FULL TITLE OF PROCEEDINGS ABSTRACTED IN THIS ISSUE

Abstracts of the Society of Wetland Scientists 20th Annual Meeting. *Wetlands: Function, Assessment and Management.* Supplement to: *Bulletin, Society of Wetland Scientists* 16(2) Held June 6-12, 1999 in Norfolk, Virginia. James E. Perry and Jason S. Goldberg, abstract editors. Copies of the abstracts are available for $15. Make checks payable to SWS '99 Meeting and send to: R. Harold Jones, Conference Chair, 1513 Sandbridge Road, Virginia Beach, Virginia 23456

Abstracts of 1999 Meeting of the Society for Conservation Biology–Integrating Policy and Science in Conservation Biology. Held June 12-17 at the University of Maryland in College Park, MD. David Inoyue, abstracts editor. Available at http://www.inform.umd.edu/EdRes/Colleges/LFSC/FacultyStaff/dinouye/scbabstracts/

GRASSLANDS

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Planting Forbs First Provides Greater Species Diversity in Tallgrass Prairie Restorations (Kansas)

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The restoration of tallgrass prairies is important if we hope to return landscape diversity to a pre-settlement condition. However, at the field scale, nearly all medium- and large-scale restored tallgrass prairies have lower species diversity than untilled and ungrazed remnant prairies. This is due, in large part, to the competitive advantage grasses have over forbs (Schramm, 1992) and the continued practice by restorationists of planting seed mixes that ensure that advantage (Weber, 1999). In order to increase the species diversity in their prairie plantings, restorationists now must find new ways to encourage the establishment of forbs (Kindscher and Tieszen, 1998; Weber, 1999). In a recent study on former cropland near Kansas City, Kansas, we compared the effectiveness of a conventional forb and grass mixture with a forbs-only mixture and found that seeding the forbs first encouraged their establishment.

In April 1996, the 40-acre Indian Grass Prairie was seeded with 50 forb species (38 locally-collected species and 12 purchased species) and seven purchased species of native grass (Kahn, 1998). All forb seeds, along with eastern gama grass (*Tripsacum dactyloides*), which has seeds too large to drill, were hand-broadcast throughout the site. We used a no-till drill for the other grass species: big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), side-oats grama (*Bouteloua curtipendula*) and western wheatgrass (*Pascopyron smithii*). When the farmer hired to drill the grass seed missed a 10-meter- wide strip through the center of the site, we seized the opportunity to compare the results between that forb-only strip and the rest of the planting. During spring of 1998 we determined the percent cover of all plant species by sampling thirty 1-m^2 plots along a transect in each treatment.

We found that seeded and native species dominated both treatments and that the amount of cover was not different between the forbs-only mix and the conventional seed mix. However, forb cover was greater ($p < 0.05$) in the forbs-only treatment (84.6 percent) than in the conventional treatment (18.2 percent), which suggests to us that forbs flourish when not planted with grasses. Perennials, seeded species, and other native species were greater in cover ($p < 0.05$) in the conventionally-seeded treatment than in the forbs-only treatment, largely because of high cover by tall native grasses in the conventionally-seeded treatment. We found that species richness was higher in the forbs-only treatment ($p < 0.05$), a difference which will be more pronounced after we add the six species of native grass previously omitted in the original seeding. We did find that some annual and weedy species, such as annual fleabane (*Erigeron annuus*) and Pennsylvania smartweed (*Polygonum pensylvanicum*), had greater cover in the forbs-only treatment. However, many seeded forbs, including plains coreopsis (*Coreopsis tinctoria*), prairie coneflower (*Ratibida columnifera*), and Maximilian's sunflower (*Helianthus maximillianii*), also exhibited significantly greater cover ($p < 0.05$) in the forbs-only treatment. Other species with higher cover in the forbs-only treatment were willowleaf aster (*Aster prealtus*), Maryland senna (*Cassia marilandica*), lance-leaved coreopsis (*Coreopsis lanceolata*), button snakeroot (*Eryngium yuccifolium*), sawtooth sunflower (*Helianthus grosseserratus*), tall cinquefoil (*Potentilla arguta*), slender-leaved mountain mint (*Pychnanthemum tenuifolium*), black-eyed susan (*Rudbeckia hirta*), blue sage (*Salvia azurea*), and rigid goldenrod (*Solidago rigida*).

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This experiment suggests to us that seeding forbs before planting grasses can enhance native forb richness in tallgrass prairie restorations. At the Indian Grass Prairie, we plan to drill grass seed directly into the existing vegetation of the experimental strip during the spring of 2000, now that the forbs have become well established.

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Dung Beetles Improve the Soil Community (Texas/Oklahoma)

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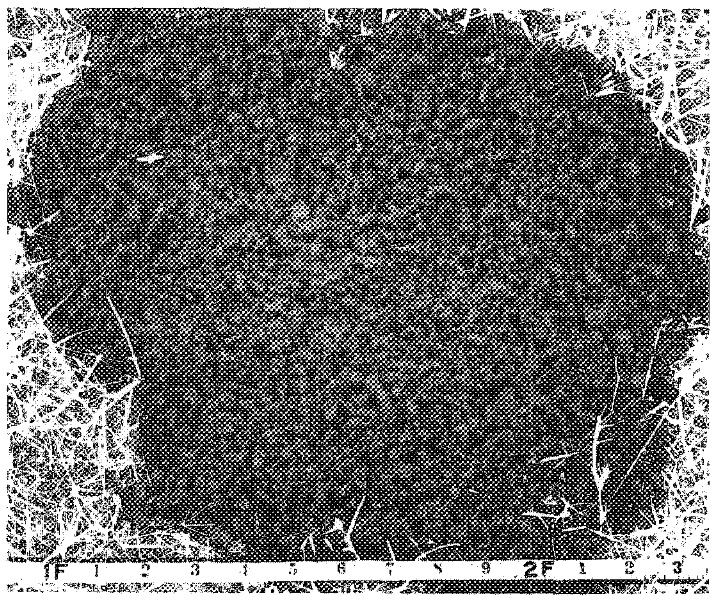
Healthy soil is an extremely complex community of living organisms that serves as the cornerstone for the well-being of both plants and animals. Humans, however, tend to ignore soil organisms because they are small, dwell underground, and, therefore, are out of sight and mind. The dung beetle, on the other hand, is a soil organism that is visible, easy to monitor, *and* one that increases organic matter, aerates the soil, removes a source of non-point pollution, increases water infiltration, and helps control pest insects. We, therefore, recommend the use of dung beetles to restorationists and others who need to restore the health of a soil. The easiest way to ensure their arrival on a pasture or rangeland is by discontinuing the use of insecticides and parasiticides.

Some of our work with dung beetles has taken place on the Davis Ranch in southern Oklahoma, where dung beetles appeared after Walt Davis stopped using insecticides in 1975. About a year later, Walt began to notice that dung piles (cow pads) looked "worked" (riddled with holes, spread out) and were disappearing more rapidly than they had before. He also began to see small brown beetles flying to and from cow pads, particularly at dawn and dusk. Dr. Truman Fincher identified these beetles as *Onthophagus gazella*, a tropical species of dung beetle introduced by the U.S. Department of Agriculture in the mid-1970s for the bio-control of face and horn flies. *Onthophagus gazella*, like other dung beetles, sequester and bury manure to use as both an incubator and food source for their young. The adults also remove nutrient-laden liquids from fresh dung.

Over the years, the dung beetle population (currently six identified species, five of which are native) on the Davis Ranch has grown to such numbers that, when rainfall is normal and stock density is at peak levels (25 animals per acre), Walt estimates the beetles will bury a ton of wet manure per acre per day and remove 90 percent of the surface material. Walt has dug as deep as 18 inches in the sandy clay loam of his pastures and still found no end to their tunnels.



Dung beetles at work. Fresh cow pad (left) is quickly broken down by dung beetles and made ready for integration into the soil (right). *Photos courtesy of Patricia Richardson and Dick Richardson*

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In drought times the beetles desiccate cow pads but do not bury as much as in periods of moderate-to-heavy rainfall. For example, in July 1998 we spent a week at the ranch studying dung beetle activity in above 100°F temperatures. One evening at dark, from an average cow pad, I counted 206 dung beetles exiting in six minutes. Cow pads were being spread out and desiccated within 48 hours, but dry manure was still mixed with undigested plant material. In contrast, during a lush spring, we have observed a horse pad on a south Texas ranch disappear underground in 24 hours, leaving only a soft fluffy layer of undigested plant material.

Thus far, *O. gazella* is the work horse at the Davis Ranch, but the ranch is near the northern limit of its range. However, we have found that multiple species of dung beetles are needed to provide: 1) uniform distribution and burial of dung; and 2) dependable activity throughout the day and night, and throughout the year–some species are active by day, others by night, some tolerate cold, others do not. Walt monitors for new species and is especially interested in those that are more cold tolerant.

On a variety of pastures with different soil conditions, we have compared water infiltration rates in spots where a cow pad has been buried by dung beetles and where no cow pad existed. We found that on average there was a 129 percent increase in infiltration rate in areas worked by dung beetles, substantially reducing the detrimental effects of both drought and flood.

Dung beetles also improve the soil for other species. For example, in 1975 Walt could find no earthworms in his pasture soils. Over the next decade, in areas where he observed concentrated dung beetle activity, he also began to see earthworm castings. In 1996, he dug large core soil samples from a number of these pastures and counted 12 to 30 earthworms per cubic foot. Today, at several sites on the ranch, harvester ants have built their mounds out of earthworm castings. We like to think of this type of reuse as a most elegant sign of rangeland restoration.

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FROM: Abstracts of the 1999 Annual Meeting of the Society of Conservation Biology.

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The Conservation Value of Roadside Restoration to Butterfly Populations. Ries, L., Dept. of Biology, Northern Arizona University, Flagstaff, AZ , Leslie.Ries@nau.edu; D.M. Debinski and M. Wieland.

These researchers conducted a comparative survey of butterfly populations found at roadsides in central Iowa that have been restored to prairie habitat and those found at roadsides dominated by weeds or non-native grasses. Prairie roadsides proved to have the greatest abundance and diversity of habitat-restricted butterflies, while grassy roadsides had the least number of either habitat-restricted or disturbance-tolerant species. In tracking studies, the researchers found that butterflies were less likely to exit prairie roadsides than the other habitat types, an indication that 1) butterfly mortality rates due to traffic and predators may be lower in prairie sites and that 2) restored roadsides are potential corridors for habitat-restricted species.

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Mycorrhizae Influence Plant Community Structure and Diversity in Tallgrass Prairie. 1999. Hartnett, D.C., Div. of Biology, Ackert Hall, Kansas State University, Manhattan, KS 66506-4901. **Ecology** 80(4):1187-1195.

Hartnett and Wilson conducted a five-year field experiment on the Konza Prairie to assess the effects of mycorrhizal fungi on plant species composition, relative abundances, and diversity. During that time, they treated several plots with the fungicide benomyl in order to suppress mychorrizal colonization, and compared these to untreated plots. The abundance of dominant warm-season C_4 tall grasses decreased in the treated plots, while the abundance of C_3 forbs and grasses and overall plant species diversity increased. The results of this study demonstrate the significance of mycorrhizal symbiosis on the structure of the tallgrass prairie plant community and document the important role that fungi and rhizosphere processes play in the aboveground composition and diversity of grasslands.

WOODLANDS

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Restoration Treatments Promote Growth and Reduce Mortality of Old-Growth Ponderosa Pine (Montana)

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In the early 1980s, visual symptoms of decline in two old-growth ponderosa pine (*Pinus ponderosa*) stands—one along the scenic Blackfoot Highway in western Montana, and the other on a nearby guest ranch—piqued my interest in restoration. Fifteen years later, following some silvicultural cutting and burning treatments, these forests are healthy, sustainable plant communities.

Both stands in this study were threatened by succession to shade-tolerant Douglas-fir (*Pseudotsuga menziesii*), intense competition between invasive Douglas- fir and old-growth pines, and a lack of healthy ponderosa pine seedlings and saplings. We also noted evidence of decline in narrowing growth rings, thin tree crowns, flat to round tops, and recent deaths of some overstory trees. In addition, there was an increasing chance for crown fires due to an abundance of sapling and pole "ladder" fuels.

These conditions prompted us to evaluate two restoration prescriptions: 1) cut/no burn, and 2) cut/burn, comparing both with an untreated control. In the cut/no burn treatment, we removed most of the ladder fuel layer, and used selection cutting to create openings for regenerating shade-intolerant pine and to increase the vigor of the remaining trees. We also removed nearly all the Douglas-fir in order to set back succession. The cut/burn treatment consisted of the same cutting treatments followed by a one-time prescribed burn of the groundlayer.

In 1984, we divided each stand into three equal-sized areas, and set up a 2.5-acre study plot in each area. We randomly

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