

# Benefits of Golf Course Naturalized Areas for Biological Control and Pollinator Conservation



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## Objectives:

1. *Initiate the first Operation Pollinator for Golf Courses project in North America.*
  - a. *Evaluate, in on–course trials, wildflower mixes adapted to the US transitional climatic zone for cost, ease of establishment, and attractiveness to native pollinators.*
  - b. *Document the biodiversity of native pollinators in both planted and fallow patches of naturalized habitat on golf courses*
2. *Evaluate permanent naturalized areas on golf courses as refuges for beneficial insects and document the extent to which such areas provide bio–control services to in–play mowed turf.*

Incorporating natural habitats in out–of–play areas on golf courses can create opportunities to increase course sustainability while enhancing the golf experience and promoting the environmental services golf courses can provide. Naturalized areas offer refuge and food resources (e.g., nectar and pollen) for bees, migratory monarch butterflies, and other pollinators whose populations are declining due to habitat loss and other factors. Naturalized roughs also support predatory and parasitic insects (natural enemies) that provide biological control of pests elsewhere on the course. This project seeks to document those benefits and develop protocols through which superintendents can implement and augment pollinator sanctuaries and beneficial insect banks on the course.

Operation Pollinator (OP) for Golf Courses was established in the United Kingdom in 2010 to help reverse the decline of native pollinators by planting native wildflower banks to create nectar– and pollen–rich habitats in out–of–play areas. Our project is the first to take OP beyond demonstration–only status by scientifically documenting the seasonality, abundance, and diversity of bees and other pollinators such plantings, and particular floral species within them, can sustain. Replicated plots were established in autumn 2011 at five golf courses and the University of Kentucky A.J. Powell Jr. Turfgrass Research Facility. They were prepared for seeding by applying fluazifop to suppress grassy weeds followed by trinexapac–ethyl to suppress grass growth, then scarified and seeded. Three mixtures of perennial wildflowers and self–seeding annuals

attractive to bees and butterflies and adapted to the transitional climatic zone were planted at each site. The mixes were evaluated for bloom sequence and (Figure 1). Attractiveness to pollinators was evaluated with traps (Figure 2) and by stalking individual insects as they landed on particular flower species (Figure 3).

Blooms started in late April and 17 wildflower species had bloomed as of August 2013. Forty–nine unique species of pollinators were attracted, including seven species of bumblebees, including three uncommon and



**Figure 1. Naturalized areas on golf courses offer refuge and food resources (e.g., nectar and pollen) for bees, migratory monarch butterflies, and other pollinators. The wildflower mixes planted in out–of–play areas were evaluated for bloom sequence.**



**Figure 2. Bee bowls trap some of the insect pollinators attracted to wildflower plots.**



**Figure 3. Individual insect pollinators were followed to determine which particular wildflower species they landed on.**

declining species, many types of butterflies and native solitary bees. More than 1000 individual pollinators were identified to species. The hand collections revealed a range of efficacy in supporting pollinator species diversity, richness, and evenness in the sampled wildflower species. The best wildflower species to be included in a transitional zone mixture include: lance-leaf coreopsis, New England aster, bergamot, purple coneflower, black-eyed Susan, sweet black-eyed Susan, annual sunflower, plains coreopsis, Eastern columbine, lavender hyssop, and purpletop verbena.

This mixture of native plants will provide season-long bloom coverage from the first year of establishment and attract diverse and abundant pollinator populations, including rare species. Based on our results, Marriott Resorts have elected to establish OP plantings on 40 of their golf courses in the United States in 2013–14. The project was featured in an article in *Golf Course Management* (Date 2013).

Studies to evaluate biological control benefits provided by naturalized roughs (NR) were done at two Lexington-area golf courses. At one course, the NR are mainly high grasses; at the other, they contain a mixture of grasses and many wild flowering plants. Five sites consisting of a stand of NR ( $\geq 5000\text{m}^2$ ) and adjacent mowed turf were established at each course. Predatory insects and spiders were regularly sampled along three parallel transects extending 1, 3, and 10 m into the NR or mowed turf along each site. Biocontrol services were assessed by exposing sentinel prey (black cutworm eggs and larvae) along each transect extending from within the NR to the edge of the nearest fairway. Some predators (e.g., spiders) were more abundant in NR, whereas others (e.g., predatory beetles) showed no differences. Ants, by far the dominant predators, were more abundant in mowed turf. Overall predation was very high regardless of site. Mowed turf within 1–2 m from the edge of a NR tended to be a predation “hotspot” but in general, ant predation in the mowed turf was so high (often  $> 90\%$ ) that that it masked any extension of biological control services from predators venturing from NR into adjacent mowed rough or fairways. NR provide numerous environmental benefits but their value as “banks” for ground-dwelling predators that provide move out from them to provide biological control to the rest of the course is questionable.

### Summary Points

- Operation Pollinator, a conservation initiative, was successfully implemented on multiple golf courses. Desirable seed mixes for transition zone golf courses and protocols for establishing them were developed.
- Operation Pollinator sites supported 49 species of bees over the first two years, many of which are rare or declining species.
- Though naturalized roughs have many benefits, they generally do not increase beneficial predator populations or predation on pests outside of their borders.