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BUTTERFLIES & ECOSYSTEM MANAGEMENT

by Ann Swengel, 2003

Conservation programs for one purpose can have conservation benefits beyond that one purpose–but to ensure benefit to butterflies, their specific requirements need to be attended to. Designating scenic areas as national parks, and conserving habitat for game or endangered species, and protecting ecosystems, all provide habitat that butterflies can live in too. But localized butterfly species require specific resources and conditions. These may not exist in adequate amounts and adequate consistency to maintain populations of a localized butterfly even though scenery, game, endangered species, and ecosystems are being conserved successfully. *Deliberate attention to maintaining the butterfly species' habitat requirements is necessary to ensure that the butterflies in a site are benefiting from conservation of the site.*

An ecosystem contains a mix of microhabitats–and particular microhabitats are what localized butterfly species live in, not general ecosystems. An ecosystem (or "*natural community*") is the set of plant and animal species that typically lives in sites with similar combinations of soil, climate, topography, and geography. Examples of ecosystems are boreal forest (taiga), which occurs across much of Canada, and the Sonoran desert in northwestern Mexico and the southwestern U.S. An ecosystem can naturally contain a wide variety of microhabitats–places that are cooler or warmer or wetter or drier or more sheltered or more exposed than average in the ecosystem, and so have plant species and/or growth conditions, and animals, particular to those microhabitats. Butterfly species require certain vegetation types to exist. The more localized the butterfly species, the more particular its habitat requirements–i.e., the more restrictive the microhabitat characteristics it requires. A fascinating part of studying localized butterflies is learning to discern the microhabitats they require. *A focus on ecosystems may not ensure recognition of these microhabitats, while a focus on individual species must pay attention to their required microhabitats.*

The Jutta Arctic is a widespread butterfly in quaking sphagnum bog ecosystems.

Natural events in ecosystems can serve either to favor or reduce particular butterfly populations characteristic of microhabitats occurring in that ecosystem. Floods, droughts, fires, pest outbreaks, animals grazing on grasses and wildflowers, and animals browsing on shrubs and trees are events–also called "*processes*"–that occur in ecosystems. These processes are among the forces driving the dynamics so readily noted in ever-changing natural landscapes. It's the

A Frosted Elfin perches on one of its caterpillar food plants, wild lupine (*Lupinus perennis*). The elfin is much more localized than its food plants.

variation in these processes in an ecosystem that contributes to natural diversity of microhabitats in the ecosystem. Even the same process can have opposite effects on a localized butterfly population, depending on the specific circumstances. For example, fire can create openings in barrens where wild lupine (*Lupinus perennis*) thrives. Frosted Elfins, which use wild lupine as caterpillar food, have colonized such openings, but fire can also extirpate Frosted Elfin populations–if the fire consumed most or all of the habitat occupied by Frosted Elfins within recolonization range of the species. Likewise, beavers cut down poplars and willows, which can create openings where wild lupine and Frosted Elfins live. But beaver dams can flood out these openings as well.

Butterfly conservation experience in North America and around the world indicates that ecosystem management (or state of the art habitat management) does not equal persistence of localized butterfly populations in the site. Management focused on ecosystems (or vegetations or habitats) may not consistently supply the resources and conditions localized butterflies need. It's possible to determine the average–or typical–frequency and intensity of ecosystem processes such as fire and grazing and flooding. But some places within an ecosystem consistently experience a different frequency and intensity of those processes than average. For example, animals may graze more heavily where they concentrate near preferred sources of water, while little grazing occurs in other areas with low densities of those animals. Likewise, some areas more prone to lightning strikes may burn more frequently than average, while other areas might rarely burn, due to a river or slope or other feature that blocks the entry of fire. Since localized butterflies don't live in "average" places, but rather in very particular microhabitats, that's why management aiming to maintain the average conditions and processes of an ecosystem doesn't guarantee the continued existence of the localized butterfly species native to that ecosystem. *An understanding of the butterfly's biology needs to inform the ecosystem (or habitat) management, rather than using an understanding of the ecosystem and its management to make assumptions about the butterfly's biology and management requirements.*

Localized butterflies can be significantly more abundant in areas burned by a single wildfire than in areas burned in rotation as ongoing management. More favorable results for localized butterflies typically occur where the wildfire, even if quite large, occurs as a single event in a landscape context containing similar habitat unburned for decades. Wildfires *create* habitat by "stand replacement" (i.e., removal of the "stand" of overstory trees), and the localized butterflies have years, even decades, to colonize these fire-created openings from population(s) in unburned areas. Sunny openings formed by the removal of overstory trees are attractive to butterflies because they are cold-blooded, requiring sunshine and warmth to become active. (In tropical areas, butterflies can reliably warm themselves without sunshine, and so relatively more species and individuals are found in forests in the tropics.) By comparison, fewer species and individuals of localized butterflies typically occur where similar habitat experiences fire more

frequently–for example, when part of the habitat gets burned in most or all years, and over 5-10 years, most of the habitat has been burned. In this case, fire is being used to *maintain* habitat already required by the localized butterflies to exist there. Since immature butterfly life stages occur in the plant matter that gets burned, they are killed in the fire. Areas burned within the last few years may be the only sources of individuals for recolonization into the most recently burned area, but these areas would likely not have full repopulation yet because they were also burned within the last few years. *These differences between wildfire and rotational fire explain why it is so beneficial to localized butterflies in sites managed with fire to select an area of their prime habitat to be a permanent non-fire management area.*

The factors affecting butterfly response to fire are also useful for understanding how other processes, events, and managements (such as mowing, grazing, and flooding) affect butterflies. The factors affecting butterflies' responses to management include how exposed to–or sheltered from–mortality the butterflies are during the event, how adverse the post-event environment is for the butterflies before the vegetation has fully regrown, the suitability of the site as habitat once the vegetation has regrown, and the ability of the butterflies to rebuild numbers in the site, either from survivors or colonizers. For example, butterflies above ground in the vegetation directly exposed to the management event usually show lower mortality and faster recovery from a single event of mowing or light grazing than a single event of fire. However, some butterfly species are particularly vulnerable to mowing or grazing, especially if the management event occurs at a sensitive time in the butterfly's life cycle, for example when their caterpillars are feeding high up on grasses. Whatever the event, if it affects only a very small portion of the butterfly population's habitat in a year, then the event will have less impact on the population than if the event affects most or all of the habitat within one or a few years. *It is the combination of these two factors–how much mortality the butterfly population experiences due to the management event and how suitable or unsuitable the resulting vegetation is–that determines the effects of the management for the resident butterflies.*

To identify the various factors contributing to a localized butterfly's habitat and management tolerances, it is necessary to survey a number of separate sites supporting populations of the butterfly over a number of years. At a single site, it is difficult to identify which factors are more or less important to the existence of the butterfly population. Furthermore, butterfly populations can exhibit large fluctuations in abundance from year to year, due to variation in the weather and in prevalence of predators and diseases. At a single site, it is very difficult to distinguish changes in abundance due to fluctuations from those due to management or changes in the habitat. These distinctions are easier to make when a number of different populations are being studied over multiple years, and these sites have different managements, and specific management events occur in different years.

The places where localized butterflies thrive may not look "natural"–but natural-looking places with an emphasis on natural management may not provide all the essential conditions and requirements these butterflies need. Localized butterflies can thrive in seemingly unnatural and unlikely non-conserved places–Regal Fritillaries in lightly grazed pastures,

A male Dakota Skipper defends a territory in a prairie managed with haying in fall.

Dakota Skippers in prairies hayed once per year in fall, and Frosted Elfins in powerline rights-of-way. No one site can capture all the natural qualities of an ecosystem. The sites where localized butterflies thrive are capturing essential natural qualities that may not currently be occurring in conserved sites, whatever the man-made or non-pristine qualities these sites may also have. *The places where localized butterflies thrive provide important information about microhabitat characteristics that need to be included in the conservation of an ecosystem, in order for all the biodiversity native to an ecosystem to be secured through conservation.*

Although invasive exotic plants (weeds) can overrun and degrade a natural place, they are rarely the actual problem, but usually a symptom of underlying problem(s). On occasion an aggressive exotic plant may invade a site with no apparent cause other than that it reached the site. But most of the time, the expansion of undesirable weeds into a site is a symptom, rather than a cause, of environmental degradation. That is, ecologically intact sites in appropriate management tend to be more resistant to many invasive plants than already degraded sites. So the most important issues are understanding how the exotics got a foothold in the site in the first place and whether anything can be done about these underlying causes of exotic establishment. Given the prevalence of exotic plants and causes of degradation in the landscape, it is unlikely that exotics can be eradicated completely. The goal is to establish conditions that favor native plants, which in turn can minimize establishment of exotics.

Exotic plant control needs to be less harmful to the butterfly community–especially localized butterflies–than the exotic plants themselves are in order for butterfly conservation to benefit from exotic plant control. Like any other management activity, exotic control affects butterflies both directly (i.e., whether they survive the treatment or not) and through indirect effects from the resulting vegetation. It is possible for exotic control to be more lethal to the butterflies than the exotics themselves are. The best defense against exotic invasion is watchful vigilance. Once an exotic incursion has been detected, investigate as soon as possible the techniques for its control and eradication. Do not act against the exotic until you have found a proven method of success in controlling it that does not cause undue harm to the butterflies and the vegetation they require. The wrong approach to exotic control can be worse than no attempt at control–the exotic may inadvertently be benefited while the butterflies and the native vegetation they need may be harmed.

The Gray Copper uses native docks (*Rumex*) as caterpillar food. These docks are favored by some soil disturbance, which can also encourage non-native weeds. Many weedy places with docks do not have all the conditions required by this localized butterfly. But many places where the Gray Copper does live are weedy to some extent.

Maintaining butterfly populations already present at a site is easier than trying to establish new populations. Habitat can be deliberately changed to become suitable for different butterflies than currently live in it.

Habitat might also be damaged and then restored, becoming suitable again for species once living at the site. In both cases, new butterfly populations might subsequently get established in the habitat either fom natural colonization or by deliberate (man-caused) introduction of the butterflies to the site. However, the first result of changing (or damaging and then restoring) the habitat will likely be harm to the butterflies–especially localized butterflies–currently living in the habitat. Furthermore, no new populations may actually get established successfully later on. It is easier to retain current populations than to create new ones. This is true even for re-establishing a butterfly once living at a site into habitat formerly used by the species and seemingly the same as when it last lived there.

Maintaining continuity of habitat is more important for conserving existing butterfly populations than improving the naturalness or diversity of an ecosystem. Less degraded habitats that are more diverse in native flora are certainly favorable for butterfly populations. It would seem logical that actions enhancing habitat quality and floristic diversity should benefit these butterflies. However, past experience in butterfly conservation has shown that it is not always obvious how to make a habitat better for a butterfly. Localized butterfly species can be very sensitive to subtle changes in habitat–even ones intended to benefit them. For example, increasing caterpillar food plants is often useful, but not if the growth condition or location or technique used to do so are unsuitable for the butterfly. A famous example of this unintended outcome is the extinction of the last population of the British subspecies of Large Blue, which occurred on a rather heavily grazed site. When this locality was conserved, the grazing was removed to allow the caterpillar food plant to increase. But this caused the species of ants in the site to change from the one species that tended Large Blue caterpillars to other ant species, which ate the caterpillars. Thus, it is essential to know what resources and conditions are essential to the butterfly population, and to insure they remain continuously available, so that the butterfly population can continue existing. *Efforts to improve habitat quality and diversity should be additive to maintaining habitat continuity, not in conflict with it.*

Consistently managing for one localized species–for example, a plant or a bird–requires the maintenance of its habitat, which provides habitat for other species, including butterflies, also living in the same area and requiring the same conditions. Often, one or several species are used as the focus for ecosystem conservation. That species–e.g., a plant or a bird–can serve as an "umbrella" species that provides conservation coverage of the habitat needs of other species in the area with the same requirements. For butterfly conservation, it is best to manage based on detailed knowledge of the species' requirements and sensitivities–but lacking that, management that maintains a consistent variety of microhabitats required by other localized and rare species benefits butterflies requiring those same microhabitats. *The challenges for making "umbrella" species conservation work for other species such as butterflies are not only to conserve those "umbrella" species successfully, but also to identify "umbrella" species that provide*

The 'Karner' Melissa Blue is federally listed as endangered. Efforts to conserve it include using this blue as an "umbrella" that provides coverage for other localized species in the blue's habitat, pine-barrens. The challenge is to maintain the blue's particular requirements without undue expense to the particular but differing needs of other rare species.

coverage for other species that require conservation help.

No one management approach for a particular habitat is best for all localized butterflies native to that ecosystem–that's why management *diversity among* different sites of the same ecosystem type is beneficial for localized butterflies. Different species of localized butterflies have different microhabitat requirements and different sensitivities to management. For that reason, no one management regime can be optimal for all localized butterflies native to a particular ecosystem. Using one management approach in different sites of the same type of ecosystem systematically favors the same set of species–but also systematically disfavors another set of species also native to that ecosystem. Thus, the most kinds of localized butterfly species will be maintained if *different* managements are used in *different* sites of the same ecosystem type.

But localized butterflies can have very narrow habitat and management tolerances–that's why management *consistency within* a particular site is beneficial for localized butterflies. Localized butterflies do best where their habitat and management preferences consistently prevail. Despite the dynamic appearance of ecosystems, this consistent availability of microhabitats in some (although certainly not all) places is also natural–this explains how localized butterflies, with their exacting requirements and short dispersal distances, could exist at all. The inconsistent history of habitat at some sites can explain why localized butterfly species are absent from some places which currently have sufficient habitat and caterpillar food plants.

Even without specific knowledge of particular butterfly species in a site, ecosystem management and restoration plans can still incorporate basic principles of butterfly population biology and management, so as to benefit butterflies more. To maintain habitat consistency within a site as much as possible, work with the site's management history when planning its conservation management. For example, both grazing and mowing can be appropriate grassland management, and some species of conservation concern prefer one or the other. It is better to implement conservation grazing in places with a pre-conservation history of grazing, and conservation mowing/haying where mowing has already occurred, rather than implementing conservation grazing in a formerly mowed site and conservation mowing where grazing formerly occurred. It is also very valuable to "hedge bets" on unforeseen consequences of habitat management by managing different sites of the same ecosystem type differently (e.g., for grasslands, grazing and no mowing at one site, mowing and no grazing at another, and localized brush-cutting with no mowing and no grazing at a third site). Furthermore, it is generally more desirable to implement managements (such as clearing brush) gradually, spaced out over many years, rather than all at once. A more gradual approach allows native plants to re-establish, rather than weeds, which promotes habitat consistency. *Consistently maintaining the greatest variety of microhabitats, mindful that each management approach can be disfavorable to some species, is a good way to "hedge bets" in conserving the range of species native to an ecosystem, since different species require different microhabitats.*