environmental news

University of Alberta
Environmental Research and Studies Centre

Volume 3, Issue 2
April 2003

Spiders at the Hub of New Forestry

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There is an old English nursery rhyme that reflects our apprehensions and deep-seeded superstitions about spiders:

If you wish to live and thrive,
Let a spider run alive

Many of us don't believe in superstitions and yet we avoid killing spiders in our homes by carefully returning them outside with drinking glasses and cards or cradled in tissue. This reverence for spiders was reinforced in mid-October last year when Russell Jervis, a farmer with a plot of land six km east of McBride, BC discovered a 'trampoline for aliens.' Unusually calm and warm autumn weather encouraged millions of typically solitary spiders to adopt a seemingly colonial lifestyle. Together, they weaved a thickly matted web entirely across Jervis' 60 hectare field of clover, unwittingly making national and international headlines.

The connections between science and public interest are oftentimes obtuse and intangible. If you happen to work on spiders, as I do, this disjunction is easily resolved. The spiders I have been classifying and counting for four years aren't as newsworthy, as the web-building spiders east of McBride; however, the species richness and overall abundance of spiders in my collections are just as awesome, particularly when you realize that they all came from one site in the mixedwood boreal forest of northwestern Alberta. I have presented stories of forest spiders to several elementary and junior high classes in Edmonton and it is always rewarding to illustrate ecological concepts with eight-legged creatures as a backdrop.

A current forest management objective in much of Canada is to harvest timber in patterns similar to those resulting from natural disturbances such as fire, insect outbreaks, and windfall. It has always been assumed that the animals and plants of a forest are adapted to natural disturbances and therefore can cope with changes similar in pattern and scale to those brought about by harvesting. Although this attractive idea is now being developed in Canadian forest management plans, it has not received serious scientific attention and my studies seek to test this 'natural disturbance' paradigm.

A large, long-term experiment involving more than 1000 hectares of mixedwood boreal forest, called Ecological Management Emulating Natural Disturbance (EMEND) was established approximately 700 km northwest of Edmonton, in 1997. The EMEND study site consists of replicated combinations of forest stand types (deciduous to coniferous) and proportion of trees left standing after experimental harvest (traditional clearcut to 75% of trees left standing). Sustainability of harvested treatments is compared to pre-harvest conditions, to experimentally and variously burned treatments and to uncut control forests. Researchers are assessing the sustainability of these treatments in relation to many physical, chemical, biological, and

Below:
Adult male wolf spider,
Pardosa moesta *Banks*

socio-economical factors. I am contributing to the EMEND effort by evaluating the biodiversity of forest-floor spiders in the harvested, experimentally burned, and control sites.

Instead of building webs, the spiders I study are active hunters that stalk and pounce on their prey. These spiders, as is true for all spiders, are top-of-the-food chain animals that provide significant linkages between smaller arthropods and larger animals, such as birds. As has been the case in similar studies in other parts of the world, the spider fauna in northwestern Alberta is as suitable for the characterization of habitats as are vascular plants. Unlike vascular plants, spiders are quick to respond to disturbance. Spiders have been used in similar studies elsewhere in relation to clear-cutting, fire, managed forests, and succession; however, there has never been an attempt to tie all these processes together.

The first goal of a biodiversity study is to list and count the species present. This may appear to be a trivial exercise, but we know so little about the arthropods in our boreal forests that identifying and counting species is an exceptionally laborious chore. Many species of spiders in our forests have never been described and are thus new to science. For example, 10 specimens of one previously unknown spider were collected at EMEND. It has since been named *Maro amplus*, but interestingly, females have yet to be found. Spider collections at EMEND over three years yielded over 48,000 specimens and 184 species. More than a third of these species are represented by two or fewer specimens, a trend commonly seen in canopies of tropical forests. This illustrates the amazing, yet largely ignored richness of the ground fauna in our boreal forests. Most of the uncommon species were trapped in control stands or in minimally harvested stands suggesting that harvesting may simplify spider assemblages to the detriment of the rare species.

It appears that assemblages of spiders are not strongly linked to the types of trees in a forest stand and instead they respond quickly to structural changes in their environment. In natural forests prior to harvesting, spider diversity was uniformly distributed across the four EMEND stand types, but after harvesting, their diversity shifted in direct response to harvesting intensity. From a spider's perspective then, it is not critical to preserve the various types of trees in a stand, but it is important to maintain overall forest structure. This is in contrast to ground-dwelling beetles collected by EMEND researchers who found that the variability of beetle assemblages is more tightly linked to stand type than to harvest intensity. The message here is that the preservation of both stand composition and structure is important if we wish to maintain biodiversity.

There are a few species of opportunistic spiders that have counter-intuitive responses to increased harvesting intensity whereby they quickly colonize openings in what used to be contiguous forest. One species in particular, a wolf spider in the Family Lycosidae called *Pardosa moesta* (see page 1), is found in large numbers after harvesting yet is uncommon in forests with a closed canopy. Typically, large openings in the forest and the resultant increased variability in the microclimate on forest floors discourage the survival of spider species with narrow tolerance ranges in heat and moisture. This is likely why a few species of spiders able to tolerate extremes (e.g. *P. moesta*) rapidly displace, consume or out-compete less tolerant and uncommon species. Because spider assemblages shift in a roughly linear fashion with increased harvesting intensity, it is difficult to determine the threshold at which we ought to limit harvesting. Instead, we must balance our desire to preserve naturally assembled biota with our economic needs.

Ultimately, this story is one of carefully guided balance. On the one hand, many of our boreal forests are under such intense pressure from human activities that their life-giving fabric has the potential to permanently disintegrate. On the other hand, Canadian society will always be dependent upon wood and wood products. Spiders are a valuable focal point in this balancing act because they allow us to effectively assess the impact of forest harvesting on the structure of whole-forest biodiversity. Looking at the forest from this minuscule level makes you realize the incredibly pervasive influence we have on all life. However, human dominance over forests does not beget ownership. Until we are able to keep a very close, anticipatory eye on forests and manage them with utmost comprehension, we will never truly have the right to assume or pass ownership. J. H. Fabre, the masterful naturalist of the late nineteenth century, described this best in his, "The Life of the Spider':

> "A Dog has found a bone. He lies in the shade, holding it between his paws, and studies it fondly. It is his sacred property, his chattel. An Epeira has woven her web. Here again is property; and owning a better title than the other. Favoured by chance and assisted by his scent, the Dog has merely had a find; he has neither worked nor paid for it. The Spider is more than a casual owner, she has created what is hers. Its substance issued from her body, its structure from her brain. If ever property was sacrosanct, hers is."

The Journey to My Conservationist Ethic

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I certainly do not sway wildly on the idealistic branches which constitute the tree of politic affiliation. Although I would never admit that I subscribe to the extreme 'left' wing, people I know have labeled me as such. So, after staring at my feet for a while, I have realized that I am firmly planted a good distance left of centre. Presumably, this designation may be associated to the landscape on which I tread; at the university even the lamp-posts lean left and don't know it. How did I arrive at this position? I know I am not the sole journeyman, and I know, like many other idealistic, conservation-minded students quenching their thirst at the fountains of reason and pragmatism, this trip has been a hard one. I hope this essay helps us realize where we have come from, understand where we are and ponder where we are going.

One facet of conservation biology must be known: it is an emotive science. This is the oxymoronic description the conservationist must come to embrace. One must assign personal value to things that do not register on economic or societal scales, and eventually defend and fight for these things. Justifying an emotive approach across a boardroom table or in a public campaign is difficult at best.

If this sounds akin to jumping over tall buildings in a single bound—not to fret, many of the greatest conservationists have operated within these bounds. Like Rachel Carson and many other successful environmental activists (David Suzuki, Henry David Thoreau, and our very own Dave Schindler), their drive undoubtedly sprung from a personal attachment to the violated organism. This is why emotion, the heart, provides the fuel while science, the head, navigates the vehicle down the road.

Someone once said, "If you are not idealistic when you are young, you have no heart. If you are not pragmatic when you are old you have no head."

Not unlike myself, too many young idealistic high school students stream into the

diploma factories with romantic dreams of saving the world with ideas and open discussion. Many that continue the hike down this idealistic path tend to be discouraged by what seems to be the uselessness of radical ideas. Some of the more socially conscious ones likely participate in some non-violent protest or public dissidence. These are likely knocked off the idealistic highway either by a lack of results or an appreciation for just how easy it is for a government, driving intoxicated on the alcohol of resource extraction, to mobilize its power. Finally, after having to succumb to "the man" once too many times, the above quote begins to make sense and they change their ideals instead of compromising the means to an end. They may not drive the largest sport utility vehicle they can afford with a bumper sticker that says "GO RALPH," but they can justify a little slip in democracy or a permanent scar on the earth in the name of old age pension or their child's academic future.

I'm writing to convince you of a middle ground. Peering down two roads diverging in a yellow wood, realizing that the one less traveled by condemns you to splash about noisily in the backwaters of society wearing hemp clothing holding a sign that reads 'save the … something' while the other requires you to compromise your ideals, I urge you to go down the middle and keep both in sight.

I see it as an argument for the ends of our common romantic cause. Get in bed with the people that wield this enormous amount of power to suit their ends and redirect it for your own. Too often people concerned for the health of the environment are seen as unmanageable and unrealistic because, most of the time, they are. Either their emotional stake in the topic may overwhelm them or they reason that Goliath is just too big and playing dirty is justified. Travel the well worn road, avoid all the hooks and brambles, but maintain that the other path leads to the destination you are seeking. Contrary to what Robert Frost wrote, and the metaphor I am milking for all it is worth, '… way does not have to lead on to way' and you can return to the other path. Do not corrupt the reason you set off on this journey, maintain your ideals.

Volunteer for worthy causes. Establish neighborhood grassroots organizations that protect societal and environmental rights using your experience as a cutthroat business person. Accept a position at the governmental agency or private industry that you mark as the root of all evil and be the person that raises an intellectually well-founded stink every time you smell something foul. Support and volunteer for your local left-wing think-tank, help them mobilize *their* resources. Lending our own personal time and effort is a distinct advantage us idealists have over others. As mentioned above, we love what we do, monetary incentives do not push us through the night, an emotive attachment does.

Gas Exploration and Arctic Plants

By J Todd Kemper
MSc Candidate, Department of Renewable Resources

With demand expected to continue rising in coming years petroleum companies are increasingly looking northward for tomorrow's supply of oil and gas. The north slope of Alaska and the outer Mackenzie Delta in the Northwest Territories contain huge underground reserves of both oil and natural gas, and a significant amount of gas hydrates trapped in pockets of frozen ice. Today, as plans for a pipeline are being negotiated with various landholders, exploration companies are actively scouring the Mackenzie Delta for more, and more refined, information on the precise location and extent of oil and gas in this area. The purpose of my research is to evaluate this exploration, and the effects it may be having on sensitive plant communities in the western Canadian Arctic. Halfway through my degree I have come to some interesting conclusions regarding the balance between man and nature, and discovered that the icy north pulses strongly in my veins.

When I decided to take on a masters project in plant community ecology I had no idea it would take me to such dramatic places or lead to such an exciting and timely research question; and therein lies the rub: without scientific and public scrutiny there can be little balance between the needs of resource extraction and environmental conservation in the Arctic, yet virtually no one is tuned in to what's happening in Canada's north.

The western Canadian Arctic was something of a mystery to me when I first arrived there in May of 2002. I was instantly awestruck. Far removed from the vast rocky archipelago to the north and east, the outer Mackenzie Delta is a unique and startling place. Nestled between the Richardson Mountains to the east, and the Caribou Hills to the west, the mighty Mackenzie River (which drains fully 20% of Canada's land base) is confined into a relatively narrow delta, which is (relative to other arctic habitats) rich in both flora and fauna. The outer delta's tundra habitats are important staging and nesting sites for a wide variety of migratory birds, which stimulated Environment Canada to create the Kendall Island Migratory Bird Sanctuary (my study area) in 1961. Located on Richards Island, the sanctuary lies within the Arctic Coastal Plain of the Mackenzie Sedimentary Basin,

and is punctuated by innumerable small river channels, tundra lakes, and poorly drained wetlands. As luck would have it, the sanctuary was later found to sit atop two of the largest natural gas fields in northern Canada.

Enter the petroleum giants.

Exploration in the Kendall Island Sanctuary began in the late 1960s and early 1970s and has intensified substantially in recent years. The main component of this type of exploration in Canada's north is winter seismic programs. These involve trains of wheeled or tracked vehicles passing over the frozen ground, sending energy (either via dynamite or vibration) into the ground and measuring the 'echo' of the returned energy. These activities occur in the dark depths of winter, when few animals are around to be disturbed by them, and when snow cover and hard frozen ground should protect plants from damage. The timing is intentional: early exploration in the 1940s was conducted during the summer months, and left permanent scars on the landscape that were devoid of vegetation and in some cases dramatically altered drainage patterns on the landscape. It was during the second wave of arctic oil and gas exploration during the late 1960s and 1970s that seismic programs were shifted to winter months, and to a great extent this has been an environmental success story.

Potential problems remain however—when the United States Congress voted to allow limited exploration within the Arctic National Wildlife Refuge during the winters of 1984 and 1985, United States Fish and Wildlife Service researchers were on hand to monitor the seismic programs and keep track of changes to the landscape. Their results were surprising to many. They reported significant and long lasting changes to Arctic plant communities and the permafrost beneath them following exploration, and this led me towards a re-evaluation of winter seismic in Canada. Through my work I hope to understand the what and how of seismic impacts on plant diversity, abundance, species composition, and also the permafrost and soil properties which may influence the ability of native plants to re-establish in a timely manner.

The effects of winter vehicle passage on Arctic plant communities depend largely on the amount of vehicle traffic and the habitat type passed over. Fresh seismic lines in wet coastal meadows are easily spotted due to the decrease in vegetative cover along them: swaths of standing water or bare ground form stark contrast to the greens and browns of the surrounding meadow. In drier upland sites, seismic lines can be spotted by the complete destruction of brittle upright shrubs, clipping of sedge tussocks, and exposure of bare soil. Some dwarf shrubs and herbaceous plants are protected by snow cover and appear to bounce back, while others have their winter buds knocked off and refuse to leaf out or flower in the first growing season following disturbance. The reduction in vegetative cover along seismic lines can lead to two main problems: the soil becomes warmer, causing permafrost to melt to deeper depths, and the exposed soil becomes a perfect site for invasive plants to take hold.

To generalize somewhat, Arctic plant communities are sensitive to change, and slow to respond to disturbance. While a single seismic line may not appear as a significant disturbance against the vast tundra, the density of seismic lines in the Mackenzie Delta becomes staggering when one looks at a single map overlaying 30 to 40 years of exploration. Such small disturbances cannot be viewed as discrete events, but rather should be viewed as cumulative disturbance that could be creating changes in arctic habitats that are occurring on such vast spatial and temporal scales that they may be difficult to detect. With a little luck I may just be able to help answer some of these questions and provide the information that industry and government need to properly manage our biological and hydrocarbon resources.

University of Alberta

Environmental Research and Studies Centre

ISSN: 1705-2343

Environmental News is published by the Centre. Articles, photos, commentary and suggestions should be submitted to:

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