5th Annual Meeting, Penticton, BC,

Abstracts

The following are a selection of the abstracts from the over 70 presentations. Abstracts are organized in alphabetical order by first author's last name.

Abstracts of the presentations are available in print form through CARCNET.

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Clayoquot Sound amphibian inventory

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The Long Beach Model Forest (LBMF) encompasses Clayoquot Sound, a key area of controversy over logging activities in British Columbia. In 1995, the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound recommended collection of baseline information on biological diversity for planning reserves within unlogged watersheds. LBMF surveyed 148 wetlands within six watersheds from May to July, 1998 and documented the occurrence of five species of aquatic-breeding amphibians, Northwestern Salamanders (*Ambystoma gracile*), Pacific Treefrogs (*Hyla regilla*), Red-legged Frogs (*Rana aurora*), Roughskin Newts (*Taricha granulosa*) and Western Toads (*Bufo boreas*). We determined which site series from 1:20,000 Terrestrial Ecosystem Mapping (TEM) were associated with breeding habitats and grouped them into four categories: (1) forested wetlands,

(2) riparian wet areas, (3) non-forested wetlands, and (4) forest areas. We proposed that all polygons classified under the first three categories should be considered for amphibian breeding habitat reserves. The fourth category contained dryer site series that, according to TEM, comprised the remainder (mostly) of each watershed planning unit. Approximately 97% of these wetlands were less than 0.1 ha and would receive no buffers under the B.C. Forest Practices Code or the Scientific Panel Recommendations. We suggested that these small isolated wetlands, once identified on the ground within harvest stands, should be partially buffered and connected to riparian reserves and uncut forest patches.

Environment Canada's South Okanagan - Similkameen Conservation Program and First Step Projects under the Habitat Stewardship Program

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In August 2000, it was announced that $1 Million from the Habitat Stewardship Program within Environment Canada would fund eight projects in the South Okanagan and Similkameen. The eight projects will be delivered by South Okanagan - Similkameen Conservation Program partners including First Nations as well as other local organizations. The eight areas of priority that will be funded are:

1. Grassland Conservation -- Weed Management;
2. Grassland Conservation -- Management of Forest Encroachment;
3. Riparian and Grassland Rehabilitation - Agricultural Stewardship ;
4. Riparian Conservation -- Sockeye Salmon Recovery;
5. Future Visioning project is to develop planning tools and techniques that support informed land use decision making and the development of an integrated land use plan. Through the use of computer modelling, the project identifies the cumulative impacts of decision;
6. Private Land Stewardship -- Landowner Contact Program

7. Land Securement and Management
8. Cooperative land use planning project between Environment Canada and The Osoyoos Indian Band

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Vancouver Island Highway Project impacts on amphibians and potential mitigation.

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The Vancouver Island Highway Project (VIHP), initiated in 1994, includes 75 km of 4-lane highway between Parksville and Campbell River, plus several new connectors. Route selection largely avoided wetlands; however impacts on amphibians include loss of forest habitat and traffic-caused mortality. Traffic mortality was assessed on Highway 4A, a connector near Qualicum, in order to predict impacts and mitigative needs for VIHP segments that were still in the design stage. Traffic-killed amphibians were counted along a 550 m segment of Highway 4A in 1996, the first year the highway was open to traffic. Mortality of migratory pond-breeding amphibians was anticipated at this site because the highway passes through moist forest habitat that is very suitable for their non-breeding use, and is 300 to 400 m from Hamilton Marsh, a 36 ha breeding site. Counts of traffic-killed amphibians were done every two to four days in spring (early March to early May) but only one to three times per month at other seasons, therefore the annual recorded mortality of 3,663 amphibians is undoubtedly conservative. That total consisted of 89% Rough-skinned Newts, 3% Pacific Treefrogs, <l% Red-legged Frogs, and 7% not identified. Most amphibians were killed before reaching the highway centreline, thus providing an indication of their direction of movement. A two-month experiment with barrier fences which led to two existing drainage culverts resulted in some passage of spring migrants (mostly newts) through the culverts. However, many newts detoured around the ends of the fences and rates of culvert use were low. The existing drainage culverts at this site appear to have relatively poor potential for amphibian passage because they are 200 m apart and because their small (60 cm) diameter limits light penetration into them. Mitigation measures subsequently incorporated elsewhere along the VIHP include additional culverts, usually 1.0 m diameter spaced 50 m apart, at locations where the highway bisects wet forest habitats or drainageways, or is adjacent to wetlands. Limited assessment of culvert use is being done by others. Mitigation measures also included the construction of small wildlife ponds along the right-of-way, which it was expected would be used by local pond-breeding amphibians. In early spring 2000, we sampled five newly constructed stand-alone wildlife ponds and thirteen other constructed aquatic facilities (water quality ponds; engineered wetlands; fisheries ponds/channels) which had been in place for two to five years. Five species of pond-breeding amphibians were detected in the wildlife ponds, one to four species in the other facilities. Evidence for amphibian use included adults trapped while migrating to ponds, adults trapped or observed in ponds, and egg masses in the ponds. The surveys were discontinued in April due to termination of funding. Although early spring wildlife use of those ponds sampled by us was encouraging, data for other seasons is needed before they can be legitimately claimed to provide wildlife compensation benefits for VIHP impacts.

Tiger salamander, *Ambystoma tigrinum*, movements and mortality on the Trans-Canada Highway in southwestern Alberta

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We report on the mid-season movements and mortality of Tiger Salamanders (*Ambystoma tigrinum*) along the Trans-Canada highway in Kananaskis Country, Alberta. The highway was surveyed for road-killed animals between April and November during 1997, 1998, and 1999. Road-killed Tiger Salamanders were collected on one day in 1998 and eight days in 1999. A minimum of 183 Tiger Salamander mortalities were recorded on a 1.05 km section of highway. The mean snout-to-vent length of eight road-killed salamanders was 103.1 cm. Movement was concentrated in one 300 m section of highway, primarily in one direction, and related to heavy rainfall events and warm weather. It was not clear whether movements were pre-breeding or post-breeding or why there was a sudden eruption in movements away from Chilver Lake. We recommend continued study of Tiger Salamander distribution and habitat connectivity in the area to assess the potential impacts of the highway and that proactive measures adopted immediately to reduce further road-related mortality.

Multiple stressor effects in amphibians: herbicide/pH interaction

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Worldwide, amphibian populations are reported to be in a state of decline. Causative factors are incompletely understood. In ecosystems of northeastern North America, multiple stressors of pesticide contamination and acidification may be involved. As an initial component of a multi-tier investigation, the effects of forest-use herbicides Vision® (glyphosate) andRelease® (triclopyr) are being studied using *Xenopus laevis*, *Rana pipiens* and *Rana clamitans*. Two different life stages of amphibians, embryos (blastula stage) and larvae (Gosner stage 25), are being used. Interactive effects of various herbicide concentrations and pH (5.5 and 7.5) are being studied using the organisms exposed in 96hr static renewal tests. The Frog Embryo Teratogenesis Assay - Xenopus (FETAX) protocol is used for the embryo stage for the determination of mortality, malformation and growth data. The larval exposures are being developed and refined to compare sensitivities to the FETAX assay. The larval 96hr static renewal exposure is followed by a 10-day water-only recovery period. Sensitivities are being compared to determine the appropriateness of the exotic amphibian *Xenopus laevis* for toxicity testing. Results on toxicity to date indicate that Vision® is more toxic to all species at pH 7.5 than at pH 5.5. The reverse has been shown for Release®. In addition, the larval stage has consistently been shown to be more sensitive than the blastula stage. Understanding species sensitivities and herbicide/pH interactions will aid in altering forestry herbicide use patterns to minimize effects on amphibians and other non-target organisms.

Amphibian Monitoring in British Columbia

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The BC Amphibian Monitoring Program (BC Frogwatch) was initiated in 1999, when funding was provided by the BC Habitat Conservation Trust Fund. The first year's work focused on development of a website and information materials, and developing a network of interested volunteers province-wide, centring on members of the Federation of BC Naturalists.

In BC, many frog species are silent or call very quietly. The majority of the human population lives in southwestern BC where we have only one "vocal" native amphibian species, the pacific treefrog. For this reason, we are developing a program encompassing all amphibian species (that will later incorporate reptiles as well) and not emphasizing "calling" species. Along with the website and associated printed materials, we have chosen at this time to focus on several areas:

Development of an educational module on amphibians for Project Wild (2000)

Development of an amphibian module for Wetland keepers program (2001)

Development of a map interface, in cooperation with stewardship partners, for stewardship groups and volunteers to determine accurate observation locations, and to map them (this is nearly complete)

Initial media coverage in 2000 generated a large amount of interest from school teachers, environmental educators, parks staff, conservation groups, naturalists and other members of the public, and a database with contact information has been developed. Work on website and printed information material will proceed through the winter, and prior to the 2001 "frog season" all volunteers will be sent a newsletter and instructions for collecting and submitting observations.

Wetland Loss and Connectivity and the conservation of Reptiles and Amphibians in North America

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Virtually all amphibians and most reptiles in North America are wetland-dependent and many live in multiple, often highly ephemeral and extremely local populations that are sustained through occasional migration. Wetland loss in Canada and the United States has been substantial and retention of minimum wetland densities of a diversity of types and hydroperiods within small landscape units (<5 km^2) is fundamental to conserving most species. Spatial

analyses of wetland maps indicate, however, that profound reductions in wetland density and proximity, beyond the thresholds that amphibian and reptile populations can likely bear, are often associated with increasing human populations. From a conservation perspective, the matrix between wetlands is often ignored but is still important, both in terms of buffer habitats around wetlands and the porosity of the landscape between wetlands. For example, recent research indicates that road mortality alone can, in at least one group -- the "land turtles," account for their declines seen over much of the eastern parts of the continent. In sum, to retain reptiles and amphibians in our increasingly human-dominated landscapes, functioning wetland mosaics of adequate density, proximity, and connectivity must be a priority.

The snake fauna of British Columbia - what we know, in general

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Nine species of snakes are known to occur in British Columbia, the second highest provincial total in Canada. Three of these species are essentially transcontinental in distribution or members of transcontinental species complexes. The remainder are confined to the western half of North America, with two more-or-less "coastal." In British Columbia, four species are restricted to the province's dry interior and a fifth is very patchily distributed, mainly on the coast. Only three species range very far north. Two species and one subspecies are red-listed; a further three species and one subspecies are blue-listed. Members of this fauna are ecologically diverse, ranging from moderately large species to the very small, and encompass three taxonomic families. At least five species are the subject of recent or ongoing systematic study and a nomenclatural change is imminent for at least one. Although aspects of the ecology of each species have been studied in British Columbia, the depth of our knowledge varies greatly among species. Garter snakes have been studied most often and at a fairly wide range of localities, but most other species have been studied at only one or two localities and usually only in a few aspects. Lack of fundamental data on natural history and demography thus could hinder management/conservation programs.

The Great Canadian Bio-Blitz

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Since 1997, communities and organizations across Canada have participated in an exciting and innovative event called the Great Canadian Bio-Blitz. The Bio-Blitz is a community- based volunteer initiative linking science, education, conservation, and public participation. The concept of the Bio-Blitz, a one-day effort to engage experts to survey and list as many taxa as possible from a particular site, originated in the fertile mind of Sam Droege, and passed over the internet to the Canadian Biodiversity Institute (CBI), which leavened it with the idea of inviting public participation, and transformed it into the Great Canadian Bio-Blitz. This programme seeks

to establish a June tradition, all across Canada, of recreational all-taxon biotic inventories to complement the December tradition of Christmas Bird Counts. A Bio-Blitz is held in a spot of potential biotic interest where there is shelter from possible rain and toilet facilities. The CBI co-ordinates and promotes the Bio-Blitz at the national level, while community organizations, naturalists clubs, or clusters of friends run the event at the local level. Since the small number of herpetological species makes herpetologists generally over-optimistic about the success of all-taxon inventories, herpetologists are natural organizers or catalysts for these events. Each Bio-Blitz keeps its own species list, and also sends the list to the CBI, which archives the records in a national Bio-Blitz database at the Eastern Ontario Biodiversity Museum.

Status, biology and recovery planning activities for the Oregon spotted frog (*Rana pretiosa*)

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The Oregon spotted frog, *Rana pretiosa*, and the Columbia spotted frog (*Rana luteiventris*) are sibling species identifiable through protein analysis and differentiated since 1997. Previously, they were collectively known as a single species, *Rana pretiosa*. The Oregon spotted frog historically ranged from northeastern California to southwestern British Columbia and likely occupied large emergent wetlands within the Fraser River Lowlands and floodplains of the Fraser River. Currently, only three sites in British Columbia are occupied. In September 1999, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Oregon spotted frog as ‘endangered' in an unprecedented emergency listing. A recovery team for *R. pretiosa* has been assembled and recovery planning activities are underway.

Conservation efforts on the Western rattlesnake and Great Basin gopher snake in the Thompson-Nicola region of British Columbia

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Both the Western rattlesnake (*Crotalus viridis*) and the Great Basin Gopher Snake (*Pituophis catenifer*) are assigned to the Blue List ('vulnerable' or 'sensitive') in British Columbia. Although the distribution of these animals is reasonably well known, information on actual den sites or local key habitats is scant, particularly in the Thompson - Nicola drainage region. Working in this area, we have conducted stratified searches and solicited sighting reports from the public, in order to identify areas where the snakes occur. Search efforts for rattlesnakes in the summer have yielded approximately one snake per 12 hours of search time (even less for gopher snakes), suggesting the animals are not very abundant in the areas searched, but we lack good comparative data from elsewhere. A sub-sample of free-ranging animals have been outfitted with transmitters in order to find their hibernacula, some of which have been surprisingly close

to human developments (although these populations seem quite small).

The proximate response of terrestrial salamanders to forest harvesting and the efficacy of buffer strips

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Forest harvesting reduces the abundance of terrestrial salamanders although the mechanism(s) of the response is unknown. To better understand the proximate response of four salamanders to forest harvesting and to determine if riparian buffers are effective in mitigating harvesting effects, amphibians were sampled at increasing distance from streams before and after harvesting in southwestern British Columbia. Three treatments were replicated twice: control, 30 m buffer and clearcut. The response of salamander species was variable. The relative abundance of aquatic-breeding salamanders (*Ambystoma gracile* and *Taricha granulosa*) remained unchanged one year post-harvest in the buffer and clearcut treatments indicating harvesting did not immediately impact their numbers. For the terrestrial-breeding salamanders, the relative abundance of *Ensatina eschscholtzii* decreased on the buffer and clearcut sites while the relative abundance of *Plethodon vehiculum* increased. Changes in abundance could reflect a response in abundance or alterations to their movement patterns that affect their capture probability. The growth rate of *Ambystoma gracile*, *Ensatina eschscholtzii*, and *Plethodon vehiculum* recaptured in clearcuts was lower than those individuals recaptured in forested habitat, which suggests there was some energetic cost for individuals located in clearcut habitat. The proportion of captures within 30 m increased in the buffer treatment after harvesting for three of the four species, as did parallel movement for aquatic-breeding salamanders. These results suggest that riparian buffers are beneficial because they serve the dual purpose of migration corridors for aquatic breeders and areas of refuge for terrestrial breeders following upslope forest removal.

The BC Wildlife Federation's wetland education projects

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The BC Wildlife Federation's newly conglomerated Wetland Education Program is a capacity development program whose goal is to raise public awareness of wetland values. It involves three main components: Wetlandkeepers, the Wetlands Institute and the Wetlandkeepers Handbook. Wetlandkeepers is a two and a half day college credit course, based out of Langara College, that aims to train interested individuals in wetland survey and study techniques while promoting the coordination of stewardship activities across the province. The Wetlands Institute is an expansion of Wetlandkeepers. A six-day annual course credited by Simon Fraser University, the Wetlands Institute builds on Wetlandkeepers by focusing on specific community projects that students bring to the Institute. The Wetlandkeepers handbook is the 'curriculum' of the Wetlandkeepers course; it includes sections on wetland ecology, surveying and sampling

techniques, landowner and legal issues, and several proposed activities. The BC Wildlife Federation is currently planning on adding a module on amphibian ecology to the Handbook.

A gate to protect a population of Coeur d'Alene Salamanders (*Plethodon idahoensis*) in southeastern British Columbia

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The Kuskonook adit is a man-made, cave-like shaft, which penetrates granite rock on the east shore of Kootenay Lake. It provides habitat for Coeur d'Alene Salamanders (Red-listed in B.C.) as well as other species, including the Blue-listed Townsend's Big-eared bat (*Corynorhinus townsendii*) and Pacific treefrogs (*Hyla regilla*). In winter dense clusters of harvestmen (*Leiobunum passleri*)use the adit as a hibernaculum. In 1996, debris, old oil cans and lead batteries were discovered on the floor of the adit. Unrestricted human access also created the potential for trampling of Coeur d'Alene Salamanders. The need for a barrier across the entrance of the Kuskonook adit was first recognized by Stan Orchard in 1991. In 1997, the Habitat Conservation Trust Fund funded a cleanup of the adit, followed by design and construction of a gate. Installed on December 4, 1999, this gate is made of 4"x 4"x 3/8" angle iron, a 1" x 6" base plate and ¾" x 6" steel. The design was developed in consultation with Bat Conservation International, so that movements of the bats were not impeded and microhabitat conditions unaltered. A lockable door allows researchers to enter the adit. The total cost of construction was less than $2,800 and included fabrication, installation and materials. This gate's completion represents the first time in British Columbia that such a barrier has been constructed for the protection of an amphibian.

Patterns of forest harvesting and the protection of amphibian habitat in the western boreal forest

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The practice of leaving uncut merchantable trees following harvesting is a form of habitat conservation well-established in North American forestry; in particular, the creation of buffer strips, along lakes and streams, is widespread. The efficacy of buffer strips in protecting the aquatic and terrestrial habitats required by amphibians is poorly documented. For the past 5 years, we have investigated the use by amphibians of riparian and adjacent upland forest at harvested and unharvested sites in the boreal mixedwood of northern Alberta. Part of this work was connected with the TROLS (Terrestrial & Riparian Organisms, Lakes & Streams) project, a large-scale manipulation of buffer-strip width around 12 lakes. We found the boreal amphibian assemblage of 4 anuran species to be quite resilient and versatile in its use of disturbed and undisturbed forest habitats, and of different types of waterbodies. Varying buffer-strip width from 20 to 200 m did not have a detectable effect on amphibian numbers. We propose that a site-

specific approach, incorporating the hydrology of forested landscapes, rather than simple prescriptive measures, provides a more effective means of generating harvesting plans that protect high quality habitat for amphibians and other wildlife.

The tiger salamander (*Ambystoma tigrinum melanostictum*) in BC: an amphibian in an endangered desert environment.

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The tiger salamander is red-listed in British Columbia and found in a limited range in the south Okanagan where it is subject to large-scale habitat alienation. We studied larval growth rates, juvenile recruitment, movements of breeding adults, and terrestrial habitat use by adults during the summer in 6 ponds, close to and including White Lake. Ponds varied in the rate of larval growth, size at metamorphosis and timing, and number of new recruits. The two most productive ponds (both alkaline) were shallow and prone to drying before completion of larval development, resulting in variable productivity from year to year. Through the summer months adult tiger salamanders did not move > 300 m (and most much less) from the pond of capture. In this arid sagebrush-grassland environment they did not select dense cover or mesic sites, and resided in small mammal burrows about 15-50 cm below the ground. Annual variation in the duration of standing water will show high degrees of spatial autocorrelation and may result in high variation in regional recruitment rates and population sizes. Smaller (<1 ha), but deeper ponds may hold water long enough to support larval development in years when the shallower, but larger ponds go dry, and be important safe sites for this metapopulation. Ponds may also go through cycles associated with drying and wetting that affects the productivity of some of the alkaline ponds.

Beyond the pond: terrestrial and landscape ecology of aquatic-breeding amphibians

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Much of our knowledge of amphibian ecology stops at the water's edge, giving us a rather limited understanding of the requirements of species that spend extended periods of time on land during the non-breeding season and/or as juveniles. The terrestrial ecology of species like spotted salamanders, wood frogs, and eastern newts is attracting increasing attention from researchers. One reason is that the quantity and quality of certain terrestrial habitats (e.g., mature forest) may become limiting factors for populations of pond-breeding amphibians in landscapes increasingly fragmented by forest management practices, agriculture, roads and other human activities. Knowledge of upland movement patterns, especially dispersal, is critical for the design of effective management strategies, which may call for buffer zones around breeding sites or corridors to facilitate movement between local populations. Such information is also essential for understanding the potential role of metapopulation dynamics in the long-term,

regional persistence of amphibians, because dispersal is the means by which declining local populations may be rescued or recolonized following extinction. Although some general principles for management of aquatic-breeding amphibians exist, it is also clear that conservation plans must account for the varied life history requirements, dispersal abilities, and behaviors of different species. Results and conservation implications of current research on a variety of species will be highlighted in the discussion of these topics.

The effect of lindane on tadpole growth and development: an outdoor microcosm study

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Recent reports of amphibian declines and the high incidence of deformities in some amphibian populations have concerned researchers around the world. Higher prevalences of hind-limb deformities have been reported in metamorphosing individuals from pesticide- exposed sites compared to control sites. Lindane, an organochlorine compound, is a component of a seed treatment for canola. A recent investigation found lindane concentrations as high as 0.4 µg/L, with a median of 0.003 µg/L, in Saskatchewan prairie ponds. A microcosm study was designed to test the chronic effect of low levels of lindane on wood frog tadpoles. Three concentrations of lindane (0.1, 1.0 and 10 µg/L), a solvent control (0.01% ethanol) and an untreated control were tested. Survival, time to metamorphosis, size at metamorphosis, and corticosterone and thyroid hormone concentrations were measured in froglets at the stage of forelimb emergence. Size at metamorphosis and water quality parameters such as conductivity, pH, alkalinity, hardness and ammonia and nitrate/nitrite concentrations were compared between microcosm and pond habitats to evaluate the ability of the microcosms to mimic tadpole-rearing habitat.

Risk assessment for conservation under ecological uncertainty: a case study using tailed frogs in B.C.

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The tailed frog (*Ascaphus truei*), classed as vulnerable (blue-listed) in British Columbia, is a habitat specialist that depends on small, montane streams and their associated riparian zones. Unfortunately, we know little about their demographic responses to habitat change. I investigated potential effects of habitat degradation due to forestry practices on local and watershed scale populations of this species using both field data and simulation models. At the local scale (i.e. within small tributaries),

I found that populations were sensitive to (in decreasing order) assumptions about growth rates, tadpole and adult survival, and fecundity. At a watershed scale, risks to populations from disturbances and effects of forest harvesting depend strongly on assumptions about the age at

first reproduction. Incremental effects of forest harvesting on risks of loss of local populations were generally small. My results imply that clinal, elevational, and local factors determining habitat productivity (e.g., growing season length, reduced light penetration in mid-seral forests), are dominant factors mediating how local fluctuations in demographic rates (e.g., annual survival; fecundity) due to harvesting practices and natural variation determine risks of loss of small populations of this species. However, uncertainties about the impacts of harvesting, forest succession, and stochastic environmental variation upon demographic rates render evaluation of alternative riparian protection systems difficult with present knowledge.

Status of the northern leopard frog in the Creston Valley Wildlife Management Area, British Columbia

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The Northern Leopard Frog (*Rana pipiens*) has undergone a drastic decline in British Columbia, with only one known population remaining. The Columbia Basin Fish and Wildlife Compensation Program began sponsoring an inventory of this population in 1996; this particular study covers from spring 1997 to the end of 1999. We monitored population size and breeding success and tracked habitat use through nocturnal calling surveys, diurnal visual surveys, road surveys, and radiotelemetry. The Northern Leopard Frogs were found in only one 460 ha compartment of the management area, and only two sites within this compartment were used for breeding. Habitat used in fall and winter was different from habitat used for breeding, and overwintering sites were generally less than 1 kilometre from spring and summer locations.