Avoiding Incidental Take of Bird Nests: From Law to Practice

Images: Harry van Oort

April 26-27, 2017
Cranbrook, British Columbia
Canada

Columbia Mountains Institute of Applied Ecology

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Forum description

A hundred years ago, on August 16, 1916, the Migratory Birds Convention was signed by Canada and the USA. The Convention was implemented in Canada by the Migratory Birds Convention Act (the MBCA). In 1980, a clause was added to the regulations under the MBCA which prohibits the destruction, disturbance, or take of nests and eggs. This prohibition applies even if the activity which causes the harm is not directed at the nest or egg and is otherwise legal. Since 1980, this prohibition has been largely overlooked and "incidental take" of bird nests has been widespread across industries. However, in recent years, there has been an increase in awareness and enforcement of the prohibition, and consequent requirements to address it in Environmental Protection Plans and Environmental Assessment processes.

Incidental take is now recognized as a major legal conundrum for many industries, including forestry, agriculture, mining, and utilities. Projects involving land clearing or vegetation management being undertaken by developers, cities, and resorts now commonly commit to avoiding incidental take, and biologists are hired to mitigate nest loss due to land clearing activities. The risk of incidental take can be minimized with guidance from nesting models, and disturbance to nests is sometimes avoided by conducting pre-clearing nest surveys. However, all approaches for nest loss mitigation have shortcomings, and it is unclear what is required under "due diligence" and how this can be demonstrated.

This forum provided an opportunity for dialogue between the federal regulator (Canadian Wildlife Service), an environmental lawyer, industry, and biologists whose work involves the MBCA and relevant mitigation. On the first day, CMI presented a roster of invited speakers to discuss the ecological impacts of take (both incidental and direct), legal risks, due diligence, perspectives from the Canadian Wildlife Service - regarding enforcement and future solutions, and the BC Ministry of Environment's framework for mitigation plans and offsets. A panel discussion and question period followed these presentations which then lead into an evening poster session and networking social. We took a break for dinner and then reconvened for a public film screening of The Messenger, an award-winning documentary that provided the larger context for songbird mass depletion. Dr. Erin Bayne, who is featured in this documentary, provided an introduction to the film and took questions from the ~150 person crowd.

On day two, participants were invited to present talks on approaches being used by industry, and ideas, results, and experiences (trials and tribulations) with respect to incidental take avoidance and approaches to mitigation. Over the lunch break on day two, interested participants had the opportunity to engage in a working group to discuss

pre-clearing nest surveys performed by biologists. They discussed tough questions such as: What is the role of the biologist? What information should be provided to the client? And who bears legal responsibility in the event of incidental take following a survey? An independent working group was formed to continue this discussion into the future with the goal of providing a document which offers guidance and expectations for biologists involved in nest searching. In addition to this discussion regarding best practices, many attendees expressed interest in composing a letter to the federal government requesting the development of a regulatory framework for activities which impact breeding birds.

This forum was held in Cranbrook at the Prestige Rocky Mountains Resort, April 26-27, 2017. CMI hosted a networking opportunity for all forum participants and CMI members in the Cranbrook region in the evening of April 25, 2017. (The CMI Annual General Meeting also took place at this time.) In total, about 220 people participated in the events that took place April 25-27, 2017.

About the Columbia Mountains Institute of Applied Ecology
www.cmiae.org

The Columbia Mountains Institute of Applied Ecology (CMI) is a non-profit society based in Revelstoke, British Columbia. CMI is known for hosting balanced, science-driven events that bring together managers, researchers, educators, and natural resource practitioners from across southeastern British Columbia. CMI's website includes conference summaries from all of our events, and other resources.

Summaries of presentations

The summaries of presentations in this document were provided by the speakers. Apart from small edits to create consistency in layout and style, the text appears as submitted by the speakers.

The information presented in this document has not been peer reviewed.

1. How Many Birds Will I Directly Versus Indirectly Kill in my Lifetime and which Matters More?

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View recording of this presentation here

Every day birds and/or their nests are killed/destroyed. When people or human infrastructure cause this mortality, it is called incidental take. Current estimates suggest 268 million birds are lost annually in Canada to incidental take (Calvert et al. 2013). Incidental take is illegal, in that knowingly killing birds or disturbing nests is a violation of the Migratory Birds Convention Act. This has led to considerable concerns from various people and industries about how they can be compliant with the law.

For wildlife managers charged with protecting birds, the underlying premise is that incidental take is having negative long-term population consequences for birds. Direct evidence to test this assumption is difficult to obtain, as some of this mortality may be compensatory to natural processes rather than additive (Arnold and Zink 2011). Far more research on population dynamics and ways of measuring vital rates are needed to quantify this assumption for most species of birds.

Regardless, concerns about avian populations abound. Industrial activities such as forest harvesting during the avian breeding season are a focal point about bird declines and the role of incidental take because of a perception that summer logging destroys bird nests. Government policy to reduce incidental take by forestry recommends timing harvest outside the breeding season. While many industries try to meet such timing constraints, social and economic constraints can make this difficult. Thus, during the breeding

season some companies also try to find nests and buffer the area where a bird is actively nesting. Current estimates of nests lost to forestry activities indicate that about 1.3 million birds may be lost to forestry activities without any mitigation (Hobson et al. 2013). Whether nest searches and buffering nests reduce this loss substantially remains very uncertain.

In contrast, over 22 million birds per year in Canada are killed when they collide with windows (Machtans et al. 2013) and 190 million are killed by cats (Blancher 2013). Window collisions and cat predation are global problems. This type of incidental take can be mitigated. Thus, from a conservation perspective finding a solution to window collisions or cat predation may have a far greater "bang for the buck" than trying to mitigate accidental nest destruction from forestry and other land-disturbances. I argue that cost-benefit analyses should be done that consider whether money currently spent by industry to mitigate the loss of a few nests might be better spent by creating a mitigation fund. Such a fund could be used to create awareness campaigns about cats and windows and/or funding that homeowners could use to make their homes more bird friendly.

However, it is important to not forget the "elephant in the room". Forestry's major impact is not in the number of nests are disturbed by summer land-disturbance. I argue the lost productivity for the mature and old-growth forest birds that comes from a landscape-level reduction in the amount of older forest is a much larger issue with far more significant population consequences. My concern is that the current focus on reducing incidental take in the short-term may be taking away important conservation capital away from effective land-use planning. Land-use planning for threshold amount of old-growth habitat by direct extension will have very strong influences on avian productivity for old-growth species over longer temporal and spatial scales. We must be very cautious that perverse consequences do not result from focusing narrowly on the issue of incidental take. When cost-effective, we should do our best to manage the short-term risk of human activities on birds. However, we cannot lose sight of the long-term consequences of habitat loss and degradation and need to do a lot more work to plan for the future habitat conditions that will ensure long-term sustainability of birds in Canada.

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Machtans, C. S., C. H. R. Wedeles, and E. M. Bayne. 2013. A first estimate for Canada of the number of birds killed by colliding with building windows. *Avian Conservation and Ecology* **8**(2): 6. http://dx.doi.org/10.5751/ACE-00568-080206

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2. *Management of Incidental Take of Migratory Birds in Canada – the Federal Perspective*

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Introduction

In this presentation, I talked about three main issues related to the federal perspective on managing incidental take of migratory birds. These were:

- Legislative Context of Incidental Take and current challenges in addressing
- Description of ECCC-developed tools and key policy positions
- Magnitude of Incidental Take across sectors

1) Legislative Context – the MBCA

Incidental refers to the killing or harming of birds or destruction/disturbance of nests and eggs, and is prohibited via the *Migratory Birds Convention Act* (MBCA), 1994. The purpose of this Act is "to implement the Convention by protecting and conserving migratory birds – as populations and individual birds – and their nests"

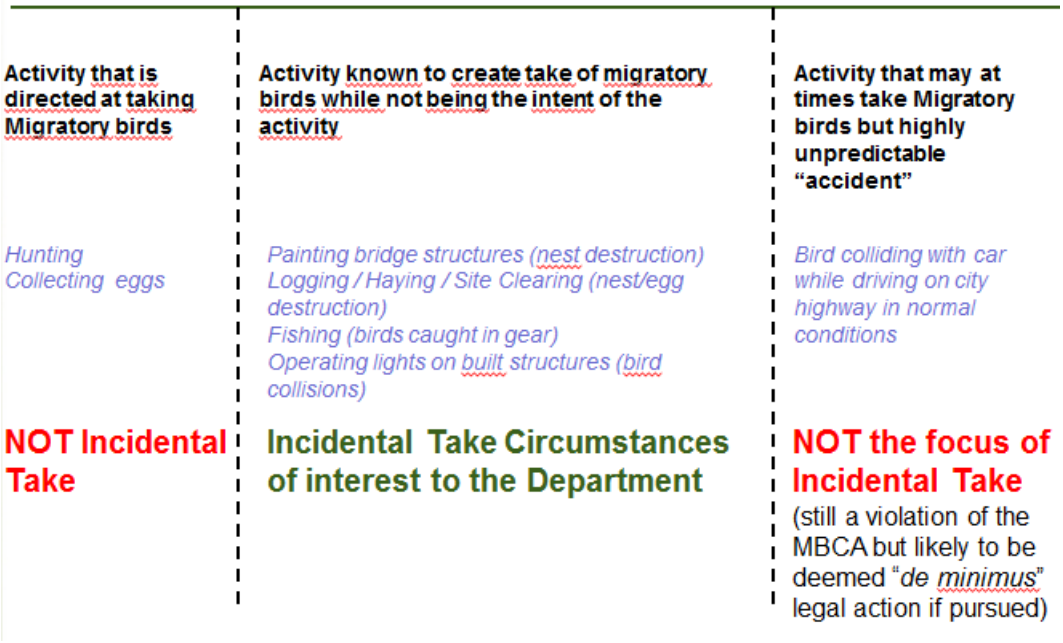
Legislative Context

Prohibitions under the Migratory Birds Regulations (MBR) and the MBCA include:

> MBCA 5.1(1) – No person or vessel shall deposit a substance that is harmful to migratory birds…
>
> 5 - MBR general prohibition: No person shall hunt a migratory bird except under authority of a permit therefor (hunt: "chase, pursue, worry, follow after or on the trail of, lie in wait for, or attempt in any manner to capture, kill, injure or harass a migratory bird, whether or not the migratory bird is captured, killed or injured")
>
> 6 - MBR general prohibition: No person shall (a) disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, or (b) have in his possession a live migratory bird, or a carcass, skin, nest or egg of a migratory bird

Other sections and other acts/regulations may apply (e.g., Wildlife Acts in several provinces) in the many of the same situations as these prohibitions.

The Department has few legal mechanisms in place to manage the intentional or direct take of birds and their eggs/nests, and can only issue permits and/or authorizations for specific activities: scientific, avicultural, damage or danger, airport, taxidermy, eiderdown. Outside of these permits/authorizations, the Department does not have a legal mechanism to authorize take – whether intentional or not (strict liability offense). In some circumstances, the killing/harming of birds or destruction/disturbance of nests and eggs is the result of human activities not directed at birds/nests/eggs. This is a circumstance the Department refers to as 'incidental take.'



("*De minimus non curat lex*" – the law does not concern itself with trifles)

Within this context, incidental take poses a major challenge. From a conservation perspective, many birds, eggs, and nests are destroyed each year during routine industrial and other activities. These activities occur with legal uncertainty. There is no authorization mechanism for stakeholders: occurrences of incidental take of migratory birds, nests or eggs have the potential to result in investigation and potentially prosecution. Incidental take is always a contravention of the MBCA.

A Brief History of Incidental Take Management Approach

2007-2010: ECCC began development of proposed regulatory amendments for permit and/or authorization (with conditions), which some industries wanted.
2010 - present: Moved away from regulatory approach (based on response to consultation and outreach activities) and toward an approach focused on avoidance messaging and decision-support tools (remains current approach)

2) Addressing Incidental Take

The Department focuses efforts on providing decision-support tools so that Canadians can evaluate risk and take measures to avoid or minimize the occurrence and conservation impacts of incidental take:

- *General Avoidance Guidelines*
- *Background Technical Information*
- *Bird Conservation Regions and Strategies*
- *Beneficial Management Practices Guidance Document*

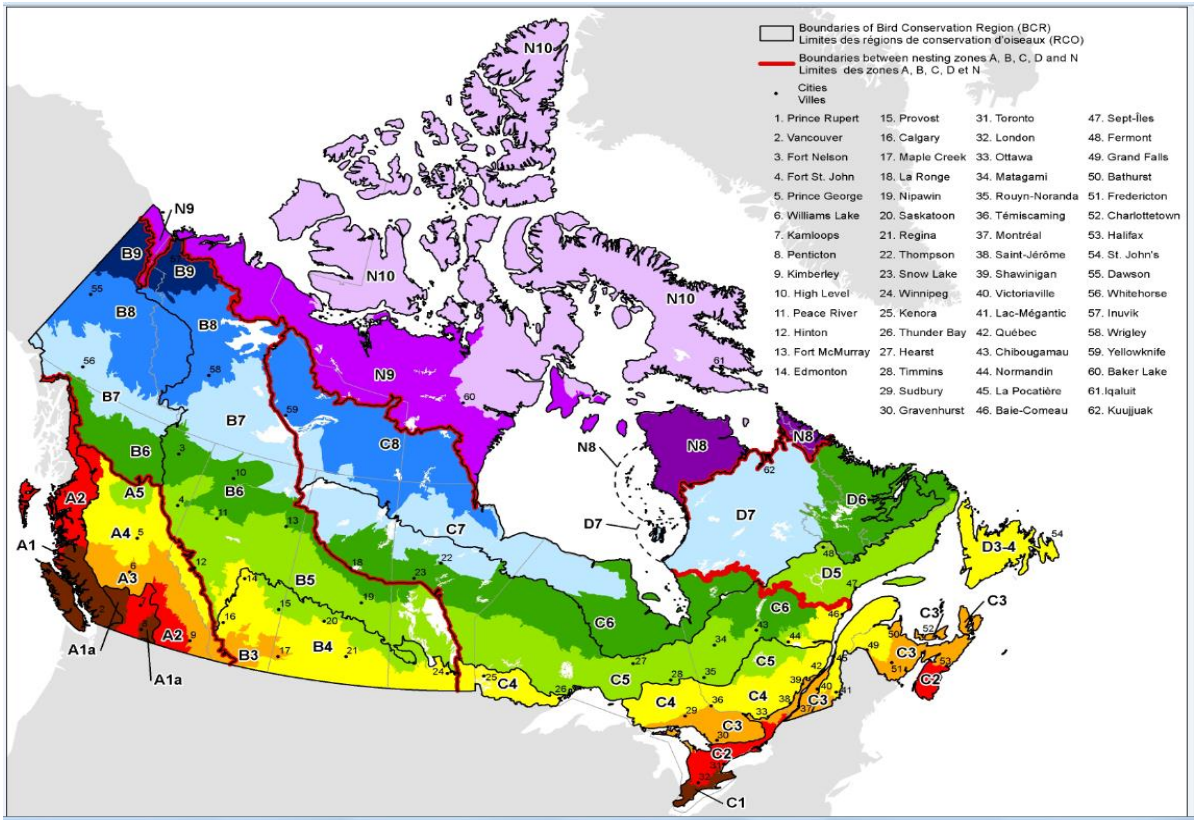
The Department can provide tools to support decisions but cannot endorse particular BMPs as this could constitute Officially Induced Error (OIE), which is a mistake of law caused by reliance upon erroneous legal advice obtained from an appropriate official. The case of officially induced error is an exception to the general rule that ignorance of the law is no excuse. ECCC seeks to avoid OIE in all our messaging with respect to Incidental Take, as it fetters the Crown in its ability to proceed with prosecutions. Given there is no legal mechanism to exempt proponents from the force of the MBR prohibitions, it is inappropriate for ECCC to endorse activities that are likely to result in violations. Risk of OIE limits our ability to endorse specific practices or BMP's that, although potentially beneficial and desirable from a conservation perspective, do not eliminate the probability of potential regulatory violations.

General Avoidance Guidelines. The Guidelines provide stakeholders with consistent and practical recommendations on reducing the risk of incidentally destroying/disturbing migratory bird nests and eggs or killing/harming migratory birds. The Department provides scientific background information to help implement the advice provided.

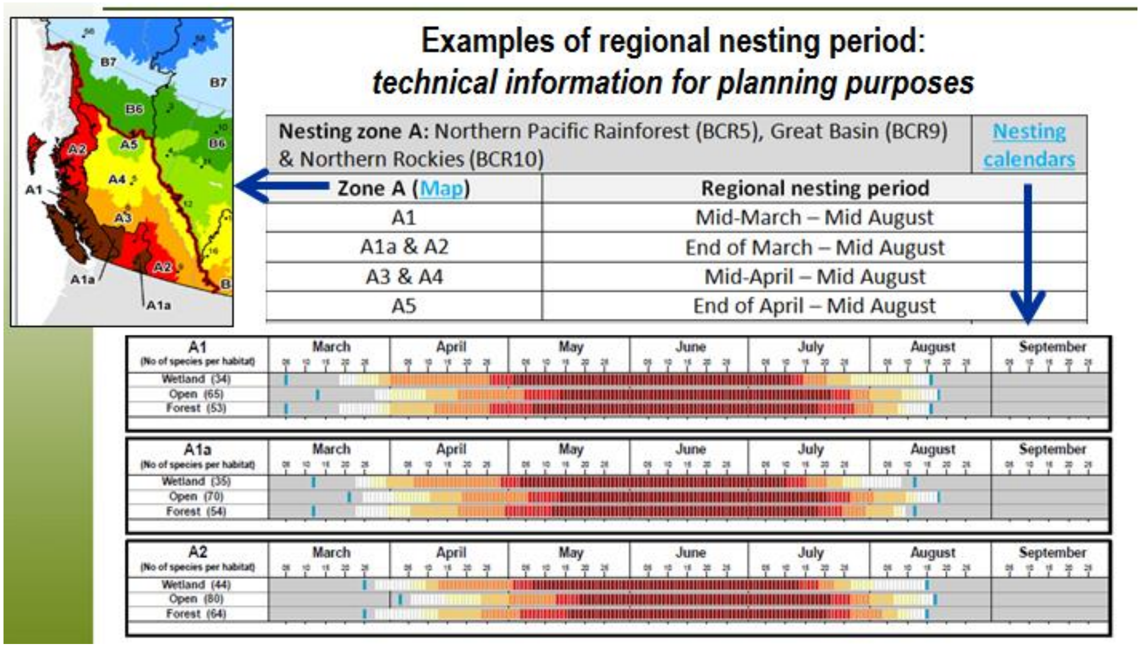
- The key risk **sites** or <u>where</u> take is most probable (e.g.: migration corridors, high-density marine areas)
- The key risk **periods** or <u>when</u> take is most probable (e.g.: migration peaks)
- The key risk **factors** or <u>how</u> take is most probable (e.g.: using guy wires, type of lighting etc.)

Technical Information: Nesting zones of migratory birds in Canada. The Department has developed specific advice related to timing of nesting across Canada, and has made this advice available on the incidental take website. Operations activities at these times in these locations carry the risk of incidental take, and should be avoided.

The advice is meant to be nationally consolidated and consistent, with a high level of precision with dates and intensity, and based on a rigorous quantitative approach (269 models – one per species). An Online version of the nesting calendar tool is being developed (including polygon capability) as well as a technical report with information for individual species.



Technical Information: Nesting calendars (rNest). With each zone, a calendar is available showing the proportion of migratory bird species that are predicted to be actively nesting on a given date for three habitat types and for each nesting zones.



Technical Information: Determining Nest Presence. The Department holds the view that nest survey techniques, under all but a limited set of circumstances, are not recommended as a way to reduce risk of incidental take. The probability of locating all nests is low, and the search effort itself carries a high likelihood of disturbance of nests. Therefore, the Department cannot recommend that active nest survey approach as a means to determine nest presence, as it is highly likely to lead to OIE. An alternative methodology that can be effective for songbirds might be standard audio point count techniques (suggested precautionary assumption: singing territorial male = probable nest).

The Department presents a summary of information that Canadians can use to determine the risk level associated with activities based on: knowledge of legal obligations, biological factors (e.g. likelihood of nesting, habitat), and the nature of the activities (e.g. intensity and duration). The following is an excerpt.

[continued next page]

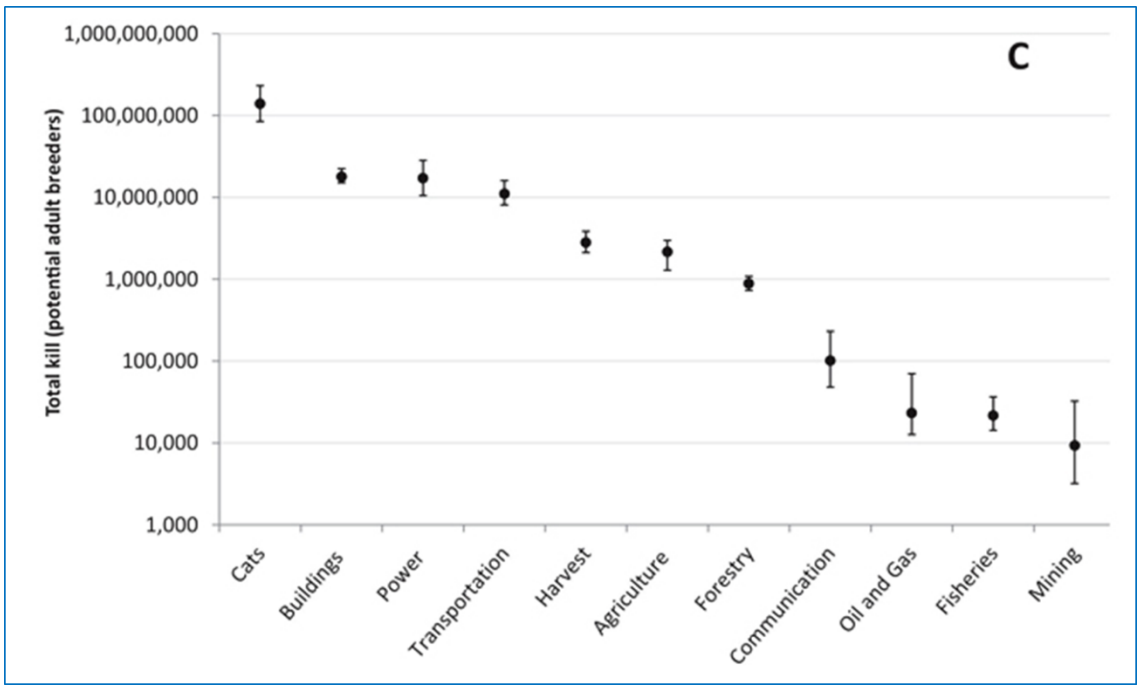
Factor associated with management of incidental take (Full text)	Example of lower risk level	Example of higher risk level
Knowledge of legal obligations	Awareness of and understanding the relevant provisions of laws and regulations pertaining to the protection of birds, nests and eggs. Notably: the *Migratory Birds Convention Act, 1994*, the *Migratory Birds Regulations* and, where applicable, the *Species at Risk Act*.	Unaware of legal responsibilities towards the protection of birds, nests and eggs.
Risk assessment and planning	Completed a thorough risk assessment in a timeframe suitable to balance project needs with risk of incidental take of migratory birds.	Little to no pre-planning or risk assessment around conservation issues related to migratory birds.

Bird Conservation Regions (BCR) and Conservation Strategies. To achieve consistency of approach for bird conservation across the country, the Department has developed BCR Conservation Strategies. This standardized approach is based on the guidance provided by national and continental bird initiatives, is science-based, and is intended to provide specific guidance on the conservation actions needed to maintain sustainable populations of birds across their breeding ranges and lifecycles both in Canada and internationally. The development of priority species is an approach used to direct conservation actions towards species facing particular threats or issues to their populations. It should be noted that the MBCA applies to all species covered by the Act, not just those that have been designated as priority species.

Beneficial Management Practices Guidance Document. Conservation of migratory birds in Canada is helped when proponents implement a management plan to minimize the risk of impacts, and to mitigate any unavoidable impacts on birds, nests and eggs. Development of management plans will be optimized by incorporating relevant Incidental Take avoidance information and other conservation recommendations into sectorial Beneficial Management Practices (BMPs). The Department facilitates development of BMPs through provision of technical support and feedback. In circumstances of incidental take, the Department does not have the authority to recognize specific BMPs as ensuring legal compliance. For information on BMP's see: www.ec.gc.ca/paom-itmb

3) Magnitude of Incidental Take across various sectors

The magnitude of incidental take in Canada was formally assessed in a series of scientific articles in a special issue of the journal *Avian Conservation and Ecology*, http://www.ace-eco.org/issues/view.php?sf=4. The industrial sectors most relevant to British Columbia were highlighted.



For power generation, this total kill is a sum of many activities: transmission line collisions, 25.6 million birds; electrocutions, almost 500,000 birds (481,000); line maintenance, almost 400,000 nests (388,000); hydro reservoirs: 150,000 nests, and wind energy: 17,000 birds. In forestry, incidental take results primarily from destruction through land clearing. In the Oil and Gas sector, the relevant activities are land clearing (especially seismic lines), and tailings ponds. In Mining, the mine Footprint often results in permanent loss, with some additional potential losses due transmission line.

Examples of activities affecting populations include long-term habitat conversion (creation or loss depending on species), edge creation (benefits or harm depending on species), and cumulative effects at the regional level. Examples of activities affecting individual birds include collisions, electrocutions, and herbicides. Examples of activities affecting nests and eggs include land clearing activities during the breeding season, and hydro reservoirs (water level fluctuations).

Conclusions

Incidental take poses a conservation and regulatory challenge for Environment and Climate Change Canada. Millions of birds are killed annually in Canada due to anthropogenic activities, and the Department is committed to reducing this loss of birds through providing reliable scientific advice for decision making, promoting the use of Best Management Guidelines, and enforcing the law when necessary.

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3. *Due Diligence and Legal Risks Under the Migratory Birds Convention Act*

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Migratory Birds Convention Act, 1994

The *Migratory Birds Convention Act, 1994* (MBCA) was originally adopted in 1916 to give effect to the *1916 Convention Between the United Kingdom and the United States of America for the Protection of Migratory Birds in Canada and the United States* (Convention), and is one of the oldest environmental statutes in Canada. The MBCA establishes a scheme for the regulation of activities affecting migratory birds listed in the Convention. The Convention is appended to the MBCA. The MBCA is applicable to all migratory birds which are listed in the Schedule to the Protocol to the Convention. This list is very comprehensive, and includes a substantial portion of Canada's bird populations. The MBCA applies to all lands and bodies of water in Canada (and its coastal territories) and to the activities of all organizations, industries and individuals.

While the original Convention and MBCA was aimed at protection of birds for the purposes of harvesting, in 1994 Canada and the United States adopted a Protocol which expanded the purpose of the agreement to include conservation of migratory birds in their nesting, migration, and over-wintering grounds. The language of the Protocol is broad enough to allow the federal government to address threats such as "incidental take." Consequently, the original MBCA was repealed and replaced with the current 1994 version, which includes the power to make regulations prohibiting harm to birds and their nests, including harm that is incidental to otherwise lawful activity, or as it is often referred to, "incidental harm" or "take", and to prohibit the deposit of substances harmful to birds. However, while the 1994 MBCA allowed prohibition on incidental harm, it did not include clear power to permit such harm.
Amendments to the MBCA passed in 2005 clarified the purpose of the MBCA to protect and conserve migratory birds as individuals and as populations and their nests and allowed the federal government to establish conditions under which incidental harm could be permitted.

Prohibitions in the MBCA and the its regulations

Prohibitions on direct harm to birds

Section 5 of the Migratory Birds Regulations (MBR) prohibits hunting of migratory birds except under specified permitted conditions. Hunting is broadly defined and includes a wide range of harm to migratory birds. However, because of the way in which the prohibition is worded, it requires an act by a person directed at the birds in some fashion, rather than incidental impacts. Thus, incidental harm to migratory birds is *not* prohibited.

Prohibitions on incidental harm to birds and nests

Section 6 of the MBR prohibits disturbance, destruction or "take" of migratory birds' nests, eggs, nest shelters, eider duck shelters or duck boxes. Unlike the prohibition against hunting, there is no language restricting the prohibitions to activities directed against the nests. Thus the prohibition against harming nests applies to *any* activities which may cause the prohibited acts, be they either directed at the nests or be otherwise permitted activities (i.e. incidental acts).

Prohibitions on deposits

Section 5 of the MBCA prohibits the deposit of a substance that is harmful to birds in waters or areas frequented by birds, or in a place where such substances may enter such waters or areas. An area frequented by a migratory bird has been broadly interpreted, and as a result it is difficult to think of many areas in the country which would not constitute such areas. This provision has been used to being enforcement proceedings against vessels at sea, and in circumstances where harmful substances have been placed in areas and subsequently caused harm to birds. Such "areas" have included tailing ponds, flare stacks, Vancouver harbour, oil wells, storm water ponds and dumpsters.

Permitting

The MBCA contains a permitting regime for hunting of migratory birds. However, while the 1994 version of the MBCA allowed for permits to cause harm to nests under limited circumstances, such as for the purpose of scientific research or protection of aviation, it did not clearly grant authority to the government to grant permits for incidental harm. The 2005 amendments improved the authority to allow regulations permitting incidental take of migratory birds nests. Unfortunately the regulatory permitting regime contemplated by the amendments has not been implemented. Efforts were made to develop new regulations, however, in 2010 Environment Canada halted the development of incidental permitting regulations and instead invited collaboration on best management practices development. There is also no permitting regime to allow deposits of harmful substances.

The combined effect of the prohibitions in the MBR and the lack of a permitting regime, means that it is an offence throughout Canada to disturb or destroy the active nest of a migratory bird, and at the moment, it is not possible to obtain a permit to allow for such harm to occur, except under limited circumstances, such as for scientific research.

Offences and enforcement

Contravention of the MBCA or the MBR is an offence. Penalties can be a fine of up to $1,000,000 or imprisonment for a term of three years. Maximum fines for subsequent offences are doubled. Fines imposed for an offence involving more than one migratory bird or nest may be calculated in respect of each as if it had been subject of a separate charge. The MBCA was amended in 2009 to substantially increase the quantum of fines. The amendments create both minimum and maximum fines of up to $6,000,000. However, these amendments are not yet in force.
Until recently, enforcement of the MBCA with respect to industrial activities has been patchy at best. However, non-enforcement of the MBCA against industry in the past does not mean it cannot be so enforced. Enforcement of law is a matter of government policy and a change in such policy can result in enforcement against industry or individuals, absent statutory or regulatory language providing exemptions.

Constitutionality

In 2008 the constitutionality of the MBCA and the MBR was challenged in the Provincial Court of New Brunswick when a company and one of its employees faced charges of having disturbed an active Great Blue Heron colony and damaged or destroyed nests during logging operations on private forest lands. The Provincial Court confirmed that the federal government has the constitutional authority to pass the MBCA under the general authority to make laws for the peace, order and good government of Canada, and under its jurisdiction over the implementation of international treaties entered into by the United Kingdom on behalf of Canada.

The New Brunswick Court also confirmed that disturbing, destroying or taking nests of migratory birds is a violation of the MBCA, even when the violation is the unintended, practically unavoidable consequence of carrying on otherwise legal activities. The court recognized that the federal government has yet to develop a system to regulate the management of unintentional, or "incidental" violations that occur during otherwise legal activities, such as clearing for natural resource facilities and pipelines. The company argued that the absence of a permitting system makes it impossible for a defendant to establish due diligence and thereby escape conviction, since engaging in an activity such as logging automatically entails the destruction of migratory bird nests. The court disagreed. According to the court: "It is up to the defendant to establish that he took those steps which a reasonable man would have taken in the circumstances." (Irving 2008)

Complaints and Petitions

In 2002, a complaint was filed by ENGOs with the Commission for Environmental Cooperation (under NAFTA) on the basis that Canada was failing to enforce the MBCA against logging companies during clear-cut logging operations in Ontario - and more specifically s. 6(1)(a) of the MBR prohibition on the disturbance and destruction of nests of migratory birds. The complaint alleged that the MBR was not being enforced in

respect of clear-cut logging activities in 53 forest management units. The CEC factual record completed in 2006 confirmed that tens of thousands of bird nests were being destroyed each year contrary to the MBCA and that Canada was not enforcing the nesting prohibitions (CEC 2002). The 2005 amendments, in part, were to address the inability of the government to permit such activity. Subsequent to the CEC findings Environment Canada began work on the development of an incidental take permitting regime however, as noted above, pulled the plug on the work late in 2010 and instead focused on developing a Best Management Practices.

In January 2011, Ecojustice filed a petition with the Auditor General of Canada (pursuant to s.22 of the Auditor General Act) respecting the abandonment of the migratory bird nest permitting regulatory initiative by Environment Canada and the ongoing failure to comply with the North American Agreement on Environmental Cooperation. The petition asked for an explanation of when Environment Canada will begin to enforce s.6(1)(a) of the MBR with respect to logging and other industrial activities, to articulate timelines and to explain the abandonment of the proposed regulatory framework, to explain the continued failure to enforce the MBCA, and to articulate the steps taken by Canada to remedy this violation. It alleged that the abandonment by Environment Canada of the "incidental take" regulatory initiative perpetuates Canada's long-standing violation of the obligation to enforce the MBCA under the North American Agreement on Environmental Cooperation and called for the government to address the long-standing failure to enforce this legislation and honour its international obligations. The Minister of Environment provided the following response to the Petition, along with a more detailed explanation from Environment Canada. (OAG 2011)

> Environment Canada is effectively enforcing the *Migratory Birds Convention Act, 1994* and subsection 6(a) of the *Migratory Birds Regulations,* undertaking a series of important actions that support this enforcement. These activities include training and designating enforcement officers; inspections and investigations, which have resulted in fines in a number of cases; and compliance promotion.
>
> Environment Canada works with stakeholders to support and promote the development of sectoral beneficial management practices to help implement the *Migratory Birds Convention Act, 1994* and further enhance compliance. This approach allows the Department to address the highest threats to the conservation of migratory birds and remain focused on compliance and enforcement of the prohibitions of the *Migratory Birds Regulations*.

Recent Enforcement Activity

There has been increased activity in the enforcement of the MBCA in Canada over the past few years.

Recently, charges have been laid under a variety of circumstances where industrial activity disturbed or destroyed migratory bird nests and fines. Some examples are as follows:

- In 2005, a British Columbia construction company was fined $10,000 for destroying one Robin's nest.
- In 2008, a forestry company was fined $60,000 for destroying eight Heron's nests.
- In 2012 a yacht club was fined $6,500 for destroying the nests of bank swallows.
- In 2016 a company was fined $8,000 and was ordered to develop habitat, after destroying the nests of bank swallows in a sand pit.
- In 2016, a company was fined $15,000 for destroying for destroying the nests of bank swallows in a gravel pit.

The prohibition on the deposit of substances harmful to birds in areas "frequented by migratory birds" has also been the subject of increased enforcement and recently resulted in the highest fine ever paid in Canada for an environmental offence. Examples include the following:

- In 2009, a waste management company was fined $12,500 in relation to a spill of 30-70 litres of hydraulic fluid into a storm sewer system and a nearby pond. Nine birds had to be euthanized.
- In 2010, an energy company was fined $125,000 for a spill of crude oil from a well site in Alberta. 300 Birds died in the incident.
- In 2010, an oil sands operator was fined $3 million after 1,600 birds died when they landed on the company settling basin.
- In 2010, a bakery was fined $35,000 when 644 litres of vegetable oil was spilled into a storm water pond. Nine birds were impacted by the oil.
- In 2010 a First Nation was fined $10,000 for a spill of 6,000 litres of diesel fuel from a storage into a nearby lake.
- In 2012, a trucking company was fined $75,000 for a spill of oil from logging equipment and vehicles when the barge they were being transported on sank.
- In 2015 an energy company was fined $250,000 after 17 ducks died in a condensate tank.
- In 2015 an LNG manufacturer was fined $650,000 after 7,500 bird were killed when they flew into a flare stack during a fog event. Separate charges and fines were also levied under the *Species at Risk Act*.

Due Diligence

In 1988, in the case of *R. v. Sault Ste. Marie*, the Supreme Court of Canada established that an entity can defend itself against an allegation of an offence under an environmental law if it can establish that reasonable care was taken to avoid the prohibited act. This is generally referred to as the due diligence defence. If the defence can be proven, the

accused will not be guilty of the offence. The MBCA contains provisions establishing that an accused can defend itself on the basis of due diligence.
Court decisions since *Sault Ste. Marie* has clarified that reasonable care does not require perfection or superhuman effort, and that what is reasonable will depend on a number of factors. In summary, the Courts have established the following factors as “rules” relevant to the question of whether appropriate due diligence was exercised:

- Reasonable care does not require that all steps be taken, but only those steps that could reasonably be expected in the circumstances, to prevent the prohibited act from occurring.
- The standard of due diligence is variable, and is directly related to the gravity of potential harm.
- An accused must establish that it considered the potential for foreseeable harm and took all reasonable precautions in contemplation of that potential harm to ensure the environment was protected.
- The degree of harm to the environment may be reasonably balanced with economic considerations.
- Previous incidents involving the same type of conduct with which the accused is charged may be a relevant factor in considering whether the accused has exhibited reasonable care.

Thus, a company will be held to a standard of reasonableness, based upon its skill level, the potential for harm and past events. The Courts will look at a variety of factors to determine what the standard of reasonableness should be, including regulatory requirements, industry standards and practice, and knowledge on the part of the accused of a potential problem or risk. It is a systematic approach, which requires that a system be put in place and that the system be effectively implemented.

It is noted that exercising due diligence is not a guarantee that there will not be an investigation by government should harm to migratory birds or their nests occur. However, in addition to reducing the risk that such harm will occur, efforts to protect birds will assist in reducing the likelihood that such an investigation would lead to enforcement or, if charges are laid, to convictions under the MBCA.

[continued next page]

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4. *BC's Environmental Mitigation Policy: Guidance for Mitigation Plans and Offsets*

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Summary:

The BC Ministry of Environment (ENV) and the Ministry of Forests, Lands and Natural Resource Operations, along with the Environmental Assessment Office (EAO) and other natural resource management agencies have implemented a policy to support a consistent approach to mitigating impacts on environmental values from development projects and activities.

In April 2014, the Natural Resource Board (NRB) endorsed the Policy for Mitigating Impacts on Environmental Values (aka: Environmental Mitigation Policy, or "EMP") and associated Procedures making it formally available for implementation within the natural resource sector.

The EMP is targeted towards proponents and qualified professionals, government staff and decision makers. It provides guidance on preparation of mitigation plans, as well as supporting more consistent, transparent and durable decision-making within government. It can apply to all levels of projects and supports a suite of natural resource legislation. Though the EMP on its own does not create any new legal requirements, proponents are encouraged to follow the policy and procedures when planning projects and submitting applications and may be required to adhere to the policy if included in the conditions of a permit or authorization; any activities must be carried out in accordance with the relevant legislation, conditions of the approval document, and/or other legal requirements.

The core of the policy is the mitigation hierarchy, a step-wise progression that prioritizes avoiding effects ahead of minimizing or counteracting them. The hierarchy is this: Avoid, Minimize, Restore On-site, Offset. That is to say, all feasible measures to avoid an impact on an environmental value must be considered first before moving to the next step in the hierarchy, Minimize; all feasible measures to minimize impacts must be considered before moving to Restore on-site, and so forth. In most cases this would be the process by which mitigation planning for a project would proceed. But with increasing focus on offsetting as a mitigation tool (both in literature and in practice globally), there is a danger that the consideration of avoidance and minimization fall to the wayside in favour of a quick 'payoff'. This policy addresses that issue - the EMP formalizes the BC government's approach to mitigation: Offsetting is an acceptable

mitigation measure but can only be considered once all other steps in the hierarchy have been addressed.

Offsetting is the last tool in the mitigation toolbox, and is not a payoff. Offsets must deliver a tangible, measureable, on-the-ground conservation outcome. The Policy and Procedures outline several options for conservation offsets, including offsite restoration, habitat securement, and habitat enhancement to name a few. Financial offsets are also considered under the Policy and Procedures; because of limited authority for financial transactions under the statutes, decisions must be made on a case-by-case basis – and the principles of transparent, science-based decisions, best conservation outcome and ecological equivalency are brought to these considerations.

Two key principles of the EMP are: Responsibility for mitigation and offsets rests with the proponent, and; offset measures should be secured for duration of the impact. The Procedures provide guidance to support implementation of these and other key pieces of the Policy, including linking mitigation measures directly to effects, identifying ecologically equivalent offsets, and planning implementation or effectiveness monitoring of mitigation measures.

For qualified professionals in BC, the concepts in the EMP are not novel. We may begin to see changes in how environmental application information is requested by government or stakeholders. We expect to see a greater focus on clearly identifying how proponents have addressed avoidance and minimization, and clearly determining residual impacts on all valued components. As the desire for transparency around environmental decision making increases, the EMP will provide guidance on how to structure mitigation and offset planning and information to ensure greater accountability.

The full Policy and Procedures documents, brief overview videos, FAQs, and supporting information are available on the Policy website:
http://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/policy-legislation/environmental-mitigation-policy

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5. *Reducing the Risk of Incidental Take in Interior British Columbia: a Collaborative Approach by the Forest Sector*

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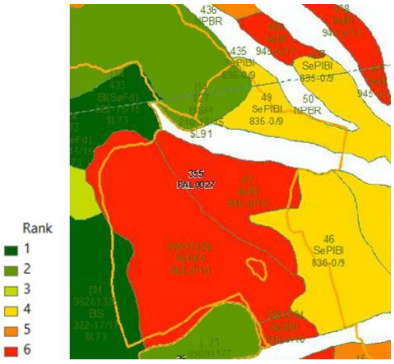
Forest companies operating in interior British Columbia developed a preliminary migratory bird tool kit to guide management of forest birds (Wilson et al. 2016). It contains 6 main components:

1. Risk Rating Matrix for Forest Stands and associated GIS layer
2. Best Management Practices to avoid or reduce risk
3. ECCC Nesting Zone Polygons
4. Standard Operating Procedures (Company specific)
5. Training
6. Testing and Monitoring



The Nest Density Ranking Matrix (Ranking Matrix, hereafter) was developed to provide a relative, non-quantitative ranking of bird density for forest stands within interior BC (Stuart-Smith 2016). A GIS layer indicating the rank of all forest stand polygons in the BC Vegetation Resource Inventory (VRI) dataset was produced from the Ranking Matrix. A list of possible beneficial management practices (BMPs) was compiled to accompany the matrix and GIS layer (Smith et al. 2016). Nesting Zones were intended to provide guidance on timing of harvest in relation to breeding seasons. Lastly, companies developed a standard operating procedure on how to apply the other elements in the toolkit, which includes training. Appropriate use of this toolkit is meant to reduce the likelihood and/or magnitude of accidental destruction of migratory birds and their nests during the breeding season (Wilson et al. 2016, Stuart-Smith 2016).

Risk Ranking Matrix

The general approach was to assign a qualitative rank (1 = low nest density and 6 = high nest density) to
forest stands based on bird habitat as indexed through four easily-recognizable habitat attributes:

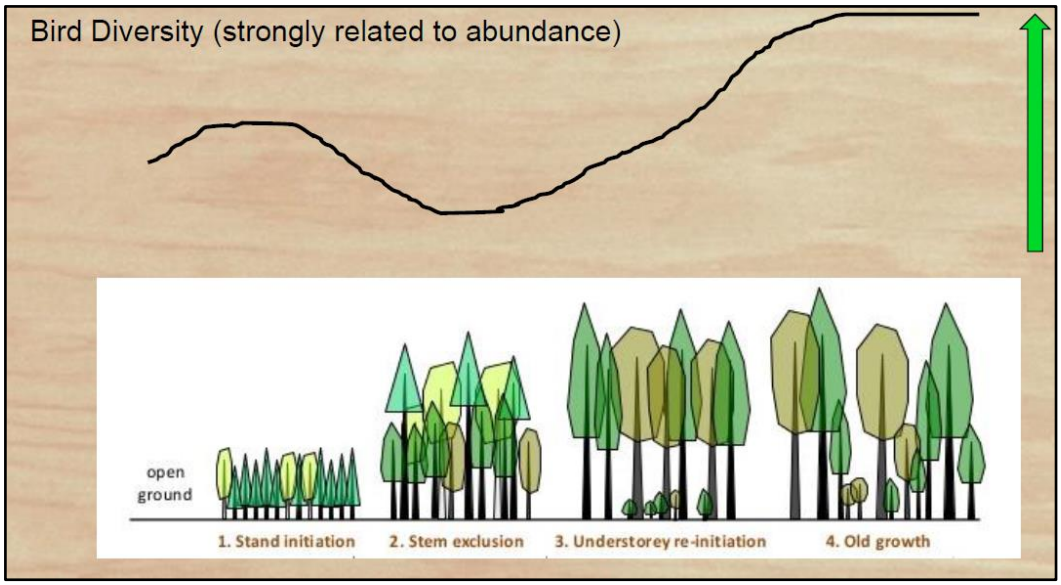
Biogeoclimatic (BEC) Zone (N=8)
Dominant tree species (N=19 stand types)
Forest age class (N=5)
Forest height class (N=4).

Of the 3040 unique stand types resulting from a factorial combination of these factors, 1409 existed with over 50 ha of forest within the BC inventory, and thus received a rank.

Leading Species	Age 3-30 years				Age 30-80 years				Age 80-120 years				Age 121-250				Age 250+			
	Height (m)				Height (m)				Height (m)				Height (m)				Height (m)			
	<10.4	10.5-19.4	19.5-28.4	28.5+	<10.4	10.5-19.4	19.5-28.4	28.5+	<10.4	10.5-19.4	19.5-28.4	28.5+	<10.4	10.5-19.4	19.5-28.4	28.5+	<10.4	10.5-19.4	19.5-28.4	28.5+
PyFd	2	1	.	.	2	1	3	.	1	2	3	4	.	2	4	4	.	.	4	5
PyFd_Decid	3	2	.	.	3	2	3	.	1	3	4	5	.	3	5	5	.	.	5	6
Fd>75%	2	1	.	.	2	1	2	4	1	2	3	4	.	2	3	4	.	.	4	4

Assumptions and principles: The ranks for each forest stand in the Ranking Matrix were developed based on basic ecological principles rather than quantitative bird data (Stuart-Smith 2016). These principles included

- Deciduous trees are a key factor influencing bird communities; stands with deciduous trees support more species than stands without deciduous trees.
- Mixedwoodand deciduous stands in the northeast region of the province generally support the highest densities of nesting birds in BC.
- Bird diversity is strongly related to the structure of the vegetation –the more complex the stand structure, the more bird species tend to occupy a stand.
- Residual trees, snags, partial cuts, etc. were not explicitly captured in the ranking system –that was too complex for this first iteration



The current Ranking Matrix is recognized as a hypothesis that should be challenged with quantitative data.

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6. Bird Density in the BC Interior – Testing a Stand Ranking Matrix

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Summary

In a highly-collaborative effort, a group of forest product companies in the interior of British Columbia created a tool to rank the value of forest stands to bird populations. Based on attributes from Vegetation Resource Inventory (VRI) data, each forest stand was assigned a rank (from 1 to 6) based on its expected bird nest density (Figure 1). While the ranks for the matrix were assigned based on ecological principles derived from a literature review, it was openly recognized that this ranking matrix and the associated spatial file were a 'best guess'. The Boreal Avian Modelling Project was contacted to evaluate the matrix using bird data.

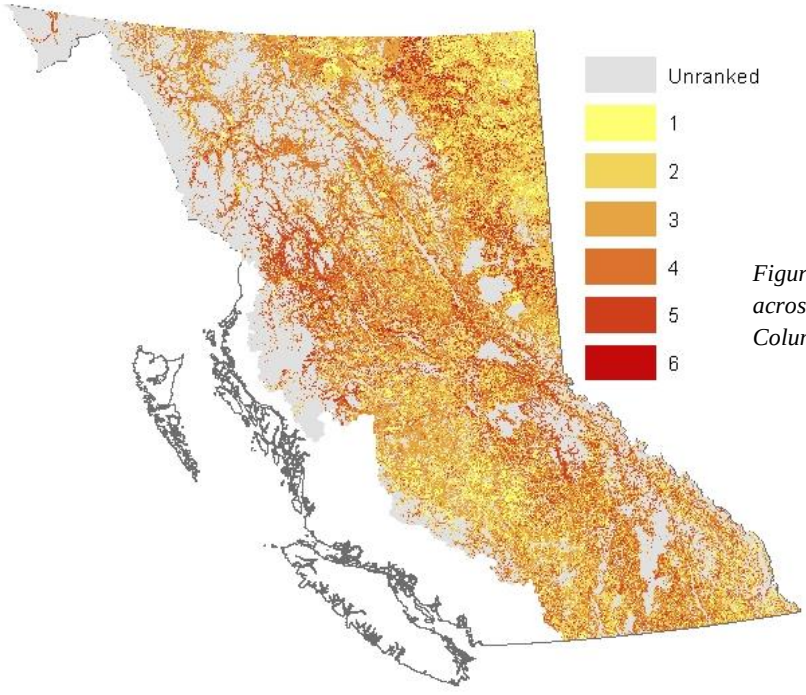

Figure 1. Distribution of stand ranks across the interior of British Columbia.

The Boreal Avian Modelling Project (BAM) is a unique, international research partnership among avian and forest researchers, conservation agencies, industry, as well as other funders and end-users of avian research (Cumming et al. 2010). The participants support the conservation and management of boreal birds by developing and applying quantitative methods to better understand avian ecology. This applied ecological research and resulting national-scale data products are possible because of BAM's extensive Avian Database of nearly 1 million partner-contributed point count surveys that have been harmonized into a common format and standardized for use in statistical analyses (Sólymos et al. 2013, Barker et al. 2015; Figure 2). In BC, we have data from over 36,000 point-count stations (Figure 3). Results presented here were based on data from only 12,600 stations, because the remaining data points had not been standardized at the time of this presentation.

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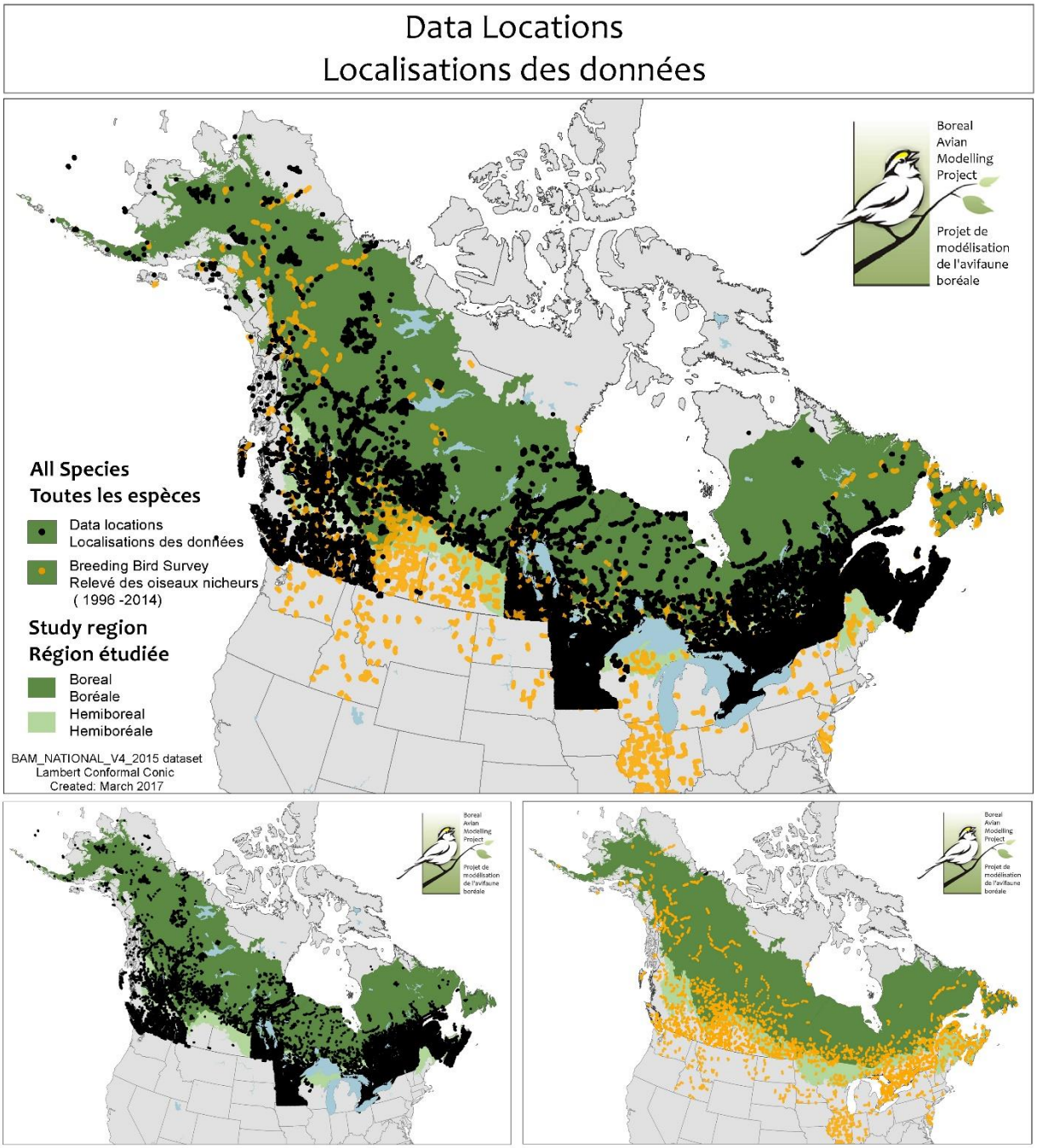

Figure 2. The BAM Avian Database as of April 2017.

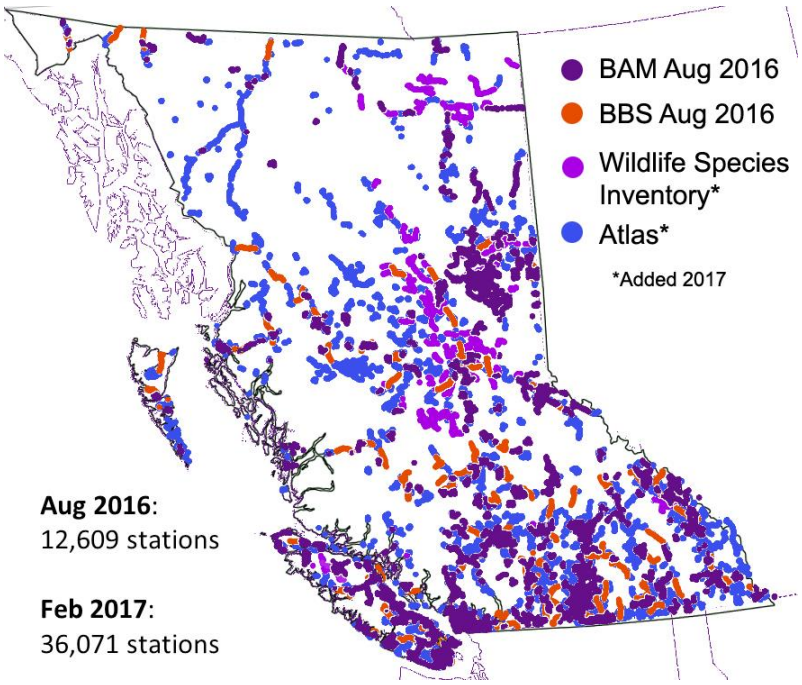

Figure 3. Point count survey locations in British Columbia.

BAM's statistical offsets allow us to analyze point-count data collected using different methodologies into the same analysis, while simultaneously correcting for detection error (Sólymos et al. 2013). The result is that we can estimate avian density rather than using count as an index of avian abundance.

Goals of this analysis were:

1) Test assumptions used to build the matrix
2) Suggest means of improving the matrix
3) Identify where more point-count sampling should take place

Some of the assumptions that went into the matrix include:

1) Nest density is positively correlated to bird abundance
2) Ranks indicate bird nest density.
3) Bird abundance shows a quadratic relationship with stand age
4) Relationship between bird abundance and forest height will depend on forest age, biogeoclimatic zone, and tree species.
5) Bird abundance is positively related to tree species diversity
6) Certain tree species are functionally the same to birds

At the time of this presentation, we had explored only assumption #2: that matrix ranks indicate bird density. We did not test assumption #1. Instead, we accepted Environment & Climate Change Canada's recommendation that a singing male indicates nesting of that species, and therefore assume that estimated bird density from our models provides a reasonable proxy for nest density.

If a stand's rank reliably relates to the number of birds in that forest stand, we would expect to see a linear correlation between rank and density (Figure 4a). However, given that our study area covers a vast geographic area spanning a range of latitude, longitude, and elevation, and encompasses many different tree species communities, we would expect some variation around that correlation. We might instead see that rank correlates to density in different ways depending on the biogeoclimatic (BEC) zone (Figure 4b), the dominant tree species, or a combination of the two factors (Figure 4c).

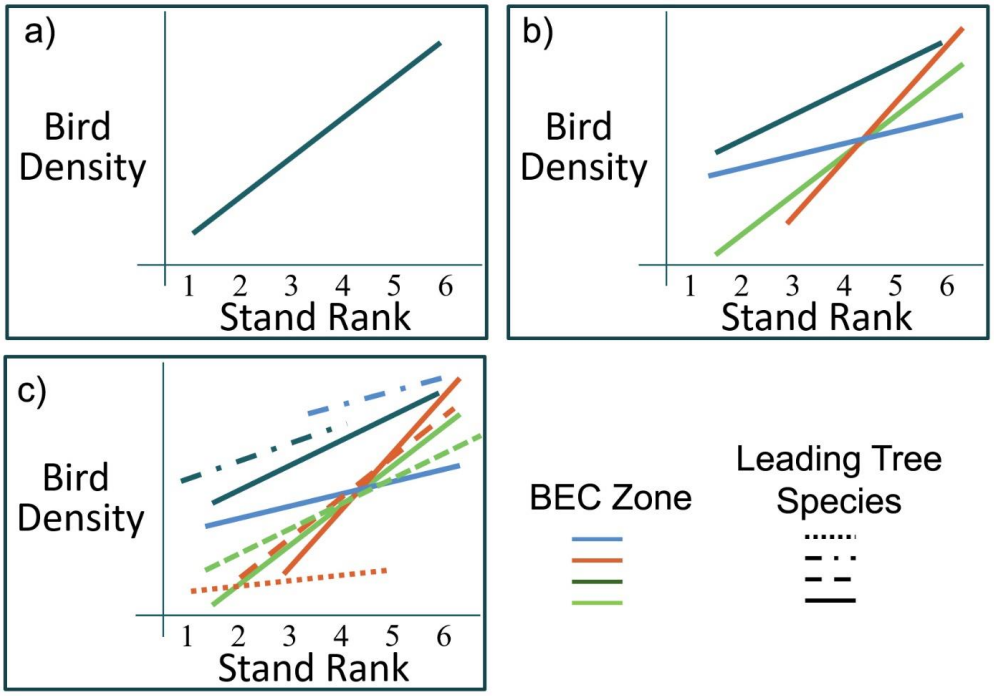

Figure 4. Expected correlations if stand rank is a reliable indicator of bird density. a) shows the situation where there is no regional variation in correlation by BEC zone or tree community. b) shows variation in the correlation by BEC Zone, and c) shows variation by both BEC Zone and leading tree species.

Preliminary analyses of a partial point-count dataset show a significant but very small correlation between stand rank and bird density. The estimated effect of rank on bird density in a Poisson GLM with bird count as response variable, stand rank as predictor, and BAM's statistical offsets as offsets, is 0.03 (std err: 0.0009).

Analyzing the BEC Zones separately, some showed stronger correlations but others showed weaker, negative, or non-significant correlations (Table 1). The relationship between rank and bird density within the Interior Douglas Fir BEC Zone was non-significant, which can be seen in Figure 5.

Table 1. Relationship between stand rank and bird density for each of the BEC Zones. Relationship is estimated from a GLM with bird count as response variable, stand rank as the predictor, and BAM's statistical offsets as an offset to correct for detection error and variable point-count survey method. BEC Zones were analyzed separately.

BEC Zone	Relationship between Rank and Bird Density	Standard Error
Bunchgrass, Ponderosa Pine	0.108	0.007
Boreal White and Black Spruce	0.027	0.002
Engelmann Spruce - Subalpine Fir	0.091	0.004
Interior Cedar - Hemlock, Mountain Hemlock	-0.011	0.003
Interior Douglas Fir	0.001	0.002
Montane Spruce	0.124	0.003
Sub-Boreal Spruce, Sub-Boreal Pine – Spruce	0.015	0.002
Spruce - Willow – Birch	-0.073	0.025

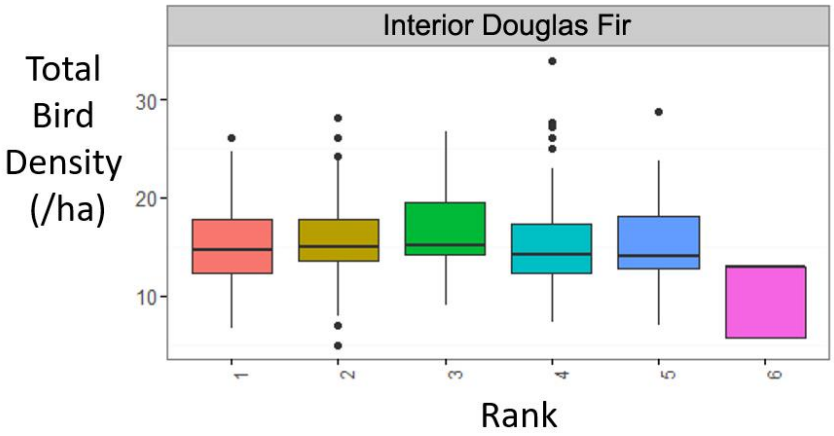

Figure 5. Variation in bird density (y-axis) across forest stand ranks (x-axis) for the Interior Douglas Fir BEC Zone.

Splitting results even further by leading tree species and BEC Zone results in some strongly positive relationships and some negative ones. Some of the variation in patterns is apparent in Figure 6.

While these results are preliminary, they suggest that stand ranks do not generally indicate total bird density in a forest stand. Further analysis are planned to explore why this discrepancy exists and how the ranks might be improved.

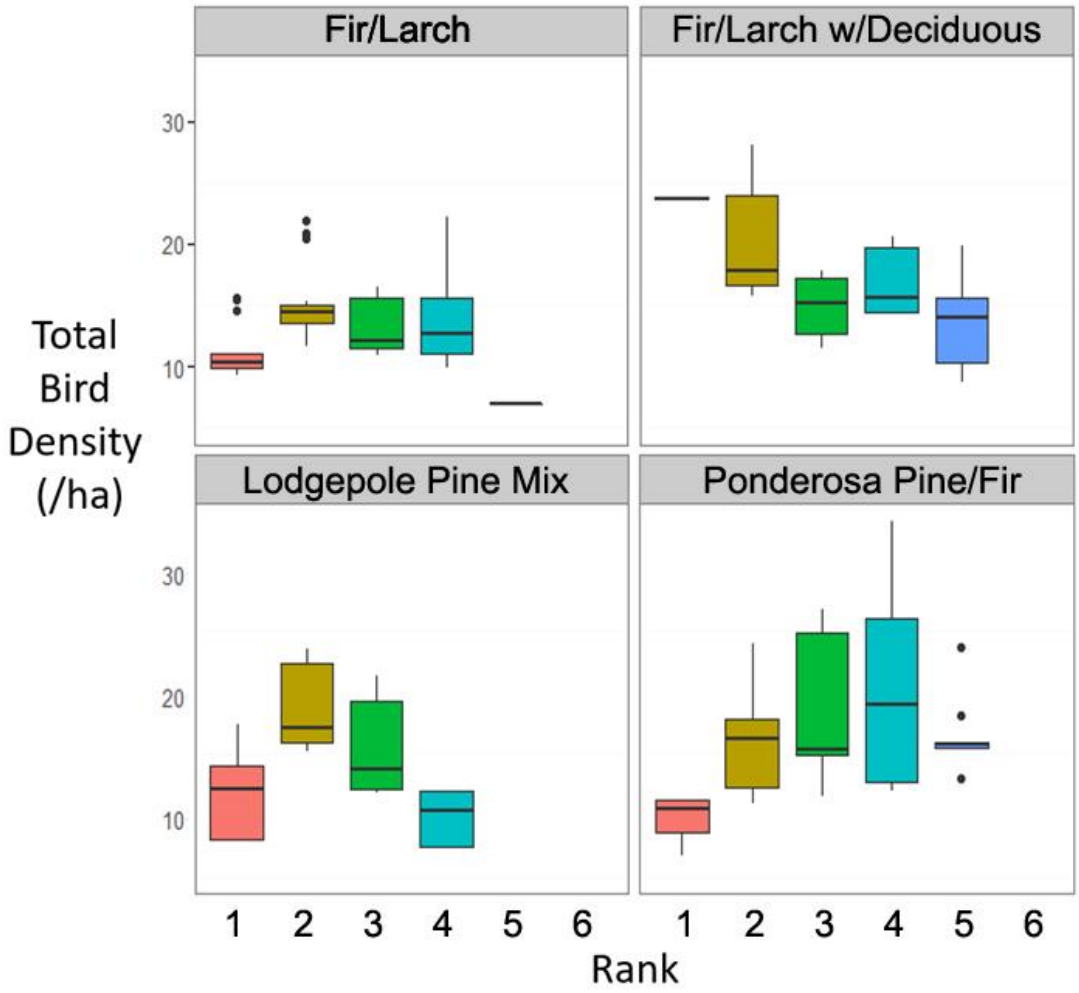

Figure 6. Variation in bird density (y-axis) across forest stand ranks (x-axis) for the four different tree species groups within the Interior Douglas Fir BEC Zone.

One option for improvement is to model bird density as a function of forest stand attributes based on stands where point count surveys have been conducted. The model can then predict bird density to unsurveyed stands based on the characteristics of the forest, resulting in a map of predicted bird density across the study region. A preliminary model was built as a demonstration of this approach, using Boosted Regression Tree analysis with BEC Zone, tree species group, forest age, forest height, and percent deciduous as predictor variables (Figure 7).

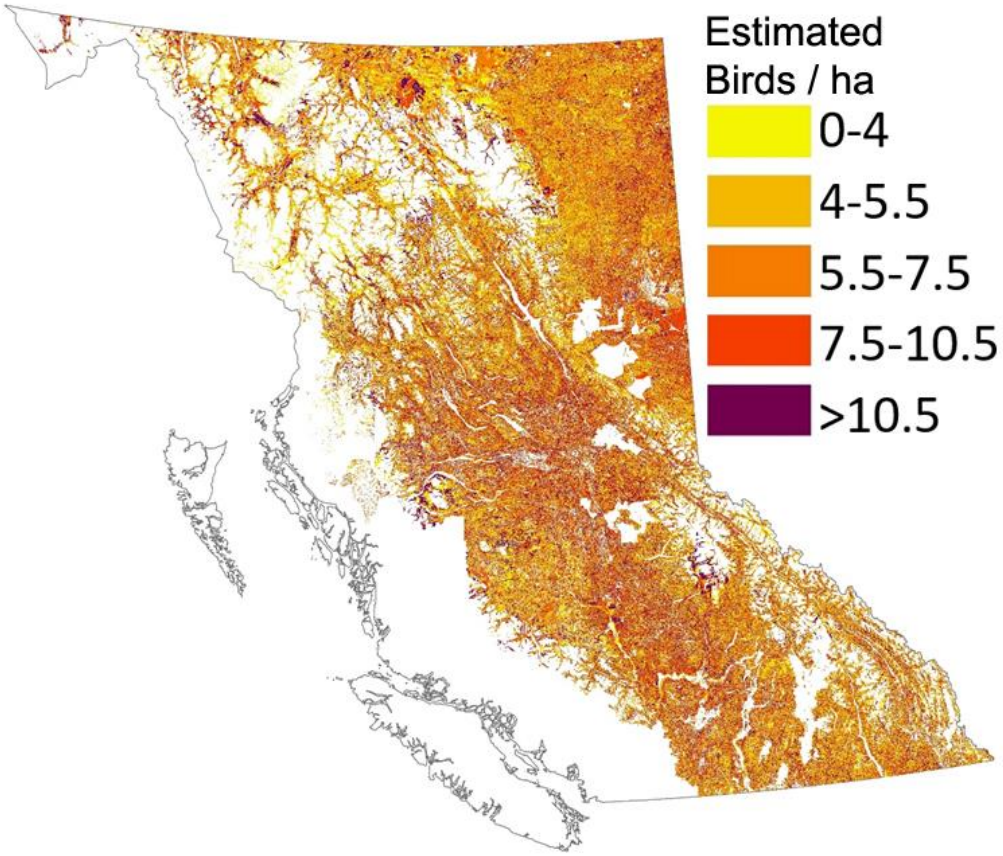

Figure 7. Predicted density (males / hectare) resulting from a Boosted Regression Tree model with bird count as the response variable, BEC Zone, tree species group, forest age, forest height, and percent deciduous as predictors, and BAM's statistical offsets as the offset.

Some statistical evaluation remains to be done on the reliability of predictions from this model. However, if its predictions are reliable, this map could be used as an alternative or complement to the ranking matrix.

Thinking further into the future, one could use models like the above to predict anticipated bird populations that might result from various forest management planning scenarios. This would provide some information regarding the long-term population-level impacts of specific forest practices, block configurations, or harvest schedules.

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Acknowledgements

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7. *Using Forest Resource Inventory Data for Consistent, Regional Prediction of Potential Incidental Take on Managed Forest Lands*

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The Cranbrook meeting addressed the incidental take of migratory birds in the normal course of commercial activities such as forest harvesting, construction or infrastructure maintenance. The main form of incidental at issue is the destruction or disturbance of active nests, actions contrary to the provisions of the Migratory Birds Convention Act. For spatially localized activities, it may be possible to locate and protect individual nests or to defer some planned activities. For more spatially extensive activities, like forest harvesting, preventive measures are not possible. Instead, forest managers are seeking to minimize or reduce the total amount of incidental take. The total density of active nests varies with the time of year, and spatially in relation to factors like climate and forest type. Thus, firms could limit their total incidental take by controlling the selection and schedule of harvest blocks. This amounts to including total nest density in forest management planning, along with the usual factors such as harvestable volume, delivered wood cost and silvicultural treatment. These factors are all predicted at the stand level from attributes such as canopy species composition, age, height and density. These stands and their attributes are defined on forest resource inventory (FRI) maps interpreted from aerial photography. Finally, to address incidental take by forest harvesting, it would be helpful to predict total nest density from FRI attributes, among other factors.

FRI data have been used in ecological modelling for at least 20 years (Rettie et al. 1997; see other references in Cumming et al. 2010). They have been used to model and map abundances of breeding bird species for almost as long (Drapeau et al. 2000; Vernier et al. 2001). Many studies have since linked such models to simulation tools in order to forecast the effects of forest management plans on bird abundances. These statistical models are built from samples of point count data. Recent methodological advances (Solymos et al. 2010) allow models of true density of individual species to be estimated from such data, rather than relative abundance as formerly. Under reasonable assumptions, the modelled densities are a good approximation of nest densities. Hence, individual models of many species (excluding only the rarest) could be summed to estimate total nest density, at least of migratory passerines. This would provide the desired link between FRI stand attributes and total nest density.

The observational data needed to estimate bird density models is not available everywhere it might be needed. Models fit to data from a small area can be unreliable for prediction elsewhere (Vernier et al. 2008). For these and other reasons, there has long been a need for a spatially comprehensive avian data set to support avian conservation and management in Canada's forest lands. The Boreal Avian Modelling Project (BAM) is a long term university based research program that seeks to address such needs. Starting in 2004, we have now assembled much of the point count data that has ever been collected in Canada (Figure 1). We have used these data to develop many kinds of species abundance models at national extents, which have used to map their present distributions and abundances, and forecast their future distributions under climate change (see the website for details and a list of publications). We are now embarking on some major efforts to apply our data to problems of forest management. These new models will be based on FRI data.

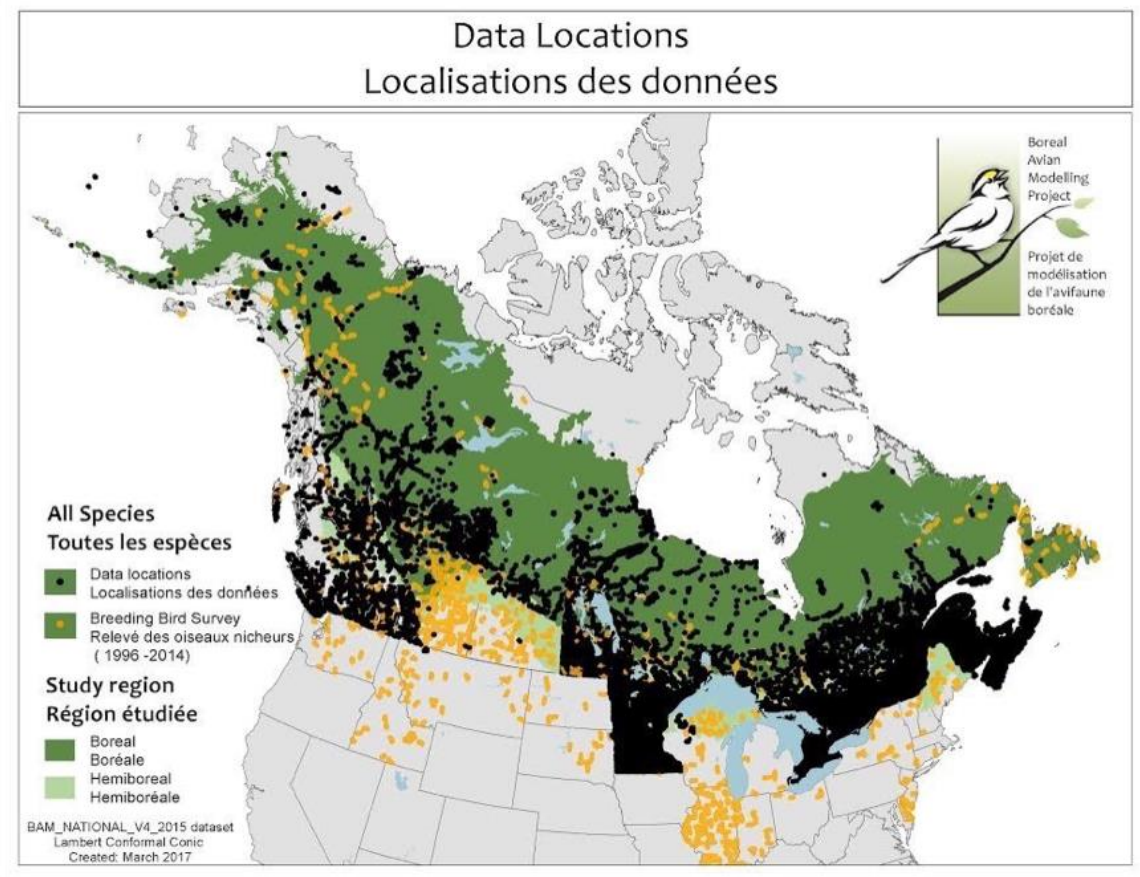

Figure 8 Data locations of the Boreal Avian Modelling Project as of 2016.

Modelling avian abundances with FRI data is nothing new. However, doing so over large areas poses great difficulties. Every Province and Territory has developed their own inventory standards. In some provinces several different standards are in use. Data ownership can be distributed amongst several government agencies and the private sector. The author and his colleagues have tackled the challenge of assembling consistent coverages of FRI data over large areas, for multiple data sources within a single province (Wang and Cumming 2009), and across several provinces (Hauer et al. 2010). This demonstrated the feasibility of assembling a more comprehensive, national coverage of FRI data. Foreseeing the present need, in 2009, Cumming initiated a project to do so, supported by BAM. We began by developing a standard to unify all the essential attributes common to Canadian FRI data (Cosco 2011), the Common Attribute Schema for Forest Resource Inventory (CASFRI). We then developed data sharing agreements with many government agencies and private sector firms allowing us to acquire their data, under varying use restrictions. The current extent of CASFRI coverage is shown in Figure 2. Some details of CASFRIs structure and an application to a national study are reported in Cumming (2014). Although CASFRI is built from over 20 source inventories of differing age, mapping standards and ownership, it can provide spatially coherent, high resolution maps of forest stand attributes (Figure 2).

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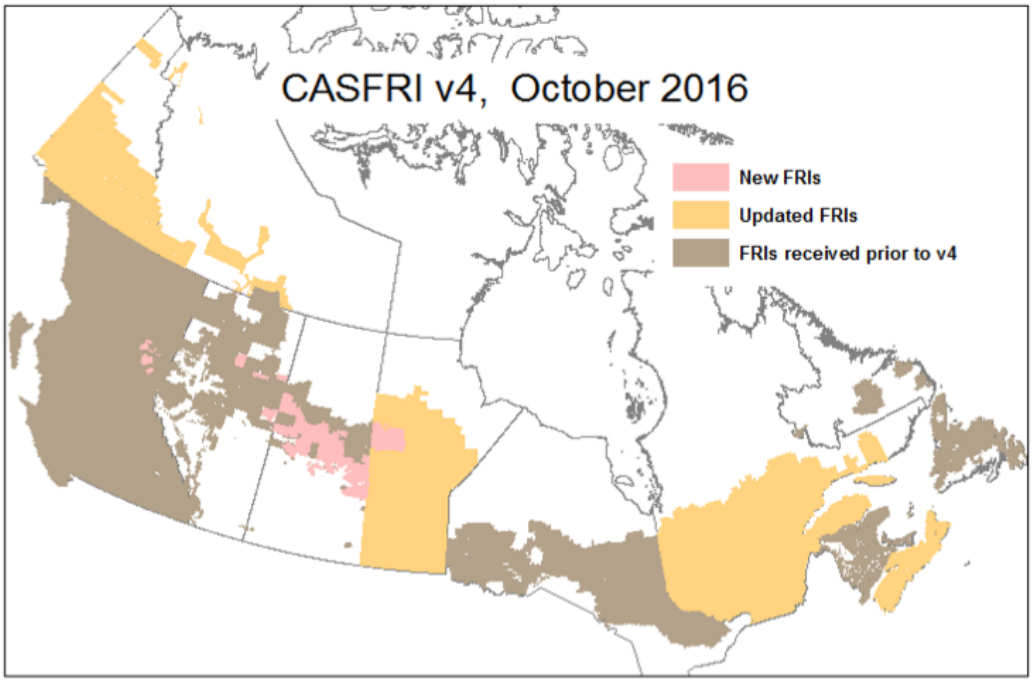

Figure 9 Spatial extent of CASFRI v4, with update history. "Updated FRIs" are areas where an older inventory was replaced by a new inventory interpreted from new aerial photography (e.g. Québec) or reinterpreted from old photography to modern standards (e.g. Manitoba).

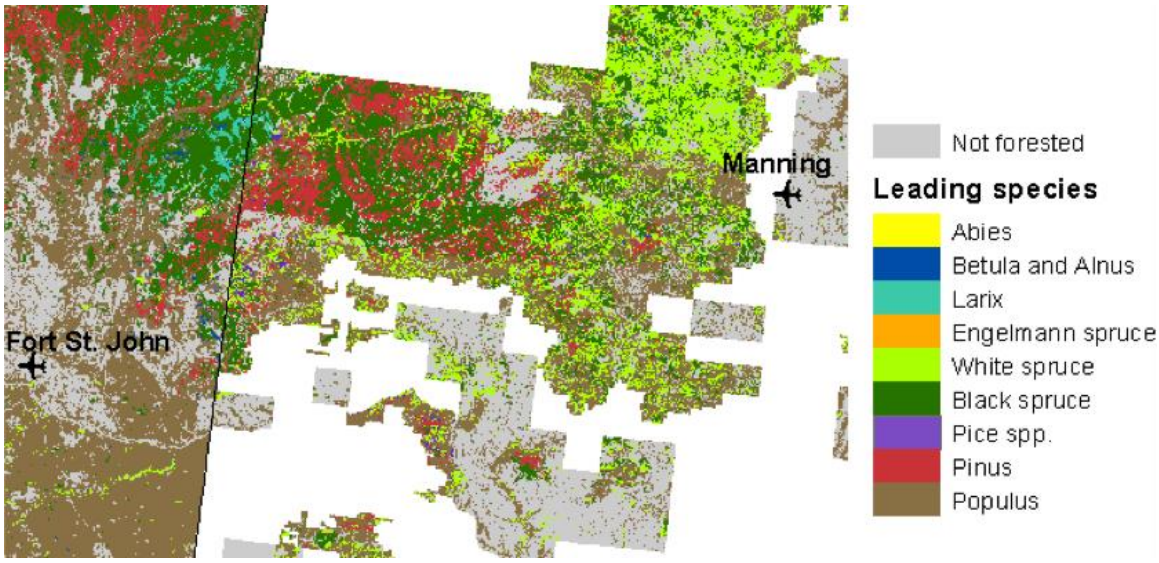

Figure 10 A map of the dominant tree species of forested stands for a region of boreal forest illustrating the coherent integration of disparate inventories from two Provinces and several forest products firms.

CASFRI was developed to support national research initiatives in avian conservation, ecological modelling, and boreal conservation planning. It could also be applied to many problems in forest management at large extents. Management of incidental take across tenure areas and jurisdictional boundaries is one such application: CASFRI has already solved the problems of data assimilation and integration. On behalf of my many colleagues and collaborators, I welcome this opportunity to acquaint you all with the BAM and CASFRI projects.

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8. *Reducing the Risk of Incidental Take of Waterfowl During Forest Management Activities in Canada's Boreal Forest*

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Introduction

In Canada migratory birds, nests and eggs are protected under the Migratory Birds Convention Act (MBCA 1994). Currently, the inadvertent harming, killing, disturbance or destruction of migratory birds, nests and eggs, often referred to as "incidental take", may be considered a violation under the Act and its regulations. Individuals/ companies found to have willfully or inadvertently violated the prohibitions of the MBCA may be subject to enforcement and penalties. As a result, the forest industry is looking for ways to reduce the risk of incidental take when undertaking forest management planning and operations and to demonstrate due diligence. Ducks Unlimited Canada (DUC) believes that using Best Management Practices (BMPs) to reduce risk of incidental take of migratory birds by industry will support waterfowl conservation in the boreal forest and assist industry in meeting their regulatory (MBCA 1994) and voluntary (e.g., forest certification) requirements. DUC is collaborating with the members of the forest products industry to develop an Incidental Take Guide specifically targeting waterfowl in Canada's boreal forest. This paper will discuss the background and purpose of the project, key components of the Guide and next steps.

At this time, Environment and Climate Change Canada (ECCC) does not issue permits for incidental take, and industry must demonstrate due diligence in avoiding incidental take when operating during the breeding season. In response to ECCC's recommendations to industry to develop BMPs and avoidance guidelines to reduce the risk of incidental take, a number of industry groups developed or are in the process of developing BMP Guides for migratory bird species (e.g., CEPA 2013). However, these guides tend to focus on species at risk and song bird species, with a gap related to waterfowl. To fill this gap, DUC developed a draft guide to reducing the risk of incidental take of waterfowl. This draft Guide is not sector specific and requires input from industry to be useful and applicable.

In 2016 DUC initiated the Forest Management and Wetland Stewardship Initiative (FMWSI), a partnership of six forest management companies and the Forest Products Association of Canada. The purpose of this initiative was to pool industry resources to fund projects of mutual interest to the members and DUC over a three year period. Developing an Incidental Take Guide for Waterfowl for the forest products sector was chosen as one of the first projects under this initiative. DUC is now working with FMWSI members to make the Guide forestry specific and to ensure we develop a useful product that meets mutual conservation goals.

This project consists of the development of an Incidental Take Guide specifically targeting waterfowl in Canada's boreal forest and the development of a short handbook for planners and operators that focuses on how to apply the information in the guide. We are currently working with FMWSI members to ensure that the Guide will:

- Help minimize the risks associated with forest management activities at both planning and operational levels;
- Combine information about waterfowl ecology and forest management activities to assess the relative risk of incidental take of waterfowl during forest management activities;
- Identify mitigative pathways to reduce assessed risk.

Guide Development

We are designing the Guide in alignment with ECCC's *Guide for developing beneficial management practices for migratory bird conservation* (2016a). The Guide will consist of a risk assessment approach, mitigation strategies and discussion on how to apply the approach.
The risk assessment approach combines knowledge of waterfowl ecology including (1) nesting phenology, (2) waterfowl abundance distribution, and (3) proximity of waterfowl nests to water, with knowledge of forest management activities and associated disturbance. This approach is intended to be a framework for making decisions into which different types of information can fit (e.g., local knowledge of waterfowl, waterfowl abundance models, mapping products, etc.).

The decision making approach (Figure 1) consists of four steps: (1) assess disturbance risk; (2) assess waterfowl nesting season; (3) identify potential high density waterfowl areas; and (4) identify areas of high nesting potential. The order of these steps can be shifted to fit with the planning approach of an individual company. For example, determining the timing of an activity may be the last step of harvest scheduling and would therefore make sense to be the last step in the decision making framework. Since the overall risk of incidental take needs to relate to risk reduction strategies, we kept the categorization simple – low, medium, or high – for each step of the approach. The

overall risk of incidental take determined through the decision making framework is also limited to these three categories. We are collating best management practices that can help reduce the risk of incidental take and we will provide guidance on what may be required in the case of high, medium, and low risk. However, each situation and user is unique. It is the user's responsibility to decide the level of risk they are able to tolerate and the practices they are able to implement to mitigate that risk.

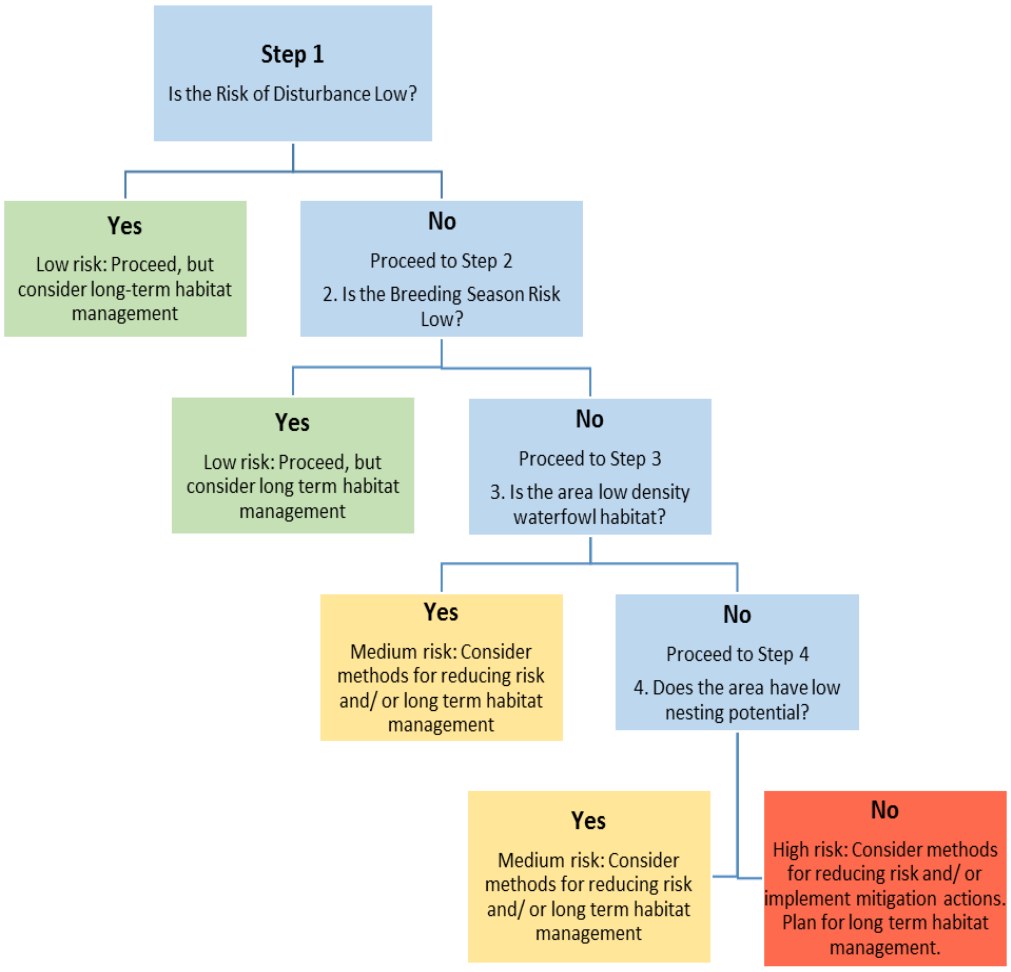

Figure 1. Incidental take decision making approach. This approach incorporates information about disturbance risk, breeding season risk, waterfowl density, and nesting habitat to assess the relative level of risk of incidental take of waterfowl when operating during the waterfowl nesting season.

Step 1: Assess disturbance risk

We have started to collate common activities grouped by habitat types (terrestrial/ aquatic) and by disturbance level (high, medium, or low). With the assistance of the

forest industry we are working to ensure the activities identified represent key activities that could pose a risk of incidental take of waterfowl. A few things to note:

- The list of activities is intended to provide guidance and is not an exhaustive list.
- An activity may fit into a higher or lower disturbance category depending on the duration and intensity of the activity.
- The list will include activities that may have physical impacts on nests and waterfowl, sensory impacts, or both.

Step 2: Assess waterfowl nesting season

Planning for operations to take place outside of the waterfowl breeding season is the only method that completely eliminates the risk of incidental take. However, we recognize that not all activities can take place outside the breeding bird season. Knowledge of waterfowl nesting timing can be used to identify time periods when a high percentage of nesting is occurring, and times in the breeding season (early and late) when risk of incidental take is lower because fewer species and individuals are nesting.

Within our draft guide, we have simplified ECCC nesting calendars (ECCC 2016b) into three risk categories: high, medium and low. High risk nesting periods are when 41% to 100% of all species are nesting, medium includes 21% to 41% of all species nesting, and low includes above 0% to 20% of all species nesting. We used the ECCC calendars for the draft guide because they provide the best nesting information across Canada's boreal. However, other nesting information, such as company nesting data or Bird Studies Canada species specific nesting calendars (BSC 2017), could also be adapted to fit the high, medium, and low categories. Regardless of the information source, nesting timing varies annually and is influenced by local conditions. So, birds in a given area will nest earlier or later depending on timing of spring melt and other weather considerations.

[continued next page]

Step 3: Identify potential high density waterfowl areas

The risk of encountering waterfowl and waterfowl nests on the landscape increases with proximity to preferred breeding habitat. To help identify areas of potential high waterfowl density we suggest using waterfowl density maps, where available. DUC's National Fish and Wildlife Foundation (NFWF) waterfowl model maps (DUC 2014) are available for parts of the boreal plains (Figure 2) and can be used to identify high, medium and low density waterfowl areas. The current extent of NFWF model coverage is shown in Figure 3. Where NFWF model coverage is not available, other waterfowl information (e.g., Barker et al. 2014) can be used. Local waterfowl knowledge can be used to refine model predictions. As part of the decision making approach, we suggest simplifying the waterfowl density distribution into high, medium, or low risk categories.

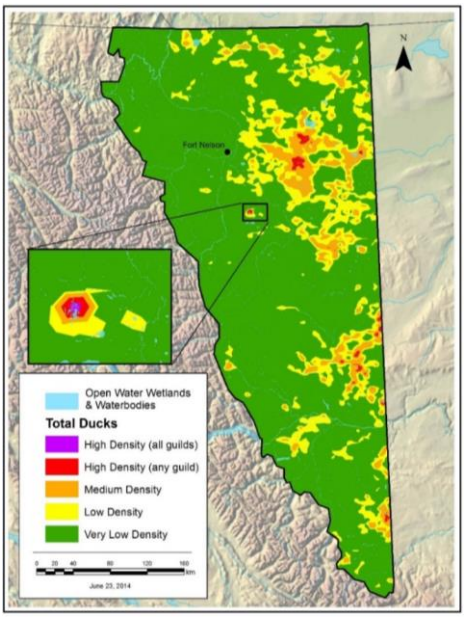

Figure 2: Example of DUC NFWF model map for all nesting guilds in northeastern BC (DUC 2014).

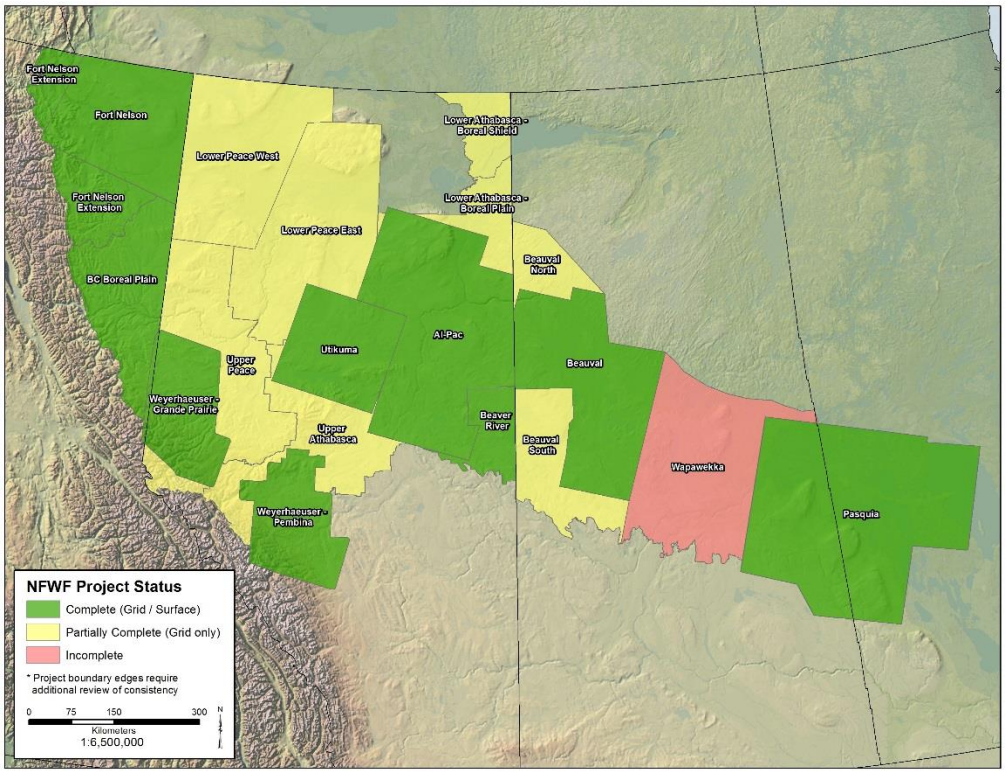

Figure 3. Current available coverage of DUC NFWF waterfowl abundance model maps.

Step 4: Identify areas of high nesting potential

To assist in identifying areas that are more likely to be used by nesting waterfowl at the individual wetland and waterbody scale we developed summary distributions of waterfowl nest distance from wetlands with open water for three nesting guilds – overwater, ground, and cavity nesting species. To develop these distributions we conducted a meta-analysis of studies reporting on nest distances from water (e.g., Maissoneuve 2004, Petrula 1994, Safine and Lindberg 2008, Townsend 1966). To be included, studies had to report species, ecozone, mean nest distance to water, sample size, and a measure of variance (standard deviation, standard error, or confidence interval), or provide raw data. For the distributions, we assumed a log normal distribution of waterfowl nest distance to water. This means that we expect the majority of nests to be located close to open water, with decreasing nest density the further you get from water. To develop summary distributions by ecozone and by species, we calculated the log-normal mean and log-normal standard deviation. We used the log-normal mean and standard deviation to calculate a range of percentile distances (i.e. what percent of nests are expected to be found x meters from water). Species distributions were rolled up to the guild level for ground, cavity, and overwater nesters.

Summary distributions *do not* address the probability of encountering a nest, they simply speak to where the majority of nests in the dataset were found. We used the results of this

analysis to make recommendations regarding areas where we expect there to be a greater likelihood of encountering a nest. These distances *are not* buffers and *do not* represent no-go areas. Within our framework, we classify these areas into low, medium, and high risk categories (Figure 4). Currently, we only have waterfowl nest locations relative to open water. A current knowledge gap is waterfowl nest locations for other wetland and upland types, including various vegetated wetlands (e.g., bogs, fens, and swamps). Future studies or industry work that collects either detailed (GPS) nest location data or nest location by wetland type can help fill this gap.

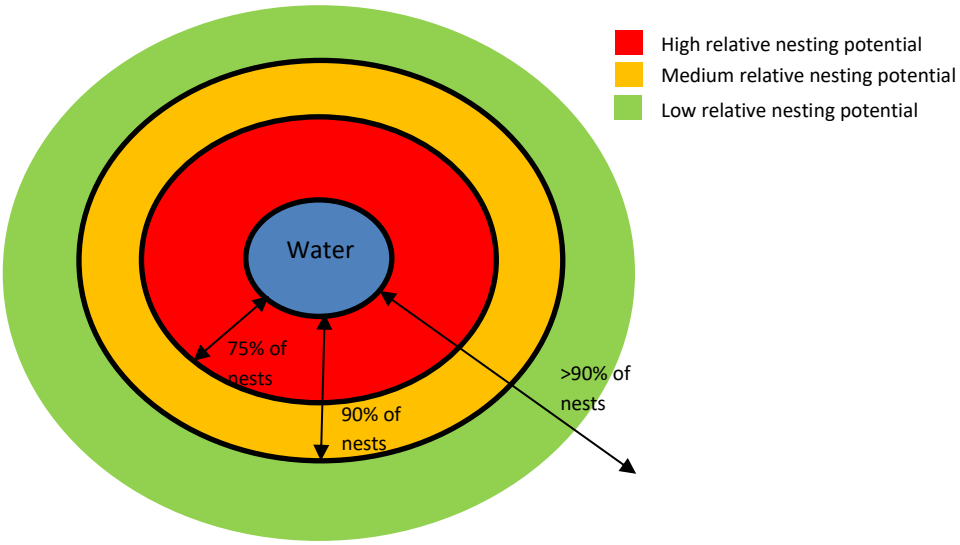

Figure 4. Nesting potential risk categories for ground nesting waterfowl based on results of the meta-analysis.

Discussion

The goal of the risk assessment approach is to promote planning so that the risk of incidental take during on-the-ground operations can be reduced to the lowest possible level while remaining economically and operationally feasible. We are also working on collating mitigation approaches that companies *may* choose to implement depending on the situation. It is the user's responsibility to decide the level of risk they are able to tolerate and the practices they are able to implement to mitigate that risk. Practices include, but are not limited to:

- Staff and contractor training to raise awareness and understanding of legal requirements, conservation objectives and approaches to meet these requirements and objectives
- Identifying current and potential nest trees suitable for retention
- Implementing practices that shift the timing of operations

- Conducting nest surveys and flag and buffer zones around located nests for avoidance in high risk habitats that cannot be avoided

This project is a work is progress and DUC is continuing to work with FMWSI members to incorporate feedback and produce a final version of the Guide. Some members are planning to conduct a desktop test of the risk assessment approach and provide valuable feedback on the utility and practical application of the approach. In addition to a full report we will be developing a short handbook for planners and operators.

Acknowledgements

DUC would like to acknowledge our collaborators on this project: Alberta-Pacific Forest Industries Inc., Canfor, Millar Western Forest Products Ltd., Tolko Industries Ltd., West Fraser, Weyerhaeuser Company and the Forest Products Association of Canada.

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9. Case Studies in Mitigating Incidental Take at Parks Canada Protected Heritage Places

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The Parks Canada Agency protects and presents nationally significant examples of Canada's natural and cultural heritage. As the Agency continues to move forward with its largest infrastructure investment ever, the implementation of construction and maintenance projects across the country is supported by national guidance for managing for migratory birds in protected heritage places. Because activities, species and habitat vary from project to project, the overarching framework outlined in the national guidance can be used to develop tailored solutions. This guidance is consistent with the general advice from Environment and Climate Change Canada and supports Parks Canada in maintaining and restoring ecological integrity.

Four case studies were presented to illustrate how the guidance is applied consistently across Parks Canada's network of protected heritage places. Additional factors were also identified that contribute to project success, including the importance of project planning, especially for the early identification of opportunities for conservation gains that benefit the ecosystem as a whole, good communication and cross-functional collaboration as well as the need for a holistic approach when projects identify competing ecological demands.

In the final case study, Parks Canada discussed how the single standard for breeding bird periods across large administrative units may not best represent the ecology of local bird populations. One challenge in planning construction activities in relation to nesting periods is that elevation correlates to temperature gradients. In the mountains of western Canada, mean temperature can sometimes vary greatly over a few kilometres when the elevation gradient is steep. The Nesting Calendar Query Tool (http://www.birdscanada.org/volunteer/pnw/rnest/warning.jsp?lang=en; accessed 4 April 2017) uses modeling that relates mean annual temperature (MAT) to nesting dates by species (Rousseu and Drolet. In prep.) in relation to over one thousand ecodistricts. We wished to gain an initial understanding of (a) the general scale of within-ecodistrict variability in temperature and the associated predicted nesting periods, and (b) whether this might be enough to affect management decisions. Two sites, representing most of the variability in areas having paved roads (Takakkaw Falls than at Radium Hot Springs), were selected for comparison, as road construction and maintenance commonly require vegetation clearing.

Five bird species were selected, representing a range of life histories and breeding strategies and for each species and each site, species accounts developed as part of phenology modeling were used to predict the dates at which 10% of first eggs would be laid and 90% of nests would be vacated based on mean annual temperature (MAT). These were then compared to dates predicted by the Nesting Calendar Query Tool for the ecodistrict as a whole. This approach indicated that breeding may start about one-half to three weeks later at Takakkaw Falls than at Radium Hot Springs, suggesting a need to carefully consider the dates used to define the beginning of restricted activity periods, depending upon elevation or, more directly, temperature. Less variation was evident in end dates.

The projected differences among sites do not account for the possibility that phenology-MAT relationships developed at a national scale may not hold as well at local scales. However, the road-presence criterion greatly restricted the potential elevation and temperature variability considered. Some activities within protected heritage places occur at even higher elevations. As such, the variability in appropriate dates to use when defining restricted activity periods for actions potentially affecting birds are likely much greater. While the variability identified is not surprising, it does reinforce that the tendency to create single standards for breeding bird periods across large administrative units may not be the best approach for individual projects. Considering the local ecology of bird populations may be necessary to ensure best practices are followed at individual sites.

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10. The City of Calgary's Approaches to Limiting the Risk of Incidental Take of Bird nests

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The City of Calgary, as a corporation, is a large private landowner, whose lands are administrated amongst a variety of business units (including but not limited to Calgary Parks, Transportation Department and Corporate Properties). Ensuring compliance within a municipality is complex because of the variety of development and operational activities that occur on City land conducted by various developers, contractors and The City itself. Due to the climate of southern Alberta, The City often performs construction and maintenance work during the times when wildlife is most vulnerable to being disturbed (i.e. during nesting or denning). In order to avoid causing negative effects on wildlife including migratory birds and their nests, The City has several processes in place for construction projects and maintenance.

Construction and Facility Maintenance

The City of Calgary has an environmental policy which all staff and contractors are required to follow (City of Calgary 2012). To promote their awareness and compliance with the policy all contractors are required to commit to our contractor environmental regulations, which are outlined in the Contractor Environmental Responsibilities Package (City of Calgary 2014). This document covers topics like erosion and sediment control, tree protection, dewatering, and spill prevention and reporting. While wildlife protection is not specified in this document, it falls under the Compliance section. It is here that contractors agree that "[they are] aware of the environmental regulatory requirements applicable to the project. I understand the importance of compliance with environmental legislation, approvals or permits, and the consequences of non-compliance" City of Calgary 2014.

All construction projects done by The City are overseen by a project manager. Project managers are found throughout the corporation within the various business units that administer City owned land. It is the responsibility of the project managers to ensure their project complies with all existing legislation and shows due diligence.

Due diligence for The City includes all phases of a project:

- Planning stage – identify baseline conditions (e.g. existing bird habitat, bird surveys) and potential impacts; recommend avoidance and mitigation measures
- Design phase – design project, including avoidance and mitigation measures. This could include the timing of the project.
- Construction – implement and document appropriate avoidance and mitigation measures, including the results of any pre-construction wildlife surveys conducted.

In order to reduce the risk of incidental take of bird nests The City recommends the removal of vegetation prior to the Restricted Activity Period (RAP). Following Environment Canada and Climate Change (ECCC) guidelines, the RAP that the City decided on (to reduce the most risk to the corporation) is April 15 – August 30 (Government of Canada 2016), although the presence of active nests may extend that period in either direction. If vegetation is not removed and needs to be removed as part of the project, or there is potential that the project could disrupt any nesting birds a nest survey conducted by a qualified biologist is required. Once the survey is complete, and any nests are protected (cordoned off with appropriate buffers), the activity can proceed outside the protected areas. Construction work can proceed within the protected areas only once the nest has fledged.

There are several policies, procedures, and programs in place to assist project managers with legislative compliance:

- *Biophysical Impact Assessment Framework* (The City of Calgary Parks and Urban Development Institute – Calgary 2010). This framework is used for projects that occur on lands that contain or are adjacent to identified Environmentally Significant Areas and any channelization or utility crossing, within a Natural Environmental Park. It helps project managers determine the level of environmental assessment their projects require and provides a set of tools to outline potential project impacts and appropriate mitigating measures.
- *Environmental Construction Operations (ECO) Plan Framework* (City of Calgary 2017). An ECO plan consists of written procedures that are developed and/or adopted by the contractor for environmental stewardship, and they are specific to the site and the construction activity. It also demonstrates how the contractor is to comply with all applicable legislation, regulations and approvals during the project.Tree Protection Plans (City of Calgary 2017). Public trees are City of Calgary property and their protection is mandated by municipal bylaws, including the Tree Protection Bylaw and the Street Bylaw. This includes trees growing in parks, natural areas and road right-of-ways. A tree protection plan

may be required if construction work takes place within six metres of a City-owned or controlled tree.

- *Habitat Restoration Project Framework* (City of Calgary 2014). This document provides detailed requirements and guidelines for conducting and reporting on habitat restoration projects in existing and future natural environment parks that have, or will be, undergoing site disturbance.
- Registration to International Standards Organization (ISO) 14001: 2004 standard for environmental management. Operational business units of The City have for more than a decade maintained individual registrations to the ISO standard through a process including having dedicated environmental resources that develop, coordinate and educate on environmental programs and procedures within each business unit. The systems are subject to annual internal and external audit and validation of efforts to continuously improve environmental management and demonstrate legal compliance.

Project managers and other City staff monitor projects to ensure compliance with regulations. Staff will review Biophysical Impact Assessments, ECO Plans and Tree Protection Plans for completeness and acceptance prior to construction. There are also several City inspectors that monitor construction sites to ensure that the mitigations outlined during the planning phase are implemented.

An example of a recent City project that required mitigation to prevent incidental nest take was the rehabilitation of the Crowchild Trail bridge over the Bow River in 2016, for which special conditions were attached to the contract tendered for this work. This rehabilitation required that the bridge bearing plates were replaced on the underside of the bridge along with concrete repairs. During the planning phase it was noted that cliff swallows (*Petrochelidon pyrrhonota*) had previously nested on bridge girders and that they could be disturbed by the rehabilitation work. It was determined that the best course of action would be to temporarily prevent the swallows from establishing nests with the installation of a relatively fine mesh (<2cm openings) netting on the underside of the bridge before nesting season. Installation of this exclusion netting was directed by a bird biologist hired by the contractor and took place over several weeks in early spring. It was a significant feat of mitigation; with unique access challenges (i.e. a busy roadway above, and a major river plus pedestrian bridge deck below) it took 1,200 person hours to install a total of approximately 1,200 m^2 of netting. The netting was installed with care and regularly monitored over the construction season to ensure there were no gaps where swallows could enter and establish nests. The netting was removed after the project was completed, allowing the swallows to nest there again in the future.

Property Maintenance

City landscaping and property maintenance work can negatively impact wildlife. Impacts to wildlife can often be avoided if these activities occur outside of nesting periods. However, if work has to occur during these periods, it is recommended that the following activities are not conducted unless a wildlife survey is conducted first:

- Removal of trees and shrubs
- Tree pruning
- Mowing long grass (1-3 year mowing rotation)
- Raking long grass (1-3 year mowing rotation)
- Using a weed wiper in tall grass or for tall weed removal.

Once the survey is complete, and any nests are protected (cordoned off with appropriate buffers), the activity can proceed. A maintenance crew can go back to the site to complete the activity after the species has vacated the area, in the cordoned off sections.

Transportation Industry Leadership

While the biological expertise and corporate "ownership" in matters of wildlife and habitat management reside mostly within the Parks business unit of The City of Calgary, the Transportation department has significant interaction with the natural environment and, accordingly, in recent years it has assumed a better defined and more visible leadership role in environmental protection. One of the seven goals of the Calgary Transportation Plan (2009) is to "advance environmental sustainability" with its objectives more specifically stated as the aims to "protect air, land, water and biodiversity in the planning, design, operation and maintenance of all transportation infrastructure". Third-party audits to the ISO 14001:2004 standard confirm the three operational business units (Transportation Infrastructure, Roads, and Transit) have mature and effective environmental management systems, with the environmental performance of staff and contractors being managed and reported on in the areas of energy and water conservation, waste management, pollution prevention, and biodiversity conservation.

With respect to biodiversity conservation, four specific areas where the Transportation department has greatest influence and sustainability opportunities are in: 1) noxious weed control along roadways and transportation corridors (recognizing that alien invasive species represent a principal threat to biodiversity worldwide, after habitat loss and destruction); 2) minimizing wildlife-vehicle interactions on roadways; 3) minimizing and compensating for loss of key habitats; and 4) preventing incidental take of migratory

bird nests in the development and maintenance of roadways, rights-of-way, bridges, and facilities.

The beneficial management practices employed by the Transportation department are in part informed by and shared with other members of the Transportation Association of Canada (TAC). TAC is a non-profit membership based association that includes provinces, territories, cities, public and private sector. The TAC is a forum to exchange ideas and information on Canadian roadway and urban transportation-related technical guidelines and best practices with significant focus on road safety, geometric design, materials, and other topics. Regulatory compliance and issues pertaining to the environment are discussed and advanced in twice annual meetings of TAC's Environment Council and standing committees, and from time to time TAC members will voluntarily contribute funds to a pool enabling targeting research and reporting work undertaken for TAC by a consultant under the guidance of a project steering committee. Late in 2014 the TAC pooled fund project entitled "Synthesis of Management Practices for Compliance with the Migratory Bird Convention Act and Regulations" was launched, with a transportation industry focus and national in scope. This project has two phases and is planned for completion in 2018, with the deliverables being published and available for sale through TAC

Phase 1 (completed June 2016) focused on the following:

- Regulatory compliance requirements
- Bird biology
- Consultation with Canadian Wildlife Service
- Case studies across North America from various industries e.g. forestry, hydro, transportation
- Potential opportunities, methods, and limitations of impact avoidance and mitigation
- Synthesis of beneficial practices drawn from the case studies.

Phase 2 (2017) focuses on:

- The development of a national framework specific to transportation sector
- Risk assessment process
- The preparation of two standalone operational guidance (BMP) documents for Maintenance of Bridges and Culverts, and for Vegetation Management, intended to be non-prescriptive and to allow for flexible application of principles for practitioners in a variety of contexts.

The following is a summary of the 17 key beneficial practices that have been identified through this project, and which will be described in detail in the final TAC publication:

1. Knowledge of legal obligations
2. Maintain written records
3. Project planning
4. Risk assessment
5. Avoidance
6. Engagement of avian expert
7. Communication
8. Temporary exclusion measures
9. Habitat modification
10. Bird deterrence devices, techniques
11. Management of harmful substances
12. Management of material stockpiles, pits
13. Regulation of water levels
14. Habitat retention after the activity
15. Use of physical barriers
16. Conservation by design, enhancement
17. Nest monitoring data for citizen science.

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11. *Working towards the Protection of Nest Trees for Lewis' Woodpecker in the Grand Forks Boundary Region*

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There have been several efforts taken in recent years to protect nest trees and habitat for the Lewis's Woodpecker *Melanerpes lewis* in the Boundary region in the southern interior of British Columbia. The Lewis's Woodpecker (LEWO) is federally listed as threatened and provincially blue listed in BC. There is an estimated 600 breeding pairs in BC (Government of Canada). In the Boundary Region of British Columbia, almost 10% are found within the City of Grand Forks, in addition to the pairs found in the surrounding Regional District and the West Boundary. In this region in the Southern Interior of British Columbia the Kettle and Granby Rivers flow through the valley and are lined with the remaining riparian cottonwood forests where the LEWO prefer to nest. Urban and agricultural development and competing recreational and aesthetic values continue to impact their breeding and nesting habitat.

This unique woodpecker is an aerial insectivore and a secondary cavity user. Their thinner skulls compared to other wood peckers limits them to using softer wood such as cottonwoods, ponderosa pines, and burned trees; they are semi colonial and form lifelong pairs and often return to the same nest year after year(Government of Canada) . Their nest trees are protected year round. In the Boundary Region, their preferred habitat of the Riparian Cottonwood Forests is a red listed ecosystem and one of the rarest in the province.

Both survey work and mapping done were critical pieces that allowed steps forward with conservation actions. Canadian Wildlife Service initiated this effort starting with nest tree surveys in 2011 and in 2012. Suitability mapping followed in addition to a GIS exercise that created a shapefile digitizing riparian cottonwood and cottonwood stands. We then broke this down into parcel pieces and prioritized them based on an array of values. We prioritized parcels for conservation, stewardship actions, and restoration. This information provided the foundation to move forward with actions strategically.

The first action was to request a stewardship agreement with the local municipalities, the City of Grand Forks and the Village of Midway. This voluntary non-legally binding agreement would provide a framework for these municipalities to support the conservation of the LEWO within their boundaries. When this agreement was first presented in 2012 both municipalities would not enter into the agreement. Earlier this

year (2017), I presented the idea again to both municipalities. Both were receptive to the idea and are currently reviewing the agreement.

A large proportion of riparian and cottonwood habitat is adjacent to or on private lands in the Boundary. Therefore private landowners play an important role in the conservation of the LEWO and their nesting habitat. An informal partnership between local environment orientated groups and professionals, the Boundary Habitat Stewards, identified a project and through the Granby Wilderness Society we received funds from the Habitat Stewardship Program for Species at Risk and other matching funds (Patagonia, Mountain Equipment Co-op, Phoenix Foundation, Regional District of the Kootenay Boundary Area D and Area E) to implement the project "Encouraging Stewardship for Species at Risk in the Riparian Cottonwood Forests of the Southern Interior." We contacted over 75 people across the Boundary on high valued properties first by letter and then follow up phone calls. For willing landowners, we did site visits on their properties to help identify nest trees, potential nest trees, other habitat features, and discuss any other habitat related matters including erosion. We developed 10 restoration plans with a goal to implement over 1000 metres of shoreline restoration and habitat enhancements. Most landowners have been very receptive and open to learning more. In many cases landowners don't have the resources or information to implement conservation actions on their own. By providing them with information and tools we are empowering them to contribute to regional and national efforts in the conservation of the LEWO and other species at risk (SAR).

Lack of resources for land management in rural areas like the Boundary may be one of the contributing factors to concerns of habitat protection for SAR. Partnerships between different levels of government and local stewardship and environmental groups can help fill these gaps and is a useful tool to deliver on SAR recovery strategies. Stewardship agreements with both the public and private sector is one example that could be used as a framework to achieve conservation goals, such as the protection of nesting trees and territories for the Lewis's Woodpecker in the Boundary Region of the Southern Interior of BC.

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12. Incorporating Nest Detection, Breeding, and Survival Probabilities into Estimates of Incidental Take of Migratory Bird Nests

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A diverse array of interests has engaged in the somewhat intractable issue of estimating and quantifying the incidental take of migratory birds and bird nests by humans. The scientific community has tackled the issue primarily in the context of population dynamics and anthropogenic effects on said dynamics. The regulatory community has approached the issue primarily from the perspective of a statutory mandate to protect a resource and as an aid to informed decision making. More recently, project proponents, industrial groups, and developers have examined the issue within the perspective of effects assessment, permitting, mitigation and compensation. Each of these interest groups view the issue of incidental take with a different lens and bring different tools and experiences to the problem.

There is an abundance of single-species models of nest density, and a growing number of extrapolative models of incidental take of birds and nests resulting from large-scale industrial and other human activities (e.g., Abraham et al. 2010, Hobson et al. 2013, Tews et al. 2013). However, we are unaware of any published or publically available models of community-wide nest densities at the spatial or temporal scale relevant to project-specific effects assessment. Hence, our motivation in developing a modelling framework for estimating incidental take of nests (and nestlings within those nests) was a desire to provide developers, project proponents, and regulators with information that would allow them (a) to engage in informed decision making at spatial scales relevant to a given project, (b) to support effects assessments, and (c) to conduct a cost-benefit analysis of where best to spend pre-development dollars and effort.
Building on existing take models and recent developments in mortality modeling at wind energy developments, we developed a project-scale incidental take modelling framework that estimates both direct (i.e., destruction of nests) and indirect (e.g., loss of future reproductive potential) incidental take. The framework estimates direct take along two pathways. The first is based on the results of abundance surveys (e.g., point counts or spot mapping) and incorporates variability in species detection rates and breeding probabilities. The second is based on the results of nest surveys, and incorporates

variability in nest detection probabilities resulting from observer effort and ability, and habitat complexity. Both pathways lead to an estimate of the number of active nests in the project area that is then modified by nest survival probability to derive direct take estimates. The estimation of indirect take also follows two pathways. The first is the simple estimation of potential lost recruitment into the population in year $t + 1$ that involves modifying the direct take estimate by annual juvenile survival estimates. The second utilizes standard demographic variables (e.g., sex ratio, life span, annual survival) to estimate lost future reproductive potential.

Our presentation focused on the first two direct pathways framed within a hypothetical conversation with a developer. This narrative utilizes the potential for incidental take as an entry to discussions about decision-making at the local scale. In our example, a developer has proposed a project near Cranbrook, BC, that will require clearing of 5ha of mixed riparian shrub-forest. The bird community utilizing this 5-ha parcel was taken from the species list of BC Breeding Bird Atlas (BCBBA) Square 11NQ88 (Table 1; Davidson et al. 2015).

In order to run our models, two demographic variables are required (Table 1): fledging success (i.e., the probability that an initiated nest fledges at least 1 fledgling) and fledging young per nest (i.e., the average number of young that fledge from successful nests). For most common and well-studied species, these data are publically available (e.g., from the Birds of North America species accounts). A third variable, expected density (# of pairs in 5 ha, in our example) can be useful in providing context for modelled take; these data are also publically available for most species. A fundamental component of our model is the explicit incorporation of detection probabilities (both of individuals and of nests) into our estimates of take. There is an abundant literature on the consistency and accuracy of census methods that highlight striking variability in detection probabilities based on technique, level of effort, habitat complexity, and community composition. To account for this variability, we have provided an estimate of take for six levels of detection probability (30%, 40%, 50%, 60%, 70% and 80%); for the purposes of our presentation, we have made the simplifying assumption that all 10 of our potential species have the same detection probabilities.

The estimation of take along Pathway 1 starts with an estimate of the composition and relative abundance of the local avian community. This is typically evaluated using a point count survey that allows for the estimate of the number of singing males in a given location (Pathway 1a; Table 2). Starting with this picture of the local avian community, our model estimates the number of potentially breeding pairs in the study area across detection probabilities. The number of potentially breeding pairs is next modified by breeding probability (as point count surveys typically do not provide any behavioural evidence of breeding activity, the necessary assumption is that all detected individuals

are a member of an actively breeding pair) and by fledging success to yield an estimate of the number of successful nests (Table 2). The number of successful nests is subsequently modified by fledging productivity to yield an estimate of take (Table 2). If additional survey effort is expended to gather better data on pairing status and breeding activity (e.g., spot mapping), the assumption of 100% breeding probability can be relaxed (Pathway 1b; Table 2). In our example, we attached breeding probabilities to the BCBBA categories: confirmed breeding (100%), probable breeding (60%) and possible breeding (20%). For species confirmed breeding, there are no differences between the results of Pathways 1a and 1b.

The estimation of take along Pathway 2 starts with direct estimate of nesting activity. In our example, we assumed that 40 nests had been detected among the 10 species. The incorporation of nest detection probabilities resulting from observer effort and ability, and habitat complexity yield an estimate of potentially active nests that ranged from 133 (30%) to 50 nests (80%), an estimate of successful nests that ranged from 57 (30%) to 21 nests (80%), and an estimate of take that ranged from 145 (30%) to 55 (80%) individuals.

A comparison of the take estimates from the three pathways (Table 3) provides several important take-away messages. First, the expenditure of even a limited amount of additional survey effort (i.e., spot mapping versus point counts) yields a reduction in the take estimates based on abundance of approximately 18% within a given level of detection probability. Second, the expenditure of additional survey effort allows the assumption of a higher detection probability; this can be achieved by using a point count methodology that allows for estimation of and improvement on detection probabilities (e.g., double observer counts) or by using a different approach (e.g., spot mapping). On average, detection probabilities for the most commonly used point count methodologies range from 40-50%; in contrast, well-executed spot mapping can yield detection probabilities around 70-80%. This translates to a reduction in the take estimate of approximately 50%. Conducting spot mapping in advance of comprehensive nest survey will allow for a direct estimate of nest detection probability, further refining the estimate of take.

On a practical and immediate level, providing the results of these models to a developer who is currently evaluating the costs and benefits of a given development pathway (e.g., whether or not to commence clearing during the breeding bird window) and the level of effort to put into pre-construction activities (e.g., bird surveys) can be effective in shifting the emphasis to the avoidance side of the mitigation scale. On a broader level, the use of detection, breeding, and nest survival probabilities to refine estimates of take is important as it provides a more accurate input into population models, it better quantifies potential effects, and helps ensure the application of appropriate mitigation or compensation.

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Table 1. Avian community at location of proposed development.				
Species (4-letter code)	Breeding class (from BCBBA)	# pairs in 5 ha	Fledging success	Fledged young per nest
American Redstart (AMRE)	Probable	7	0.50	1.1
American Robin (AMRO)	Confirmed	6	0.26	2.5
Dark-eyed Junco (DEJU)	Confirmed	6	0.55	3.8
Gray Catbird (GRCA)	Confirmed	10	0.62	2.4
Orange-crowned Warbler (OCWA)	Probable	5	0.38	1.7
Song Sparrow (SOSP)	Confirmed	15	0.36	2.9
Spotted Towhee (SPTO)	Confirmed	15	0.41	3.2
Warbling Vireo (WAVI)	Possible	4	0.44	1.8
Willow Flycatcher (WIFL)	Probable	2	0.28	2.1
Yellow Warbler (YEWA)	Possible	16	0.42	2.2

Table 2. Comparison of model output for two abundance based pathways: 1a (point counts) and 1b (spot mapping).																				
	singing males (1a) or pairs (1b)	Breeding probability	Potentially breeding pairs (across detection probabilities)						Successful nests (across detection probabilities)						Take (across detection probabilities)					
			0.30	0.40	0.50	0.60	0.70	0.80	0.30	0.40	0.50	0.60	0.70	0.80	0.30	0.40	0.50	0.60	0.70	0.80
AMRE	4	1a - 1.00	13.3	10.0	8.0	6.7	5.7	5.0	6.7	5.0	4.0	3.3	2.9	2.5	7.3	5.5	4.4	3.7	3.1	2.8
		1b - 0.60	13.3	10.0	8.0	6.7	5.7	5.0	4.0	3.0	2.4	2.0	1.7	1.5	4.4	3.3	2.6	2.2	1.9	1.7
AMRO	4	1a - 1.00	13.3	10.0	8.0	6.7	5.7	5.0	3.5	2.6	2.1	1.7	1.5	1.3	8.7	6.5	5.2	4.3	3.7	3.3
		1b - 1.00	13.3	10.0	8.0	6.7	5.7	5.0	3.5	2.6	2.1	1.7	1.5	1.3	8.7	6.5	5.2	4.3	3.7	3.3
DEJU	5	1a - 1.00	16.7	12.5	10.0	8.3	7.1	6.3	9.2	6.9	5.5	4.6	3.9	3.4	34.8	26.1	20.9	17.4	14.9	13.1
		1b - 1.00	16.7	12.5	10.0	8.3	7.1	6.3	9.2	6.9	5.5	4.6	3.9	3.4	34.8	26.1	20.9	17.4	14.9	13.1
GRCA	6	1a - 1.00	20.0	15.0	12.0	10.0	8.6	7.5	12.4	9.3	7.4	6.2	5.3	4.7	29.8	22.3	17.9	14.9	12.8	11.2
		1b - 1.00	20.0	15.0	12.0	10.0	8.6	7.5	12.4	9.3	7.4	6.2	5.3	4.7	29.8	22.3	17.9	14.9	12.8	11.2
OCWA	3	1a - 1.00	10.0	7.5	6.0	5.0	4.3	3.8	3.8	2.9	2.3	1.9	1.6	1.4	6.5	4.8	3.9	3.2	2.8	2.4
		1b - 0.60	10.0	7.5	6.0	5.0	4.3	3.8	2.3	1.7	1.4	1.1	1.0	0.9	3.9	2.9	2.3	1.9	1.7	1.5
SOSP	10	1a - 1.00	33.3	25.0	20.0	16.7	14.3	12.5	12.0	9.0	7.2	6.0	5.1	4.5	34.8	26.1	20.9	17.4	14.9	13.1
		1b - 1.00	33.3	25.0	20.0	16.7	14.3	12.5	12.0	9.0	7.2	6.0	5.1	4.5	34.8	26.1	20.9	17.4	14.9	13.1
SPTO	9	1a - 1.00	30.0	22.5	18.0	15.0	12.9	11.3	12.3	9.2	7.4	6.2	5.3	4.6	39.4	29.5	23.6	19.7	16.9	14.8
		1b - 1.00	30.0	22.5	18.0	15.0	12.9	11.3	12.3	9.2	7.4	6.2	5.3	4.6	39.4	29.5	23.6	19.7	16.9	14.8
WAVI	2	1a - 1.00	6.7	5.0	4.0	3.3	2.9	2.5	2.9	2.2	1.8	1.5	1.3	1.1	5.3	4.0	3.2	2.6	2.3	2.0
		1b - 0.20	6.7	5.0	4.0	3.3	2.9	2.5	0.6	0.4	0.4	0.3	0.3	0.2	1.1	0.8	0.6	0.5	0.5	0.4
WIFL	2	1a - 1.00	6.7	5.0	4.0	3.3	2.9	2.5	1.9	1.4	1.1	0.9	0.8	0.7	3.9	2.9	2.4	2.0	1.7	1.5
		1b - 0.60	6.7	5.0	4.0	3.3	2.9	2.5	1.1	0.8	0.7	0.6	0.5	0.4	2.4	1.8	1.4	1.2	1.0	0.9
YEWA	10	1a - 1.00	33.3	25.0	20.0	16.7	14.3	12.5	14.0	10.5	8.4	7.0	6.0	5.3	30.8	23.1	18.5	15.4	13.2	11.6
		1b - 0.20	33.3	25.0	20.0	16.7	14.3	12.5	2.8	2.1	1.7	1.4	1.2	1.1	6.2	4.6	3.7	3.1	2.6	2.3
	Pathway 1a		**183**	**138**	**110**	**92**	**79**	**69**	**79**	**59**	**47**	**39**	**34**	**30**	**201**	**151**	**121**	**101**	**86**	**76**
	Pathway 1b		**183**	**138**	**110**	**92**	**79**	**69**	**60**	**45**	**36**	**30**	**26**	**23**	**165**	**124**	**99**	**82**	**71**	**62**

Table 3. Comparison of modelled estimates of take across all three model pathways: 1a (point counts), 1b (spot mapping), 2 (nest survey).

	Pathway	Take (across detection probabilities)					
		0.30	0.40	0.50	0.60	0.70	0.80
AMRE	1a	7.3	5.5	4.4	3.7	3.1	2.8
	1b	4.4	3.3	2.6	2.2	1.9	1.7
	2	3.7	2.8	2.2	1.8	1.6	1.4
AMRO	1a	8.7	6.5	5.2	4.3	3.7	3.3
	1b	8.7	6.5	5.2	4.3	3.7	3.3
	2	8.7	6.5	5.2	4.3	3.7	3.3
DEJU	1a	34.8	26.1	20.9	17.4	14.9	13.1
	1b	34.8	26.1	20.9	17.4	14.9	13.1
	2	20.9	15.7	12.5	10.5	9.0	7.8
GRCA	1a	29.8	22.3	17.9	14.9	12.8	11.2
	1b	29.8	22.3	17.9	14.9	12.8	11.2
	2	24.8	18.6	14.9	12.4	10.6	9.3
OCWA	1a	6.5	4.8	3.9	3.2	2.8	2.4
	1b	3.9	2.9	2.3	1.9	1.7	1.5
	2	4.3	3.2	2.6	2.2	1.8	1.6
SOSP	1a	34.8	26.1	20.9	17.4	14.9	13.1
	1b	34.8	26.1	20.9	17.4	14.9	13.1
	2	24.4	18.3	14.6	12.2	10.4	9.1
SPTO	1a	39.4	29.5	23.6	19.7	16.9	14.8
	1b	39.4	29.5	23.6	19.7	16.9	14.8
	2	26.2	19.7	15.7	13.1	11.2	9.8
WAVI	1a	5.3	4.0	3.2	2.6	2.3	2.0
	1b	1.1	0.8	0.6	0.5	0.5	0.4
	2	5.3	4.0	3.2	2.6	2.3	2.0
WIFL	1a	3.9	2.9	2.4	2.0	1.7	1.5
	1b	2.4	1.8	1.4	1.2	1.0	0.9
	2	3.9	2.9	2.4	2.0	1.7	1.5
YEWA	1a	30.8	23.1	18.5	15.4	13.2	11.6
	1b	6.2	4.6	3.7	3.1	2.6	2.3
	2	30.8	23.1	18.5	15.4	13.2	11.6
TOTAL	**1a**	**201**	**151**	**121**	**101**	**86**	**76**
	1b	**165**	**124**	**99**	**82**	**71**	**62**
	2	**145**	**109**	**87**	**73**	**62**	**55**

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13. Nest Searching: How Much Effort is Required?

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One common condition of BC provincial environmental assessment certificates (EAC) states, "Pre-clearing nest surveys will be conducted by a Qualified Professional for development during the sensitive breeding period." Recent federal EAC conditions have not included pre-clearing surveys, following Federal Guidelines for the Avoidance of Detrimental Effects to Migratory Birds (http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1). In most cases and habitats, the ability to detect nests remains very low while the risk of disturbing birds and active nests is high. Thus, during the environmental assessment process, ECCC-CWS encourages avoidance of clearing during sensitive periods for migratory birds instead.

Despite these risks, pre-construction and -clearing nest surveys are a tool often used by industry to demonstrate due diligence for the BC Wildlife Act and the Migratory Bird Convention Act. As part of Wildlife Mitigation and Management Plans for BC EAC compliance, guidelines and protocols for nest surveys generally recommend one hour per hectare of search effort with one to three visits to a site. These searches usually take the form of transects through sites and effort may vary depending on habitat complexity, though one hour per hectare is the most common target. We compared this effort to that used while nest searching as part of bird research in four different habitat types of varying complexity: alpine, sub-alpine, riparian, and forested. Skilled researchers using behavioural cues took between 1.67 hrs/ha (horned larks in alpine) and 10.8 hrs/ha (catbirds in riparian) of effort to find nests with various success rates (85-100%). Industry guidelines for nest surveys do not generally consider detection probability of nests, which is also problematic when a maximum of three visits to a site is recommended before clearing. As an example, in forested sites searching for cavity nesters, at the third visit the proportion of detected nests was on average 80%, but can be as low as 30% in some cases. Further, nest detectability may be even lower for other forest birds, such as those nesting in the canopy, due to their low visibility.

Comparing industry guidelines for nest searching effort with that required in an avian research context to successfully find nests reveals a large gap in effort on the ground, particularly when considering that effort which would be needed to avoid incidental take. Given the high risk of loss of nests and nestlings, even under ideal search conditions (e.g. structurally simple sites, highly detectable nesting species), ECCC-CWS continues to not recommend pre–construction and -clearing nest surveys.

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14. Birds, Bulldozers, and Buffers – Managing Incidental Take in the Face of Uncertainty

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Introduction

Under federal, provincial, and territorial law it is prohibited to disturb, destroy, or take the nest or egg of a migratory bird, and of many other species not classified as a migratory bird. Development and maintenance activities, particularly vegetation clearing during the peak nesting period, have the potential to cause incidental take in the form of nest destruction or disturbance. Avoiding the nesting period is considered the best way to avoid incidental take, yet this is not always a viable option as development and maintenance activities may be constrained by schedule, labor availability, weather and ground conditions, and restricted activity periods for other species. When avoidance is not possible, a plan is needed to manage risk of incidental take.

From 2007 to 2010, awareness and concern for incidental take increased rapidly. This increased awareness stemmed largely from emerging, downward-trending population estimates of many bird species. While the causes of bird population declines are known to be many (see Longcore and Smith 2013), Industries that may cause incidental take can also play an active role at eliminating or greatly reducing the potential for incidental take.

In 2014, Stantec Consulting Ltd. (Stantec) created an internal Bird Mitigation Advisory Team, tasked with developing an internal standard operating procedure (SOP) that would serve as basis for advising clients how to avoid incidental take and reduce risk. The SOP was based on more than 30 years of accumulated professional experience, client and regulatory feedback, and existing and emerging guidance. The SOP was developed as a living document, with the intent of updating it annually to reflect new information and to resolve identified gaps or challenges.

The purpose of the SOP is to provide consistent guidance, messaging, and methods to staff and clients, regardless of activity. Thus, the SOP can be useful for providing basic advice for information purposes, or be used to develop a project-specific bird nest mitigation and management plans for small and large projects. The guiding principles of the SOP relate directly to those provided Environment and Climate Change Canada (ECCC 2017):

- Know your legal obligations
- Avoid engaging in potentially destructive or disruptive activities in key sensitive periods and locations, in order to reduce the risk of affecting birds, their nests or eggs
- Develop and implement appropriate preventive and mitigation measures to minimize the risk of incidental take and to help maintain sustainable populations of migratory birds

This paper addresses some of the lessons learned, and uncertainties, that Stantec has identified through the development of its SOP and subsequent implementation of eight project-specific bird nest mitigation and management plans. Stantec believes that the SOP and project-specific plans have raised awareness with industry proponents and reduced the risk of incidental take. However, lack of guidance and uncertainty persists in several key areas, including buffer size effectiveness, protection of cryptic- or canopy-nesting species, and protection of nests that may be re-used in future years. It is also recognized that there is a lack of empirical evidence demonstrating that loss of nests contributes to population declines, especially in forested habitats, among resource sectors, and in consideration of other, potentially confounding, life history factors.

Methods

Stantec's SOP was developed using seven key elements considered important for implementing effective avoidance mitigation: 1) applicable legislation; 2) project activities; 3) habitats; 4) species; 5) preventive measures; 6) timing restrictions, and; 7) setbacks/buffers. Collectively, these seven elements are used to develop project-specific mitigation plans.

Since 2014, Stantec has developed, implemented, and overseen eight project-specific incidental take mitigation plans for pipeline construction, geotechnical investigation, and infrastructure demolition in British Columbia. Stantec has also provided advice and completed site visits for several municipal projects, including for drainage management, property development, sewer replacement, and bridge maintenance. Each project-specific plan included consideration of the activities being performed, the types of habitats affected, the bird species that could be affected, and recommended methods for determining the likely presence of nests and applying nest-specific timing restrictions and buffers to protect them.

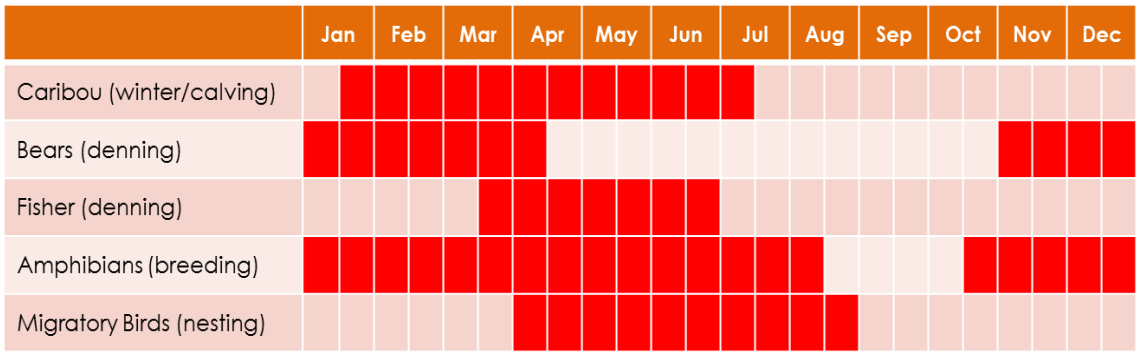
A key component of each plan was a decision and mitigation framework, which clearly identified roles and responsibilities, preventive actions to be undertaken and when, and communication channels. Each plan also included a pre-disturbance nest survey protocol, specific mitigations for active, suspected active, and inactive nests, and procedures for monitoring and reporting.

Results

Avoidance Mitigation

Avoiding the period when birds are nesting is considered the most effective way to avoid incidental take (ECCC 2017). In Canada, this period is primarily from mid-April to mid-August, but may be longer depending on the species or area. Avoidance however is not always possible, and numerous competing factors can affect when a project activity is likely to proceed. For example, there are restricted activity periods for other species that can have a profound effect on project-scheduling. In the Peace Region of British Columbia, the restricted activity period for the central group of Southern Mountain Caribou (*Threatened*), bear dens, fisher dens, breeding amphibians, and breeding migratory birds account for nearly 90% of a calendar year, leaving just six weeks that are not affected a timing restriction (Figure 1)(BC MFLNRO 2014; ECCC 2017). Given that weather, ground conditions, and labour availability can affect a project schedule, it is very unlikely that restricted activity periods can be avoided.

Figure 1 Example of overlapping restricted activity periods (red bars) for different wildlife values in the Peace Region of British Columbia.



ECCC provides nesting calendars for migratory birds in Canada, which are geographically divided among various Bird Conservation Regions and nesting zones representing similar, broad-scale habitats. The nesting calendars provide an index of the number of species expected to be nesting within each nesting zone and broad habitat type (wetlands; open; forest), by week. For the SOP, Stantec adopted a "Primary Nesting Period" (PNP) approach based on these calendars. The PNP, defined as when more than 10% of the species in a given area are expected to be nesting, is a trigger for initiating pre-disturbance breeding bird and nest surveys. For species that may be nesting outside of that period, a project-specific risk assessment is completed to determine if mitigation is needed.

Field Surveys

The first step in Stantec's SOP decision framework is to determine whether a project activity will overlap with the PNP (i.e., high risk) or the low risk period. If project activities overlap with the low risk period, awareness training is provided to project personnel, and mitigation guidance is described for nests that are discovered incidentally. If project activities overlap with the PNP, specific guidance on how to undertake pre-clearing/pre-construction surveys is provided. Stantec's SOP describes two methods for assessing and mitigating the risk of incidental take: 1) passive breeding bird surveys, and 2) low-intensity nest searches.

In most instances, particularly in vegetated settings where vegetation clearing is planned, both methods are used. Passive breeding bird surveys use standard point count, transect, or spot-mapping methods that generate evidence-based indicators of nesting activity (e.g., birds copulating; carrying nest materials or food; alarm calls; repeated observation in the same area). Low-intensity nest searches require qualified observers to search for nests, but not in a manner that would be considered overly invasive. Low-intensity nest searches tend to focus on the nests of species that are relatively easy to find (i.e., conspicuous and relatively common nesting species such as cavity-nesters, shrub-nesters, and ground-nesters), although all nests are documented when discovered.

Stantec recognizes that not all nests can be found, particularly for those species that occur in the canopy of forests. However, Stantec's experience has been such that the discovery of relatively few nests can render project activities logistically challenging to execute. For example, at one site (200 m x 400 m) in northeast British Columbia, the discovery of just five nests (1 Swainson's thrush and 4 yellow-bellied sapsucker) in early July caused clearing of the entire area to be delayed by three weeks.

Setbacks and Buffers

Once a nest has been discovered, an appropriate setback or buffer is implemented to reduce the risk of incidental take. ECCC states that "setbacks and buffers are to be prescribed in consideration of risk factors associated with the take and disturbance of migratory birds, their nests, and eggs" (ECCC 2017). Aside from the direct and inadvertent destruction of an active nest, Stantec considers noise and human activity around a nest to be likely leading factors that could cause incidental take following nest discovery. Therefore, the implementation of a setback or buffer needs to take into consideration how large a setback or buffer should be.

Stantec uses provincial and federal guidance pertaining to setback distances, recognizing however that there is little empirical evidence supporting the effectiveness of a given buffer compared to an alternative. Subsequently, Stantec takes into consideration project-species details pertaining to noise (Figure 2) and visual (Figure 3) disturbance. In cases where a client might request whether the setback distance can be reduced, several factors are reviewed as part of the decision-making process, including the type and duration of activity to be undertaken, setting (i.e., habitat and terrain), and species.

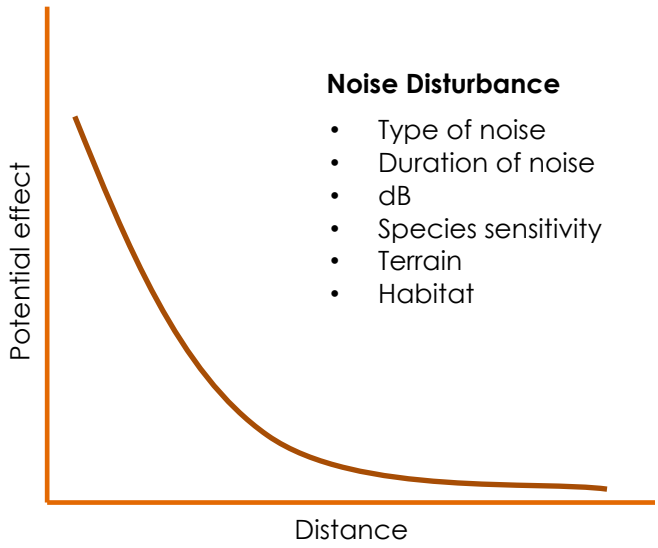


Figure 2 Relationship between the potential effect of noise with distance on nesting birds

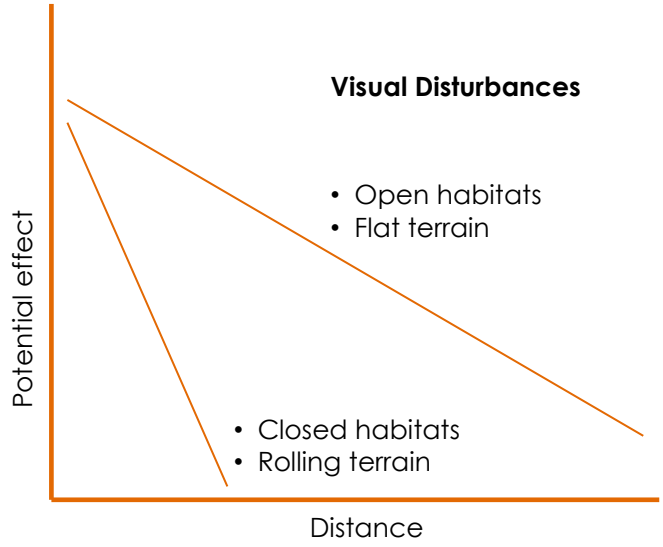


Figure 3. Relationship between the potential effect of visual disturbance with distance on nesting birds

Discussion

Development of an SOP and project-specific bird nest mitigation and management plans has greatly improved consistency and communication on the issue of understanding and mitigating incidental take. Because the SOP is a living document, project-specific plans are based on best available information. Each project plan clearly describes legal obligations, methods to avoid incidental take, and preventive and mitigation measure to reduce risk of incidental take and to help maintain sustainable populations of birds. Of particular utility and operational benefit to proponents is a decision framework, which clearly identifies communication pathways and responsibilities, as well as triggers for specific actions. While mitigating the risk of incidental take has garnered increased attention over the past decade, there still remains a number of uncertainties relating to field survey protocols, setback effectiveness, and re-use of old nests. A brief discussion of each follows.

Field Survey Protocols

There is considerable debate amongst professional biologists and regulatory agencies as to what kind of field methods, if any, should be used to assess the risk of incidental take. In the mid-2000s, the prevalent method was to focus on "sweeping" an area for active nests three times on three successive days prior to giving the "all clear" (assuming no nests were found). Once the "all clear" was given, clients were typically advised that they had seven days in which to commence their activities, after which another survey would be required if the breeding period was still applicable. This method is still in practice, but no longer supported by regulatory agencies as it once was.

Stantec's methods, and the methods of others that presented at the Columbia Mountains Institute conference on Incidental Take (April 27, 2017), include habitat as part of the risk assessment. This assessment is completed either as a desktop exercise or as part of field methods. Stantec currently uses a single-sweep method, but uses a combination of passive surveys and active nest searches to reduce risk of incidental take. When identified, both active and suspected active nests are mitigated (e.g., a setback and timing restriction). Stantec continues to use the 7-day "all clear" window, but puts considerable emphasis on commencing activities within 24-48 hours of the field survey being completed.

Stantec does not include the monitoring of nests once they are discovered, except in certain circumstances (e.g., raptor or heron nests that are easily observed and where a typical setback cannot be achieved). This lack of monitoring is in recognition of ECCCs guidance which suggests that the monitoring of nests could be construed as a form of

disturbance and lead to incidental take. Therefore, Stantec determines at the time of discovery what an appropriate nest-specific restricted activity period should be. The duration of the nest-specific restricted activity period is determined from observational evidence (e.g., nest-building; egg-laying; age of nestlings), and the timing restriction remains in effect until nest activity is considered to have ended (i.e., fledged young), regardless of actual fate.

Setback Effectiveness

In British Columbia, guidance on the size of setbacks from active nests is available through provincial and federal guidelines. Generally, there is little empirical evidence supporting setback sizes compared to potential alternatives. This is particularly true for the range of potential factors that could lead to increased risk of incidental take (e.g., noise; visual disturbance; species' sensitivity), after accounting for potential confounding factors and causes of natural nest failure (e.g., weather; predation).

Factors that should be taken into consideration when determining what size of setback to implement include the type and duration of activity (e.g., hours or days; use of heavy equipment; large workforce), species sensitivity and nest concealment, and habitat type and topography (as a natural buffer for noise and visual suppression). The smallest buffer that Stantec uses is 30 m (for songbirds), although for some species and activities the buffer could be reduced (e.g., for a barn swallow nest on infrastructure) or increased (e.g., for an individual showing a particularly high level of stress).

Re-use of Old Nests

The *Migratory Birds Regulation* applies to "nests", whether that nest is active or not. ECCC (2017) state that some species "may re-use the same nest structure year after year, and the loss of these nests could have a negative impact on future nesting success". Conversely, for most migratory bird species, "removing the nest after the breeding season will have no effect on the ability of birds to nest again" (ECCC 2017).

There is no clear guidance on which species' nests fall into the category of re-use, or whether the removal of old nests that could be re-used leads to population-level declines. For some species, such as osprey and great blue heron, it is well-known that nests used in one year are likely to be re-used in subsequent years. For other species however, such as cavity-nesters, there is considerable variation in successive use, including by which species uses a given cavity. Similarly, species such as barn swallow, cliff swallow, and eastern phoebe may use the same nest site in successive years, but may need to repair or rebuild a nest at that site.

There is little guidance for managing risk of incidental take for birds that typically nest in or on anthropogenic structures (e.g., vehicles; buildings; facilities; bridges) and which typically re-use their nests. When such instances occur, ECCC (2017) recommends installing deterrents to prevent birds from nesting in the following year. This recommendation however is in potential contradiction with regard to protecting nests that may be re-used.

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15. Managing Incidental Take for Pipelines and Powerlines

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Introduction

Industrial development has been identified as a source of incidental take of migratory birds, which is the inadvertent destruction or disturbance of birds' nests, eggs or young as described and prohibited under the *Migratory Birds Convention Act*, 1994 (MBCA). For linear developments, such as pipelines and powerlines, incidental take may occur due to activities during construction and operations (including maintenance activities) that may affect birds directly (e.g., destruction of a nest or egg during vegetation maintenance) or indirectly (e.g., noise from project equipment causing nest abandonment).

Due to the nature of regulatory expectations for proposed and operating industrial developments, the need for due diligence (i.e., in terms of avoidance or implementation of other mitigation) with respect to the MBCA, and the *Species at Risk Act* (SARA), is an important consideration for developers in Canada. In addition, regulatory expectations have broadened to include birds not covered under the MBCA or SARA, but are protected under other legislation (e.g., raptors). Because of increased regulatory attention to incidental take, proponents have put increased effort and attention on mitigating the risk of incidental take during all phases of their activities.

Interaction with Birds: Construction

During the construction of pipelines and powerlines, incidental take may occur due to vegetation clearing (i.e., during site preparation) and potential sensory disturbance from construction equipment and workers. However, the magnitude or severity of the risk will vary depending on several factors, including time of year (i.e., depending on overlap with the migratory bird nesting period), habitat (e.g., grassland, forest, urban/industrial), the scale of the project (i.e., length of construction schedule, size of project footprint), whether existing right-of-ways are used during route planning, magnitude of activity (i.e., type of equipment used), and species occurring near the project (e.g., SARA-listed birds). Generally, vegetation clearing for pipelines occurs along the entire right-of-way; however, for powerlines, the amount of vegetation cleared will differ in grassland and forested areas (i.e., clearing in grasslands is limited to substations and tower bases, where

necessary). As a result, for powerlines located in grasslands, it is generally easier to avoid peak nesting periods.

Interaction with Birds: Operation

During the operation of pipelines and powerlines, the risk of incidental take differs between the two developments. Vegetation maintenance along the right-of-ways may be necessary depending on the surrounding habitat (e.g., grassland vs. forest). Similar to vegetation clearing during construction, the risk of incidental take associated with vegetation maintenance will vary, although the timing of the activities will have the largest influence on the risk of take. Routine maintenance at aboveground facilities (e.g., towers, substations, pump stations) also has the potential to disturb occupied nests occurring on facilities or adjacent to them. The primary difference between pipelines and powerlines is mortality risk associated with collisions and electrocutions from powerlines and associated facilities.

Challenges in Avoiding or Reducing the Potential for Incidental Take

For the construction and operation of these types of linear developments, there are various challenges in avoiding or reducing the potential for incidental take, including the timing of vegetation clearing, including:

- Routing (e.g., landowner, municipal, and environmental constraints weighed against engineering requirements and costs)
- Schedule (e.g., pressure to meet in-service dates, socio-economic effects of delays in schedule)
- Project size (e.g., large projects take time and may need to overlap nesting periods)
- Vegetation clearing is generally necessary during construction of new projects and during operations (e.g., vegetation maintenance)
- Uncertainty regarding the risk of incidental take due to sensory disturbance
- Nesting periods for birds are not the only constraint that affect when activities need to occur (e.g., frozen ground in wet areas, municipal requirements, timing restrictions for other wildlife, such as caribou)
- Ability to detect nests is difficult

Managing the Risk of Incidental Take

Proponents that own and operate pipelines and powerline have placed significant emphasis on mitigating incidental take that could result from their activities. Both sectors have been actively involved in developing best management practices (BMP) as they pertain to mitigating incidental take. Primarily, a lot of time is spent during the project planning phase such that infrastructure routing takes into consideration environmental and social factors, and identifying where risk of incidental take may be highest (e.g., grassland vs. cultivated fields). This planning phase also includes the development of internal awareness training programs that will be used to educate staff and contractors on the risks of incidental take and what to look for when in the field (i.e., bird activity as it pertains to potential nesting activity, not how to search for nests).
Without legal provisions for permitting incidental take, the primary mitigation for managing risk and mitigating unavoidable effects on nests is the development of BMPs. As a result, individual companies and industry organizations have focused on the development of guidance documents to assist with managing risk, with consideration of applicable legislation and safety requirements.
BMP documents can include:

- federal and provincial regulatory guidance for identifying risk of incidental take
- a framework designed to reduce the risk of incidental take
- timing restrictions (i.e., nesting periods and provincially or federally recognized restricted activity periods)
- recommended setback distances for nests
- recommended methods for identifying active (and non-active) bird nests
- nest management recommendations when nests are encountered
- the use of qualified biologists

For powerlines, proponents reducing the risk of collision typically requires routing:

- avoid habitats where birds congregate (e.g., wetlands)
- avoid habitats used by birds that have poor maneuverability (e.g., cranes, swans and other heavy bodied waterbirds)
- avoid bisecting key habitats (e.g., lines between foraging habitat and nesting colonies)

These routing considerations can greatly reduce the need for mitigation (e.g., use of bird diverters).

Due to the nature of these linear developments, close collaboration between proponents, contractors (e.g., construction workers), and biologists is key. When new pipelines or powerlines are being constructed, there can be a high risk of incidental take when activities overlap the bird nesting periods. When breeding bird surveys and nest searches are implemented as a means of assessing and mitigating risk, the communication of survey results needs to be efficient so that construction crews can actively work the results into their schedule. The use of mobile technology (e.g., data loggers) can allow for biologists to upload survey results into a format that is aligned with construction requirements (e.g., alignment sheets).

For proponents of pipelines and powerlines, the risk of incidental take will depend of variety of different factors during construction and operation. Increased awareness internally on the issues surrounding incidental take has promoted the growth and implementation of best practices across the country. Continued collaboration internally, between companies (i.e., sharing experience), and with regulatory agencies will be key to promoting the effectiveness of these best practices going forward for these sectors.

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16. Nest v. Shovel: Migratory Bird Mitigations at Heavy Oil Mine Sites

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Paul holds a Bachelor of Science degree in Environmental and Conservation Science from the University of Alberta, majoring in Wildlife and Rangeland Resources Conservation as well as a Master of GIS through the Department of Geography at the University of Calgary. Paul currently works as a Wildlife and Biodiversity Specialist for Shell Canada where he manages human-wildlife conflicts, injured and nuisance wildlife, migratory bird mitigations, and species-at-risk programs. Paul has also worked for the Canadian Wildlife Service and Parks Canada, where he worked on bioinformatics, geomatics, and species-at-risk programs.

The Shell Canada Energy Albian Mine Site (Albian) is located north of Fort McMurray, Alberta, and is comprised of two active mine leases: Muskeg River Mine and Jackpine Mine. Muskeg River Mine started operations in 2002, with the Jackpine Mine operations starting in 2010. Albian is located within Bird Conservation Region 6 (Environment Canada 2013), and is surrounded by coniferous and mixedwood forests, extensive wetlands, and is located directly east of the Athabasca River. A variety of habitats are still available on the mine site, however as the mine site advances (Figure 1) natural habitats must be actively cleared and disturbed.

Migratory bird issues typically arise at the leading edge of mine development, where forest and wetlands still exist. Before the mine can advance, all surface vegetation must be removed, the area must be dewatered, and the soil salvaged for future reclamation programs. These activities create situations where incidental take is possible. Additionally, migratory birds do interact with industrial features, such as buildings, infrastructure, and tailings, presenting conflicts between nest sites and active mine operations. Occasionally, migratory birds build nests on mobile equipment that remain stationary for too long (Figure 2).

Albian adopts a mitigation hierarchy approach to avoid incidental take based on Environmental Dynamics Inc (2014). Albian's approach is to avoid conducting activities during the critical nesting season as much as is reasonably practical. This restricted activity period (RAP) is defined as April 15 and August 30 (Environment Canada 2017). Efforts to complete forest and wetland removal outside of the migratory bird nesting period for the region is both the cheapest and most successful approach to avoiding

incidental take, however, some activities must be completed within the RAP.

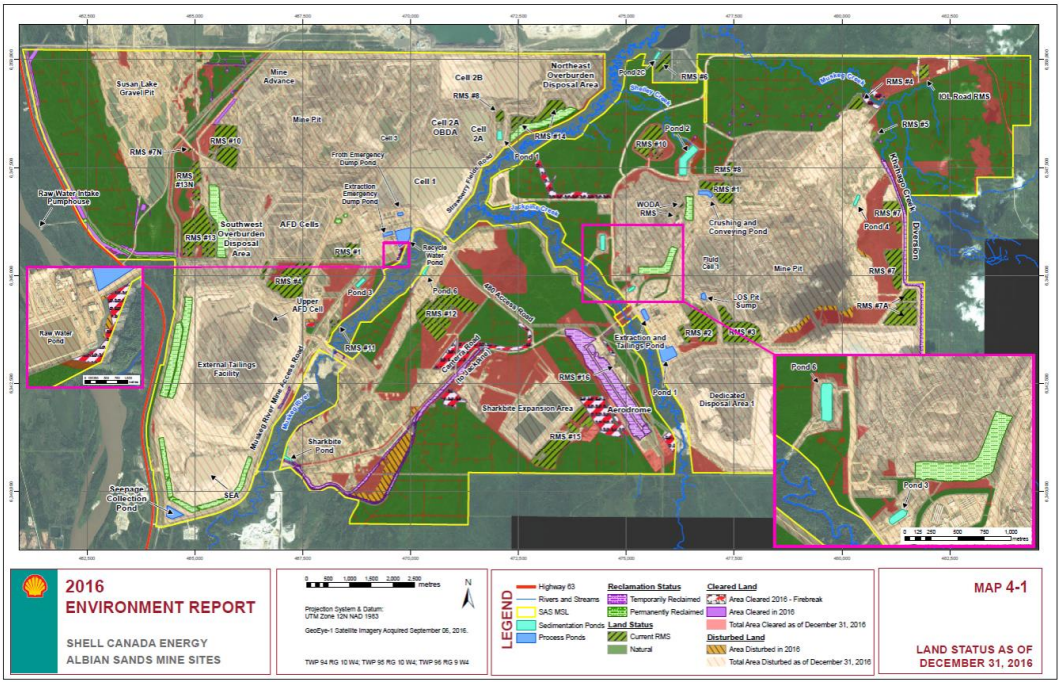

Figure 11 Annual Land Status Mapping Example

Management Tool

When working inside the RAP, Albian sands has created a GIS-based tool (Markosyan 2015) to help assess risk of working in areas on-lease. This tool:

- takes advantage of vegetation and wildlife habitat models produced during Environmental Impact Assessments;
- annual land status GIS data sets, which divides the lease into 4 categories: natural, cleared, disturbed, and reclaimed; and,
- project footprints.

The GIS tool uses the footprint data (project specific) to run a series of update, clip, and erase functions to evaluate what species habitats are still within the active mine footprint. The GIS tool outputs are series of maps that show where specific sensitive habitats are within the proposed construction footprint. The output will also export predicted vegetation cover that has been matched to the BCR Bird Conservation Strategy habitat categories to associate risk to nested birds. Both model outputs are used to re-valuate the work scheduled within the RAP.

Different industrial activities produce different risks to nested migratory birds. Certain activities, like traversing vegetation by foot or ATV do require little mitigation, as the risk is low for incidental take. However, complete vegetation removal is deemed high risk, and is typically delayed until fall and winter to avoid incidental take. Some activities, if taking place in cleared areas, may be conducted during the RAP if appropriate mitigations can be established to avoid incidental take with nesting birds. Based on industrial activity, type of habitat, and time of year, one of four mitigation approaches can be chosen.

Mitigation Response

*Figure 12 American Robin (*Turdus migratorius*) Nest on Shovel Equipment*

Low Risk Projects:

- Projects with low impact on vegetation or water levels.
- Projects are within heavily disturbed lands and habitat has mostly been removed.
- Projects occurring during shoulder seasons of nested bird restricted activity period.
- Reliance on education and ensuring site workers report any incidental wildlife during work period (Miistakis Institute 2017) using a website and mobile app custom application.

- Moderate-Low Risk Projects:
- Projects with a moderate impact on vegetation (removal of vegetation) or water levels (dewatering activities).
- Projects are within areas with some remnant habitat remaining, but within the shoulder seasons of the nested bird restricted activity period.
- Use education and awareness with site workers, and promote the use of reporting incidental wildlife.

- Perform a rapid wildlife reconnaissance of the project footprint to document wildlife present and to further assess risk:
    - reconnaissance performed by Albian staff or consultants who have formal wildlife training;
    - record any potential signs of nesting (singing males, alarm calls, visual confirmation of nests) bird species;
    - detect presence of other wildlife that might require mitigation, such as active mammal dens, toad breeding ponds, etc.
- Reconnaissance surveys that detect potential nests are given mitigation measures such as:
    - buffers around nest or potential areas with nests (Figure 3); or
    - project deferral until birds are finished nesting.
- Any mitigations must be monitored to assess if they were successful. Monitoring protocols follow Nest Watch (2013).

- Moderate-High Risk Projects:
- Projects with a moderate impact on vegetation (removal of vegetation) or water levels (dewatering activities).
- Projects that have been cleared, but not yet salvaged.
- Projects that occur within the core of the nested bird restricted activity period.
- Use education and awareness with site workers, and promote the use of reporting incidental wildlife.
- Perform a one-pass nesting bird survey of the project footprint to document any potential nests of migratory birds:
    - Reconnaissance performed by registered professional avian biologists.
    - Teams of two biologists examining an area by foot to detect any indications of potential nesting (singing males, alarm calls, visual confirmation of nests) of any migratory bird species.
    - Project teams can cover ~1 to 1.5 ha an hour, depending on habitat.

Figure 13 Standard Nest Buffer Warning

- Surveys that encounter potential nests are given mitigation measures such as buffers around either confirmed nests or potential areas with nests.
- Any mitigations must be monitored to assess if they were successful.

High Risk Projects:

- Projects with a high impact on vegetation (removal of vegetation) or water levels (dewatering activities).
- Projects that have been cleared, but not yet salvaged.
- Projects that occur within the core of the nested bird restricted activity period.
- Use education and awareness with site workers, and promote the use of reporting incidental wildlife.
- Perform a multi-pass nesting bird survey of the project footprint to document any potential nests of migratory birds:
    - Reconnaissance performed by registered professional avian biologists.
    - Teams of two biologists examining an area by foot to detect any indications of potential nesting (singing males, alarm calls, visual confirmation of nests) of any migratory bird species.
    - Project teams can cover ~1 to 1.5 ha an hour, depending on habitat.
    - Multiple passes are required until biologists determine that potential nests have been detected.
- Surveys that encounter potential nests are given mitigation measures such as buffers around either confirmed nests or potential areas with nests.
- Any mitigations must be monitored to assess if they were successful.

For areas that have standing natural forest or wetlands, project planners are expected to reschedule or plan their work for outside the restricted activity period.

Summary

Incidental mitigations at Albian focus on several steps to avoid incidental take:

1. Apply good site planning standards, recognize restricted activity periods, and plan activities accordingly;
2. Avoid natural undisturbed forest and wetlands in the migratory bird restricted activity period.
3. If work must occur in the restricted activity period, ensure major vegetation removal and dewatering is completed outside of period.

4. Assess type of mitigations required using known vegetation and habitat models to understand project footprint risk.
5. Assess risk to nested birds using type of industrial activity, type of habitat, and time of year.
6. Implement mitigations based on risk, with increasing effort to detect nested birds with increasing risk to incidental take.
7. Any potential or confirmed nests or nesting areas must be buffered to prevent incidental take.
8. Any buffer established around a potential or confirmed nest must be monitored to ensure success and that incidental take was prevented.

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17. Conducting Bird Sweeps in Alberta's Oil Sands, Rural, and Municipal Setting

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As environmental consultants, a wide variety of our clients require bird sweeps as part of proposed project developments. We thus, conduct sweeps for the energy sector, including oilsands developments (e.g., well pads and pipeline projects) and electrical distribution (e.g., powerlines and hydro dams), but also for public authorities such as cities, municipalities, and government agencies (e.g., urban/rural communities and road construction/realignments). To properly sweep such a wide array of project sites, survey methodologies and mitigations must follow and meet regulatory standards and guidelines, while still be sufficiently adaptive to the individual projects (i.e., be of feasible application):

- **Oilsands Site Clearing:**
  - A designated area set for habitat clearing
  - A team of two qualified avian biologists ground search the area walking meandering transects
  - Habitat typically consists of shrubs and small treed areas
  - Nest buffers determined by the federal and/or provincial agency
  - An established process that is well respected by industry and good relation with regulator.

- **Urban restoration – pathway repairs and bank stabilization:**
  - Survey was requested after the observation of a Canada goose nest
  - One qualified avian biologist walking the bank of the river
  - Habitat consisted of manicured lawn and exposed riparian area
  - Following regulator consultation, monitoring was agreed upon during heavy equipment operation and contractor changed piling approach to reduce sensory disturbance
  - Difficult to explain the value of protecting one Canada goose nest when the species is so abundant, also in the urban landscape.

- **Flood mitigation – river bank restoration project:**
  - A team of two qualified avian biologists ground search the area walking meandering transects

- Habitat consisted of short grasses, shrubs, and exposed river banks
- A colony of bank swallows was detected nesting in the bank
- Due to Fish RAP conflict for completing in-stream work, the regulator recommended monitoring and a reduced buffer for the colony to ensure compliance with the Fish RAP
- Monitoring later confirmed fledglings in the area
- Good interface with the regulator who recommended smaller buffer due to the Fish RAP

Clearing for a powerline:

- Habitat clearing required for a 48 km long powerline
- Four crews of two qualified avian biologists sweeping ahead of clearing crews with transects spaced 5 m apart in a wide variety of habitats
- Nest sweep methodology was developed in collaboration with provincial government
- Used modern technology (Collector App) to instantly map and buffer nests and communicate with various contractors
- All regulatory interactions were done by the client prior to the nest sweeps (including set species buffers)

Carrying out bird nest sweeps for a variety of clients, in very different project settings, and across different provinces poses various challenges from a consultant's perspective, most of which pertain to the regulatory process and client understanding of regulations. On the regulatory side, there is a high need for consistency when it comes to government agency expectations for bird sweeps, methodologies, and mitigations, but also the enforcement of such expectations. A lack of regulatory consistency also undermines a client's understanding of the regulatory requirements and creates challenges for the consultant to justify the implications of non-compliance. Thus, making it difficult to have proponents commit to the requirements of nest sweeps and subsequent mitigations.

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18. AltaLink's Avian Approach, Successes and Challenges

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AltaLink owns and operates over 13,000 km of transmission lines and 300 substations servicing 85% of Alberta's population. Avian interactions are a key consideration during transmission system development, operation and maintenance requiring consistent adaptive approaches across the province. The presentation discusses interactions with nesting birds during operations and maintenance, proactive steps in implementing nest survey criteria for workers, how changes in land use such as rotating crops or unharvested crops can alter avian flight paths as well as best management practices. AltalInk was the first utility company in Canada to develop and implement an Avian Protection Plan based on US Fish and Wildlife criteria as outlined by the Avian Power Line Interactive Committee (APLIC 2005).

Adaptive approaches start with effective lines of communication, when juggling multiple requirements and overlapping restricted activity periods consistent messaging is critical. Maintenance of infrastructure encounters conflicting requirements such as managing weeds as per the Alberta *Weed Control Act* and as requested by landowner and municipalities during the breeding bird season. One approach AltaLink developed to reduce potential nest disturbance was nest search training for all employees and contractors completing maintenance work. This training is designed to help them identify bird signs and high risk nesting areas where a Qualified Avian Biologist is required to conduct a nest survey. Construction and maintenance activities have limited non-restricted periods with avian restricted activity periods in spring-summer and ungulate RAP's mostly during the winter.

Maintaining an adaptive Avian Protection Plan (APP) provides a consistent approach to plan, monitor and respond to avian interactions. Managing for compliance with the *Migratory Bird Convention Act* can lead to non-compliance with other legislation such as the Alberta *Hydro Electricity Act* or the Alberta *Weed Control Act*. Compliance is challenging in consideration of the demand for uninterrupted service and the vast landscape, habitat types and nesting encountered. Avoidance of high risk areas and effective mitigation when they are encountered requires a dedicated corporate commitment and qualified staff. AltaLink's APP has evolved to incorporate research findings from APLIC and its members. Spacing for line marking of the overhead shield wire has been reduced from 10 m to 5 m and several new line markers-diverters, the most recent being the Power Line sentry design, which has been tested and replaced

older diverter designs. Wildlife cover ups to prevent electrocution in substation is another effective mitigation and AltaLInk has retrofitted 95 substation to date with an overall 94% reduction in the frequency of load interruption.

AltaLink Environment has developed an activity matrix which evaluates the potential risk of 45 specific construction, maintenance and operational activities on wildlife, across the province of Alberta. This matrix is a key planning tool during restricted activity periods (RAP's) for wildlife and provides supporting documentation to senior management as to why high risk activities are to be scheduled accordingly. However, even when high risk areas are avoided utility infrastructure or disturbed or modified lands still provide nesting opportunities and required enhanced vigilance to prevent non-compliance. Several examples are presented identifying active nests encountered, effective strategies and effects to planned activities.

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19. Dam Birds! Managing Nesting Birds at BC Hydro Dams in the Kootenays

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In 2010, BC Hydro began a program to refurbish the Spillway Operating Gates (SPOGs) at several of its dams in the Kootenays. The program includes removing the SPOG hoists and decks, and the installation of a new hoist system and power sources, replacement of electrical conduits, and structural reinforcement of the SPOG towers. One of the first projects was on the Duncan Dam, part of BC Hydro's Columbia River system, which was completed between December 2010 and July 2011. Environmental management planning for the project identified that cliff swallows (*Petrochelidon pyrrhonota*) nested on an adjacent rock bluff and indicated that the disturbance of active nests was prohibited under the *Migratory Birds Convention Act*. Although no nests were present within the SPOG structure, bird nesting locations and activity were monitored due to the close proximity to the work area. This experience led BC Hydro to recognise the need to develop a more formal approach to managing nesting birds on the subsequent SPOG refurbishment project, which was scheduled for the Hugh L Keenleyside Dam (HLK) near Castlegar from 2012-2016.

The HLK superstructure is heavily used by cliff swallows as nesting habitat, which are assumed to have been nesting on the facility since shortly after its construction in 1968. The HLK structure provides excellent nesting habitat for this and other species, with dry, sheltered overhangs in close proximity to water. Barn swallows (*Hirundo rustica*), raven (*Corvus corax*) and rock dove (*Columba livia*) also nest on site, while the surrounding area is used by many other bird species.

Recognising that the SPOG refurbishment program at HLK could not avoid working within the breeding bird season due to safety and logistical constraints, BC Hydro and the Prime Contractor (HMI Construction) developed a joint program to avoid incidental take and work delays, and to demonstrate due diligence. The main goals of the program were to:

- Reduce impacts to nesting birds
- Avoid work stoppages and delays
- Develop a joint program between BC Hydro and HMI Construction
- Document the effort

The program had five main elements:

1. All personnel working on the project were provided bird awareness orientation training so that everyone working on site was familiar with the legal requirement and their part in the program.
2. Preventative measures to reduce the likelihood that birds would nest in key work areas. These included the removal of a small number of non-active nests located in key work zones, the installation of exclusion netting (±1/16" mesh) to prevent access to certain work areas, and the installation of bird deterrents and alternative nest sites.
3. A monitoring program to assess new or active nests. The program included surveys up to 3x/week during the most active part of the breeding season, and followed a standard format that included a timed (minimum of 3 min/station) visual and auditory survey of locations in the Project Area.
4. Information sharing – observations and survey results were communicated immediately to the Project team
5. Documentation of the planning, survey effort, mitigation measures and results for due diligence purposes and to provide a resource for future projects.

The program allowed the project to complete the project and avoiding incidental take. Preventing bird access to major work areas using exclusion netting was a key factor in the success of the program, and there was some flexibility in re-scheduling work in certain areas to avoid direct disturbance. However some work was still completed in close proximity to nesting birds. In many of these cases, the breeding pairs had elected to nest in an area while there was active work occurring and were acclimated to some level of noise and human presence.

Acknowledgements

BC Hydro, HMI Construction, FMI, Socomec, Aluma Scaffolding, Golder Associates, Masse Environmental Consultants.

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20. Power Lines: Lethal Lines and Lessons Learned

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Canada has over 230,000 kilometers of transmission lines (Rioux et al. 2013) and over 500,000 kilometers of distribution lines (Calvert et al. 2013). The Province of Alberta has approximately 26,000 kilometres of transmission lines crossing the province, and even more distribution lines (AESO 2016). While necessary to our infrastructure, these lines often bisect avian flightpaths and have proven to be a major risk to migrating birds. Mortality rates are difficult to estimate, due to study-specific differences in species, habitat, power line types, and time periods (APLIC 2012). As a result, mortality estimates extrapolated from different studies can vary widely. Despite these challenges, research is demonstrating that collisions with transmission lines are a major contributor to avian mortalities. A recent study estimated that collisions with transmission lines in Canada result in 2.5 million to 25.6 million bird deaths annually (Rioux et al. 2013). Another study estimated that between 8 and 57 million birds are killed by collisions with transmission lines in the U.S. annually (Loss et al. 2014). Neither of these estimates include mortalities due to electrocution or collision with distribution lines, which are even more prevalent on the landscape than transmission lines. Calvert et al. (2013) compared estimates of human-related avian mortality, and transmission line collisions were one of the leading causes of mortality, following feral and domestic cats (Figure 1).

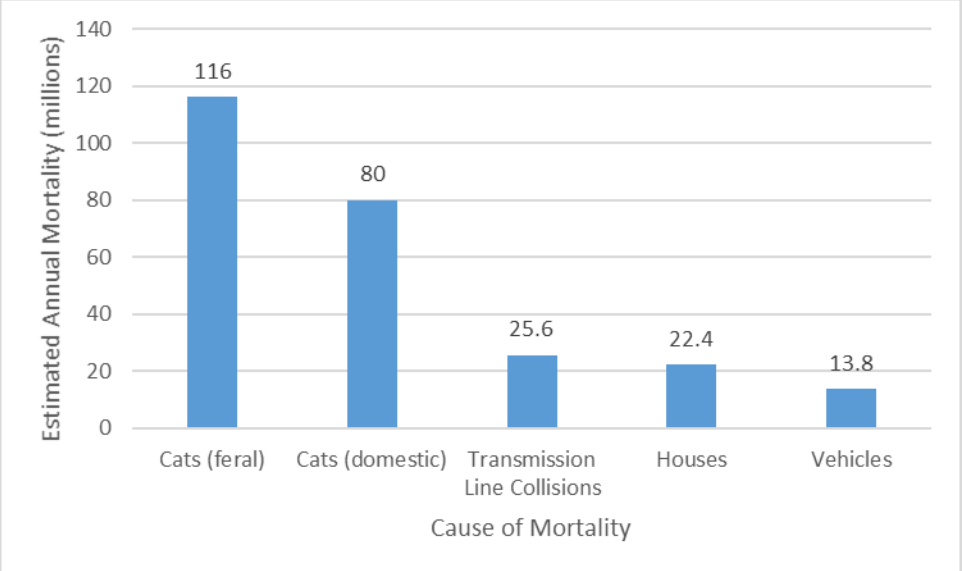

Figure 1. Top five sources of human-related avian mortality in Canada (Sourced from Calvert et al. 2013).

While birds as small as sparrows can be killed, species with higher wing loading, like swans, are more susceptible to collisions with lines (APLIC 2012). They are larger, heavier, and their lower maneuverability makes it harder for them to avoid lines. The Alberta Trumpeter Swan Recovery Plan 2012-2017 (AESRD 2013), stated that collisions with power lines (both transmission and distribution) are believed to be the most significant cause of adult trumpeter swan mortality in Alberta. Studies in South Africa have estimated that collisions with power lines may account for 12% of blue crane annual mortalities (Shaw et al. 2010) and 11-15% of Ludwig's bustard annual mortalities (Jenkins et al. 2011). Prior to the implementation of mitigation measures, electrocution was estimated to account for 60% of mortality in the Iberian Peninsula (Ferrer and Hiraldo 1992).

Altalink's 1201L transmission line runs through the northwest corner of Frank Lake, within the Frank Lake Important Bird Area (IBA). It was constructed in the early 1980s, well before the stabilization of Frank Lake in 1988, and prior to the AltaLink's acquisition of the transmission system from TransAlta in 2002. AltaLink's new 1037L-1038L transmission line (constructed in 2014) runs north-south along the west side of Frank Lake, also within the IBA. In 2016, the transmission line appeared in local papers, accompanied by photos of dead trumpeter swans. Since March 2015, a local wildlife biologist has found the remains of eleven trumpeter swans and one snowy owl beneath the line. AltaLink conducted an investigation that resulted in the installation of 7,500 bird diverters on the lines around Frank Lake. Since the incident, Altalink has also updated the GIS modelling component of their risk assessment program for their 12,000 km of lines to enhance the assessment of bird collision risk across their system.
In 2016, ATCO Electric submitted a Facilities Application to Alberta Utilities Commission (AUC) for their proposed Grande Prairie POD Transmission Project. The project would include construction of a 15-km transmission line along the east side of Bear Lake, within Grande Prairie – Trumpeter Swan IBA. The line would pass within 250 m of the 800-m Trumpeter Swan buffer around Bear Lake. As part of their Facility Application, ATCO conducted a wildlife survey along the proposed routes. The wildlife survey included a stick nest survey and a snake hibernacula survey; but no breeding bird surveys or waterfowl surveys were conducted. The wildlife report failed to even mention trumpeter swans, despite the vicinity to breeding and staging habitat, and the only proposed mitigation was to install bird diverters.

Like Frank Lake IBA, Grande Prairie – Trumpeter Swan IBA is globally significant for congregatory species and waterfowl concentrations, particularly trumpeter swans. The area is home to the largest population of trumpeter swans in Alberta. Bear Lake has been identified as a key staging site for migrating trumpeter swans, and was the location of the

largest flock observed during ASRD's trumpeter swan survey in 2000 (James and James 2001).

International Bird Areas are sites that have been identified as areas of international significance for bird conservation. However, IBAs in Canada do not have any form of legal protection, unless they overlap with areas that are separately protected (e.g., national and provincial parks, migratory bird sanctuaries, ecological reserves). According to the IBA Canada website:

- Nearly 70% of Canada's IBAs have little or no overlap with protected areas
- Approximately 50% of Canada's IBAs do not overlap at all with protected sites
- Only 36% by land area is protected

These sites need to be protected. Effective protection measures should be a requirement for development activities within these areas and not be merely voluntary. When planning transmission line routes, sincere consideration should be given to avoiding environmentally sensitive areas. Bird diverters have been shown to reduce collisions by 50-80% in many studies, but they are not 100% effective at eliminating incidental take (APLIC 2012). Also, a recent study only showed a decrease of 9.6% (APLIC 2012), so results can vary due to methodology and site-specific conditions. Effective use of bird diverters is an important mitigation, but perhaps it should be treated like personal protective equipment – the last line of defence, but not the only one.

In 2010, FortisAlberta moved and buried a portion of their distribution line that ran through a wetland that was a well-known staging area for trumpeter swans (AESRD 2013). Although burying lines is rarely deemed economically feasible in North America, Europe has several examples of utility companies moving their distribution lines and low-voltage transmission lines underground (Haas et al. 2005). When planning their new transmission lines near Cooking Lake (SWED) and Frank Lake (1037/38L), AltaLink conducted waterbird surveys to determine flight paths and heights near the proposed lines. These are just a couple examples of showing due diligence in following the *Migratory Bird Convention Act*.

Until IBAs are given more importance and protection, their future lies in the hands of the regulators. The AUC must weigh social, economic, and environmental factors when making decisions. Until the public gives more value to protecting IBAs and the species that use them, the AUC may continue to put financial cost before environmental cost when protecting the public interest. Because of this, continued public education and awareness is paramount to protecting our migratory birds for future generations to enjoy.

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Posters & Displays

1. Mitigation Measures Arising from Bird Sweeps

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Canadian and Provincial regulatory requirements establish a restricted activity period for both migratory and nonmigratory birds. Within this period, avoidance of all active bird nests is the preferred preventive measure to avoid disruption to these species. Because avoidance cannot always be met, certain circumstances allow for implementation of other means of mitigation. Over the last several years, in consultation with Alberta Environment and Parks, and the Canadian Wildlife Service, Amec Foster Wheeler has designed and implemented several mitigation measures to allow proponents a window of opportunity to complete tasks, within the restricted activity periods for birds. Bird sweeps have been used to identify the presence of any active nests. The mitigations developed include: nest monitoring for Canada geese, nest relocation for Swainson's hawk, sharp-tailed grouse lek monitoring, and the installation of migratory bird deterrents. With appropriate mitigations, proponents have been granted access to clear a select land base within the migratory or non-migratory restricted activity period.

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2. Nest Detection Rates During Replicate Pre-Clearing Nest Surveys

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Golder Associates Ltd. (Golder) presented a poster examining the efficacy of replicate pre-clearing nest surveys (hereafter nest survey) using empirical data from a linear development project in northwestern British Columbia. There is currently no provincial or federal standard for completing nest surveys or providing guidance on the number of replicates that are most effective. As such, the number of replicates commonly varies across projects and discretion is often left up to the qualified environmental professional (QEP) overseeing the work. Up to three replicate nest surveys were completed per segment of the project right-of-way at the discretion of the QEP based on time of year, habitat characteristics and overall bird activity. A nest detection rate (NDR) (nests/man-hour) was calculated for each replicate survey completed from May 15 to July 20, corresponding to the period of peak nesting intensity in the region. When all of the data was considered, the second replicate survey appears to have the lowest nest detection rate. As this data analysis represented all surveys regardless of sites or timing, this may be due to surveys having expired in a particular area; thereby requiring repeat surveys in possibly non-ideal habitat that had previously been assessed as requiring a single replicate. For sites that received two replicate nest surveys, the NDR was greater during replicate two. For sites that received three replicate nest surveys, the NDR increased with each successive replicate. None of the differences in NDR between replicates were statistically significant. Replicate surveys were generally conducted in habitats assessed as productive or complex with high levels of bird activity or potential for nesting. As a result of selective replication in areas with a higher probability of discovering an active nest, the resulting NDR is likely inflated for each successive replicate. The results of this case study suggest that in areas with high levels of bird activity or complex habitats, one replicate nest survey may not be sufficient and three or more replicates may be necessary.

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3. *Probability of Nest Detection – Lessons from a Long-term Nest Monitoring Project*

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Nest searching is a fundamental tool for ecological studies on avian communities. In any study with a focus on life histories, survival analysis, or productivity, successful nest detection is paramount. In addition to ecological studies on birds, nest searching is commonly used in settings where mitigation of disturbance to birds and their nests is required. As a mitigation measure, nest searching can be unreliable because of low nest-detection rates due to the habitat being surveyed, bird species present, and time available for searching.

Nest detection as a function of effort varies with bird species and habitat. The predicted probability of finding a nest increases linearly as more effort is invested into a site. While this is obvious, and the most significant term in the model was the number of cumulative hours spent at a site, it is also important to note that hours spread over multiple visits to the site pay greater dividends with regards to nest detection than one visit of many hours. The models do not include nest stage (e.g., incubation) as a covariate, but this likely influences the probability of detection also.

The probability of finding nests needs to be considered when using nest searching for mitigation. The likelihood of experts finding nests after a short period of nest searching remains low for all species; each of the figures on the poster illustrate this. For the species included in this analysis three days of nest searching should be considered a minimum. For forested species, this minimum effort is likely much higher and detection of all nests may not be possible possible.

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4. Minimizing Nest Disturbance when Conducting Nest Surveys

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I examined whether more frequent nest visits increased the probability of nest abandonment or depredation during each nest stage (building, laying, incubation, nestling) using a nine-year, multi-species nest monitoring data set from three sites within the northern Columbia River Valley. The only significant result suggested that more frequent nest visits can lead to Savannah Sparrow nest abandonment during incubation (β: 1.15, SE: 0.31, $p < 0.01$); 4% of these nests were abandoned during incubation. There was some evidence that Cedar Waxwing and American Redstart were more likely to abandon nests during building and laying, respectively (β: 0.54, SE: 0.29, $p = 0.06$; β: 3.04, SE: 1.75, $p = 0.08$). No relationships were found between the number of nest visits and depredation. These nests were monitored using typical protocols to minimize nest disturbance (e.g. short visits, being careful to not disturb vegetation), which these results suggest are sufficient to minimize observer effects on nest survival for most species.

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5. Skookumchuck Prairie Important Bird & Biodiversity Area (display)

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Skookumchuck Prairie Important Bird and Biodiversity Area was designated by Bird Life International for its significance to Long-billed Curlew - holding 1% of the Canadian population. This display introduces the habitats and species of the IBA, as well as human usage and enhancement work. Summarized is the most recent threat, utility-scale solar arrays, to this remnant native grassland, a globally threatened ecosystem. For more information, contact Dianne Cooper, Rocky Mountain Naturalists.

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Nest Search Working Group

Because of the conundrum whereby biologists' services are both needed and dismissed as inadequate, we cannot look to agencies to provide guidance. At the CMI Incidental Take Forum, a lunchtime discussion took place where we asked the following questions:

1. Is there is a need for a document to outline the role of the biologist and an expectation with respect to the services they provide?
2. Who should take ownership of this initiative?
3. Who would be the readership?
4. What is the best format for this document (pamphlet, white paper, peer-reviewed paper) and where would it be archived?
5. What sort of content would be included? (high level overview, detailed protocol)

The first question was answered quickly with a resounding 'YES', but the four follow-up questions were not clearly answered and require further discussion.

To the second question, it was expressed that the APB might want to be involved, but not the CAB. There seemed to be support for exploring involvement by the APB.

Regarding the third question, there was strong interest in a document aimed at biologists. However, writing a document that has non-biologist proponents as the readership may also be considered, to help proponents understand what they are paying for (e.g., how legal risks might be mitigated).

Question 4 was not discussed in any detail. There may be a possibility for CMI to archive the document if needed/desired. But the decision depends in part on the answer to the first part of the question (what type of document it is).

Question 5 was also not discussed in detail due to time restraint.

CMI gathered a contact list of the people present at this discussion who expressed interest in carrying the discussion forward (44 people in total.) CMI has sent out an email to all participants to connect them with each other and helped to identify volunteers to help keep this discussion live, and rolling.

Question of the Day - Summary

At this forum, every participant was asked to consider this question:

You are a qualified, professional consulting biologist. A prospective client calls in early May and says they need to clear 5 ha of mixed forest land before July. The lot ranges from shrubs to closed-canopy mature forest. What do you tell the client?

The most common reply was to advise delaying clearing until August if possible, but otherwise attempt to decrease the risk of destroying nests using nest-searches and placing buffers around the nests during the land-clearing. Some people also included point counts as a part of the nest detection process. Others roughly quantified the area that would likely be buffered and the potential costs this process would incur for the client. There was also mention of using bird deterrents (such as audio deterrents) and doing specific surveys for Species at Risk.

Eight replies stated that they would simply advise the client to wait until August to clear the land. Three replies mentioned they would use something similar to the forestry matrix presented by Kari Stewart-Smith to determine the risk to birds if the land was cleared.

An example of a typical reply:
"Inform the client about the Migratory Bird Convention Act and the protection of birds and nests. Discuss options to proceed with clearing outside of the bird nesting period. If clearing must be undertaken during nesting season, then use pre-clearing surveys and recommendations from ECCC to avoid incidental take."

Field trip descriptions

1. Early Morning Birding

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Three birding field trips were offered on the morning of April 27th, arranged by Ian Adams with the help of the following volunteers with the Rocky Mountain Naturalist Club: Dianne Cooper, Ruth Goodwin, Marianne Nahm and Darryl Calder. Many thanks to everyone for sharing their time, expertise and enthusiasm. Participants reported having had a great morning.

Field Trip 1 & 2: The Trench Special – Grasslands and Wetlands.
Field Trip 3: Elizabeth Lake – The Cranbrook Special.

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Summary of forum evaluations

There were ~180 people at the forum, and 81 evaluation forms were returned.
Not all forms had a response for each question.

1. ***How well did the conference meet your expectation?***

Exceeded Expectations: 25 people
Fully met expectations: 41 people
Met most expectations: 14 people
Met only a few expectations: 1 person
Did not meet any expectations: 0 people

* In all evaluations rated as Met Most or less, the participant identified that they were seeking more direction from the regulators.

Evaluation responses to the rest of the questions asked are too numerous to list. Key questions asked and some sample responses are as follows:

- **Please suggest two or three key things that you learned at this event that will have an impact on your work. Are there things that you will be doing differently in the future?**
    - "Risk Management Modeling – this is something I've been interested in but have had trouble finding good information on, and I haven't known who has already made progress in this area. I made some good connections with people who will be able to help me in this regard."
    - "Legal support! This will be very useful when talking to project managers/engineers. This will also help me to create stronger arguments for avoidance and detailed planning."
    - "The idea of paying more attention to legacy effects and stressing that prevention, not mitigation, is what qualifies as due diligence."
    - "I didn't realize how ineffective nest searches are – that was a big eye-opener. I will be looking for more upfront planning, as opposed to emergency nest searches."
- **Was there anything that you hoped to learn that you did not?**
    - "A solution to the regulatory impasse around the MBCA."
    - "Guidance from ECCC regarding alternatives to nest sweeps/surveys. No solutions to the issue were provided."
    - "Was hoping for more clear desired outcomes from regulators – great that CMI gave them an opportunity to speak but it wasn't that helpful."

    - "What are the best/most practical way of amending MBCA since the regulation clearly isn't achieving the goals of protecting migratory birds as it is meant to."
- **If we run a sequel to this event, what topics would you like to see included?**
    - "Effectiveness of mitigation measures to provide alternative nest sites, ex., success of nest boxes, planted wildlife trees, and other alternative structures."
    - "Working group to look at modelling and solutions to addressing inadequacies of MBCA."
    - "Discussion group to develop a nest survey protocol that is standardized."
    - "More case study explorations of the legal side of things."
- **Do you have any other comments about this event?**
    - "EXCELENT! Wonderful speakers and great diversity of attendees. Very well-organized."
    - "I was impressed the number and diversity of speakers. I thought it was very well-organized, and I thought the additional activities were both interesting and great for networking. Great communication from start to finish. Thank you for all your hard work."
    - "Really useful perspectives across disciplines – scientists/academics/regulators/land managers/industry. It was great, and so well organized."
    - "The lawyer really scared me – I don't think we're doing our due diligence!"

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