



# Pollinator Information & Resources

## RANCHING SUSTAINABILITY ANALYSIS INFO SHEET

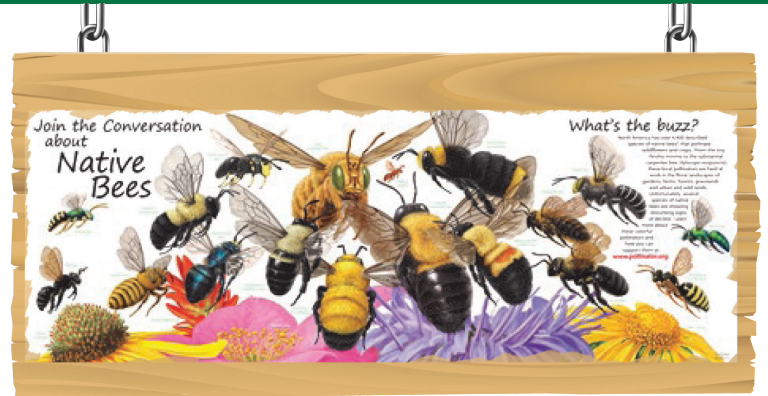
Pollinators are animals that enable reproduction of many species of flowering plants by transferring pollen from one flower to another of the same species. In some cases, cross-pollination among species results in hybridization and could lead to new species. Regardless, pollination is responsible for much of the genetic diversity within species of flowering plants. The National Biological Information Infrastructure (NBII) program describes pollination as follows:

*A pollinator initiates fertilization of a plant by moving pollen from the male anthers of a flower to the female stigma of a flower. As pollinators get their food from the flower of the plant, they brush up against the male anthers which are covered in pollen. The pollen sticks to the pollinator, and as feeding continues from flower to flower, the pollinator rubs pollen onto the female stigma. Once fertilized, a plant will produce fruit and/or seeds that will lead to plant reproduction.*

Pollinators and these flowering plants are mutually dependent; neither can exist without the other.



Approximately 90% of flowering plants, 75% of human crops, and 33% of human food depend on animal pollinators. Flowering plants represent a significant proportion of our global plant communities, which through photosynthesis and respiration—converting solar energy to food, taking in carbon dioxide, and giving off oxygen—created the breathable planetary atmosphere upon which we depend. Plants serve as air and water filters, are an indispensable part of the water cycle, prevent erosion of valuable soil resources, and



give us numerous foods, fibers, and medicines. Thus, pollinators are critical to biodiversity, ecosystem services, agricultural productivity, world economies, and our quality of life. Population declines (due to habitat loss and fragmentation, loss of food sources, disease, and pesticides) of many pollinator species have prompted concern at local, national, and international levels and spawned numerous conservation initiatives.

Herein we offer many interesting and useful facts about pollinator biology, economic benefits, and population declines, followed by lists of resources for further learning.

### Pollination Biology

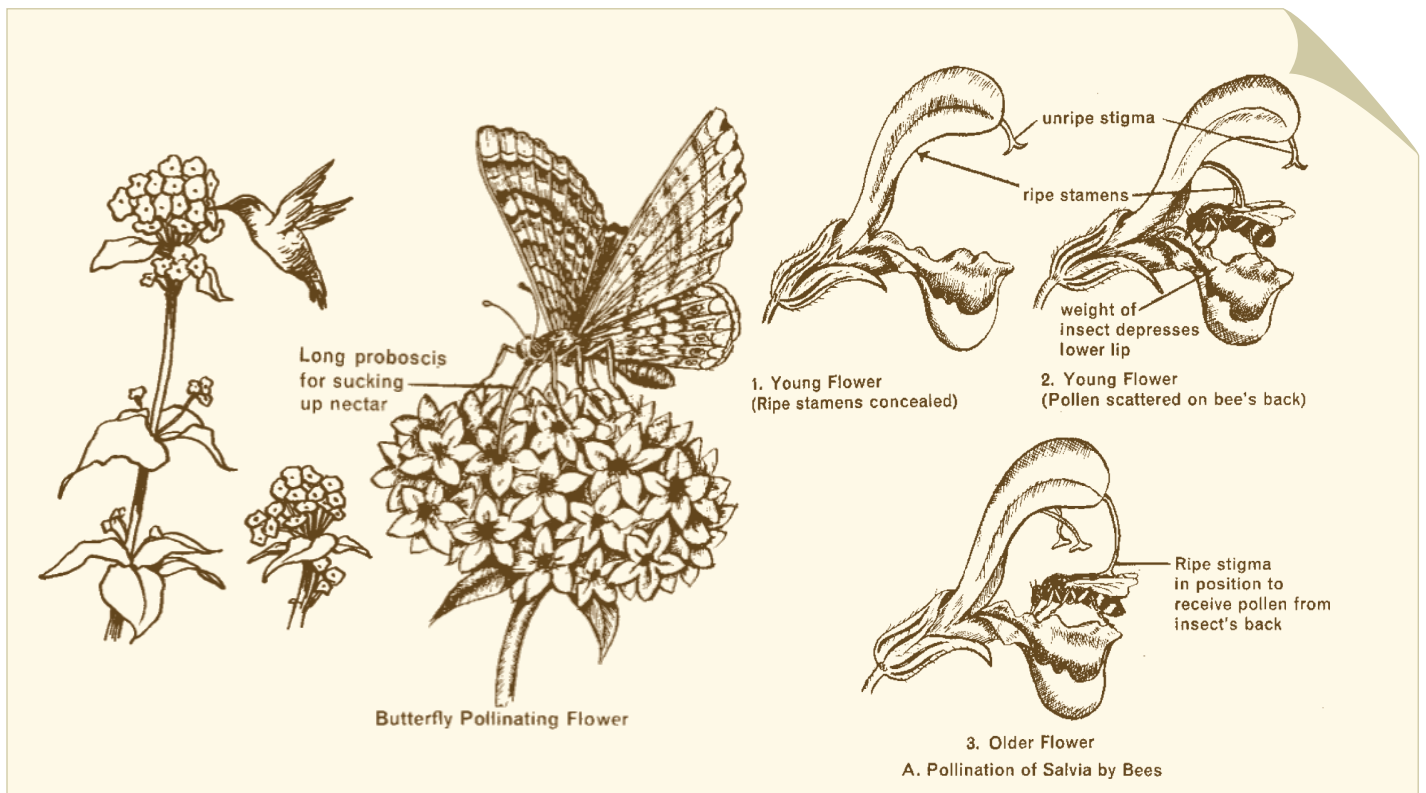
- Many people think only of allergies when they hear the word pollen, but pollen plays a vital role in the health of our environment. Pollen, the plant's male sex cells, must be transferred from the anther to the stigma of the same or another flower for the plant to produce fruit and seed. While some plants are self- or wind-pollinated, the great majority of flowering plants cannot move pollen without help from an animal pollinator.<sup>1</sup>
- Pollinators make up a significant portion of the total diversity of species on this planet. In fact, as many as 300,000 invertebrate species—such as butterflies, beetles, moths, flies, mosquitoes, and bees—are estimated to serve globally as pollinators as well as around 2,000 vertebrate species, including

birds (e.g., hummingbirds and perching birds), mammals (e.g., flying foxes, fruit bats, opossums, and lemurs), and reptiles (e.g., gecko).<sup>1, 3, 4</sup>

- Pollination is required to produce seeds and fruits in up to 90% of the world's 250,000 kinds of flowering plants, including 2/3 of the world's food plants.<sup>1, 3, 4</sup>
- Worldwide, at least thirty percent of 1500 crop plant species depend on pollination by bees and other insects.<sup>1</sup>
- Pollinators are essential components of the habitats and ecosystems that many wild animals rely on for food and shelter.<sup>2</sup>
- Pollinators support biodiversity: there is a correlation between plant diversity and pollinator diversity.<sup>4</sup>
- Approximately 25 percent of birds include fruit or seeds as a major part of their diet.<sup>2</sup>
- Plants provide egg laying and nesting sites for many insects, such as butterflies.<sup>2</sup>
- Berries and other fruit form a significant part of the late-summer diet of animals, such as grizzly bears, which fatten themselves in preparation for winter hibernation.<sup>2</sup>
- Exposure to pollinators may be a way of maintaining and promoting genetic diversity in crops and other plants.<sup>3</sup>
- Climate change has the potential to affect the distribution of pollinators and the plants they pollinate, as well as the timing of flowering and migration.<sup>4</sup>

## Economic Benefits

- Pollinators play a significant role in the production of over 150 food crops in the U.S.—among them apples, almonds, blueberries, cranberries, kiwis, melons, pears, plums, and squash.<sup>1</sup>
- Worldwide, of the estimated 1,330 crop plants grown for food, beverages, fibers, condiments, spices, and medicines, approximately 1,000 (75 percent) are pollinated by animals. It has been calculated that one out of every three mouthfuls of food we eat, and beverages we drink, is delivered to us by pollinators.<sup>1, 2</sup>
- In the U.S., the annual benefit of managed honey bees to agriculture was estimated as \$14.6 billion in 2000.<sup>1</sup>
- Native, unmanaged pollinators—primarily bees—are estimated to contribute \$3 billion to the value of crops pollination in the U.S.<sup>1</sup>
- The southeastern blueberry bee illustrates the economic significance of native pollinators. In her few weeks as an adult, a single female bee visits about 50,000 blueberry flowers, resulting in over 6,000 marketable blueberries worth about \$75.<sup>1</sup>
- Studies in California's Central Valley have shown that a suite of three dozen or more native bee species provide pollination services on a single farm and can deliver sufficient pollination even for crops with a "heavy" pollination requirement such as watermelon. In watermelon up to 1,000 grains of pollen must be deposited on each flower within only a few hours to get marketable fruit.<sup>1</sup>



## Did you know?

Pollen transferred among many plants of the same species represents considerable exchange of genetic material—resulting in tremendous genetic diversity within flowering plant populations. Just as biodiversity in general offers dynamic stability to ecosystems, this particular genetic diversity acts as a reservoir of traits and potential traits that lend adaptability and resilience to plant communities, including cultivated crops. These attributes are vital to maintaining ecosystem functions and services, especially in the face of our rapidly changing global climate.

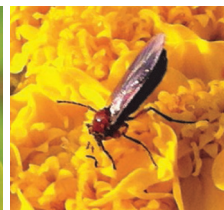
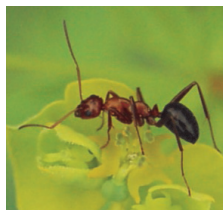
- Bumble bees have long been recognized as important pollinators of crops and native plants. In recent years, they have been reared commercially and used to pollinate greenhouse crops, particularly tomatoes and eggplant.<sup>1</sup>
- The work of pollinators ensures full harvests and seed production from many agricultural crops and provides for healthy plants grown in backyards, community gardens, and other urban areas.<sup>2</sup>
- More than half the world's diet of fats and oils comes from oilseed crops. Many of these, including cotton, oil palm, canola, and sun-flowers, are pollinated by animals.<sup>2</sup>
- In the U.S., pollination by insects produces \$40 billion worth of products annually.<sup>2, 3</sup>
- There are over 3,500 native bee species in the United States. They pollinate many crops including almonds, apples, avocados, blueberries, cantaloupes, cherries, cranberries, cucumbers, sunflowers, and watermelon. Examples of native pollinating bees are sweat bees (Family: Halictidae) which take their name from their habit of landing on people and licking their skin, squash bees (*Peponapis pruinosa*) which collect pollen only from cucurbits like squash, pumpkins, and gourds, and leafcutter bees (*Megachile* spp.) which are reported to prefer legume blossoms, are important pollinators of North American wildflowers, and are used commercially as pollinators of crops like alfalfa, carrot, and blueberry.<sup>3</sup>
- Of the hundred or so crops that make up most of the world's food supply, only 15% are pollinated by domestic bees, while at least 80% are pollinated by wild bees and other wildlife.<sup>4</sup>
- Honey bee poisonings result in annual losses of \$13.3 million.<sup>4</sup>
- Many crops that would benefit in quality and quantity from more thorough pollination are not sufficiently pollinated because of heavy pesticide applications. Income from harvests could increase by an estimated \$400 million per year if pollinators were available in sufficient numbers.<sup>4</sup>

## Pollinator Declines

- The National Research Council report, Status of Pollinators in North America, unequivocally states that pollinator declines are occurring. The report identifies the main causes of decline as habitat loss, pesticide use, and, especially in honey bees, diseases. It spotlights the urgency of action to conserve pollinators and their habitat.<sup>1</sup>
- Many species of wild pollinators are in decline. Disruptions of localized pollination systems, and declines of certain species of pollinators, have been reported on every continent except Antarctica.<sup>1</sup>
- The number of managed honey bee colonies in the U.S. has decreased by more than 50 percent since 1945. Another 50% have been lost since then, half of that during the 1990s.<sup>1</sup>
- Domesticated honey bees, which are commonly used to pollinate crops, have declined dramatically in recent years. Parasitic mites were responsible for some of the declines, more recent declines are from Colony Collapse Disorder (CCD).<sup>4</sup>
- Many factors are believed to be responsible for what is being called "Colony Collapse Disorder": some combination of pathogens, parasites; environmental stresses, and management stresses are likely to be the cause. Many experts suggest that these declines illustrate the danger of our heavy reliance on a single species for most of our pollination needs.<sup>1</sup>
- Habitat loss and fragmentation are two of the greatest threats to native pollinators. Foraging areas and nesting sites of many pollinating organisms are jeopardized when wild lands are converted to domestic uses such as housing, suburban development, agriculture, or pasture.<sup>1</sup>



Examples of pollinators include invertebrates such as ants, bees, beetles, butterflies, flies, moths, and wasps as well as vertebrate wildlife such as bats and birds. Invertebrates are by far the most numerous of all pollinators (photos © J. Zingo).





- Pesticides also pose a major threat to insect pollinators. Changes in the type and timing of pesticide use, avoidance of overspray, better regulation, and organic agricultural methods can reduce pollinator mortality rates.<sup>1</sup>
- Bees recover slowly from insecticide spraying and other disturbances because of their low fecundity (they are unable to reproduce rapidly or in great numbers) which also makes them more susceptible to local extinction. It may take 3 to 4 years for bumble bee populations to return to pre-pesticide application levels.<sup>4</sup>
- Declines in pollinators may make plants more vulnerable to extinction.<sup>4</sup>
- The impact of diseases, parasites, and pathogens on pollinator populations is of growing concern. Managed honey bees are affected by parasitic mites, diseases such as foulbrood, and pathogens. Commercially reared bumble bees are also affected by diseases and pathogens, and there is evidence that these can spread from commercial colonies to wild colonies around greenhouses.<sup>1</sup>
- For migratory pollinators, such as bats, hummingbirds, and the monarch butterfly, the identification and protection of nectar corridors is important. If nectar is unavailable anywhere along their migratory route at the time of migration, it could result in the death of part of the population. Nectar sources near areas where pesticides are sprayed may be tainted or, where herbicides are used, eliminated.<sup>4</sup>

- At least 3 bat, 5 birds, and 24 butterfly, skipper and moth, one beetle and one fly species in the United States that are federally listed as endangered under the Endangered Species Act of 1973, as amended, are pollinators. It is unknown how many of the listed plants require pollinators.<sup>4</sup>
- The elimination, replacement or reduction of a specific species of pollinator may result in the decline of a specific plant species, which in turn may affect relative plant abundance, and hence community dynamics and impact wild animals and humans that depend on those plants.<sup>2</sup>
- Further research is necessary to improve the understanding of pollination dynamics and the consequences of pollinator decline. Specifically, we need to know more about the effects on wild pollinators of pesticides, grazing, logging, and urban sprawl; the significance of diminishing pollinator populations and the potential for cascading extinction; and the identification of economically important plant-pollinator relationships.<sup>1</sup>

**Adapting to Changing Climates**

Crops produce optimally with a suite of pollinators...  
A diverse assemblage of pollinators, with different traits and responses to ambient conditions, is one of the best ways of minimizing risks due to climatic change. The “insurance” provided by a diversity of pollinators ensures that there are effective pollinators not just for current conditions, but for future conditions as well. Resilience can be built in agroecosystems through biodiversity.

United Nation’s Global Action on  
Pollination Services for Sustainable Agriculture  
[www.internationalpollinatorsinitiative.org](http://www.internationalpollinatorsinitiative.org)

## References .....

The above items were quoted or adapted from the following sources, as indicated by the footnotes:

1. Ecological Society of America. Communicating Ecosystem Services Pollination Toolkit: Key Points. Updated June 20, 2008. Online at [www.esa.org/ecoservices](http://www.esa.org/ecoservices).
2. North American Pollinator Protection Campaign (NAPPC)—<http://pollinator.org/nappc/pollinators.htm>
3. National Biological Information Infrastructure (NBII), Ecological Topics: Pollinators—<http://www.nbii.gov/portal/server.pt/community/pollinators/222>
4. U.S. Fish & Wildlife Service, More Facts About Pollinators—<http://www.fws.gov/pollinators/pollinatorpages/AboutPollinators.html>

## ORGANIZATIONS AND WEBSITES

### Butterflies and Moths of North America

[www.butterfliesandmoths.org](http://www.butterfliesandmoths.org)

### California Native Plant Society

[www.cnps.org](http://www.cnps.org)

### Calflora Database

[www.calflora.org](http://www.calflora.org)

### Ecosystem Services Bibliography: Pollination

[blog.lib.umn.edu/polasky/ecosystem/4-specific-goods-and-services-and-biodiversity/j-pollination](http://blog.lib.umn.edu/polasky/ecosystem/4-specific-goods-and-services-and-biodiversity/j-pollination)

### Global Action on Pollination Services for Sustainable Agriculture, Food and Agriculture of the United Nations

[www.internationalpollinatorsinitiative.org](http://www.internationalpollinatorsinitiative.org)

### The Great Sunflower Project

[www.greatsunflower.org](http://www.greatsunflower.org)

### Lady Bird Johnson Wildflower Center's Native Plant Information Network

[www.wildflower.org/explore](http://www.wildflower.org/explore)

### National Academy of Sciences, Resources on Pollinators

[dels-old.nas.edu/pollinators](http://dels-old.nas.edu/pollinators)

### National Biological Information Infrastructure (NBII), Ecological Topics: Pollinators

[www.nbio.gov/portal/server.pt/community/pollinators/222](http://www.nbio.gov/portal/server.pt/community/pollinators/222)

### Natural Resources Conservation Service (NRCS)

[www.usda.nrcs.gov](http://www.usda.nrcs.gov)

#### Plant Materials Program

[plant-materials.nrcs.usda.gov](http://plant-materials.nrcs.usda.gov)

#### PLANTS Database, USDA NRCS

[plants.usda.gov](http://plants.usda.gov)

### North American Pollinator Protection Campaign (NAPPC)

[pollinator.org/nappc](http://pollinator.org/nappc)

### The Pollinator Partnership

[www.pollinator.org/index.html](http://www.pollinator.org/index.html)

### UC Statewide Integrated Pest Management Program

[www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu)

### The Urban Bee Project, UC Berkeley

[nature.berkeley.edu/urbanbeegardens](http://nature.berkeley.edu/urbanbeegardens)

### USDA Agricultural Research Service, Pollinating Insects Research Unit

[www.ars.usda.gov/Main/site\\_main.htm?modecode=54-28-05-00](http://www.ars.usda.gov/Main/site_main.htm?modecode=54-28-05-00)

### U.S. Fish & Wildlife Service, Pollinators

[www.fws.gov/pollinators/Index.html](http://www.fws.gov/pollinators/Index.html)

### U.S. Forest Service, Celebrating Wildflowers: Pollinators

[www.fs.fed.us/wildflowers/pollinators/index.shtml](http://www.fs.fed.us/wildflowers/pollinators/index.shtml)

### The Xerces Society, Pollinator Conservation

[www.xerces.org/pollinator-conservation](http://www.xerces.org/pollinator-conservation)

## ONLINE MULTIMEDIA

### BLM Pollinator Program podcast

[media.nap.edu/podcasts/nax22pollinator.mp3](http://media.nap.edu/podcasts/nax22pollinator.mp3)

### Operation Pollinator (Europe)

[media.nap.edu/podcasts/nax22pollinator.mp3](http://media.nap.edu/podcasts/nax22pollinator.mp3)

### Podcasts from 2008 National Pollinator Week, courtesy of USFWS

[www.fws.gov/pollinators/PollinatorPages/PollinatorWeek08.html](http://www.fws.gov/pollinators/PollinatorPages/PollinatorWeek08.html)

### Other podcasts from 2008 National Pollinator Week

[www.pollinator.org/podcast.htm](http://www.pollinator.org/podcast.htm)

### Pollinators in Crisis podcast, National Academies Press

[media.nap.edu/podcasts/nax22pollinator.mp3](http://media.nap.edu/podcasts/nax22pollinator.mp3)

### The Pollinator Pyramid, a video produced for Washtenaw County, Michigan

[www.in-sitevideo.com/Site/pollinators.html](http://www.in-sitevideo.com/Site/pollinators.html)

### Protecting Pollinators, NRCS videos

[www.youtube.com/watch?v=EK1Ljd2wm8g&feature=player\\_embedded](http://www.youtube.com/watch?v=EK1Ljd2wm8g&feature=player_embedded)

## ONLINE AND PRINTED PUBLICATIONS

Most of these items are free downloads

### General

*Introduction to Insect Pollinators*, USDA NRCS-Oregon  
[www.plant-materials.nrcs.usda.gov/pubs/orpmcbr7561.pdf](http://www.plant-materials.nrcs.usda.gov/pubs/orpmcbr7561.pdf)

*Our Forgotten Pollinators: Protecting the Birds and Bees*  
[www.pmac.net/birdbee.htm](http://www.pmac.net/birdbee.htm)

*Pollinator Biology and Habitat*, USDA NRCS New England  
Biological Technical Note, April 2009  
[ftp://ftp-fc.sc.egov.usda.gov/NH/WWW/New%20England\\_NRCS\\_Pollinator\\_Tech\\_Note\\_FINAL.pdf](ftp://ftp-fc.sc.egov.usda.gov/NH/WWW/New%20England_NRCS_Pollinator_Tech_Note_FINAL.pdf)

*Pollinator Biology and Habitat in California*, USDA NRCS  
Technical Note TN-Biology-CA-19, April 2009  
[plant-materials.nrcs.usda.gov/technical/publications/featurepubs/TN\\_Biology\\_19\\_Pollinator\\_Biology\\_CA\\_5-09.pdf](http://plant-materials.nrcs.usda.gov/technical/publications/featurepubs/TN_Biology_19_Pollinator_Biology_CA_5-09.pdf)  
(primarily bees)

*The Simple Truth: We Can't Live Without Them*, U.S. Forest Service  
[www.fs.fed.us/wildflowers/pollinators/documents/simpletruthbrochure.pdf](http://www.fs.fed.us/wildflowers/pollinators/documents/simpletruthbrochure.pdf)

*Status of Pollinators in North America*,  
National Academy of Sciences  
[www.nap.edu/catalog.php?record\\_id=11761](http://www.nap.edu/catalog.php?record_id=11761)

### Bats & Birds

All About Birds, Cornell Lab of Ornithology  
[www.allaboutbirds.org/Page.aspx?pid=1189](http://www.allaboutbirds.org/Page.aspx?pid=1189)

Bat Conservation International  
[www.batcon.org](http://www.batcon.org)

Bat Pollination, U.S. Forest Service  
[www.fs.fed.us/wildflowers/pollinators/bats.shtml](http://www.fs.fed.us/wildflowers/pollinators/bats.shtml)

Bird Pollination, U.S. Forest Service  
[www.fs.fed.us/wildflowers/pollinators/birds.shtml](http://www.fs.fed.us/wildflowers/pollinators/birds.shtml)

Patuxent Bird Identification InfoCenter, USGS  
[www.mbr-pwrc.usgs.gov/id/framlst/infocenter.html](http://www.mbr-pwrc.usgs.gov/id/framlst/infocenter.html)

### Hedgerows

*Establishing Hedgerows on Farms in California*,  
UC ANR Publication 8390  
[anrcatalog.ucdavis.edu/Items/8390.aspx](http://anrcatalog.ucdavis.edu/Items/8390.aspx)

*Hedgerows: Turning Farm Waste Areas into Active IPM Life Cycles*, Yolo County RCD  
[www.cdpr.ca.gov/docs/pestmgt/grants/97-98/finlrpts/97-0247.pdf](http://www.cdpr.ca.gov/docs/pestmgt/grants/97-98/finlrpts/97-0247.pdf)

*Hedgerows for California Agriculture: A Resource Guide*,  
Community Alliance with Family Farmers  
[www.caff.org/Hedgerow.pdf](http://www.caff.org/Hedgerow.pdf)

### Insects

*Alternative Pollinators: Native Bees*, National Sustainable  
Agriculture Information Service (ATTRA)—  
<http://www.attra.org/attra-pub/PDF/nativebee.pdf>

*Bumble Bee Pocket Identification Guides*, The Xerces Society  
[www.xerces.org/identification-guides](http://www.xerces.org/identification-guides)

*Attract Butterflies*, National Wildlife Federation tip sheet  
[www.nwf.org/backyardwildlifehabitat/pdfs/Butterflies\\_TipSheet\\_Final.pdf](http://www.nwf.org/backyardwildlifehabitat/pdfs/Butterflies_TipSheet_Final.pdf)

Invertebrate Conservation Fact Sheets, The Xerces Society  
[www.xerces.org/fact-sheets](http://www.xerces.org/fact-sheets)

*Bumble Bee Conservation*

*Farming for Bees: Guidelines for Providing Native Bee  
Habitat on Farms*

*Farming with Pollinators*

*Nests for Native Bees*

*Pollinator Conservation: Three Simple Steps to Help Bees  
and Butterflies*

*Tunnel Nest Construction and Management*

*Western Monarch at Risk: The Plight of Monarch Butterflies  
Along the West Coast*

USDA National Agroforestry Center, Agroforestry Notes  
[www.unl.edu/nac/agroforestrynotes.htm](http://www.unl.edu/nac/agroforestrynotes.htm)

*Sustaining Native Bee Habitat for Crop Pollination*

*Improving Forage for Native Bee Crop Pollinators*

*Enhancing Nest Sites For Native Bee Crop Pollinators*

*Pesticide Considerations For Native Bees In Agroforestry*

### Management (General)

*Attracting Native Pollinators: Protecting North America's Bees  
and Butterflies*, The Xerces Society, Feb 2011, 384pp., ISBN  
978-1-60342-695-4

[www.xerces.org/announcing-the-publication-of-attracting-native-pollinators](http://www.xerces.org/announcing-the-publication-of-attracting-native-pollinators)

*Managing Alternative Pollinators: A Handbook for Beekeepers,  
Growers, and Conservationists*, The Xerces Society, 162pp.  
[www.xerces.org/store](http://www.xerces.org/store)

NRCS Fish & Wildlife Habitat Management Leaflets  
[www.whmi.nrcs.usda.gov/technical/leaflet.htm](http://www.whmi.nrcs.usda.gov/technical/leaflet.htm)  
e.g., *Bats; Butterflies; Pollinators (Native)*

*Note to Producers: Conservation Buffers Still Work...*

*Economically & Environmentally*, NRCS

[nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=429&buffersStillwork](http://nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=429&buffersStillwork)

*Pollinators and Roadsides: Managing Roadsides for Bees and Butterflies*, The Xerces Society

[www.xerces.org/wp-content/uploads/2010/05/roadside-guidelines\\_xerces-society1.pdf](http://www.xerces.org/wp-content/uploads/2010/05/roadside-guidelines_xerces-society1.pdf)

*Pollinators in Natural Areas: A Primer on Habitat Management*, The Xerces Society

[www.xerces.org/store](http://www.xerces.org/store)

*Pollinator-Friendly Parks. How to Enhance Parks and Green-spaces for Native Pollinator Insects*, The Xerces Society

[www.xerces.org/store](http://www.xerces.org/store)

*Pollinator Friendly Practices*, NAPPC

[www.wildlifehc.org/new/wp-content/uploads/2011/01/Pollinator-Friendly-Practices-Guidelines.pdf](http://www.wildlifehc.org/new/wp-content/uploads/2011/01/Pollinator-Friendly-Practices-Guidelines.pdf)

*Using Farm Bill Programs for Pollinator Conservation*, Technical Note TN.190.B.78, August 2008

[plants.usda.gov/pollinators/Using\\_Farm\\_Bill\\_Programs\\_for\\_Pollinator\\_Conservation.pdf](http://plants.usda.gov/pollinators/Using_Farm_Bill_Programs_for_Pollinator_Conservation.pdf)

*Yolo Natural Heritage Program Pollinator Conservation Strategy*, The Xerces Society

[www.xerces.org/guidelines](http://www.xerces.org/guidelines)

## **Pest Management**

*A Whole-Farm Approach to Managing Pests*, Sustainable Agriculture

[www.sare.org/publications/farmpest/farmpest.pdf](http://www.sare.org/publications/farmpest/farmpest.pdf)

*Farmscaping to enhance biological control*, National Sustainable Agriculture Information Service (ATTRA)

[www.attra.org/attra-pub/PDF/farmscaping.pdf](http://www.attra.org/attra-pub/PDF/farmscaping.pdf)

*Integrated Pest Management: Reducing Risks to Pollinators from Pest Management Activities*, U.S. Fish & Wildlife Service

[www.fws.gov/pollinators/pdfs/IPMpol.pdf](http://www.fws.gov/pollinators/pdfs/IPMpol.pdf)

*Integrated Pest Management (IPM) and Wildlife*, USDA NRCS Fish and Wildlife Habitat Management Leaflet

[www.whmi.nrcs.usda.gov/technical/leaflet.htm](http://www.whmi.nrcs.usda.gov/technical/leaflet.htm)

*Protecting Pollinators: Why and How Pesticide Applicators Can Help Them*, NAPPC

[www.pollinator.org/PDFs/NAPPC\\_pesticide.broch.Applicators17.pdf](http://www.pollinator.org/PDFs/NAPPC_pesticide.broch.Applicators17.pdf)

*Solving Your Pest Problems Without Harming Pollinators: How You and Your Garden Are Needed*, NAPPC

[www.pollinator.org/PDFs/NAPPC\\_pesticide.broch.Consumer%20FINAL%2005%2027%2010.pdf](http://www.pollinator.org/PDFs/NAPPC_pesticide.broch.Consumer%20FINAL%2005%2027%2010.pdf)

## **Plants for Pollinators**

*California Native Plants for Crop-Pollinating Bees (Central Valley)*, The Xerces Society

[www.xerces.org/wp-content/uploads/2008/11/california\\_plants\\_for\\_bees\\_xerces.pdf](http://www.xerces.org/wp-content/uploads/2008/11/california_plants_for_bees_xerces.pdf)

*California Plants for Native Bees*, The Xerces Society

[www.xerces.org/fact-sheets](http://www.xerces.org/fact-sheets)

*Flowering plant species and their relative attraction to honey bees and native California bees in Albany and N. Berkeley*, UCB Urban Bee Project

[nature.berkeley.edu/urbanbeegardens/docs/FullPlantList.pdf](http://nature.berkeley.edu/urbanbeegardens/docs/FullPlantList.pdf)

*Gardening for Bees - Seasonal Recommended Plant Lists:*

*Spring and Summer*, UCB Urban Bee Project

[nature.berkeley.edu/urbanbeegardens/docs/ubg\\_master\\_list.pdf](http://nature.berkeley.edu/urbanbeegardens/docs/ubg_master_list.pdf)

*Plant Management for Nectar Corridors*,

NRCS Conservation Security Program

[plants.usda.gov/pollinators/Plant\\_Management\\_for\\_Nectar\\_Corridors\\_EPL41.pdf](http://plants.usda.gov/pollinators/Plant_Management_for_Nectar_Corridors_EPL41.pdf)

*Role of the Plant Materials Program in Creating and Improving Pollinator Habitat*

[www.plant-materials.nrcs.usda.gov/pubs/etpmcmt8051.pdf](http://www.plant-materials.nrcs.usda.gov/pubs/etpmcmt8051.pdf)

*Selecting Plants for Pollinators*, Ecoregional Guides,

[pollinator.org/guides.htm](http://pollinator.org/guides.htm)

*California Coastal Range Open Woodland, Shrub, Coniferous Forest, and Meadow Province*

*California Coastal Chaparral, Forest, and Shrub Province*



## Bare ground—good or bad?

*Won't leaving bare ground as nesting areas for native bees lead to erosion?*

Where and to what extent bare ground occurs will dictate susceptibility to erosion. Patches of bare ground are a fact of life on even the best managed range-land. For ground-nesting bees, patches as small as one square meter or less can be useful and, if on level ground or gentle slopes, are not very likely to be an erosion problem on otherwise well vegetated ground. Bees will use these nest areas year-round even if vegetation fills in for part of the year. Preferring sites with several hours of daily sun exposure or south-facing slopes, bees also will use abandoned rodent burrows, soil piles from excavations, and even potted plants. Raised beds bounded by logs or untreated lumber can offer habitat for both wood- and ground-nesting bees while alleviating some concerns about erosion or hoof disturbance. Bare ground in strategic locations around ranch structures and gardens can be beneficial as well. On wet days, mud puddles on bare ground provide butterflies with a much-needed water source.

### What is the RSA?

A voluntary program developed by California ranchers for use by the California ranching community, the Ranching Sustainability Analysis is a proactive self-assessment tool to foster successful practices and help ranchers achieve sustainability—**long-term economic, environmental, and social viability.**

### Assessment Categories

- Livestock Management
- Soil Management
- Forage Management
- Biodiversity and Wildlife Conservation
- Regulations and Regulators
- People and Relationships
- Economics
- Energy
- Monitoring
- Pest Management
- Water Quality



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