Trip to the Ecological Society of America Congress

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The Grassland Society of Southern Africa Trust kindly sponsored my travel expenses to present a paper at the Ecological Society of America Congress in Portland Oregon in August 2004, and to visit sites in Kansas and Minnesota. It is cheaper to fly to the USA via London than to fly direct, which gave me an opportunity to stop off and spend time in the UK with Mike and Kath Walters and visit the famous Rothamsted agricultural experimental station. Mike studied grassland science with me and did his MSc on burning Mopane in the Lowveld of Zimbabwe.

Mike and I collected Colin and Terry Everson from the bus stop in Watford and after a quick cup of coffee at Mike's place drove to Rothamsted in the town of Harpenden, which is only a 15 minute drive from Watford. Rothamsted houses the longest ecological experiment in the world, the Park Grass Experiment, started in 1856. It also houses the Broadbalk Winter Wheat Experiment, started in 1843 as well as several other long-term experiments. We met at 9:30 am with Professor Keith Goulding, who is head of the agriculture and environment division at Rothamsted and discussed research interests and the various experiments at the station. Following tea we were taken by Paul Poulton out to the Park Grass Experiment. I was particularly interested in seeing this experiment having read much about it and because of its similarity to our long-term grassland fertilization experiment at Ukulinga. Like Ukulinga, it has two different types of types of nitrogen (N) fertilizer treatment, ammonium sulphate and sodium nitrate (Ukulinga has ammonium nitrate). These different N fertilizers influenced soil pH and composition. *Arrhenatherum elatius* dominated the higher soil pH sites fertilized with sodium nitrate or N-fertilized limed sites, whereas *Holcus lanatus* dominated the lower soil pH sites fertilized with ammonium sulphate (Tilman *et al*. 1994). The acidifying ammonium sulphate reduced species richness to a much greater degree than sodium nitrate. Interestingly, plots were split about 10 years ago, with half of a plot no longer receiving N fertilizer. Species richness has recovered strongly in the half of the plot that used to receive sodium nitrate but has shown no recovery in the plot that used to receive ammonium sulphate. Liming greatly ameliorates the negative effect of N fertilizer on species richness, as it does at Ukulinga. Treatments that include various combinations of P, K, Na and Mg have effects on some of the less dominant species. Another interesting feature of the Park Grass Experiment is how some of the present dominants only attained dominance after 90 years of treatment applications. Thus, we should be cautious about drawing conclusions from short-term experiments. Owing to its manipulation of a wide range of soil nutrients and its 150-year existence, the Park Grass Experiment makes an impressive and extremely valuable contribution to plant ecological research.

Paul then took us to the Broadbalk winter wheat experiment. This famous experiment investigates the effects of various organic and inorganic fertilizers on wheat yields as well as the effect of excluding agrochemicals and different rotations on wheat yields. We were also taken to the soil and grain archives where soil and grain samples from the various experiments at Rothamsted have been stored at intervals since 1850. Analyses

of these samples has allowed extremely valuable insights into the effects of various fertilizers and cropping regimes on soil organic carbon, the effect of nuclear bomb testing on C14/C12 ratios in the earth's atmosphere and the establishment of pre-pollution standards. All in all Rothamsted is an extremely impressive place and well worth a visit. We were treated to lunch at the Rothamsted cafeteria to round off a very enjoyable visit.

I then flew to the twin cities of Minneapolis and St Paul in Minnesota, USA. Minneapolis and St Paul are joined by a few bridges over the Mississippi river. It's lovely in summer but you don't want to be there in their freezing winter. I had arranged to visit David Tilman's sites at Cedar Creek, but was unable to contact the assistant director of Cedar Creek to finalize my visit so decided to visit some friends in Zimmerman about 45 minutes drive from Minneapolis. They took me around the Sherbourne wildlife refuge where I was able to have a good look at the prairie/oak savanna that characterizes the natural vegetation of the region. I also got to see bald eagles and my first look at one of the dominants of tallgrass prairie, Big Bluestem (*Andropogon gerradii*). The soils of this region are derived from glacial outwash and are very sandy and extremely low in N (50 300 mg kg^{-1} in Minnesota compared with 1500 3000 mg kg^{-1} in most South African soils). Consequently, competition for N appears to be one of the major determinants of plant community composition in Minnesota (Tilman 1988; Wedin & Tilman 1993).

After spending a few days in Minnesota, I flew to Portland, Oregon for the Ecological Society of America Congress, which was held at the Oregon convention center. This is the biggest ecological congress in the world with over 4000 oral and poster presentations. I managed to get on one of the congress tours to Mount St Helens. We were privileged to have as our guides researchers who have been at the forefront of ecological research on the mountain following the devastating eruption in 1980. We heard about all the research that is been done on the mountain to see how the ecosystem was affected by the eruption and its recovery over 24 years. Again, the slow rate of nitrogen accumulation in the lava flows is the principal factor constraining the rate of ecosystem recovery.

The conference was very interesting, with many parallel sessions encompassing all the various disciplines of ecology. The theme of the congress was: “lessons of Lewis and Clarke: ecological exploration of inhabited landscapes”. Lewis & Clark were two explorers commissioned by President Thomas Jefferson to find a water-navigable route across the western continent to the Pacific Ocean, to learn about the biological and geological resources of the vast northwestern landscape and to make peaceful contact with the native people living along the route and to learn about their societies. They left St. Louis, Missouri in May 1804 and returned in September 1806. They traveled more than 3000 miles through uncharted territory. Along the way, they observed, collected and described dozens of plant and animal species that were new to science.

At the conference I concentrated on the grassland ecology and biodiversity sessions. It was great to see presentations by people whose papers one often reads such as Shahid Naeem, Brian Enquist, Brian Foster, Mark Westoby, Alan Knapp, Scott Collins and many others. My presentation was entitled “Plant strategies and the determinants of community composition in South African mesic grasslands” by R.W.S. Fynn, C.D. Morris, K.P. Kirkman and T.G. O'Connor. I drew on work that we have been doing on our two 54 year old experiments at Ukulinga, the burning and mowing experiment and the

fertilizer experiment, as well as other work on natural productivity gradients and various competition experiments. I presented evidence of the strategies (tradeoffs in competitive ability, tolerance of moisture stress, suppression- versus tolerance-based competitive strategies) that plants are using to allow them to dominate at various positions on environmental gradients (e.g. burning or mowing frequency, soil depth, soil fertility etc.).

After the conference I spent a few days hiking down on the Oregon coast. The scenery is spectacular with beautiful forests, rugged coastline characterized by sheer cliffs thousands of feet high, forests above the cliffs and isolated beaches. It is very similar to our wild coast in many ways and even has a "hole in the wall". This is where Lewis and Clarke reached the Pacific Ocean after their amazing hike across the continent from St Louis, following first the Missouri river to its source and then hiking down Columbia River to the Pacific Ocean.

After a few days on the coast, I caught a bus back to Portland and flew to Manhattan, Kansas, which is the location of Kansas State University, which oversees the famous Konza prairie research station. Tony Swemmer, who is doing a PhD with Alan Knapp, showed me around Konza the first day. It was great to see all the burning and grazing experiments and others that I had read about in various papers (Knapp & Seastedt 1986; Gibson & Hurlbert 1987; Seastedt *et al*. 1991; Gibson *et al*. 1993; Collins *et al*. 1998; Knapp *et al* (1998). I also had some great close up viewing of bison as they grazed all around our car. I spent the second day with John Blair who is in the Division of Biology at Kansas State University. John Blair is well known for his research on grassland ecology, soil ecology and terrestrial biogeochemistry in tallgrass prairie. He showed me around his lab and took me out to Konza where we had a detailed look at the various experiments and projects running there such as the grassland fertilization and mowing experiment, the Hurlbert burning plots, a prairie restoration experiment, published recently in *Oecologia* (Baer *et al*. 2004), and the landscape-scale burning and bison grazing experiments. It was a surprise to me that two of the dominants in these grasslands, Big Bluestem (*Andropogon gerradii*) and Switch grass (*Panicum virgatum*) are much less sensitive to burning frequency and soil depth than some of our dominants. For example, in South African mesic grasslands, *Themeda triandra* tends to only dominate with regular burning (Everson & Tainton 1984; Fynn *et al*. in press) and generally on well-drained and relatively infertile soils (Fynn & O'Connor 2005). In tall grass prairie, however, Big Bluestem and Switch grass may dominate long-term unburnt grassland, long-term annually burnt grassland and shallow and deep soils. However, they tend to be most dominant in annually burnt treatments. Switch grass is also most dominant on deep fertile soils near streams, similar to our *Panicum maximum*. One main difference between these prairie dominants and our dominant species is that they are rhizomatous whereas ours are tufted species. A rhizomatous growth habit may give these prairie species an ability to tolerate high levels of litter accumulation in unburnt treatments (Knapp & Seastedt 1986) and low light availability in productive sites. John Blair also introduced me to Loretta Johnson who is doing some interesting work on belowground processes in prairie and Alaskan systems. I had coffee with her and learnt about some interesting new research that she is pioneering looking at which genes in various species are turned on under various stresses and environmental conditions. This has great potential for gaining insight into the mechanisms that enable species to succeed under various environmental conditions.

I spent my third day at Konza helping one of Alan Knapp's PhD students, looking at water potentials in a number of grass and forb species on shallow and deep soils. I learnt to

identify *Andropogon gerrardii, Panicum virgatum, Sorgastrum nutans, Schizachyrium scoparium* and a *Bouteloua* sp. This concluded my visit to the USA and I flew back to South Africa via London.

The trip was a great experience for me; I learned a great deal and was able to make some very good contacts. I am extremely grateful to the Grassland Society of Southern Africa Trust for funding the travel expenses, the Discipline of Grassland Science, University of KwaZulu-Natal and my father for contributing towards conference registration fees and other expenses.

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