

SNAKES IN FORESTED ECOSYSTEMS: QUESTIONS AND DISCUSSIONS

Moderator: Ron Black

Ron Black - The area that I'm responsible for managing pretty well takes in the entire eastern Georgian Bay range. Some of the issues I've been dealing with over the last five years include subdivisions in areas where we know rattlesnakes occur, which requires roads to be built across Crown and private land, and across provincially significant wetlands. We have an illegal quarry along the side of the road that required some mitigative measures to try and help restore a little bit of the habitat around the quarry. Then we have a twinning project on Highway 69 you've heard a lot about from various comments so far, as well as other quarry applications and a forest management plan. Throughout the Crown lands in the area, which are about 60% of the areas that I manage, we have partial cutting systems, shelterwood cutting, and selection cutting that occurs throughout those lands in about 60, maybe 50% when you look at protected areas. What I'm interested in is any information that's out there to help answer these things, and comments people may have...

Bob Johnson - First point - negative impacts of forest operations? I was going to ask Chris... you gave good data showing segregation of gravid females into the open habitats... can you comment on the canopy? We've been focusing on rocks, so that means a non-gravid female and the males are really in a forested ecosystem, and they're really important for all the other population that's not gravid. Can you comment on the quality or the type of habitat from the variables you have? Is it dense forest, closed forest? Relating that to forest operations, would opening a canopy or leaving a closed canopy have impacts on the massasauga?

Chris Parent - I would say the same - the gravid females are using more open habitat. It is a relative thing; just because gravid females are more open, that doesn't mean the males and non-gravid females are using closed forest. Just to give you an idea of the numbers - gravid females are using areas upon average of 24% canopy cover, the non-gravid females and the males are at about 38% canopy cover. So in either way you're still looking at less than 50% canopy cover that the snakes are using. So we find in Killbear, while you will occasionally find the massasauga in closed canopy forest, it's fairly rare. Usually they're moving through it. And when you do find them in forested ar-

reas they're typically at an ecotone, at the edge of some clearing. So we don't typically find them in solid closed-canopy forest.

Justin Quirouette - I had a quick question about Chris' scatter plot that he was showing. In your discriminate analysis, was your random sampling somehow stratified, and did you consider the effects of spatial autocorrelation?

Chris Parent - It was random, we tracked the snakes for one year and got a feel for where they were hanging out in the park. And then using that area where the snakes were known to occur, we randomly chose points within that.

Ron Black - Are there other people from the States that have logging operations going on in massasauga habitats? Some of the people that operate in swamp systems - any comment there?

Glenn Johnson - I'd like to make a comment - there's no logging operations involved. What I found in a swamp forest is similar to what Chris found, that non-gravid females and the males would use situations that were of reduced canopy cover compared to what was available. Probably in the neighbourhood of 40% canopy cover

Gary Casper - I guess I can echo that... in Wisconsin, on the Mississippi River, we've got populations in the floodplain forest. And those areas have undergone drastic changes in the last hundred years, both hydrologically and from overgrowth of vegetation because of fire suppression. And the areas where the massasaugas are still hanging on are becoming increasingly closed-canopy, and the spots where we find them are any kind of opening.

Richard King - In my area, gravid females were going to openings that had open canopies, but the openings in the bottomland hardwood forest were where the males and non-gravid females were. So all of them are using some opening of one sort or another, it's just that in the bottomland hardwood forest that Gary's talking about, the only openings that are left are where they're concentrating. And I also said yesterday that in Wis-

consin, all we have left is some bottomland hardwood forest where the snakes are hanging on, and one peat area. But most of the population didn't occur in that habitat. Historically they were in mesic prairies. Same thing for Iowa, and I'm sure in northern Illinois their populations were probably the same, and that certainly is open canopy, it's just agriculture now. So certainly, I think maintaining and protecting open canopy is important.

Ron Black - Well, our forestry operations typically take a relatively closed canopy in a deciduous forest and reduce crown closure to maybe about 50 to 60 percent on a twenty-year cycle, and that canopy then fills back in relatively quickly. In the shelterwood cut, it's a little bit more reduction, maybe down to forty-five percent crown closure over a similar period. Now there are these natural openings and bedrock outcroppings in the forest, and what I've done to protect some of these sites, brooding sites for instance, is try to key in with tree markers to identify these areas where there might be a rookery site, and protect that from a company who might, in another case, put a log landing on that site because it's an open area already. They don't have to cut any trees off it and they have to usually try and pick a relatively flat site so they could come in with a bulldozer and just bulldoze off the table rocks off the site like that and destroy a good rookery site. We've put some guidelines in place to deal with that.

Bob Johnson - What I've been hearing then, kind of a gross simplification, is that opening the canopy has a beneficial effect, and we have a certain model of that in our forest systems when we put through hydro lines or telephone lines or pipelines, where we do open up the canopy. I know when I started looking for rattlesnakes, I used to walk power lines. Would you say that along power lines you're finding any more snakes than you do in your other study sites?

Chris Parent - I can actually provide some anecdotal evidence along those lines. We have power lines going through Killbear, and when they were originally cleared of course trees started growing back up. When I started at Killbear many of those trees were at least three to four metres in height, and they were at that point when we started the radio telemetry work. We found snakes for the most part avoided those areas because at that point, three to four metres high is still a closed canopy forest for a massasauga, from a massasauga's perspective. In the summer of 1996 a decision was made to cut under the power lines to make sure that that vegetation didn't get any higher and cause a potential short of the electrical cables. So a number of work crews went in with power saws and trimmed all the trees. Within several weeks we

found that rattlesnakes, our transmitter-equipped snakes, were starting to use those power lines. That's probably an influence of decreased canopy cover, it may also reflect that the trees that were cut were just left there, so now you've got these big piles of brush, it's probably attracted some rodents as well. I'd say there was a tremendous increase in the use of that narrow power line corridor, and that was due entirely to the felling of that brush.

Bob Johnson - I was talking with someone the other day about prey density, and the relationship of snakes and prey density. Can you comment on that? Because I wonder how much you can tease out whether that's an opening in the canopy, and/or just increased prey density that's drawing these snakes to these areas?

Rich Seigel - Two things - first, obviously you have to have enough prey density... The only worry I have about opening the canopy and doing this kind of stuff, is making sure you're doing it in the right places. Because if you just open the canopy, that might attract the snakes because of the thermal profile. However, if there are other aspects of the habitat are inappropriate, you could easily be creating sinks. And I think you have to be very careful of saying, '30% canopy cover is what they'll like, let's go ahead and make some open canopy patches.' You could put those in places that have high predator densities, that don't have good retreat sites, the snakes move to them because the thermal profile all of the sudden looks good, and they get nailed by something. And I think you have to be a little careful with the manipulations to make sure you're really doing something that's going to be beneficial as opposed to something that you think is going to be beneficial. The two may actually be different.

Chris Parent - Just a question, Ron - you said you're trying to protect some of these clearings within the woods. What sort of radius are you protecting around those clearings?

Ron Black - At this point it's just a matter of having the markers recognize the site might be a potential brooding site and for them not to locate a road or a landing at that vicinity. We really haven't talked about buffers around them or a leave area around them but that could be a recognition thing as well.

Chris Parent - The reason I'm asking is that one of our best hibernation site complexes would be in closed canopy forest and it's about a hundred metres from one of these clearings which does act as a rookery site. And this is in keeping with our general observations that most rookery sites are within about a hun-

dred metres of hibernation sites. So protecting that rookery site may be great or if you protect that clearing that's fine, even leaving a ten metre buffer of trees around it, that's good, but you may end up having the destruction of the hibernation sites within the closed-canopy forest if it's logged, and then even if a gravid female does show up and give birth, there's nowhere for her and her young to go for hibernation sites.

Ron Black - That's really problematic in the type of forestry operations that we're dealing with, because we may be dealing with an area of a hundred hectares. We can pick out bedrock outcroppings from an aerial photograph but we can't pick out hibernacula, as you know. What I've traditionally done is look at the model of the low wet area and try to interpret air photos and pick out some of those sites and leave areas around those, 15 metres of uncut area around those to try and retrieve hibernacula. Maybe what you're suggesting might be a better approach, or a different approach might be to set up a hundred metre 'area of concern' around a brooding site and that might be appropriate for hibernacula.

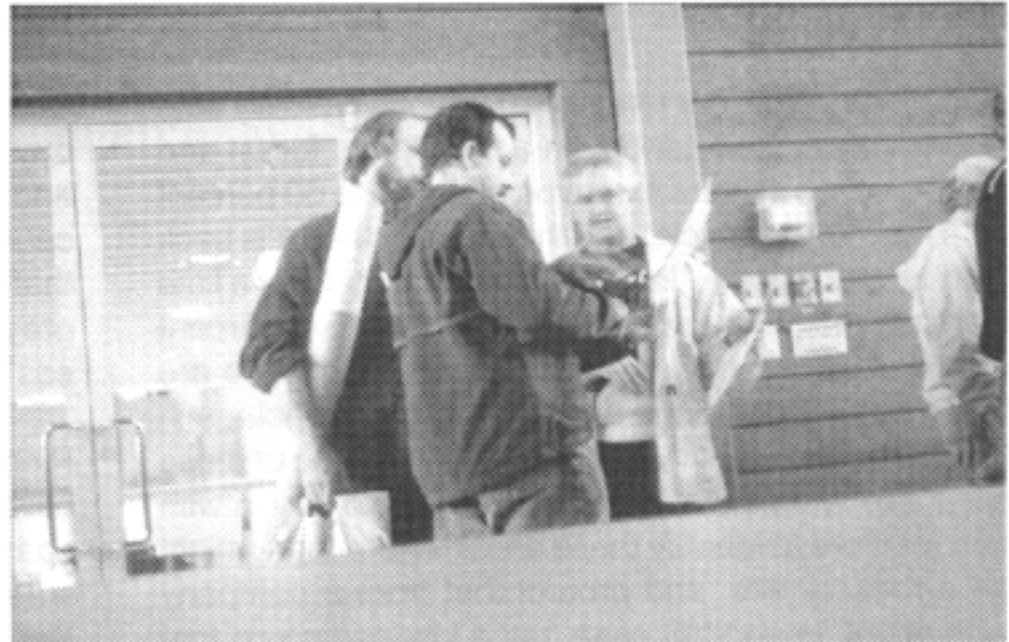
Chris Parent - Maybe say a 150-metre radius around both these clearings that does have either a known rookery site or a suspected rookery site. I don't know how feasible that is, after you check all these clearings and make all your 150-metre radius circles you may end up with three trees you're allowed to cut.

Kent Prior - I think the key is really that these things use the landscape and that there are key elements that they need; they may need them at different times of the year and they may need them during different parts of their life. If you protect one component of it and don't consider all the others, and the stuff that's in between that might not be places that they hang out but they need to move through to access all these other parts. We've really only addressed part of the problem if we've just protected a brood site and a buffer around it or we've just protected a hibernation site and not recognized the connectivity that's required between these key elements. I think that that's one of the key things that all of these telemetry studies have demonstrated - these things move around to many different places and you need to consider the entire sort of 'world view' that all the different cohorts have.

Rob Wilson - I was just going to say if you're going to do that, the best thing I think too is look at a rookery site in one of these clearings, and then around that site create the buffer zone. So you have the rookery site and an open clearing beside that - a low-lying wet area for example. That's what we did when I was looking for them. Whereas I would have searched in inap-

propriate forested areas for a long time without much luck. The rookery is a good focal point for that kind of a buffer zone around it.

Ron Black - I would like to touch on the road construction and quarrying issue. Anyone with experience there in terms of mitigation?



Rich Seigel - This is slightly off topic although it does bear directly on your road quarrying. I'm sitting here this morning trying to integrate some of the material from Chris' field trip and Lisle's presentation yesterday and Bruce's presentation this morning, and my overall conclusion is that your populations are a lot more vulnerable than you might be thinking. Based on the spatial data, based on the hibernacula use, what the populations up here you're predicting to be and what you're actually finding is highly spatially and genetically segregated, existing at very low numbers. To give you some examples of some figures I worked out this morning - Bruce, you had 71 total snakes that you found in hibernacula, 42 of which exist at three sites. So about 65% of your animals are found at three hibernating sites. 19 total gravid females, so you've got eight or nine females producing clutches in a year. I just ran a quick simulation here this morning, based on your 130 neonates, based on the mortality rates that you gave them the other day, 130 neonates will produce at adulthood 9 females. And those 9 females will produce at 8% survivorship over five years after they reach adulthood. So therefore will produce a maximum of about three broods. So based on the spatial segregation and based on that demography, what you should get are these highly segregated, very small populations that are highly dependant on a very small number of critical hibernation sites. Which means the vulnerability of the population to something like road quarrying, road mortality or habitat development, picking off just one good hibernation site is going to have a highly disproportionate effect on the population's persistence.

So what you're going to wind up with is that you have lots of populations. I think that's what you've got, you've got lots of discreet populations, all of which are existing at relatively low densities. Very balanced on a knife-edge in terms of mortality, very heavily dependent on these spatially segregated rookeries and hibernation sites. You can easily predict they're just going to wink out, 1, 1, 1, because of road quarrying, or logging, or increasing highways, and it'll be fine for the next 30 or 40 years, but in about fifty years, you're going to wind up finding that about half of the dots on those maps are gone.

Bob Johnson - I guess the question then is, as it relates to roads and forests, touching on Rob's comments about protecting the brood sites, it's going to be hard, realistically, for the MNR and Ron to go through and say 'Oh, we have a brood site with two females on it, we don't want you to put your road there or we don't want you to log there.' Realistically he has to come up with some way, not knowing where all these sites are, you have lots of small populations, widespread, highly dependent upon these focal points as you suggest. Assuming we don't know where all these focal points are going to be in a given year, how do we make recommendations about logging, or road construction, and I guess the only answer I would have, a quick one, relates back to what Kent said, is that at a landscape level, you just need a mosaic of disturbed and undisturbed habitats that change over 25 or thirty years. So as long as you have a sufficiently large area that has impacted and there's a sufficiently large area that hasn't impacted, you're going to have to assume that the snakes, at a population level, are going to persist. I guess if they don't, for local means, they're not going to recolonize those sites that are disturbed. But what then do you suggest, how does Ron use that now to make our recommendations next week?

Gary Casper - Perhaps if the populations are small and you're going to impact any of them as you go through, if there are several different sorts of human activities, maybe you can concentrate them in a particular corridor, where you are essentially sacrificing that corridor rather than dispersing your activities all over the place. You would have no activities in the designated areas.

Ron Black - That fortunately will probably be the case for a lot of this highway construction. Once we get north of Parry Sound we'll likely (due to the lack of private land issues up there) be twinned right along the existing lanes that are there now. But there are some areas where the highway will deviate into undisturbed habitat. The forestry operations are ongoing throughout undisturbed Crown lands, those issues have to be dealt with I think, like Kent says, at a landscape level.

But also recognizing that if we can identify local features of critical habitats, that we put some protection around those that is acceptable in terms of the amount of area tied up to the logging companies. That's always an issue as anyone who's worked with forestry operations will know.

Anne Yagi - I just had a question about the highway - is it mostly a concern about the loss of hibernacula, or is it loss of habitat at a landscape level? Would culverts work to funnel snakes under the highway?

Rich Seigel - Obviously both. I mean, clearly you're worried about wiping out hibernacula, if they are spatially concentrated around two hibernacula then the loss of one hibernation site has a disproportionate effect. Obviously you're not going to know that where your highway's going in, because you haven't had the chance to go through and do the kind of intense work that Chris has done to identify where the hibernacula are. As far as the idea of, yes, clearly, if you put a highway through and that happens in a corridor where they move from hibernation to rookery, then you've got an equal damage to that population. I have the same feeling about culverts as I do about translocation - that we should be studying them prior to getting into a crisis situation, to see what snakes are going to do. Because really at this point there's very little data on snakes actually using culverts...

[UNKNOWN] - We've tried culverts - but without a big budget. The culverts only had about 50 metres of funnelling fence on each side. In over two years no snakes at all, let alone rattlesnakes, have used the culverts. We put them in an area where we guessed the snakes might be crossing based on topography, because we had a crisis situation where we had to put the culverts in right away. Without information on where snakes cross the road, we had to do that. We decided that the only effective way to use culverts in that situation would be to use extremely large run of drift fencing - maybe the whole thing has to be fenced to funnel all animals, all snakes into the culverts, and not leave it up to chance or your intuition.

Ron Black - What size of culverts were you using?

[UNKNOWN] - They were about 30cm in diameter, very small.

[UNKNOWN] - I just wanted to suggest that wherever possible a span is going to be more effective than a culvert. Obviously it's more expensive, but when you have a critically endangered species, it's helpful.

Ron Black - OK, I'd like to take the last few minutes and ask what people feel about a study - we have this

opportunity here to study the impacts of this highway construction on rattlesnake populations. These highway construction projects usually go in 20 to 30 km segments. The segment we're faced with next, we don't have the opportunity to collect information before disturbance occurs. But we do have an opportunity to look at construction and post-construction impacts and test some mitigative measures to see what their efficacy would be. So what I'm looking for is advice, comments on what a study should entail, and how long should the study be.

Tom Anton - I think the more years on either end, the better. You've got a project that's slated to begin at this date, the more years you have on either side of the project for monitoring, microhabitat use, the clearer the picture you'll get in whatever situation. You've got to have multiple years of data.



Ron Black - Certainly my discussions with Chris have made that clear too - you can't expect to find results in one or two years.

Scott Parker - I was just thinking as the highway's going through, are you going to start thinking about ongoing maintenance? Roadside vegetation, how it's going to be mowed, the timing of the mowing. I know with brood pairs there's evidence to suggest that when you put this corridor in, maybe you don't create that grassland habitat on the side of the road, let that grass grow as high as you can - maybe you don't create that edge effect that you get when you keep the grass down really low with mowing or herbicides. I think you've got an opportunity to try different maintenance regimes along that highway like how widely you mow it, things like that. I wasn't just thinking of inhospitable to snakes - I was also thinking of predators of snakes, or things that may facilitate disease transmission along that corridor, to get away from this single species and look

at the whole ecology along that corridor as much as possible.

Rich Seigel - You are going to have an opportunity to look at some of the before effects on other parts of the highway, is that correct?

Ron Black - I think we will have that opportunity down the road, it could be ten years down the road, and it could be in a little different situation where the highway is only being twinned along the existing highway. Whether or not we will have an opportunity to look at an area that's going through undisturbed habitat in this case, I'm not sure. There will probably be other cases down the road where we could.

Rich Seigel - And when is the construction actually starting? Even if they started in six months, could you not get in next spring using the GIS and Chris' information and identify potential hibernacula sites along the route, and get to those as or before the highway construction reaches them? Allowing you at least get some information, maybe get some of those snakes telemetered before the highway construction gets there?

Ron Black - This fall we did identify a couple of rookery sites. We certainly could put transmitters in snakes next year, before the construction occurs. They are already grubbing and clearing vegetation at this one interchange where we found these two sites. The offramp will be within twenty metres of one site and probably within 100 metres of another. So there are certainly going to be some opportunities.

Rich Seigel - They normally do heavy construction up here during the middle of the winter?

Ron Black - They do it all year long if they can... the other thing that I've addressed in the environmental assessment so far is the timing restrictions, and again, thinking about hibernacula, when the snakes are at hibernacula, at certain times of the year we figured a time restriction where there would be no grubbing or blasting or that sort of activity occurring beyond October 1st through to May 15th or thereabouts. Of course they're reluctant to do that for the whole length of the highway because that cuts the construction time down in half and puts the costs up substantially. If we could identify critical habitat areas where we could put those timing restrictions in place, that might be something to do. What I'd like is some real research done to address some of these questions and provide the answers we need.

Ben Porchuk - I was just going to say that without a study like Chris' before, it's going to be really hard to identify those areas. Just driving up that road, you can look over and see that nice mosaic of wetlands and open rock outcrops. So I kind of think that at this stage, the best thing would be to work with them and maybe create some small openings for some rookery sites in the area, because it seems like they're taking a lot of those areas away, and it looks like really good habitat that we're looking at. So unless you have some areas where you know massasaugas are hit on roads there, but otherwise I don't think scrambling for one year will really identify where these sites are. Because as Chris has shown, even after the first year it's really hard to really see anything.

Rich Seigel - I think if you've got a couple of rookeries, and you definitely monitor those, and even if you don't have much pre-construction data you'll determine what's going on there. You get those animals marked with PIT tags, or you get transmitters into them, you can find hibernation sites along that corridor. You get as many of those animals marked and monitored as you can, in whatever way you can, at least PIT tags, and then you make sure that any road kills, any snakes that are killed or any snakes that are found or reported to you, that you get either the carcass or the snake, use the markings for that snake. You won't be able to say, 'this is what the impact was of the road' without pre-construction data, but we can at least say 'this is what the snake does, this is what the snake's behaviour is in a construction zone'. You may be able to make some inferences out of that... it's certainly better than nothing.

Ron Black - Could you draw inferences on the mortality of your transmittered snakes in that situation and compare that to Chris' population in Killbear, and measure the stochastic event of a highway going through on that population?

Rich Seigel - You don't have controls to make a direct comparison... because you're assuming that your site and Chris' site are similar with the exception of the road... I mean, there may be some obvious patterns from the telemetry data - for example, you have snakes in the construction zone never come within 50 metres of the highway. Or they come within 50 metres of the highway and they get killed by operations, or picked off by hawks. There's going to be weak inferences, but recognizing the constraints you have and that this is the hand you've been dealt, I think the safe thing would be to get the sites that aren't being impacted just yet done, and I would try to focus on those. Secondly, get as many snakes marked and telemetered within the confines of the construction zone as you can, make sure you know what those animals are doing and what their long-term survival chances are.

Bruce Kingsbury - Do you not think if your population is smack dab in the middle of where the highway is going, get a little telemetry information on them and then persist in following them and watch what their behaviour is as the highway goes through?

Rich Seigel - If they get killed by road workers, cars or construction equipment, then I think it's safe to say it was a result of the highway. At least you can say that. And any of that mortality is clearly additional to what you would have had normally - if you get crushed by a bulldozer you can't argue that.

Ron Black - I should end off by saying that in dealing with the Ministry of Transportation in Ontario we have a good relationship with them in the last couple of years. We are dealing mainly with engineers who don't really understand snakes all that well. We have come a long way - they provided a financial donation to support the symposium, and they have made some commitments to do more.