FOREST SCIENCE PROGRAM

Project Number: LOI Amphibians r Y08-3027

Final Technical Report 2007/2008

Amphibians as Indicators of Wetland Habitat Conservation under Variable Retention Harvesting

Report Prepared for:

Bill Beese
Western Forest Products Inc.
118-1334 Island Highway
Campbell River, BC V9W 8C9

By:

Elke Wind
E. Wind Consulting
Suite A – 114 Fifth Street
Nanaimo, BC V9R 1N2

March 2008

ABSTRACT

This project built on an existing long-term study investigating the effects of forest harvesting on small wetlands habitats and associated aquatic-breeding amphibian populations. In 2003, we initiated a pre- and post-harvest experiment at three study sites with 70+ small wetland habitats less than 1 ha in size in the Nanaimo River Watershed to investigate the effects of forest harvesting on the hydroperiod and presence of breeding amphibians. Pacific Treefrogs, Red-legged Frogs, and Long-toed Salamanders occurred in numerous wetlands within the three study sites, including many relatively small wetlands (e.g., 0.003 ha). Results to date suggest that: 1) there are species-specific habitat requirements that affect where amphibians breed (e.g., Red-legged Frogs breed in only a few small wetlands); 2) amphibians continue to reproduce in wetlands within cutover areas initially after harvesting; and 3) at least two of the species appeared to exploit previously unoccupied wetlands due to changes in the habitat characteristics (e.g., decreased canopy cover). The survival of young in cutblocks is a concern (e.g., sink habitats). However, our results to date indicate that in-pond conditions may not be limiting as the small wetlands experienced longer hydroperiods initially after harvest due to a combination of increased water depths and slower drying rates.

In addition to the findings of our research, we recognized a number of management issues in relation to small wetlands in landscapes managed for timber production that related to mapping and site-level operations (e.g., infilling, location of roads). The ability to effectively manage these small wetlands lies in the hands of the individuals that walk proposed blocks (e.g., engineers), as most wetlands less than 1 ha in size cannot be identified from air photos. However, we also observed that variable retention harvesting methods often anchored retention patches over small wetlands, usually the largest of these small wetlands, inadvertently providing a riparian buffer. Even small amounts of riparian retention appeared to help protect the quality of the in-pond environment. From these observations, we determined that there was information that could be provided to forestry field personnel that could help them allocate potentially limited retention resources in the most beneficial way for amphibians (e.g., beyond wetland size).

Based on our observations and research results to date, the question we had with respect to this FIA/FSP study was: *What factors influence where pond-breeding amphibian species reproduce and can this information be packaged in such a way so that forestry field personnel working on proposed blocks can identify and prioritize ponds for retention*? The purpose of this study was to create a user-friendly wetland assessment card for forestry field personnel that could be used to help them identify and assess potential amphibian breeding ponds that should be considered for retention. This was accomplished by utilizing the existing pre-harvest data set from the long-term monitoring sites located in the Nanaimo River watershed. Habitat analyses indicated that wetland size, canopy cover, and in-pond vegetation were important factors influencing amphibian breeding pond selection. The field card was field tested by E. Wind and volunteer foresters and technicians in 2007 to ensure that it was user-friendly and effective before a final version was produced. Field testing consisted of a comparison of results from amphibian breeding surveys to those from assessments from foresters using the field card only. Approximately 50% of wetlands with confirmed breeding had similar ratings between the amphibian surveys and the field card assessments. However, over 70% of wetlands matched or had an upward versus downward ranking between the two assessment methods, and 71% of Red-legged Frog wetlands matched field card assessments and were ranked as having a high probability of breeding (i.e., should receive retention). Based on the assessment results and recommendations made by the volunteer foresters via a field card evaluation form, a new, final version of the field card was produced, extensively promoted, and distributed to foresters on the south coast in 2008.

ACKNOWLEDGEMENTS

This study was funded under the Forest Investment Account Forest Science Program. Bill Beese was instrumental in supporting and facilitating this study. Island Timberlands, Western Forest Products, and BC Timber Sales allowed access to sites in 2007, and provided volunteers. Many thanks to the field card assessment volunteers: Steve Stupich, Russell Brewer, Robert Thomas, Wayne Brown, Tony Norris, Kevin Telfer, Kathryn Willis, Shannon Irvine, Ken Dodd, and Paul Kutz. Lastly, thanks to John Deal, Sue McDonald, and Bill Beese for providing input into the final version of the field card and to Jeff Hoyt at the Ministry of Environment for his recommendations and 'stamp of approval'.

Table of Contents

List of Figures and Tables

1.0 INTRODUCTION

The majority of amphibian species within British Columbia are aquatic breeding, utilizing a variety of lentic water bodies including small wetlands and ponds that dry regularly (e.g., seasonal or semi-permanent). These latter habitats contain conditions conducive to improved larval development and overall fitness such as reduced predation and increased water temperatures (Alford 1999, Ultsch et al. 1999). However, under natural climatic conditions these habitats are unpredictable and larval survival rates fluctuate extensively from year to year. The success of aquatic-breeding amphibian populations is dependent upon the interactions that exist among ponds with various hydroperiods across the landscape (e.g., migrations between ponds). This 'boom or bust' life cycle is a natural strategy that helps maintain healthy amphibian populations.

Small wetland habitats are numerically abundant across the landscape (e.g., see Wind 2003), and play an important role in maintaining connectivity among populations of wetland biota such as amphibians (Gibbs 2000). Species dependent upon moist environments use depressions, seeps, and small wetlands and streams as stepping stones to facilitate their movements throughout the landscape. Models from eastern North America suggest that all wetlands greater than 0.4 ha in size need protection in order to retain minimum wetland densities required to sustain wetland fauna such as amphibians which are dependent upon these habitats for breeding, cover, foraging, and hydration (Gibbs 2000). However, wetland legislation in North America is based on areal extent even though studies have not shown a relationship between wetland size and amphibian species richness (Snodgrass et al. 2000). For example, in British Columbia isolated wetlands less 0.50 ha are not afforded riparian protection under the *Forest and Range Practices Act* (BC Ministry of Forests and Range 2004). However, proposed changes to the Act may require forestry companies working on crown land to maintain and protect see small wetlands associated with species at risk (i.e., defined as a Wildlife Habitat Feature; Ministry of Environment 2007).

The greatest concern associated with forest harvesting and small wetland habitats is that they may act as population sinks for amphibian species. Amphibians may be attracted to breeding in ponds in newly harvested blocks due to increased solar radiation and the potential for greater productivity. However, one of the greatest factors that affects in-pond amphibian survival rates is hydroperiod. This variable is highly dynamic, greatly influenced by local climatic conditions, and it may be affected by the loss of forest cover. Larvae and/or newly metamorphosed juveniles emerging from ponds during the hottest, driest time of the year may also be negatively affected by forest harvesting, resulting in reduced overall abundance. In this way, riparian buffers may serve to protect characteristics of the in-pond environment and provide cover for newly emerged metamorphs. Concern for small vernal pools has increased in the United States, especially in the east (e.g., see Lawrence et al. 1998), but has lagged behind in most western states and provinces (except California). To my knowledge, no studies have investigated the role or importance of small wetlands, or the effects of timber harvesting on these habitats, in the Pacific Northwest.

Variable retention harvesting methods often anchor forest patches over small wetlands, effectively creating a riparian buffer. However, riparian buffers may not be required or logistically possible around all small ponds and their use should be allocated according to the habitat requirements of amphibian populations to optimize their conservation value. Forestry field personnel require information that can help them make decisions regarding where to allocate retention within a proposed block to maximize the protection of small wetland habitats. In order to fill this gap, we have developed and tested a small wetland assessment field card that will help forest technicians identify priority ponds for retention based on the probability that they contain breeding amphibians, so that these sites can receive retention where options exist.

1.1 Project Objectives

The main objectives of this FIA/FSP project were to identify characteristics of small wetlands used by breeding amphibians and package that information into a user-friendly field card for forestry workers when assessing the location of retention patches in proposed cutblocks to maximize amphibian and wetland conservation. The first draft of the card was completed in 2006/2007.

The objectives for 2007/2008 were to:

- conduct field testing of the small wetland and amphibian assessment field card
- complete the final version of the card based on the results of field testing and the evaluation form
- promote, print, and distribute the card among south coast WFP divisions, other forestry companies, government agencies, consultants, etc.

2.0 METHODS

2.1 Study Sites and Project Scope

The long-term monitoring sites where the majority of the field card data was collected in 2004 and 2005 are located on Island Timberlands private land in the Nanaimo River watershed. The three main study sites are Rheinhart, Bear Creek, and Dunsmuir (Table 1). Because amphibians utilize wet areas for numerous life history requirements, all wetland areas less than 1 ha in size were included in this study, regardless of size, depth, hydroperiod, or amphibian presence. Some of the wetlands can be classifiable according to the "Wetlands of British Columbia" field guide as marshes, bogs, or fens (MacKenzie and Moran 2004), but the majority of the small, unvegetated wetlands are considered unclassified. Wetlands were identified by the presence of indicator vegetative species associated with wet/saturated soils and by a lack of vegetation (e.g., mud depressions)—the Riparian Areas section of the *Forest and Range Practices Act* (FRPA) regulations (BC Ministry of Forests and Range 2004) defines a wetland as:

> *"…a swamp, marsh, bog, or other similar area that supports natural vegetation, that is distinct from adjacent upland areas"*

Table 1. Description of field sites where baseline information was collected on amphibians and small wetlands in 2004 and 2005 that was used to develop the wetland assessment field card.

Site	Unit # (map)	Block	BEC Zone/Var.	Forest Patch Size (ha)	Stand Age	Elev.	Total # of Ponds	Harvest Date
Rheinhart	310327 (92F010)	5507	CWHxm2	14.6	320	320	23	Fall 2005 (roads installed fall 2004)
Bear Creek	310267 (92F010)	4512	CWHxm1/ xm2	21.9	85-88	340	26	Fall 2005 (roads installed fall 2004)
Dunsmuir	310387 (92F010)	4513	CWHxm1	8.5	343	370	22	Fall 2004

In winter 2007, foresters at various Western Forest Products (WFP) divisions and forestry companies on eastern Vancouver Island, Port Alberni, Campbell River, and on the Sunshine Coast were asked to identify potential wetland field card test sites, which consisted of proposed blocks below 500 m elevation that contained numerous small ponds < 1 ha in size. Three field sites used as part of an amphibian study from 2000-03 near Nanaimo River and Nanoose on Island

Timberlands' private land were selected as test sites, as were two BC Timber Sales sites near Cassidy and Powell River identified during other amphibian-related work, and a WFP block south of Powell River. No appropriate sites could be found near Port Alberni or Campbell River. In total, 6 sites and 35 wetlands were used for field-testing the card (Table 2).

Table 2. Wetland assessment field card test sites used in 2007

Company / Agency (Location)	Op. / Block #	BEC Var.	Proposed Block Size (ha)	Stand Age (yrs)	Elev.	# of Small Wtlds	Forestry Personnel (Testers)
IT (Nanoose)	294132 (R905OGE)	CDF mm1	27.8	99	180	7	W. Brown, T. Norris
IT (Nanaimo River)	94266 (T-Line)	CWH mm2	23.2	OG area = 450 2nd growth = 55	710	7	S. Stupich, K. Dodd[a] (and 1 summer staff / student)
IT (Nanaimo River)	101341 (J3A)	CDF-CWH	22	200-450	350	8	S. Stupich (and 1summer staff / student)
BCTS (Cassidy)	0101	CWH xm01	11.3	60	300	7	R. Thomas (1 student / summer staff, and K. Telfer - MOE)
BCTS (Powell River)	WL-937	CWH dm	37	80-100	225	5	R. Brewer, Paul Kutz[b]
WFP (Powell River)	ST324	CWH dm	28	61-80	250	1	R. Brewer, Paul Kutz[b]

[a] K. Dodd completed an assessment of this site but it was not submitted and could not be included in the final analyses.
[b] Due to logistical constraints, P. Kutz could not assess his assigned sites.

BC has highly variable environments related to maritime and elevational gradients. The geographic extent to which this wetland assessment field card is most applicable are areas with similar climatic conditions and amphibian species as the main baseline study sites in the Nanaimo River Watershed (CWHxm, 300-400 m; e.g., the Georgia Basin—southeastern Vancouver Island, the Sunshine Coast, and the Lower Mainland). The effectiveness of the card outside of this area is unclear.

2.2 Development of a Wetland Assessment Field Card

To the best of my knowledge, the data we have collected on small wetlands from the three Nanaimo Lakes study sites from 2004 to the present is the most extensive data set in relation to effects of forest harvesting on small wetland habitats and amphibians in coastal British Columbia, and likely in the Northwest. This data includes bi-monthly species occurrence data during the egg and larval stages, maximum water depth measurements until pond drying or early Sept. (whichever came first), and habitat characteristics of the ponds such as canopy cover, percent cover of in-pond vegetation, percent shallow water (< 50 cm), etc. recorded before and after harvesting (see Wind 2005 to 2007b).

Exploratory analyses were conducted on pre-harvest wetland and amphibian data in 2006/2007 to identify variables that differ between amphibian/breeding-occupied versus no-detection ponds (see Wind 2007a). This data, as well as information on local aquatic-breeding species (i.e., Pacific Treefrogs, Red-legged Frogs, and Long-toed Salamanders) from other parts of Vancouver Island

and throughout the species' range within the Pacific Northwest were used to develop the Wetland Field Assessment Card for forestry workers.

2.3 Field Testing

2.3.1 Amphibian Surveys

Amphibian breeding occurrence was recorded at the 35 ponds in the 6 wetland-assessment test sites in early spring and mid summer. During each visit, as much of the wetland area as possible was visually surveyed for eggs and larva. Breeding occupancy was recorded based on observations of eggs or larva for each species and wetland. Habitat information was also collected at each wetland, including overhead canopy cover, percent cover of in-pond vegetation in broad categories (trees, shrubs, herbs, moss, graminoids), downed wood, open water, and shallow water (< 50 cm), approximate length of the wetland, average width, and maximum water depth at the time of the survey.

Upon completion of all amphibian surveys, each wetland was categorized as low, medium, or high priority for retention based on confirmed amphibian breeding—low = no breeding detected, medium = at least one species observed breeding, high = Red-legged Frog breeding confirmed.

2.3.2 Volunteer Forester Wetland Assessment Field Card Testing

The supervisors of various divisions / offices of Western Forest Products, Island Timberlands, and Timberwest were contacted in Nanaimo, Campbell River, Port Alberni, and the Sunshine Coast to gain their support for the study and to ask for a list of volunteers that could be approached for the assessment. Due to logistical constraints, some areas and volunteers could not be included in the assessment. However, during work on other projects I was able to find new sites and volunteers (e.g., BCTS sites and staff). In total, 7 full-time, volunteer forestry workers were recruited from Island Timberlands (4), BC Timber Sales (2), and Western Forest Products (1) to assess at least one site each during spring and summer 2007 (see Table 2); the results from 5 of the 7 full-time staff were included in the analyses. In addition, a Ministry of Environment Biologist and two forestry summer staff / students also used the card and assessed its utility while on site with the foresters.

Before the assessments were scheduled to begin in spring 2007, I met with each volunteer forester and gave them a package that contained the following information (see Appendix A for example sheets):

- Objectives and instructions for conducting the wetland evaluation
- Wetland assessment results form (with the site and pond numbers filled in for each individual)
- Field card evaluation form
- Site and pond location information (e.g., access roads, GPS coordinates)
- Small Wetland and Amphibian Assessment Field card

During these instructional meetings, we went through each form to make sure that everybody understood the objectives of the project and what the assessment entailed. Specific instructions were emphasized that could bias the results, such as discussing the results with others assessing the same wetlands before the evaluations had been completed, looking for amphibians during the assessment, conducting the assessment at the appropriate time of year (i.e., randomly assigned to each person), and ensuring assessments were conducted at the correct wetland (each was distinctly ribboned and clearly labeled). Spare, blank forms were also left at each office in case they were needed (e.g., if their information package was lost, they found new wetlands[1], or they

[1] I asked each forester to watch for additional sites with small wetlands that could be included in the evaluation, but none were brought forward.

invited others to evaluate existing sites). Volunteers were asked to submit their results to me via: a blank Word template form, original hand-written form scanned and emailed or mailed to me, or picked up at their office.

2.3.3 Assessment of Field Card Effectiveness

The results from the forester's assessments were compared to the data collected on amphibian occupancy to determine the effectiveness of the field card at identifying ponds with a medium to high probability of having amphibian breeding (priority ponds for retention). An effective field card was predetermined to be one that would see:

- all high priority ponds receive retention by all volunteers
- at least 75% of medium ponds receive retention
- low variability among assessments per pond (i.e., rated similarly among volunteers), and
- a conservative error trend, where a higher probability of retention was assessed versus lower (i.e., a trend for low ponds to be assessed as medium and medium as high, but not vice versa)

In addition to the wetland assessments, all volunteers were asked to fill out an evaluation form regarding the field card itself that focused on ease of use, likelihood of using the card in the future to assess retention priorities, and other related issues (see Appendix A).

After field testing, changes were made to the field card and a final version was made available to forestry workers throughout the Georgia Basin (eastern Vancouver Island and the Sunshine Coast) via various extension and promotion activities (see below). The card is considered a work in progress and should be adapted in the future based on its continued use and effectiveness, and any changes to wetland or forest management practices (e.g., proposed FRPA Wildlife Habitat Features).

2.4 Extension and Promotion

Potential venues for promotion and extension were investigated that would provide access to the greatest number of applicable field card users (e.g., working in south coastal areas), such as foresters, government personnel, consultants, etc. Forestry, resource management, and biological meetings being held in late winter 2008 were the primary target based on the timing of completion of the analyses and field card.

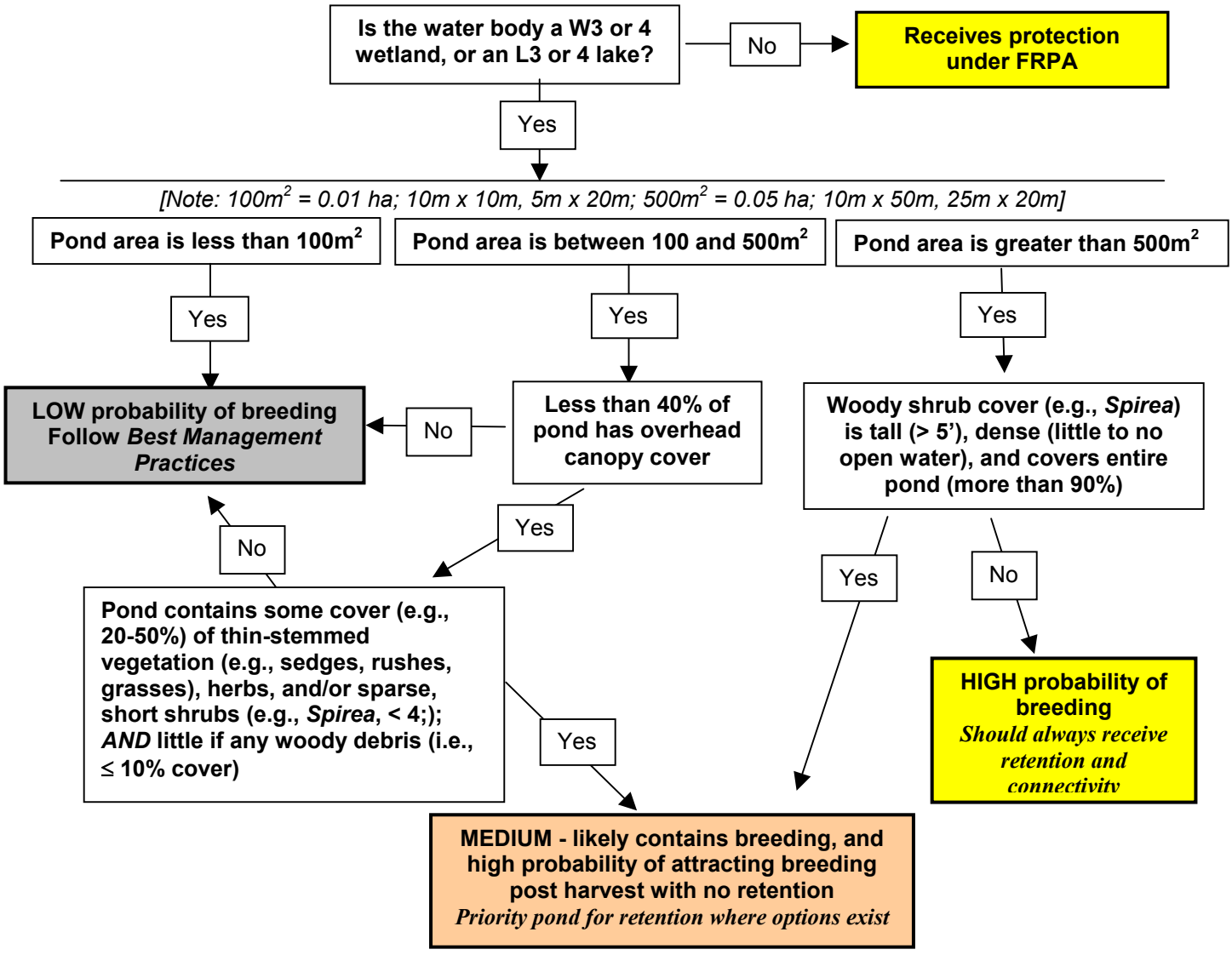
Future promotion includes Western Forest Product's Coast Forest Strategy website, maintained in conjunction with the UBC Centre for Applied Conservation Research (*www.forestry.ubc.ca/conservation/forest_strategy/*), and publication in:

- Western Forest Products' Technical Project Summary Series brochure
- Publication in peer-reviewed journals (e.g., Forestry Chronicle, Forest Ecology and Management, Wetlands, Herpetologica, Northwestern Naturalist)

3.0 RESULTS

3.1 Draft Wetland Field Card Used in Field Testing

The variables identified as being important for distinguishing small wetlands with and without breeding, based on evaluations conducted in 2006/2007, were wetland size, canopy cover and in-pond vegetation and woody debris (see Wind 2007b). Various designs were considered for packaging this information into the wetland field card. The design that was selected for the first draft (i.e., used during testing) was based on striking a balance between effective variable selection and not making the assessment task onerous or unrealistic for forestry workers (e.g., how the variables are measured and when, keeping the skill set and knowledge base of the workers in mind). The design of the card was done in such a way as to allow individuals to rapidly, visually assess each wetland as having a low, medium, or high probability that it is used for breeding by amphibians (Fig. 1; see Wind 2007b).



a) Front of field card

SUMMARY OF *BEST MANAGEMENT PRACTICES* FOR
SMALL WETLAND HABITATS AND AQUATIC-BREEDING AMPHIBIANS

1. **Protect as many ponds as possible with windfirm riparian buffers**.
2. **If there are many small ponds within a block, and retention cannot be retained around all ponds, prioritize retention by using the field card. Additional factors to consider while using the field card include:**
    a. *hydroperiod* – breeding most likely in ponds with standing water present until at least the end of June
    b. *flow rates* - amphibians are less likely to breed in flowing water
    c. fishless sites are high priority
    d. where retention is limited *consider less extensive or partial buffers* (e.g., southwest side only)
    e. protect clusters of ponds
3. **Create linkages between ponds, and between ponds and surrounding patches of continuous forest, if possible**.
4. **Keep roads and machinery back** - have *all wet areas clearly marked on maps* and ribbon <u>all</u> wet areas; one colour for retention and another for *machine-free zones*.
5. **Keep all limbs and tops out of ponds, and avoid yarding through ponds and riparian areas.**
6. **Avoid infilling or (re)plant ponds (e.g., with cedar)**
7. **Do not spray herbicides or other chemicals over or near ponds** - especially during the spring breeding season or mid summer (fall is the best time)

Limitations on Use:
This card is based on data collected on wetland habitats and amphibian species located between 320-370 m on the southeast side of Vancouver Island. As such, it is most applicable to south coastal systems and species only. Habitat relationships and effects of forest harvesting outside of this area require additional research.
2007 FIELD TEST RESULTS WILL HELP ESTABLISH WHETHER THERE ARE SUCH LIMITATIONS

b) Back of field card

Figure 1. Front and back of original draft Small Wetland and Amphibian Assessment Field Card used for field testing in 2007.

3.2 Draft Wetland Field Card Assessment Results

3.2.1 Amphibian Breeding

Four amphibian species were confirmed breeding in 19 of the 35 wetlands at the 6 sites used for the evaluation in 2007 (Table 3). Long-toed Salamanders were the most common amphibian observed breeding at the test sites—eggs and/or larva were observed at 15 wetlands of the 35 wetlands, across 5 of the 6 test sites. Northwestern Salamander eggs and/or larvae were observed at 3 wetlands at 2 sites, both of which had at least one permanent wetland (T-Line and J3A); Northwestern Salamander larvae take more than one year to metamorphose so they are associated with permanent water bodies[2]. Rough-skinned Newt adults were observed at 9 wetlands across 3 sites, but no eggs or larva were observed. In contrast to salamanders, both Red-legged Frog and Pacific Treefrog eggs and/or tadpoles were observed at 4 wetlands in 3 sites. Adult Red-legged Frogs were observed at 10 wetlands across 3 sites, one site of which did not have any breeding observed in any of the test wetlands (R905OGE).

Half of the wetlands estimated to be smaller than 100 m^2 in size (which would automatically lead to a "low" probability ranking based on the field card) had confirmed breeding, and many wetlands larger than 500 m^2 (which would automatically lead to a "medium" or "high" probability ranking based on the field card) did not have breeding observed (Table 4). However, the only species confirmed breeding in wetlands smaller than 100 m^2 was the Long-toed Salamander, which was the most common species in both the smallest and mid-range wetland size classes (50% of wetlands in both). All of the four amphibian species were confirmed in 14% of wetlands larger than 500 m^2 (i.e., each was observed in only 1 of the 7 largest wetlands).

For all species, the largest proportion of confirmed breeding wetlands were within the mid-range size class. For example, three of the four wetlands where Red-legged Frogs were observed were in the mid-range size class (Fig. 2).

Wetlands and sites with relatively high species richness were #0101 at Mackay Lake near Cassidy, #2754 at J3A in Nanaimo Lakes, and #2539 at T-Line also in Nanaimo Lakes. All of these wetlands had at least three amphibian species breeding in a single wetland including Red-legged Frogs—wherever Red-legged Frogs were observed breeding, at least one other amphibian species was also confirmed breeding. All 7 wetlands at R905OGE in Nanoose had Long-toed Salamander breeding.

Based on two surveys for breeding amphibians, 16 of the 35 wetlands were classed as low (had no breeding observed), 15 were classed as medium (had at least 1 breeding amphibian), and 4 were high (contained breeding Red-legged Frogs and more than 2 breeding amphibian species).

[2] No permanent wetlands were present at the three Nanaimo Lakes watershed baseline study sites.

Table 3. Amphibian species and life stages confirmed at wetland field card test sites surveyed in 2007.

Oper.#	Wtld #	Northwestern Salamander	Long-toed Salamander	Rough-skinned Newt	Red-legged Frog		Pacific Treefrog	
		Egg or Larva	**Egg or Larva**	Adult	Adult	**Egg or Tadpole**	Adult	**Egg or Tadpole**
ST324	A		**1**					
WL-937	A							
	B							
	C		**1**					
	D							
	E							
R905 OGE	10A		**1**	1				
	10B		**1**	1	1			
	11		**1**	1	1		1	
	14		**1**					
	15		**1**	1	1			
	16		**1**		1			
	8		**1**	1				
T-Line	2522							
	2529							
	2531							
	2534	**1**						
	2539	**1**				**1**		**1**
	2529A							
	2539A							
J3A	A	**1**		1				
	B				1			
	C		**1**	1		**1**		**1**
	D							
	E							
	F							
	G			1	1			**1**
	H						1	
0101	1			1			1	
	2A		**1**					
	2B		**1**			**1**		
	3		**1**		1			
	4A				1			
	4B		**1**		1		1	
	5		**1**		1	**1**		**1**

Table 4. Percentage of wetlands per size class where breeding was confirmed per species.

Wetland Size Class (m^2)	**Number of wetlands**	**Northwestern Salamander**	**Long-toed Salamander**	**Red-legged Frog**	**Pacific Treefrog**
< 100	6	0.0%	50.0%	0.0%	0.0%
100-500	22	9.1%	50.0%	13.6%	13.6%
> 500	7	14.3%	14.3%	14.3%	14.3%

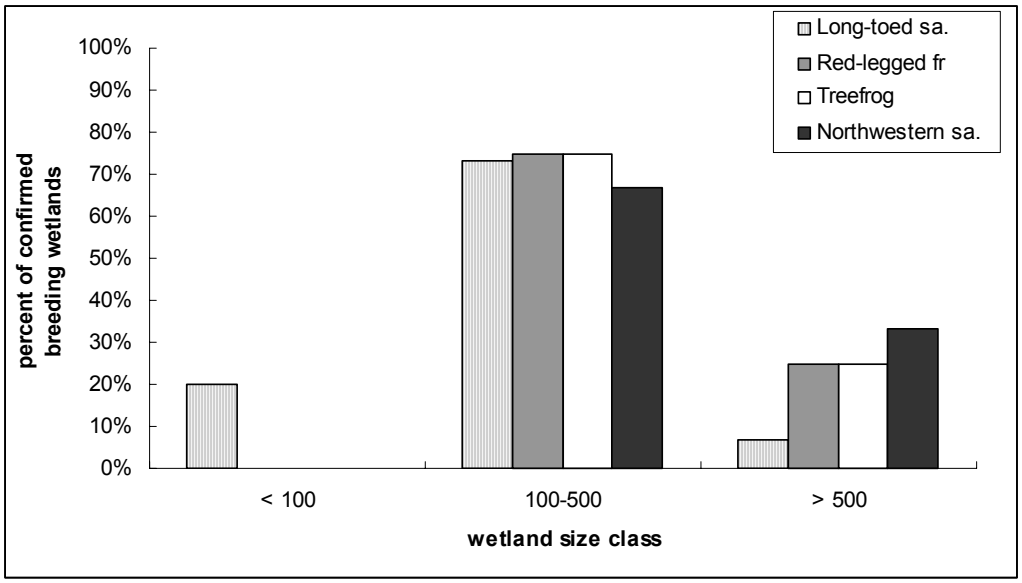


Figure 2. For wetlands with confirmed breeding per species, percentage that fell within each size class in 2007 test sites.

3.2.2 Site Assessments by Foresters

In total, all 6 sites and 35 wetlands were included in the final assessment results, but multiple assessments per wetland were not always conducted or available (e.g., one volunteer could not complete his evaluations on the Sunshine Coast, and the results of one site assessment for T-Line were misplaced).

Overall, of the 35 wetlands ranked using the field card, 25 was ranked as low, 21 as medium, and 11 as high (Table 5); 2 were ranked as low-medium and 1 as medium-high.

For the 22 wetlands that had more than one assessment conducted, 14 (64%) had at least two similar rankings (i.e., foresters ranked them as the having the same probability of breeding).

3.2.3 Comparison between Amphibian Breeding and Forester Field Card Assessments

Table 5 summarizes the results from the breeding surveys in comparison to the wetland rankings by the foresters based on the field card. Just over half of the 35 wetlands (18) had at least one forester's assessment that matched the breeding survey results. For all 57 forester assessments, 25 matched the amphibian breeding results. However, over 70% of wetlands matched or had an upward versus downward ranking between the two assessment methods (68% when a non-forester was included). Approximately 50% of wetlands with confirmed breeding had similar rankings between the amphibian surveys and the field card assessments, and 71% of Red-legged Frog wetlands matched field card assessments and were ranked as having a high probability of breeding (i.e., priority site for retention).

Almost a third of the forester's assessments had a different size classing for the wetlands compared to my calculations, which immediately led the forester down an alternate decision pathway. As well, there were approximately 12 instances where the field card assessment was correct given the habitat characteristics of the wetland, but there were breeding anomalies that did not match the card as designed. For example, two of the wetlands less than 500m^2 had breeding

Table 5. Rating of wetlands based on breeding and card use.

Oper.#	Wtld #	Amph. Br. Rank[a]	My Size Cat.	Volunteer Forester Ratings via Field Card			Issues
				Vol. 1	Vol. 2	Vol. 3	
ST324	A	**med**	100-500	high			sized differently and misinterpretation of card (in pond veg. cover)
WL-937	A	**low**	100-500	med			misinterpretation of card (in pond veg. cover)
	B	**low**	100-500	low			✓ matches
	C	**med**	100-500	low			misinterpretation of card (in pond veg. cover)
	D	**low**	> 500	high			matched card; breeding anomaly (none for size)
	E	**low**	> 500	high			matched card; breeding anomaly (none for size)
R905 OGE	10A	**med**	100-500	low	med		✓ matches Vol. 2; Vol.1 sized differently
	10B	**med**	100-500	low	med		✓ matches Vol. 2; Vol.1 misinterpretation of card (in pond veg. cover)
	11	**med**	100-500	low	med		✓ matches Vol. 2; Vol.1 misinterpretation of card (in pond veg. cover)
	14	**med**	< 100	med	low		✓ matches Vol. 2; Vol.1 sized differently
	15	**med**	100-500	low	low		matches card; anomaly - relatively large wetland with high canopy and breeding (long and linear)
	16	**med**	100-500	low	med		✓ matches Vol. 2; Vol.1 misinterpretation of card (in pond veg. cover)
	8	**med**	< 100	low	med		✓ matches Vol. 2; Vol.1 misinterpretation of card (in pond veg. cover)
T-Line	2522	**low**	> 500	med			matches card; breeding anomaly
	2529	**low**	100-500	med			matches card; breeding anomaly
	2531	**low**	> 500	med			matches card; breeding anomaly
	2534	**med**	100-500	low			different canopy estimate (or sized diff.?)
	2539	**high**	> 500	high			✓ matches Vol. 1
	2529A	**low**	< 100	med			sized differently? If smallest should not go to med
	2539A	**low**	100-500	low			✓ matches Vol. 1
J3A	A	**med**	100-500	low	low-med		Vol. 1 diff. canopy estimate; Vol. 2 matches card; breeding anomaly
	B	**low**	100-500	med	low		✓ matches Vol. 2; Vol. 1 diff. estimate of cwd, included salal in veg. cover
	C	**high**	100-500	high	med-high		✓ matches Vol. 1 & 2; even though estimated size to be on border went with large size class (erred upwards - good); breeding anomaly
	D	**low**	< 100	low	low		✓ matches Vol. 1 & 2; even though sized diff. ended in same ranking due to canopy and cwd
	E	**low**	100-500	med	med		Vol. 1 matches card; breeding anomaly
	F	**low**	< 100	low	low		✓ matches Vol. 1 & 2
	G	**med**	100-500	high	high		Vol. 1 & 2 sized diff.
	H	**low**	100-500	med	med		Vol. 1 & 2 misinterp. of in-pond veg.
0101	1	**low**	> 500	low[b]	low	low-med[c]	✓ matches Vol. 1 & 2 (& 3)
	2A	**med**	< 100	low	low	low	matched card; breeding anomaly
	2B	**high**	100-500	med	med	med	matched card; breeding anomaly (Red-legged Frog)
	3	**med**	100-500	med	med	low	✓ matches Vol. 1 & 2; but Vol. 2 sized differently and misinterpretation of card (in pond veg. cover)
	4A	**low**	100-500	med	low	high	✓ matches Vol. 2; unclear interpretation for Vol. 1 (sized differently?)
	4B	**med**	> 500	med	med		✓ matches Vol. 1 & 2; but Vol. 1 sized differently and misinterpretation of card (in pond veg. cover)
	5	**high**	100-500	high	high	high	✓ matches Vol. 1 to 3; sized differently; breeding anomaly (Red-legged Frog)

[a] low = no breeding observed; med = at least one breeding species observed; high = Red-legged Frog breeding observed
[b] Summer staff / student (not given direct training by me)
[c] Ministry of Environment biologist (not given direct training by me and not a forester); almost all ponds sized differently

Red-legged Frogs, and one wetland larger than 500m^2 did not have any confirmed breeding by any species. Many volunteers misinterpreted the assessment of in-pond vegetation and assumed that values below the 20-50% in-pond vegetation cover example were negative and rated the wetland as low versus medium. Conversely, they saw vegetative cover greater than 50% as positive and increased the rating (e.g., low as medium, and medium as high).

3.2.4 Evaluation of Wetland Field Card by Foresters

In general, the volunteers responded positively to the field card. Four of five foresters that filled out an evaluation form said that they found the card easy to use, and all five found it useful, said that that they would use it in the future, and that they would recommend it to others.

The major suggestions or comments regarding the card included:

Level 1 – wetland classification

- "add wetland classification table"; "It would be helpful to have the wetland classifications somewhere on the card for reference"; "include cheat-sheet for wetland class and make card specific to crown or private forest land"; "the key should also include a reference to non-classified wetlands as that is what most of these small ponds key out to."
- "define bog, swamp, pond, wetland define card to either pond or wetland (i.e., pond = standing water, wetland = wet area with ponds)"
- "For your first box, you might want to define W3, W4 or L3, L4. You could include this in some reference material or on the back of the assessment card? It would be better to have this information with your field card somehow?"
- "I believe the first Yes and No boxes need to be switched."
- "should include a field for BEC site on the assessment card (e.g., wetland classification can change depending on whether in CWHdm or CWHvm)"

Level II – Wetland Area

- "define perimeter - where is the end of the wetland/start of non-wetland? This will be clearer with some training"
- "There might be some confusion around the wetland size and how and where we measure that from? I would assume we need to measure from the outside edge of the wetland vegetation. Don't just measure the area of the wetted perimeter or where the standing water sits? Might want to define this for everyone so everyone measure the same thing."
- "large wetands can have a lot of trees and/or cover; may want to consider "low" category for treed wetland"
- "talk about shape of wetand-circular versus long and skinny; a long narrow wetland might exceed 500m^2, but still have > 40% canopy closure"
- "just a comment, there is a fine line between whether a pond keys out as low or high depending on estimated size…not sure if you want the rating to be this borderline based on estimated size."

Level III - Canopy Cover

- " "less than 40% has overhead" easier to measure if "Crown closure at centre of feature is 0-40% - yes; 41-100% - no"
- " "< 40% of pond has overhead canopy cover" is misleading"
- "I had to keep reading the box that says "Less than 40% of pond has overhead canopy cover". This is almost confusing? If it said "Does pond have <40% overhead canopy cover", it would be much easier to answer and read."
- "For overhead cover, do we consider alder, spirea, arbutus, maple and crab apple etc as contributing to the overhead cover? These don't have leaves for a large part of the year?

Should it just be conifer overhead cover? You should clarify this for everyone. This could be very misleading. We would want everyone to measure this consistently."

Level III – In-pond Vegetation

- "I had to keep reading the box that says "Pond contains some cover (e.g., 20-50%) of thin stemmed vegetation....". This is confusing? I read it wrong the first time I used the card. If it said "Does pond contain <50% of thin stemmed vegetation…" it would be much easier to answer and read."
- "When you put the card together you might want to include some pictures (or reference material) of the most common wetland plants that you are using in your matrix? I was confused about Spirea? I always thought that was the grass or hardhack not a scrubby tree…"

Low, Medium, and High Rankings

- "You should shade in the High probability box. Be consistent with the shading of the Low and Medium probability boxes."
- "You should better define what you mean by the High and Medium sites receiving retention? Maintaining saplings and non-merchantable trees around these sites, will that be enough? Do they need future larger woody debris input?"
- "For your High and Medium sites you suggest they should receive retention. You might also want to suggest that we fall and yard away from them?"
- "When the determination has been made on a Medium or High probability of breeding, it would be useful to have the best management strategy for these wetlands on the card, what should be retained around the wetland and what kind of connectivity required in the High breeding sites."
- "For the Low Probability Sites you say we should follow the Best Management Practices. What is that?"
- "General Comment - For our past practices, I would expect that 90+% of our wetlands that come out as a high or medium site, would have some measure of protection already. They would be ribboned out and have saplings and non-merch trees around them and be yarded and felled away from."

General Comments

- "I am surprised the form does not mention amount of water? How much standing water? How deep is it? I would guess that the more water a wetland has in it, the better the site for breeding? Should this variable be put in the matrix (Flowchart) somehow?"
- "2 sided card with matrix on back"
- "score sheet form might be better"
- "I liked the Low, Medium, and High designation, and the pond area determination was straight forward to use."
- "I like the card and key and have already directed our layout crews and contractors into paying more attention to ponds, especially given that breeding ponds will likely become wildlife habitat features under FRPA"

3.3 Extension and Promotion

3.3.1 Field Card Printing

The final version of the field card was printed at Queen's Printer in Victoria—1,000 copies of the card were printed onto 4.5" x 7.25" 6-hole drilled, waterproof Yupo paper (index card), using black ink (grey scale) on two sides. The final version of the card included an extra double-sided page that contained background information on small wetlands and management guidelines as recommended by the volunteer foresters.

3.3.2 Presentation of Results and Distribution of Field Cards
The results of the study and promotion of the field card were made at the:

- Coastal Silviculture 2008 Winter Workshop in Cowichan Bay, BC January 29-30, 2008
- Association of BC Professional Foresters EXPOFor2008 held in Penticton, BC February 20-22, 2008
- Society for Northwestern Vertebrate Biology annual meeting in Missoula MO, February 26-29, 2008
- WFP Adaptive Management Monitoring and Research Annual Workshop in Nanaimo, BC March 13, 2008.

Based on these promotional efforts, over 300[3] cards were ordered by foresters, consultants, and government personnel from 13 agencies and companies throughout the south coast.

In addition, training was provided to Western Forest Products field crews at their Jordan River, Port Alberni, Englewood, Gold River / Nootka, Mid-Island, and Stillwater divisions in spring 2008. Lastly, given the contribution of Island Timberlands to the project, a private land version of the card was developed for use on their extensive Vancouver Island land base.

Lastly, the summary presented at the ABCPF meeting has been published as:

Wind, E. and B. Beese. 2008. Little known and little understood: Development of a small wetland assessment field card to identify potential breeding habitat for amphibians. BC Journal of Ecosystems and Management 9(1):47–49. Published by Forrex Forest Research Extension Partnership. url: http://www.forrex.org/publications/jem/ISS47/vol9_no1_art5.pdf

4.0 DISCUSSION

4.1 Effectiveness of Wetland Field Card

Wetland Size and Shape Issues
Discrepancies in wetland size classing by the foresters was problematic in that it led individuals down a decision pathway on the card that may not have provided options for coming to the same / correct conclusion as observed regarding amphibian breeding. This may relate to the fact that some volunteers did not understand which area should be assessed where the area of standing water was smaller than the full extent of the wetland. As wetland size increases, and the shape more convoluted, interpretation may be more difficult. As will the amount and density of shoreline vegetation. If the assessor only stands on shore (e.g., behind a dense, tall perimeter of hardhack shrubs), or does not walk the perimeter, it may be difficult to see the entire wetland and accurately assess its size.

The design of the original card was also limiting. For example, wetlands classed as 100-500m^2, either correctly or incorrectly, provided no option for rating a wetland as having a “high” probability of breeding. Three of four wetlands with Red-legged Frog breeding were within this size class (changes were made to card to account for the high proportion of mid-sized wetlands that had confirmed breeding and breeding by Red-legged Frogs—see below). However, in the case of Red-legged Frogs, many of the assessments at these mid-sized wetlands still resulted in a “high probability” ranking because the forester’s estimated the wetland size as larger than what I had estimated and/or they thought the size was borderline between the two upper size classes and

[3] Orders are still being taken.

they erred upwards (i.e., took the conservative approach). Alternatively, wetlands rated as > 500m^2 could not be ranked as "low". However, this latter pathway was initially done on purpose during the card design because of the value of large wet areas for meeting other life history requirements beyond breeding, and the fact that *Spiraea* (hardhack) ponds may have greater value than I have observed due to detectability issues (e.g., larva are harder to detect in wetlands with dense shrub cover). However, I was reminded that a wetland type not found at the three Nanaimo Lakes study sites that occurs in south-coastal areas (i.e., treed skunk cabbage swamps) and has a relatively low probability of breeding may fall within this size class—changes were made to the card to allow for a medium ranking of treed swamps (see below).

Percent Cover Estimates and In-pond Vegetation
Using a visual estimate of percent cover for overhead canopy or in-pond vegetation can be problematic when using a field card such as this, especially where individuals have not been calibrated. Many volunteers misinterpreted the description of in-pond vegetative cover. For example, they assumed that cover outside of the example range given (20-50%), such as 70% was a negative factor and led to a low versus medium ranking for that wetland. Or, they assumed that very high cover was a positive characteristic for breeding.

As expected, at the site where two assessors visited the site within different seasons (August versus October), wetlands assessed during the dry season where water was low or absent tended to be given a lower value than assessments conducted when water levels were higher. These latter assessments tended to be less accurate due to a misinterpretation of the in-pond vegetative cover, which would appear more visually dominant in late summer during periods of low water levels.

Anomalies
On numerous occasions, the forester assessment matched the wetland card accurately, as well as my wetland habitat data (e.g., size class, canopy and in-pond vegetation cover) but the rankings between the assessment and breeding did not match. In most cases, this was because amphibian breeding was expected based on the size of the wetland but none was observed (i.e., the field card assessment led to a medium or high probability but the ranking based on amphibian surveys was low). Many of the amphibian assessments may not have been accurate, as two visual surveys may not have been sufficient to confirm presence especially in forest wetlands where low light levels can hamper detectability.

One wetland had an odd shape that made size estimation a challenge. In addition, due to it's linear shape along one end it resulted in relatively high canopy cover and a low ranking by one of the foresters even though breeding was confirmed at the wetland. Wetlands with a more convoluted shape and/or mosaic of microhabitats and vegetative cover are more likely to be misinterpreted or fall out as anomalies.

4.2 Changes to the Field Card

A final draft of the field card was developed that addressed issues brought up by the foresters during field testing, issues raised by the WFP biologists, and my assessment of the field testing. In most cases, more information and/or examples were provided at each decision level to ensure greater accuracy. As a result, the original double-sided single sheet was changed to two double-sided sheets. Additional text included information on calculating wetland area, descriptions of in-pond vegetative cover, a definition of a wetland, and management guidelines for each ranked wetland (Appendix B). For example, a text box was inserted to estimate wetland area that included an example of how area was measured during baseline surveys (i.e., longest length x average width) and a description of the wetland area to be included in the assessment (i.e., area is to be

calculated right to the terrestrial vegetation / forest edge). An additional assessment box was added to allow for wetlands > 500 m^2 that are shallow and contain more than 90% hardhack, or are classified as shallow, treed swamps, to be ranked as having a medium probability of breeding. Lastly, the wording of each level was made more user friendly. Each box was made into a question with 'Yes' leading to a more positive or higher ranking to make the preferred habitat conditions more obvious to the assessor. For example, the percent cover of in-pond vegetation is positive for graminoids and negative for tall, dense hardhack. A number of points were added to the guidelines for using the card that explain the need to project what the wetland would look like under deeper water conditions (e.g., in spring) for assessments conducted in mid-late summer (i.e., look for the high water mark, understand that high, dense annuals can bias the appearance of wetlands in summer).

5.0 CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Overall, the small wetland and amphibian assessment field card was well received and relatively successful at delineating wetlands with breeding amphibians versus none. Field testing was invaluable in examining the effectiveness of the field card and the final design was greatly improved upon compared to the original version. There were some anomalies in the testing which likely related to the limited number of amphibian surveys conducted in 2007 (e.g., detectability issues) and/or varying conditions between the test sites and those upon which the card was based (e.g., some test sites were at higher elevation, on the Sunshine Coast, etc.). This reinforces the "limitations" statement on the card regarding its use outside of the area from which it was based, supports the notion that foresters should err on the side of caution when conducting the assessment, and that further field testing should be done outside the area where the baseline data was collected. With support for the field card coming from within the forest industry itself, use of the card will raise awareness among forestry personnel about the importance of small wetland habitats for protecting biodiversity. As well, it will lead to greater protection of small wetland habitats and associated species.

Based on the results from field testing, the following recommendations will increase the effectiveness of its use and improve forest management for wetland-associated wildlife species:

- **Promote the card and its use**—*Promotion is required at some management level to ensure that the card is well received.*

- **Offer some training with the field card**—*To be most effective, potential users should be offered a limited amount of introductory training (e.g., 1-hour workshop) regarding the field card in order to:*
    - introduce the concept and objectives of small wetland management for amphibian populations (having a basic understanding of why the card is useful and an explanation of how easy it is to use may avoid having it perceived as "adding more work")
    - go over the field card and how it's used (to avoid errors in use)
    - provide opportunities to ask questions and get clarification on terms and techniques
    - provide opportunities for feedback to the biologist to improve the card, especially after it has been in use for a few years

- **Develop a similar card for different ecosystems and species (**e.g., higher elevation, interior, west and north coasts)—*Feedback from foresters and other resource managers (e.g., consultants and government biologists) suggests that a variety of resource managers are looking for tools such as this to help guide them in the decision-making process and provide a more concrete or biological basis for their decisio*ns

6.0 LITERATURE CITED

Alford, R A. 1999. Ecology: resource use, competition, and predation. Pp. 240-278. *In*: R.W. McDiarmid, and R. Altig (eds.). Tadpoles: The Biology of Anuran Larvae. University of Chicago Press, London.

BC Ministry of Forests and Range. 2004. Division 3 – Riparian Areas. Forest Planning and Practices Regulation. B.C. Reg. 14/2004. Forest and Range Practices Act. Victoria, BC. Taken from the World Wide Web Dec. 2005: [http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm#part4-div3]

Beasley, B., C. Addison, and K. Lucas. 2000. Clayoquot Sound Amphibian Inventory 1998. The Long Beach Model Forest Society and the Ministry of Environment, Lands, and Parks. Port Alberni, BC.

deMaynadier, P.G. and M.L. Hunter, Jr. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. Environmental Review 3:230-261.

Gibbs, J.P. 2000. Wetland loss and biodiversity conservation. Conservation Biology 14(1): 314-317.

Lawrence, J.D., E.L. Preisser, and J.R. Yelin. 1998. Here Today, Gone Tomorrow? Connecticut's Vernal Pools. A Policy Guide to Ephemeral Wetlands Protection. Centre for Coastal and Watershed Systems. Geoffrey C. Hughes Foundation.

MacKenzie, W.H., and J.R. Moran. 2004. Wetlands of British Columbia: a guide to identification. Research Branch, BC Ministry of Forests. Victoria, BC. Handbook No. 52.

Ministry of Environment. 2007. Proposed Wildlife Habitat Feature (WHF) Order: Review And Comment. Environmental Stewardship Division. June 2007. [http://www.env.gov.bc.ca/wld/frpa/proposed_whf.html]

Snodgrass, J.W., M.J. Komoroski, and A.L.Jr. Bryan. 2000. Relationships among isolated wetland size, hydroperiod, and amphibian species richness: implications for wetland regulations. Conservation Biology April 14:414–419.

Ultsch, G.R., D.F. Bradford, and J. Freda. 1999. Physiology: coping with the environment. Pp. 189-214. In: McDiarmid, R. W., and R. Altig (eds.). Tadpoles: The Biology of Anuran Larvae. University of Chicago Press, London.

Wind, E. 2003. Aquatic-breeding Amphibian Monitoring Program: Analysis of Small Wetland Habitats on Vancouver Island. Annual Progress Report 2002. Unpublished report Prepared for Weyerhaeuser Company, Nanaimo, BC.

Wind, E. 2004. Aquatic-breeding Amphibian Monitoring Program: Experimental Wetland Buffer Study. Annual Progress Report 2003. Prepared for Weyerhaeuser BC Coastal Group, Nanaimo, BC.

Wind, E. 2005. Aquatic-breeding Amphibian Monitoring Program: Pre-treatment Wetland Buffer Study. Annual Progress Report 2004. Unpublished report Prepared for Weyerhaeuser Company, Nanaimo, BC.

Wind, E. 2006. Amphibian Monitoring Program: Small Wetland Buffer Study Year 2. Annual Progress Report 2005. Unpublished report Prepared for Cascadia Forest Products and Island Timberlands, Nanaimo, BC.

Wind, E. 2007a. Habitat Requirements of Amphibians in Relation to Wetland Conservation Under Variable Retention Harvesting. Forest Science Program Annual Report 2006/07. LOI Amphibians r Y072027. Report submitted to Bill Beese, Western Forest Products, Campbell River, BC.

Wind, E. 2007b. Pre- and Post-harvest Amphibian and Small Wetland Study: Year 3. Annual Progress Report 2006. Unpublished report Prepared for Island Timberlands Limited Partnership and Western Forest Products Inc., Campbell River, BC.

APPENDIX A. EXAMPLE GUIDELINES AND ASSESSMENT AND EVALUATION SHEETS PROVIDED TO EACH VOLUNTEER FORESTER DURING INFORMATION MEETING.

WETLAND FIELD CARD ASSESSMENT GUIDELINES

Objectives:
1. *Of Field Card* = to help prioritize which wetlands receive retention where a choice needs to be made (biological basis for retention)
2. *Of Card Test* = to determine whether the card accurately delineates low, medium, and high probability breeding sites

Methods:
1. Each wetland is visually assessed for amphibians at least 2 times by Elke
2. Each wetland is assessed by an engineer/forester in spring and summer (at least 2 times by at least 2 different people)
3. I compare the results from breeding to the rankings of the engineers/foresters via the card

Engineer/Forester Assessment Procedures:

Equipment needed:
- these guidelines
- GPS (if possible) and/or map of each site
- location coordinates of ponds
- list of pond i.d. numbers/names for each site
- wetland field card
- field card assessment sheet and evaluation form

Guidelines:
1. Using map of site and/or UTMs of the ponds, locate each of your assigned wetlands - look for the triple pink & black ribbon at each pond with pond i.d. written on each ribbon (please make sure you are at the correct wetland)
2. At each wetland, fill out the wetland field card assessment sheet using the field card
3. Enter the data on the assessment form and either:
    a. mail the hard copy to me at: 114 A Fifth St., Nanaimo, BC V9R 1N2
    b. leave somewhere for me to pick up, or
    c. I can send you a digital copy of the forms and you can email me the results

TO ENSURE AN UNBIASED ASSESSMENT, PLEASE *DO NOT*
1. Discuss your results with other participants
2. Search for amphibians while at a wetland
3. Assess each pond based on current site conditions/block layout – evaluate each pond on its own (you can comment on site factors in the comments column after you have rated each wetland using the card)

Part I: Field card wetland assessment and evaluation

Name: _____ **Site (on map): _____**

Date of assessment (dd-mm-yyyy): _____

PART I: Wetland Assessment (fill out one assessment per site per season)

Wetland # / i.d.	**Wetland Class**	**Wetland Size**	**Ranking** (low, medium or high)	**Justification** (e.g., canopy cover, in-pond vegetation, etc.)	**Additional Factors / Comments**

PART II: Field Card Assessment
(only needs to be filled out once)

Field Card Evaluation:

1. Did you find the field card easy to use? Yes / No

Why?_____

2. Do you feel the field card will be useful? Yes / No

Why?_____

3. Would you use the card regularly in the field? Yes / No

Why?_____

4. Would you recommend it to other forestry workers? Yes / No

Why?_____

5. What changes would you recommend to make it more user-friendly, effective, etc.?

_____

_____

_____

APPENDIX B. REVISED, FINAL VERSION OF *SMALL WETLAND AND AMPHIBIAN ASSESSMENT FIELD CARD*

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

OBJECTIVE

This wetland assessment field card was designed to provide forest professionals with a tool to identify and manage priority aquatic-breeding amphibian habitat when retention options exist. It is meant as a guide only, to be used in addition to FRPA and other government standards. Forest professionals also need to be aware of other obligations that may exist, for example Wildlife Habitat Features.

Due to the coarse scale of the assessment, it is recommended that individuals *err on the side of caution* (i.e., choose a higher ranking) when unsure of the ranking of a wetland. For example, for wetlands that are borderline between two size classes use the larger class.

GUIDELINES FOR USING THE FIELD CARD

1. Determine the Wetland Riparian Class (W1-W5) and Riparian Management Area, if applicable—refer to the Ministry of Forests Riparian Classification Field Card FS 900A.
2. Determine the probability of amphibian breeding using the field card (page 2). Work your way through the flowchart of questions until you have obtained a low, medium, or high ranking for each wetland (note definitions).
3. Determine appropriate management practices based on your ranking and the guidelines on page 3.

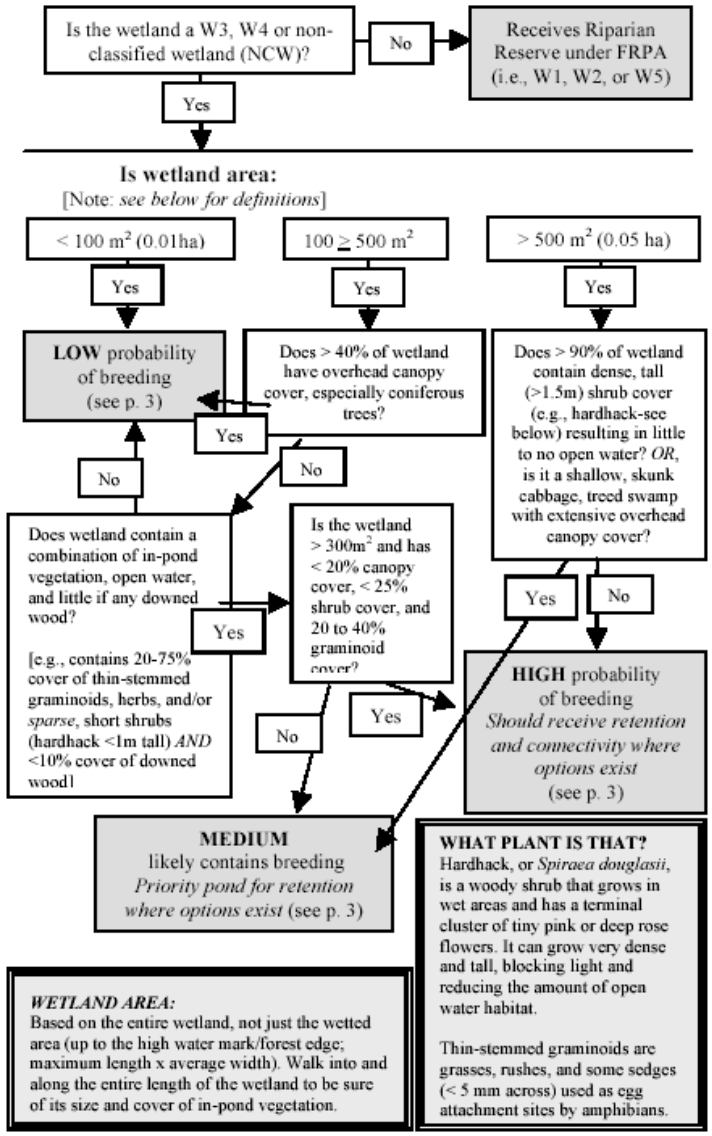
Please keep the following points in mind during your assessment:

- Accuracy will greatly improve if you have a complete view of the wetland—e.g., walk into or along the length of the wetland to view the entire wetland (to estimate area and cover).
- Wetlands vary extensively in physical appearance throughout the year (e.g., dry in August but 2m deep in April). Assessments during dry periods may be biased towards lower rankings. Look for the high water mark, envision the wetland with water (e.g., in early spring), and remember that **wetlands that retain water until at least the end of June may be used for breeding**.

WETLAND:
"…a swamp, marsh, bog, or similar area that supports natural vegetation, that is distinct from adjacent upland areas" (FRPA Riparian Guidelines)

For amphibians, this includes wetlands of all sizes and hydroperiods and ones that may contain little to no in-pond vegetation.

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD



SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

MANAGEMENT GUIDELINES BY RANKING

LOW probability of breeding:

- create a 5m machine-free zone around the wetland that contains shoreline vegetation (e.g., shrubs, non-merchantable trees)

MEDIUM probability of breeding:

- where possible, retain a windfirm, variable width, uncut or partial-cut buffer of at least 3m
- ensure connectivity to upland forest and/or other wetlands whenever possible by maintaining a corridor of shrubs and non-merchantable trees that provides cover and retains moisture

HIGH probability of breeding:

The management priorities are, in order of preference:

- exclude the wetland from the block or include it within a retention area (≥ 0.25 ha) whenever possible
- retain a windfirm, variable width, uncut or partial-cut buffer of 5 to 15m

Ensure connectivity to upland forest and/or other wetlands where possible by maintaining a corridor of shrubs and non-merchantable trees that provides cover and retains moisture

Wetland-breeding Amphibians of the South Coast:

Northwestern Salamander	Pacific Treefrog (or Chorus Frog)
Long-toed Salamander	Red-legged Frog*
Rough-skinned Newt	American Bullfrog (*non-native*)
Western Toad*	Green Frog (*non-native*)

**** Species at Risk***

Limitations on Use:
This card is based on data collected on wetlands located between 320-370 m on southeastern Vancouver Island (i.e., CWHxm). As such, it is most applicable to south coastal systems and species only. Habitat relationships and effects of forest harvesting outside of this area require additional research.

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

COMMON MANAGEMENT GUIDELINES

1. Prioritize retention by using the field card. Additional factors to consider while using the field card include:

a. *Hydroperiod* – breeding is most likely in ponds that retain water until late June (a site visit in mid June is ideal for a small wetland assessment)
b. *Flow rates* – many pond-breeding amphibians are less likely to breed in flowing water (e.g., > 5cm/sec.)
c. *Fishless sites* are high priority – fish prey on amphibians
d. Where retention opportunities are limited, consider *less extensive or partial buffers* (e.g., south shoreline only)
e. Protect *clusters of wetlands*
f. *Amphibians can become attracted to wetlands in cutblocks, but their survival rates are unknown.* As such, wetlands ranked as having a medium or low probability of breeding could benefit from retention or exclusion from the block to maintain riparian cover.

2. Manage as many moderate and high priority wetlands as operationally feasible with windfirm buffers. Where there is a high probability that some trees will fall into a wetland, windfirm (top or prune) or remove high-risk trees.

3. Where possible, create connective corridors and linkages between wetlands, and between wetlands and surrounding forest, by retaining shrubs and non-merchantable trees. Designating these areas as machine-free zones, and falling and yarding away from these corridors, may facilitate amphibian movement.

4. Fall and yard away from small wetlands. Remove introduced debris.

5. Where possible, avoid road locations near wetlands and employ sediment control measures as required.

6. Avoid planting in wetlands.

7. Do not spray herbicides or other pesticides over or near wetlands, especially during the spring breeding season or mid summer (fall is the most suitable period).

Development of this field card supported by

FIA Forest Investment Account Forest Science Program