Assessing Habitat Quality for Management of Marbled Murrelets

Minutes of workshop held January 30, 2007 at the Nanaimo Aquatic Center, Nanaimo, BC, from 0830 to 1600hrs.

Co-sponsored by the Ministry of Forests and Range (Louise Waterhouse), Simon Fraser University (Dr. D. Lank), and the Ministry of Environment (Stewart Guy).
Workshop co-ordination supported by FORREX (Carolyn Whittaker). Funding support: Forest Science Program.

ATTENDEES

Bertram, Doug (Canadian Wildlife Service)
Burger, Alan (UVIC)
Chatwin, Trudy (MOE)
Cober, Alvin (MOE)
Donald, Dave (MOE)
Donaldson, Ann (Consultant)
Dunsworth, Ken (MOE)
Erickson, Wayne (MOFR)
Flug, Derek (Field Pilot)
George, Greg (MOE)
Gray, Malcolm (ILMB)
Harfenist, Anne (Consultant)
Hobbs, Jared (MOE)
Lank, David (SFU)
Leigh-Spencer, Sally (Consultant)
Lindsay, Dave (TimberWest Forest Ltd.)
McConkey, Darryn (MOE)
Mather, Monica (MOE)
McClaren, Erica (MOE)
McCulligh, Laurie (BCTS)
McDonald, Sue (Western Forest Products)
McDougall, Ian (ILMB)
Prescott, Erin (MOE)
Schroeder, Bernard (Consultant)
Simpson, Lauren (Keystone Consultants)
Silvergeiter, Mike (SFU masters student)
Steventon, Doug (MOFR)
Todd, Melissa (MOFR)
Wilson, Steve (Consultant)
Volker, Michelfelder (MOE)
Wall, Wayne (International Forest Products)
Waterhouse, Louise (MOFR)
Whittaker, Carolyn (FORREX)
Williams, Liz (SARCO, ILMB)
West, Heather (MOFR)

OBJECTIVES

1. Participants will increase their knowledge of three Marbled Murrelet habitat classification approaches (GIS-based algorithms, Air photos and Low-level aerial surveys) and provide input on how these approaches may be used to address different habitat management objectives for Marbled Murrelets.
2. Participants will increase their knowledge of the current level of verification testing for GIS-based algorithms and provide input on potential strengths and weakness of these algorithms with respect to their use in management of Marbled Murrelet habitat. Participants will provide input on further approaches to verify GIS-based algorithms.
3. Participants will increase their knowledge of new research that tests relationships between habitat quality ratings and murrelet habitat use. Participants will provide input on how these results apply to the interpretation of the current habitat quality classes, standards and management of Marbled Murrelet habitat.

4. Participants will increase their knowledge of how the different habitat quality classifications compare to one another based on testing and will provide input on how use of different tools can or cannot be integrated for different management applications.
5. Participants will devise and discuss strategies to address potential variances and uncertainties in the habitat classification standards, mapping data coverage, and application of the methods.

WORKSHOP MINUTES

8:30 am Introduction - David Lank

Morning Session

8:45-10:40 GIS Based Algorithms - Presentations

Current use of Marbled Recovery Team based algorithm for strategic habitat mapping (Monica Mather, MoE).
http://www.forrex.org/program/con%5Fbio/pdf/workshops/mamu/references%20and%20weblinks.pdf

Verification testing of MMRT based habitat algorithm with low-level aerial surveys (Dave Donald, MoE).
http://www.forrex.org/program/con%5Fbio/pdf/workshops/mamu/references%20and%20weblinks.pdf

Calculating change detection using satellite imagery and the MMRT based algorithm habitat map layer (Malcolm Gray, ILMB).
For copies of this report please contact Liz Williams, ILMBSARCO - Species at Risk Co-ordination Office.

Mid Coast Habitat Algorithm (Jared Hobbs, MoE).
http://www.forrex.org/program/con%5Fbio/pdf/workshops/mamu/references%20and%20weblinks.pdf

North Coast Habitat Algorithm (Alan Burger, UVic).
http://wlapwww.gov.bc.ca/wld/documents/fia_docs/mamu_standard.pdf

Clayoquot Habitat Algorithm (David Lank, SFU).
http://www.sfu.ca/biology/wildberg/mamuweb/welcome.htm

Summary of Key Points from Presentations

- CMMRT-based algorithm useful for strategic (regional and landscape) coast-wide mapping of potential suitable habitat (provides 2002 benchmark needed by the CMMRT)

- Upgrading of potential suitable habitat maps produced from CMMRT-based algorithm is ongoing using refined mapping from other classifications or algorithms. This improves accuracy of amount estimates and line work (i.e., reduces inaccuracies of underlying forest cover mapping, while inclusion of mapping at more refined scales may account for other structures or landscape metrics considered predictors of murrelet habitat).
- Can use strategic mapping to produce preliminary estimates of habitat amounts required and amounts protected. Preliminary estimates given using the CMMRT-based algorithm on amount needed coast wide and % in protected areas.
- Can use satellite imagery to correct forest cover mapping (or other mapping) for past disturbance (by time period). Corrected resultants can be used to calculate change in habitat amounts (this could be done using any provided habitat overlay for any species , demonstrated here for mamu on Sunshine Coast using CMMRT-based strategic maps) to examine % net change in amount of habitat (annualized) and % decrease per year. *Other metrics/indicators could likely be calculated in addition to habitat amount.
- Can use strategic algorithms to direct efforts for applying further field assessments for WHA planning.
- Strategic algorithms such as the CMMRT-based algorithm are binomial; other algorithms and mapping methods use a range of classes (4 – 6) to rate habitat suitability.
- The Mid-coast (and North coast) habitat algorithms include a weighting of tree species and have 4 rating classes. Using >2 rating classes may be useful for identifying most 'superior' habitat among that predicted as suitable for some types of management planning i.e., if habitat quality is related to nesting density.
- Verification testing is ongoing using low-level aerial surveys (deemed to be the more reliable method to determine habitat quality because of detectability of platform structures needed for nesting).
- An area based comparison of habitat maps (4 Landscape Units) produced by low-level aerial survey then overlaid with the CMMRT-based algorithm resultant indicated 4.1% landbase overestimated as suitable habitat and 4.1% underestimated as suitable habitat.
- Verification testing of habitat suitability classed by CMMRT-based algorithm compared to that classed by low-level aerial surveys (using plots) indicated ~75 - 80% suitable habitat correctly predicted and ~70 -80% unsuitable habitat correctly predicted on Vancouver Island. North Coast comparisons slightly differed when using similar methods suggesting algorithm good at predicting suitable habitat, but less reliable at predicting unsuitable habitat (Class 6 - Nil) i.e., predicts habitat unsuitable when really suitable?
- Important to consider will the algorithm have lower accuracy if the scale of verification testing differs e.g., patch to polygon, or in drier forest ecosystem types with generally lower epiphyte development?
- Correlation analysis North Coast showed that no one feature of habitat predicts the nesting sites, so the models that use combinations of multiple variables are critical.

- Using SFU nest sites to test Clayoquot algorithm confirmed it has good predictive capacity and could be improved adjusted distance to ocean variable. Nest sites not excluded from sub-optimal habitats, but higher densities indicated for higher quality areas (yet birds not indicated as packing into these for nesting).

10:40:11:00 GIS Based Algorithms – Discussion

1. Effective habitat versus gross habitat
   Is suitable habitat effective habitat? If not how do we measure effective habitat e.g., taking into account edge effects, etc.
   Currently for management treating gross habitat amount as effective amount.
2. Fragmentation and Edge Effects
   Do we need this? Is this important to prove?
   Edge question is as yet unresolved except where shown in campgrounds.
   CMMRT treats natural edges as neutral with limits around hard edges adjacent to <30-40 year old stands.
   How we measure edge using GIS may not match our perception of edge. Does using airphotos provide better assessment? Satellite imagery may have potential but need to define patch size and buffers and significance of this.
3. Macrohabitat influences
   Do large scale effects drive habitat availability and use? Has radar been used to see if high use of habitats associated with aspect, wind direction (i.e., protection from), and fog belts? If so does density change with suitability?
4. Forest cover concerns
   a) Height class standards – can be a 'grey' zone.
   b) Forest transitions into old. How suitable is it if converting into 140 years? Or into 250 years? Does it have the right attributes?
   c) Gaps – How can gaps in the forest cover be addressed, need to improve field efforts through use of up-to-date imagery.
5. Helicopter methods
   a) Observer variability – can be incorporated into results, or resolved during survey, difference between 'teams' and 'observers'. Need to formalize process as more aerial surveys are likely to be completed during habitat analysis.
   b) Tree species – difficult to rank or 'weight' habitat suitability by species as some species are ubiquitous. Some flights reveal areas with higher percentages of certain species likely to classified unsuitable. These results may be ecosystem and location specific. Forest cover not good at predicting percentages of tree species.
6. Habitat model classes
   How many different habitat classes or scales are sufficient, can you improve the accuracy of a 2-class model with 4 categories?
7. Clayoquot model

a) Bias – geographical bias depending on where radio-tagged birds where caught, temporal bias as birds where caught late in the season. Note that where birds nested in forest is relatively unbiased.
b) Nesting habitat in Clayoquot is relatively contiguous forest.

8. Verification testing
    a) Need to think about how differences (non-agreement) applies on an area basis because much larger portion of the land base is non-suitable i.e., 4.1% of suitable is much smaller area than 4.1% of unsuitable.
    b) At random what agreement occurs between classification of sites by low-level aerial surveys compared to algorithm classifications.(is this accounted for in using randomized designs?).
9. Integrating mapping data
    Need to consider that maps produced from MMRT-based algorithm includes data sheets compiled from different dates i.e., likely integrates a decade of work. Therefore need to think about how use 2002 as a baseline.

11:00-11:30 Air Photo Standards - Presentations

New Research-Testing habitat use described on air photos at nest sites for the Queen Charlotte Islands and West Vancouver Island (Louise Waterhouse, MoFR).
http://www.forrex.org/program/con%5Fbio/pdf/workshops/mamu/references%20and%20weblinks.pdf

Queen Charlotte Islands/ Haida Gwaii Mapping Project: Adjusted Oikos algorithm, objectives for air photo mapping and management, data collection (Alvin Cober, MoE, Brian Smart, Consultant).

- Queen Charlotte Islands/ Haida Gwaii Mapping Project: used to move away from a MAMU habitat map based on an algorithm to one based on air photo interpretation
- The airphoto mapping creates a reliable seamless (TFL, TSA, Park, Private) and consistent nesting habitat layer for strategic and operational planning purposes.
- Project completed 5 phases 2003-2006 for 1 million hectares (the entire land base of the archipelago/Haida Gwaii Conservation Area). Data likely ready for public release end of this fiscal.
- Preliminary comparisons between the airphoto resultant with resultants of two algorithms (LUP and Cortex) suggests there is a significant shift in the distribution of habitat supply between the algorithm-based and airphoto interpreted mapping, and that airphoto mapping refines the areas considered higher quality habitat. Therefore, airphoto mapping not only improved linework but better quantifying habitat with potential suitable structures for MAMU.

Summary of Key Points from Presentations

- Air photo variables indicate habitat is used non-randomly, and this supports use of the airphoto classification

- The classification may potentially be refined using some of the more recent results.
- When using airphotos consider that habitat selectivity may vary with geographic location
- Consider that different combinations / weights of variables can predict same probability of use (i.e., according to Resource Selection Function); therefore nest habitat best predicted from combination variables.
- Consider scale may influence habitat selection and we tested variables within patches (stand, patch) not at landscape scale.
- To meet differing management objectives need to consider how to balance selectivity results (for habitat quality class) against range of classes used for nesting.
- Consider that by combining classes for management into suitable and unsuitable (going to bimodal classification) we're losing information gained from having a 6 class system (i.e., we are no longer assuming that habitats classed as Very High differ in relative likelihood of use from those classed lower if all grouped together)
- *This research information will be published in detail this year –including the details on the individual variables - see citations*
- Queen Charlotte Islands/ Haida Gwaii Mapping Project: used to move away from a MAMU habitat map based on an algorithm to the air photo interpreted version
- The airphoto mapping creates a reliable seamless (TFL, TSA, Park, Private) and consistent nesting habitat layer for strategic and operational planning
- Project completed 5 phases 2003-2006 for 1 million hectares (most forested landbase on archipelago). Data likely ready for release end of this fiscal.
- Preliminary comparisons between the airphoto resultant with resultants of two algorithms (OIKOS and Cortex) suggests there is a shift in the distribution of habitat supply between the algorithm and airphoto mapping, and that airphoto mapping refines the areas considered higher quality habitat. Therefore, airphoto mapping not only improved linework but better quantifying habitat with potential suitable structures for MAMU.

11:30-11:40 Air Photo Standards – Discussion

1. Landscape uniformity
   Non-significant results in Clayoqout could be due to uniformity of landscape (only testing in >140 year stratum) combined with small sample site having less power to discriminate given the low variability.
2. Difference between air photo mapping project and algorithm results
   a) Differences in projected amounts by class could in part be due to forest cover inaccuracy.
   b) For large landbases with limited data, this method could be cost effective but must have recent air photos to ensure accuracy.
   c) Ground truthing of maps in process.
3. Misclassification of suitability

Nest locations are pretty accurate as they are plotted by field technicians onto the photos as well as using GPS – this is also partly why we used 100-m radius plots; and from Volker's and Dov's study in Clayoquot even when sites fell in predicted sub-optimal habitat, they were still much closer to high quality habitat than random sites.

AFTERNOON SESSION
12:30-13:00 Low-level Aerial Survey Standards – Presentations

New Research - testing habitat use described from low-level aerial surveys at nest sites for the South Coast and West Vancouver Island (Louise Waterhouse, MoFR).
http://www.for.gov.bc.ca/rco/research/mamu/mamu.htm

Coast -Wide mapping project: objectives for management, data collection, status (Sue McDonald, Western Forest Products; Wayne Wall, International Forest Products; Sally Leigh-Spencer, Brian Smart, Consultant).
http://www.forrex.org/program/con%5Fbio/pdf/workshops/mamu/references%20and%20weblinks.pdf

Summary of Key Points from Presentations

- Low-level aerial survey variables indicate habitat is used non-randomly, and this supports use of the this classification to map murrelet habitat.
- Habitat Quality, Moss Development, Trees with Platforms, and Large trees were strongly intercorrelated and significant predictors – but moss development may prove a more useful predictor in some landscapes (still draft results).
- Scale of assessment i.e., patch verses a stand can affect rating of habitat quality – therefore important to consider mapping intensity when surveying landscapes.
- Similar questions regarding management and use of classification as to those points highlighted for the air photo research presentation.
- Coast -Wide mapping project using low-level aerial surveys intended to provide seamless coverage for management (i.e., want for structured decision making; initial use will be for WHA design).
- Surveyed ~ 2 million hectares Vancouver I., Sunshine Coast, Soo TSA.
- Two field methods currently used: Non-moving satellite hardcopy map and moving map techniques. Different reasons identified outlining benefits of each application, but testing has not been undertaken comparing resultants of the two differing methods.
- Data will be transferred to ILMB, but need to resolve data accessibility / sharing.
- There are still some data gaps, next step to fill them.

13:05-13:15 Low-level Aerial Survey Standards – Discussion

1. Heli-techniques for mapping

a) How to identify areas out of polygons? Continual adjustment at landscape level utilizing all observers. Unmapped good quality sites can be picked up.
b) How during surveys is an area predicted as unsuitable systematically covered? i) Adjust during flight at landscape level by probing boundaries of unsuitable habitat and adjusting sampling accordingly; ii) during surveying may not survey as much of the lower classes but pick up most of the higher classes.
c) The maps created from plots produced by moving map technique are considered to be "soft lines" (i.e., some judgement used).

2. Patch size for research
   What size patches? Heli plots are tighter than air photo plots – intent was to approximate 3ha using 100m radius plot. Fixed patch size to control area effects for research tests.

13:15-13:30 Comparing Classifications - Presentation

Comparisons of Algorithm, Airphoto and Low-level aerial classifications for the Queen Charlotte Islands/Haida Gwaii Mapping Project and nest sites (Alvin Cober, MoE and Louise Waterhouse, MoFR).

- Verification study in progress to 1) Determine relationship between air photo and aerial survey classifications, 2)Identify how to best integrate the methods, 3) Determine sensitivity to spatial scale of implementation
- Have 4 main study areas stratified by airphoto classes (1 – 5) in each stratum they have surveyed using low-level technique ~10 random plots

Sub-sample for one area (*published in the cited report in references*) suggests strong agreement between ratings of the two classifications for the High and Very High classes. Therefore, if draft result persists with larger analyses interpret that low-level aerial surveys more likely useful in Moderate to lower classes

13:40-13:55 Landscape Metrics and Edge - Presentation

Adding Productivity to habitat management decisions (David Lank, SFU).

- Using radio telemetry have indexed nesting success from parental movement patterns Desolation Sound and Toba Inlet
- Preference was shown using the Desolation sample (n=121) and landscape metrics for: steeper slopes, closer to roads and streams, closer to hard edge, slightly lower than average elevations
- Examining map nests can see (eyeball test) those nests close to ocean shore don't do as well and that those closer to edges with young forest may fail more
- Research with this sample has shown that birds in Desolation use small patches (<10 ha) and larger patches (>200 ha) – but don't know if this is general result or particular to this area. Clayoquot (n = 36) there is under representation of small patch sample.

- Fragmentation can be a problem if increase predators therefore vulnerability of nests
- Desolation: surveys indicate fewer predators at higher altitudes. Is this the mechanism effecting success results getting in this area?
- Some current work at SFU producing results that indicate may be differences between soft and hard edges on nest success, and differences in types of predators depending on geographic location.

14:00-14:15 Multiple Scales – Presentation

Setting Objective Habitat goals at multiple scales: desirable properties; scale, uncertainty (Doug Steventon, MoF).

1. For effective management a tool to help meet management objectives needs to consider: links regional to site level, starting conditions, explicit inclusion of uncertainty, flexibility for different scenarios, neutral and objective in its application and can be updated and tested with field data (as becomes available)
2. Using a Baysian Belief Probability Network can use a supervised model approach accounting for the above criteria.
3. This approach was demonstrated by Doug using the North Coast example. Using radar data the habitat model in his BBN was calibrated using continuous functions thus relating numbers of birds to habitat quality. Using continuous functions enabled accounting for any area within a whole landscape having a probability of use (instead of the either / or approach of the binomial model). The model could then be used to propose solutions (amounts of various types of forest) most consistent with management objectives for nesting carrying capacity or persistence probability, given the total amount (hectares) of mature and old forest to be retained. The solution considers the starting landscape composition and the relative habitat value of different forest types. The model can be implemented spatially. In the BBN can examine the individual variables and combinations of scenarios

14:15-14:30 Comparing Classifications/Landscape Metrics/Multiple Scales – Discussion

1. Habitat protection
   If there is limited amount of habitat to protect, should protect better quality habitat. How does this effect density? As imagery quality increases, density numbers increase as nest sites are mapped more accurately and landbase is made smaller for density calculations (non-suitable habitat identified and removed from calculation). Cost/benefit analysis is needed on classes, where is threshold and what are the risks of shifting thresholds? Gain in nest sites verses cost of setting too much aside.

2. Site fidelity
   Natural disturbance factors may effect how areas are preserved in the long-term. Difficult to determine if birds returning to areas that have been logged, radio tracking cannot work over a long time frame. Information on site dispersal is not available. Studies in California indicate birds returned 5-6 years and where unsuccessful. Preserving areas does not mean that they may not ever be disturbed.- natural disturbance patterns.
3. Elevation
   What is happening above 900m? Some birds were at higher end than what they typically used. Possibly early nesters with experience are willing to fly farther – not known.

GROUP SUMMARY
15:00-16:00 Discussion

A. Field methods – interpretation and classification

- Nesting density data collection labour intensive (i.e. tree climbing), radio-telemetry can work but need more of it. Large scale radar can be used to get density estimate at watershed level. Could use radar work and an adaptive management framework (less modified landscapes) to manipulate landscape experiment.
- Radar counts to habitat quality distributions in watershed. Limited to data available. No change in radar numbers found for last 10 years; did not look at habitat data. Next step as a strategic tool could be to take radar watershed (a couple hundred) and run it through and see how consistent it would be in other regions.

B. Effectiveness

- Need to know if we just going through a process or are we being effective (i.e. impacting population; meeting needs) distribution and interpretation of classifications. Comparing what it should look like (from models) and identifying the next steps.
- Need to link habitat quality to number of birds.
- Regionalization of models- experiment/comparison could do it (small working group). Next recovery team meeting discuss more.
- Are the models and surveys giving similar results? Depends on forest cover data and region. Agreements must be made so that data is available to all. Issue with scale for data sharing, polygon size, etc.

C. Meeting management objectives

- There is multiple scales and strategic versus operational issues.
- If we reach a time when we cannot support population- what are we going to do to keep that narrow niche functioning? Government decision on MAMU expected-assembling contributing pieces (SARCO) sometime this year (late summer, early fall). Stress importance of knowing what is out there (habitat, birds), considering Recovery Team recommendations, and where we are to go?

- WHAs will change therefore need to consider this if goal to maintain specific population.

D. Management for other species

- Other management tools to consider (Protected Area, OGMAs).
- Consider other species; eagle nests have been mapped by some when out flying.
- Example: Using murrelets to study for Northern Goshawk- is there overlap in habitat suitability and can we use them, or is it too broad. Concern of observer expertise in the air, most people are specialized to one species. Overlapping is beneficial for budgets but need landscape level objectives in place to be effective. Must consider prey/predator relationships.
- Need for sharing of data and to consider ecological scale (multispecies projects), including OGMAs, ungulate winter range, other species.
- Caution of using a coarse filter for multispecies; may lose attributes that are used in fine filters.

16:00 Session Wrap-Up