Chocolate's Sweet Little Secret

"A tiny fly no bigger than the head of a pin is responsible for the world's supply of chocolate."
                                                                        —Allen Young, a leading cacao expert

When you bite into a sumptuous piece of chocolate do you ever wonder about the biological processes that brought it to you? Chocolate, derived from the seeds of the cacao tree, is an excellent example of a product dependent on the critical, and often under appreciated, work of pollinators.

CACAO PRODUCTION
POLLINATION
The cacao flower, while only about the diameter of a nickel, is complex in design and behavior, necessitating a special kind of animal to pollinate it. Recent studies in cacao plantations indicate that midges, tiny flies that inhabit the damp, shady rain forest, are the only animals that can work their way through the complex cacao flower and pollinate it. A member of the same insect family as the "no-see-um" flies that plague us with their bites, this millimeter-long fly is from the family Ceratopogonidae and the genus *Forcipomyia*--a very tiny animal with a very long name. These cacao-pollinating midges are endemic not to plantations, but to the tropical rain forest itself.

FLOWERS TO FRUIT
The odorless white flowers (and the fruit) are on the trunk of the cacao tree, which flowers (and fruits) all year long. This means that cacao has the very unusual quality of having flowers and fruit on the tree at the same time! It takes 5 to 8 months to progress from blossom bud to ripe fruit. Although they possess both male and female parts, the flowers cannot fertilize themselves, so must rely on a pollinator to transport pollen.

CACAO PLANTATIONS
On cultivated cacao plantations, on average only 3 out of 1,000 flowers are pollinated, fertilized and progress to fruit. It turns out that the cacao plantations themselves are the reason for the extremely low fertilization rate of the cacao flowers, and the potential chocolate shortage that has chocolate manufacturers and consumers worried.

The cacao-pollinating midges require humid shade with a wide range of plant species and decaying matter on the ground, which is the natural habitat of cacao. The bigger a cacao plantation, the less likely the midges will find their way into the sunny, dry and cultivated groves of cacao trees to pollinate individual flowers. Additionally, while wild cacao flowers give off over 75 distinct aroma ingredients (compare that to 14 in the rose and 7 in the onion) to attract pollinators, cultivated cacao has only a small percentage of those, leaving the midges even less likely to venture onto the plantations.
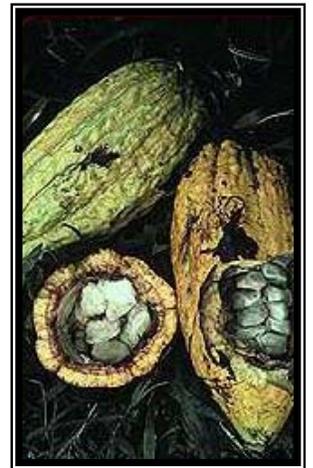
ALFALFA PRODUCTION
A MILK CHOCOLATE ESSENTIAL
Pollinators are also essential for production of alfalfa, a major fodder source for dairy cows, which in turn contributes to milk chocolate. Alfalfa's major pollinator is the alfalfa leaf-cutting bee (*Megachile rotundata*), a solitary bee that is extensively commercially propagated to supplement wild populations. Other pollinators include bumblebees (*Bombus* sp.), honeybees (*Apis mellifera*), and alkali bees (*Nomia melanderi*).

RESOURCES
http://sciencebulletins.amnh.org/biobulletin/biobulletin/story720.html
http://www.mgonline.com/chocolate.html
http://www.pollinatorparadise.com/Pollinationecology.htm
http://www.mpm.edu/collect/tirimbina/choctree.html
http://www.xocoatl.org/tree.htm
http://gears.tucson.ars.ag.gov/book/chap5/cacao.html
http://www.menschmedia.com/chocolate/index.html

Pollinators: *The Forgotten and Fragile Link in our Food Chain*

Humanity, for its own sake, must attend to the forgotten pollinators and their countless dependent plant species.
<div align="right">- E. O. Wilson, foreword to "The Forgotten Pollinators"</div>

WHAT IS POLLINATION AND WHO DOES IT?

Pollination occurs when pollen is moved within flowers or carried from one flower to another of the same species by birds, bees, bats and other animals, or by the wind. This transfer of pollen in and among flowers of the same species leads to fertilization and successful seed and fruit production for the plant. Pollination ensures that a plant will produce full-bodied fruit and a full set of fertile seeds, capable of germinating.

WHY ARE POLLINATORS IMPORTANT?

- Eighty percent of the food plant species worldwide depend on pollination by animals, almost all of which are insects. One out of every three mouthfuls of food we eat, and of the beverages we drink, is delivered to us by pollinators.

- More than half of the world's diet of fats and oils comes from oilseed crops, many of which are pollinated by animals, including cotton, oil palm, canola and sunflowers.

- Worldwide, approximately 1,000 of the estimated 1,330 crop plants grown for food, beverages, fibers, condiments, spices and medicines are pollinated by animals.

- Products of pollination by honey bees and other insects are worth $40 billion annually in the U.S.

WHY ARE POLLINATION ISSUES WORTHY OF ATTENTION?

Pollination is an issue that brings the concepts of sustainability and conservation home to nearly all people. Pollination links urban and rural concerns. Since pollinators are currently largely overlooked, assessing their condition and economic importance, seeking to understand better their circumstances, biology and benefits, and working to help keep them healthy are positive, pro-active approaches to an emerging conservation issue.

WHO IS EXPLORING THIS ISSUE?

A fast-growing collective of concerned government agencies, landowners, conservation groups, scientists, and private businesses from across the continent has already rallied around this critical issue to form the North American Pollinator Protection Campaign or NAPPC (see the NAPPC website for a complete listing of partners). The NAPPC and others extol the benefits provided by pollinators and the importance of protecting them.

NEXT STEPS?

Comprehensive scientific documentation and assessment of current knowledge on the status of pollinators are essential to understanding pollination issues. The subjects to be addressed, among others, include the status of pollinator populations and communities, the threats to their health, and the socio-economic issues that affect pollinators and their beneficiaries.