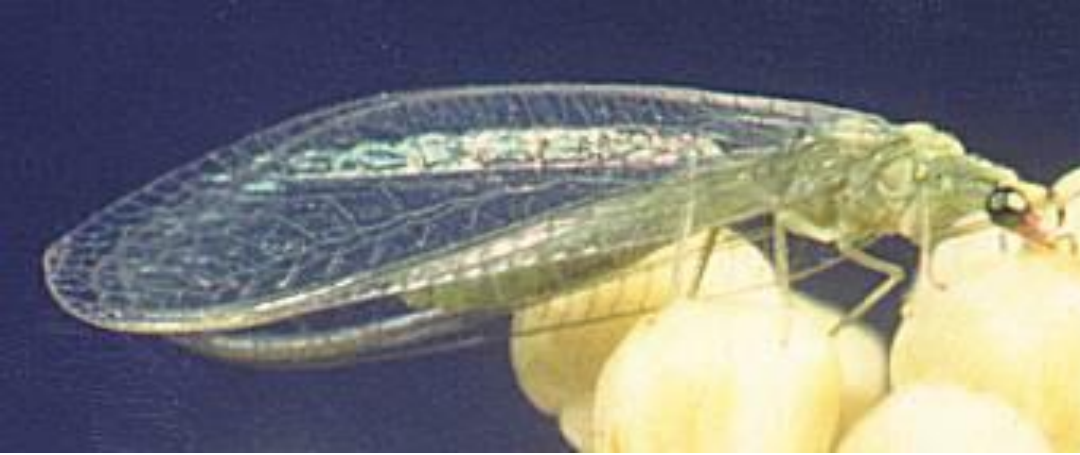


Feltiella acarisuga
Cecidomyiidae
- mites





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**Family Chrysopidae:
Lacewings
Larvae feed on soft-bodied insects
Adults feed on nectar**



The Statewide IPM Project
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**Family Vespidae:
Yellow Jacket Wasps
Adults prey on large insects in summer**



Araneidae
Orbweaver



Opiliones
Daddy Long-legs



Salticidae
Jumping Spider

Theridiidae
Tangled-Web Spiders





**Thomisidae
Crab Spiders**



Agelenidae
Funnel-web Spiders
Hobo spider



Linyphiidae
Sheet Weavers



Gnaphosidae
Ground Spiders





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Family Phytoseiidae: Predator Mites





Parasitoids lay eggs inside host



Ichneumonidae *Ophion* spp.



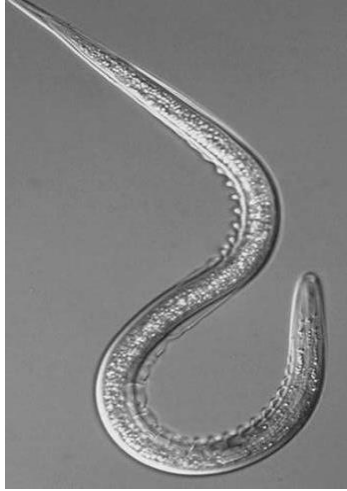


Tachinidae

Pathogens



Viruses



Nematodes



Fungi

Conserving Beneficial Insects



n Conservation

q Preserving existing natural beneficial insects

q Reduce or eliminate pesticide use

q Refine pesticide application methods and timing

q Provide necessities for beneficial insects

n Overwintering sites

n Summer food sources

n Alternate hosts/prey

n Access to Clean Water

Nesting Resources



nest entrance in soil



nest made in sloping soil



nest made in burrow



holes in a tree that could be used by bees



nesting box constructed for cavity nesting bees

Conserving the Ecosystem

n **Soil Conservation**

q **Reduced disturbance**

q **Organic content**

q **Preserve structure**

n **Water Conservation**

q **Drought-tolerant plants**

q **Rain capture**

q **Terraform**

Web Resources

n **Michigan State University – Dr. Doug Landis**

q <http://www.nativeplants.msu.edu>

n **Plant Database**

q <http://www.wildflower.org/plants/>

n **P r a i r i e Plantwatch**

q <http://plantwatch.naturealberta.ca>

n **Plant Phenology**

q <http://budburst.org/home>

Web Resources, cont.

- n **IPM Accreditation Ontario**
 - q <http://www.ontarioipm.com/>
 - n **PMRA Reduced Risk Pesticides**
 - q <http://www.pmra-arla.gc.ca/english/pubs/rr-e.html>
 - n **Canada Organic List**
 - q https://www.cog.ca/uploads/PermittedSubstancesList_2015.pdf
 - n **OMRI List of Organic Products**
 - q http://www.omri.org/OMRI_products_list.php
 - n **National Organic Program (U.S.) List of Organic Products**
 - q <http://www.ams.usda.gov/nop/NOP/standards/ListReg.html>
-

Risk Maps

- n Sustainable Resource Development

- q <http://aep.alberta.ca/lands-forests/forest-health/forest-pest-conditions/default.aspx>

- n Alberta Pest Monitoring Network

- q [http://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/prm13779](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/prm13779)

- n Western Committee on Crop Pests

- q <http://www.westernforum.org/>

Insect Identification Sites

n **Bee Genera of Canada**

q [http://pick5.pick.uga.edu/mp/20q?
guide=Bee genera United States and Canada](http://pick5.pick.uga.edu/mp/20q?guide=Bee_genera_United_States_and_Canada)

n **Bug Guide**

q <http://bugguide.net/node/view/15740>

n **Discover Life**

q <http://www.discoverlife.org/>

Insect Identification Sites

n Butterflies & Moths

q <http://www.butterfliesandmoths.org/>

n Earthworms

q [http://www.naturewatch.ca/english/wormwatch/
resources/key/index.html](http://www.naturewatch.ca/english/wormwatch/resources/key/index.html)

n Forest Pests

q <http://www.forestryimages.org/pests.cfm>

Insect Identification Sites

n Yellow Jackets in Edmonton

q <http://homebuggarden.blogspot.ca/2009/08/biodiversity-gone-bad-hornets-in-home.html>

n Royal Alberta Museum

q <http://www.royalalbertamuseum.ca/natural/insects/bugsfaq/bugsfaq.htm>

n Key to common pests

q <http://agspsrv34.agric.wa.gov.au/ento/pestweb/default.idc>

Insect Identification Sites

n Bumblebees of North America

q <http://www.nhm.ac.uk/research-curation/research/projects/bombus/wnearctic.html>

n Yellow Jackets of Western North America

q <http://academic.evergreen.edu/projects/ants/TESCBiota/kingdom/animalia/phylum/arthropoda/class/insecta/order/hymenoptera/family/Vespidae/Kweskin97/KEY.HTM>

Insect Identification Sites

n **Key to Butterflies and Moths of Canada**

q http://www.biology.ualberta.ca/bsc/ejournal/d_17/d_17_download.html

n **Key to Aquatic Invertebrates of Alberta**

q http://sunsite.ualberta.ca/Projects/Aquatic_Invertebrates/index.php

n **A A F C Monographs**

q <http://esc-sec.ca/aafcmono.php>

Bee Identification Keys

n **List of species in North America**

n **Leafcutter Bees of Canada**

n **Bee Genera of Eastern Canada**

- many of these are in Western Canada

n **Bees of North America**

n **Yellow Jackets of North America**

n **Bee Genera of Canada**

More Bees...

n **Pollination Canada**

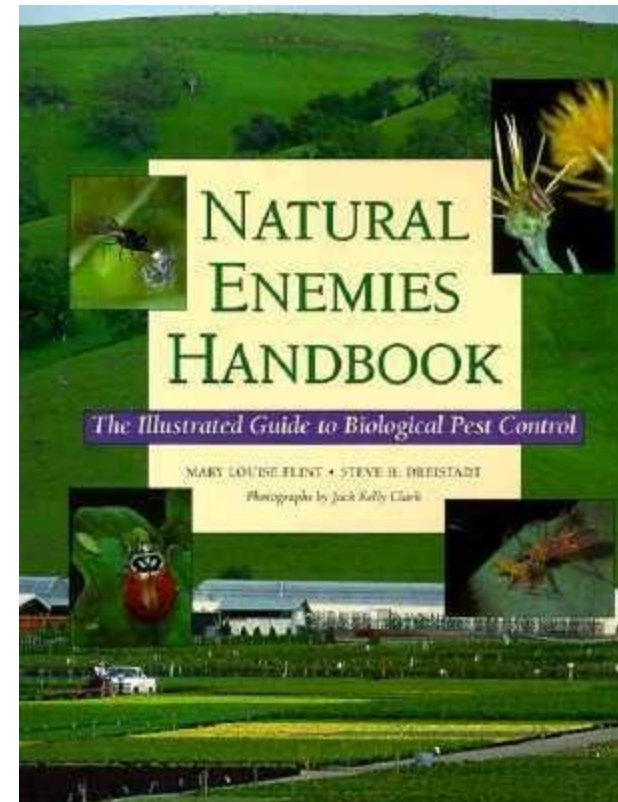
- a site for details on all pollinators in Canada

n **Images of Bumble Bees**

n **Bumble Bee Watch**

- a citizen science project for bumble bees

- n **Flint, M.L. 1998. Natural Enemies Handbook. The Illustrated Guide to Biological Pest Control.**
- n **University of California
Division of Agriculture and
Natural Resources: Publication
3386**
- n **[http://anrcatalog.ucdavis.edu/
InOrder/Shop/ItemDetails.asp?
ItemNo=3386H](http://anrcatalog.ucdavis.edu/InOrder/Shop/ItemDetails.asp?ItemNo=3386H)**

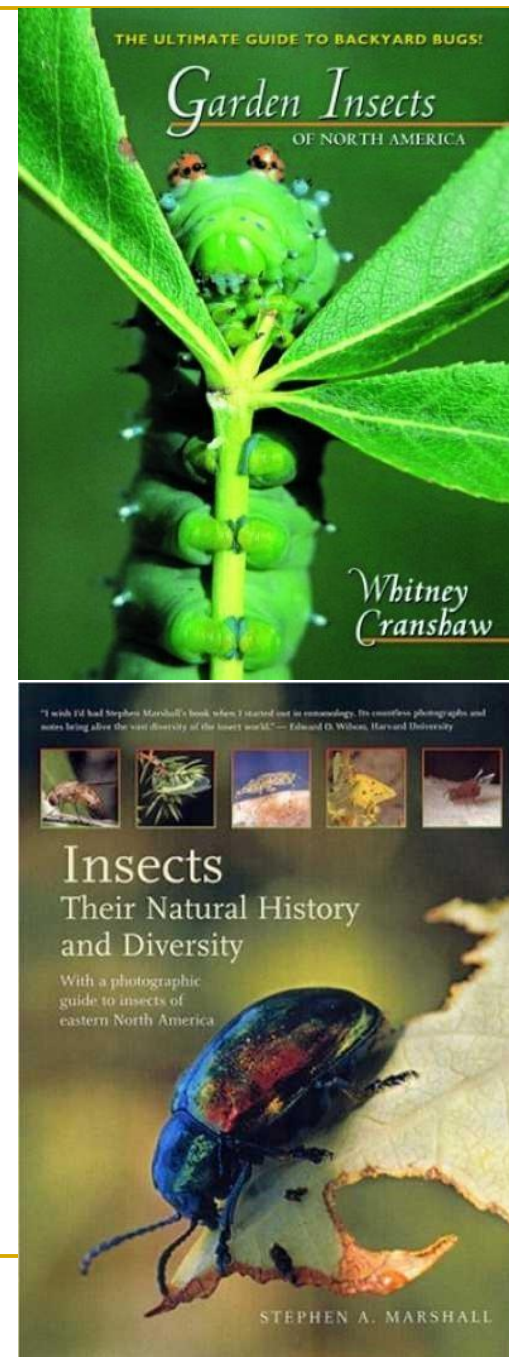


n **Garden Insects of North America**

q **C r a n s h a w, W. 2004.**
Princeton University Press.656pp.

n **Insects: Their Natural History and Diversity**

q **M a r s h a l l, S.A. 2006.**
Firefly Books. 718pp.



n **Tree & Shrub Insects of the Prairie Provinces**

q Ives, W.G.H. & Wong, H.R. 1988, \$35.00

n **A Field Guide to Forest Insects and Diseases of the Prairie Provinces**

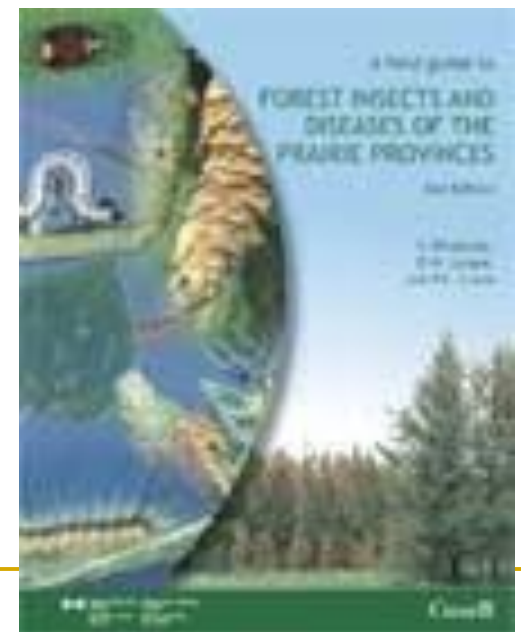
q Y. Hiratsuka *et al.* 2004, \$35.00

q **U B C Press (c/o UNIpresses)
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n **Pests of Landscape Trees & Shrubs 2ND Ed.**

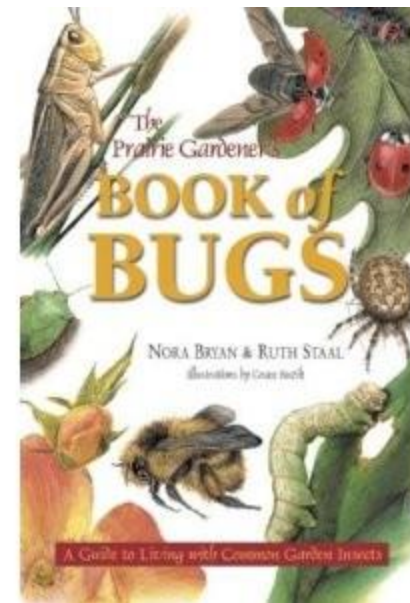
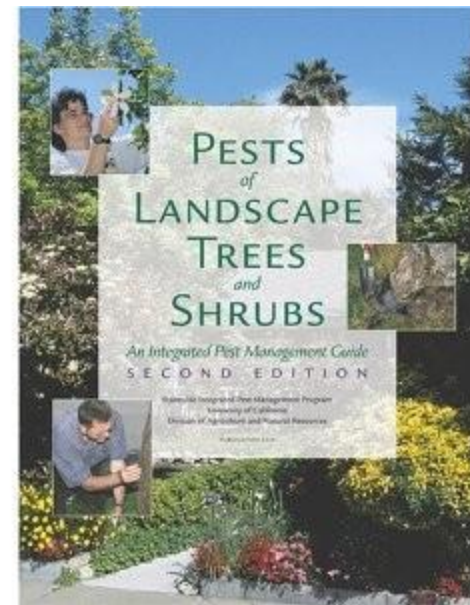
q **Publication 3359, Dreistadt, S.H. 2004, U.S.\$42.00**

q [http://www.ipm.ucdavis.edu/
IPMPROJECT/ADS/
manual_landscape.html](http://www.ipm.ucdavis.edu/IPMPROJECT/ADS/manual_landscape.html)

n **The Prairie Gardener's Book of Bugs**

q **Nora Bryan & Ruth Staal**

q **Fifth House Ltd. 200pp.**



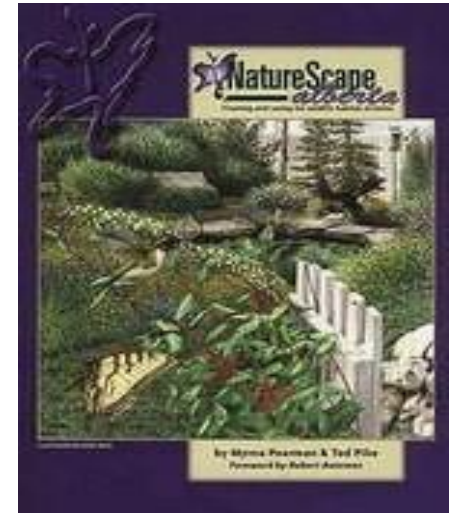
n NatureScape

q **Alberta** **Prentiss, M. & Pike, T. 2001.**

q **Red Deer River Naturalists,
Federation of Alberta Naturalists**

q www.fanweb.ca

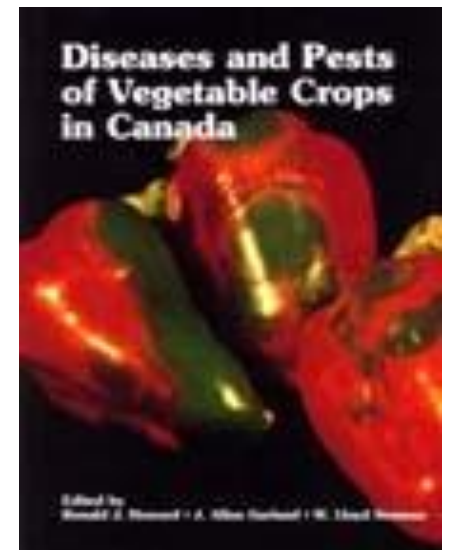
q **\$ 2 4 . 9 5**



■ Diseases & Pests of Vegetable Crops in Canada

— Howard, R.J. et al. 1994, \$65.00

— <http://esc-sec.org/disease.htm>



n **Garden Bugs of Alberta**

q **Fry, K. et al. 2008.**

q **Lone Pine Publishing**

q **\$ 21 . 9 5**

