

Cerulean warbler information workshop NCTC Jun 2006

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Common and complicated: life history of the cerulean warbler

High mortality around fledging time - little data

Migration issues - weather, stopover conditions, endpoint conditions

Very tall trees, heterogeneous vertical structure

If doesn't die coming out of nest, probably dies during migration. Much less mortality at endpoints, they think - little data.

Records of birds that have made the trip a dozen times (6 yrs)

9 gm bird, forest interior breeder, insectivore

May gain as much as 33% of body weight prepping for migration

Overwinter in northern S Am and down the AndesH

Molt is energetically demanding time

early migrant - moving south in July and August - peak of hurricane season

apparently fly directly across the Gulf of Mexico (fattening habitat needed)

human population increasing in overwinter habitat

social system and site fidelity poorly understood

longevity poorly understood, as is population age structure

difficult to study

want to see some sky in the forest, vertical structural and species heterogeneity

nests out at end of limb 17-18 m and higher

if nest destroyed or decide not to nest, then disassemble nests. apparently may thief nest material from other species?

Think monogamous, single brood, female alone builds nest and incubates, both feed and care for young and fledglings

response to natural disturbance - 2 major ice storms, one in AR, one in Ontario In Ontario, caused a year of problem. in AR, population collapsed

Habitat and scale - central hardwoods and some of the northern hardwoods

Use a variety of forest types but only a subset of what's available in a local area

Dominant trees may be early or late successional species, but are always big

complex vertical structure

WV/OH/PA nexus is the best - larger good area incl KN, TN, AR, IN

post-breeding dispersal of young unk

age- and sex-related habitat segregation on nonbreeding period unk

migratory routes unk

habitat-specific demography unk

there is a cerulean warbler technical group, 5 years old, formed in 2001, open membership, representation from all countries with the permanent residency of species incl Colombia, Venezuela, Ecuador Q-A

- how long breeding? 4-5 days to build nest clutch size maybe 4 maybe 1 egg/day (up to 8 d) incubation 10-11 d (up to 15 d) nestling 10-12 d (27 d) post-fledging care maybe 21 more d (48 d) functional independence and molt - not known apparently single brooded, but female

may try 2-4 times to get a successful brood

nests so hard to find that nest success estimates may be too low because never find the subsequent nests. Is possible to raise a nest to near fledging, fail, reneest and succeed - so time for two nearly full nests

intra-pair breeding is known - female may breed with all males with which she overlaps territory - social mates? idea of "pair" may be unhelpful males will have one arrangement before females arrive, then when females arrive, males get very aggressive male's song perch location and ability to project song may be important

- there's an extinct warbler and a listed warbler - what makes ceruleans different from "average" warbler that's doing OK

early migration - shortens breeding season

length of migration and how they accomplish it - may do numerous long overwater flights - at whim of weather during these habitat change on breeding ground - destruction of forests. Ohio River Valley drainage habitats are gone to ag - were primary at one time climate change, deforestation in Andes - don't know how these play in - maybe in combination

- what do we know about prey? what? foraging behavior? not many stomach analyses bring most common green caterpillars to nest, eat other insects as well. leaf gleaners -

peer and hop, don't flycatch. forage in areas with lots of leaves birds can peel xmtr off whilst going through dense foliage

is there flexibility in breeding ground decisions?

I think so, but I don't know how. birds breed in one area as adults that bred elsewhere in

the previous year may move territory during a season due to failure to find a mate during one season one bird roosted in two different areas multiple km apart on alternate nights John R. Sauer, Patuxent (and William A. Link)

NA Breeding Bird Survey and Estimation of Population Change for Cerulean Warblers (have ppt notes)

NA breeding bird survey started in 1966. Roadside survey conducted in June 24.5 mi routes with 50 3-min point counts sum of counts for each species over 50 stops form index of abundance for the route. unbalanced over time - routes added important limitations imposed by survey design

average counts high in WV, along south of OH, spot in Cumberland on KY-TN border and lighter spot in s IN

analysis at a variety of scales

have used a variety of statistical methods historically - route regression methods in past 5 years transitioning to hierarchical models (paper in Ecology on ceruleans with Link)

The hierarchical model is a log-linear model with year effects, observer/route effects, first-time observer effects, and overdispersion effects. Models year effects, observer/route effects, overdispersion as mean zero normal random variables. stratum-specific intercept

using ratios of counts at different years (dispersion analysis)

BCR=bird conservation region = physiographic regions.

Appalachians and Central Hardwoods BCR have the greatest # of routes (143, 35) and highest RA (birds/route): 1.03, 0.18

most trends from 1966-2005 are negative and "credible interval" is below zero

1996-2005 trends have huge credible intervals (Bayesian methods - no confidence intervals)

At the state levels, WV has highest RA, 2.75, and 45 routes. Only seen on 243 routes

overall survey negative short and long-term, also WV. other states don't have negative credible interval in short-term.

caveats:

not everyone loves the BBS for population change info - know not seeing all the birds, know observers differ, know roadsides are not representative of overall habitat analysis accomodates start-up observer effects, inter-observer effects.

scaling the survey data to absolute numbers is arbitrary

on-vs-off road can't be addressed directly, but can be done through habitat modeling, etc. some research being done now

no info exists on actual bias in bbs estimates field studies useful to evaluate on-off road issues, detectability use additional data

adding more routes only helpful if they are chose to address information gaps - better route density improves data, new areas add to range-wide info but doesn't do the best job on rare or poorly-sampled species

QA

•given comments about inappropriateness of BBS survey against consistent results from BBS data - do you believe that ceruleans are declining?

my greatest concern (I have a couple) is habitat change along routes is differential to grand habitat change - kinks in remotely sensed land use (they change methods of remote

sensing interp every time they do the analysis) also how spotty estimation influences the analyses (vm - I think spatially spotty)

- how good a job does BBS do in estimating interior species (given road routes and species that doesn't like roads)?

concern is that you're only encountering peripheral components of population, which may be responding as the bulk of the population does - my concern is that habitat change along routes may cause changes not representative of changes in overall pop.

- any way to control road effects by looking at type of road?

original intent of bbs was to be on undisturbed roads - old undisturbed routes have become disturbed while new routes tend to start on undisturbed roads, more variation on siting of original routes - didn't necessarily all start on secondary roads.

- people in the NE don't believe ceruleans are continuing to expand in the NE but "maps

of change" tend to continue to show expansion Maps haven't changed yet, also only show direction of estimate, not significance.

what does it take for an analysis to be included in the cerulean analysis

needs to have one cerulean observed one time during the period of analysis - that's all. there are a fair number of routes with very low counts. in theory Poisson can handle this, but precision falls apart eventually. could use site occupancy analyses to deal with these, but no general indication of failure of models to represent reality at this point.

Ken Rosenberg - Cornell Lab of O [Using population estimates to set conservation objectives](#)

Assumption: return population of priority species to pre-BBS levels over next 3 decades

Partner-in-Flight estimates of population size

PiF objectives:

if >50% loss, double population if 15-50% loss, increase 50% if stable or increasing, maintain population

Using BBS data (count to 400 m radius) - 25.1 sq km over 50 stops. not true, apply correction factors based on detectability - average maximum detection distance for forest birds = 128 m (Emlen and DeJong 1981) intermed species (bobolink sparrows = 200 m). some species use full area - calling crows, raptors in open habitat ...

Assume one member of pair is detected at any time, so double for # of individuals; additional correction for change in detectability with time of day

Get an estimate of 570,000 individuals (285,000 pairs) (vm +/- 50% if I heard properly in other conversations - see also Thogmartin's presentation)

most other warblers are in millions or 10s of millions - cerulean is one of least common song birds in North American

They feel the rate of decline is at least 50%, so objective would be to double population (vm - i'm not clear on which # they want to double - thought it was 2005 count, but now not sure)

quicker talk inserted at last minute

Wayne Thogmartin - USGS Upper Midwest Environmental Sciences Center

Cerulean Warbler population projections based on Breeding Bird Survey data

BBS provides annual estimates of an index of relative abundance yields index of total national population size and pop size within BCR polygons he confines inference to national or range-wide level for cerulean and to BCRs used indices of relative abundance in a time series to reconstruct time series of population sizes, assuming changes in bbs reflect changes in population size population - route count average over time and space, adjusted by area, adj by pair correction, detectability adj, and time-of-day (cf Rosenberg minitalk) use ratio of index in 1995 to index at time t (1995 is ref point)

1.4 million in 1966 to 570,000 in 1995 = 70% decline, loss of a million bird using count-based PVA to characterize trend stochastic realization of population growth process uncertainty must increase with time as we predict into the future μ is a stochastic population growth rate. When $\mu > 0$, $\lambda > 1$ even with a currently decreasing population, there is often a nonnegligible possibility of

increase due to the variability around the estimate - confidence or credibility interval goes into positive territory if we know μ and its sd, then can calculate prob of quasi-extinction use diffusion approximation approach (he works from E Holmes stuff because he's only been in this game quite recently and wanted a solidly described basis) calculated a probability of a 90% decline with a century using a 40-year time series from BBS Also did a sensitivity analysis assessing space, time interval, and initial population size on prob of decline looked at last 30, 20, and 10 years of time series as well as overall 40-

year interval some evidence that earlier in BBS series, decline was worse, so looking at more recent data softens the picture - reduces

prob of 90% decline

the PiF estimate was "moderately" accurate and "highly" precise which translates to +/- precision

the growth rate is negative for entire pop and for all BCRs. survey-wide is -3.1%, BCRs vary more widely due to less sampling. at core of range, also -3%

posterior probability (Bayesian approach) for lambda is essentially all left of 1, suggesting very little possibility of increasing pop in future. used a prior prob of asymptotic increase in probability of decline over time

prob of quasi extinction - 90% prob of a 90% decline within 100 years

in heart of range, BCR28, prob of 90% decline is 60% at 100 years

if we change our time interval to later data only, risk declines, with interaction - change in trend estimate but also decrease in power from loss of sample size

full time series is highest, last 30 and last 20 lower, but similar (20 is actually marginally higher than 30; >90% of value for full series - vm), last 10 lower yet (70% of full series, by eye - vm)

in doing sensitivity to initial estimate: If use 50% of initial estimate, get similar probability of losing 90% of initial estimate If use 150% of initial estimate, pushes extinction risk into next century Randy Dettmers

habitat selection on the breeding ground

large tracts of mature deciduous forest, away from hard edges in landscapes with high % forest cover

structural char most important late succ stages, large mature sawtimber trees, multi-layered canopy and midstory

ridge top, floodplain and mesic cove

large forested (70-80%) landscapes have highest abundances

or large forest patches (1780 ac in MC), 4000 ac in Miss Alluvial Valley

regional variation in sensitivity to habitat

prefer later succession, larger than average dia at stand and nest tree level and also relatively tall trees for their diameter class (emergent trees for song perches) diverse vertical veg structure - relatively dense at multiple layers from canopy through mid-story, but not closed-canopy

general avoidance of hard, contrasting edges but found in areas that have diverse canopy structure or canopy gaps regional variation in association with canopy gaps or "internal edges" - positive association in PA, WV and eTN, but none in ON, wTN/AR

natural gaps and gaps associated with old logging trails are not avoided, but a power corridor is (wTN)

higher than ave elev helps create mult-layer veg - significant topographic relief associated with mesic, north-facing slopes more often than expected by chance wide range of elev across range, but locally often restricted to narrow elev range in Appal, more often associated with upper slopes and ridges

nests often way out on later branches

canopy of male core areas (Ontario) had more trees with late leaf-out (hickories) that may improve song transmission) males and females with different microhabitat prefs - nest trees vs singing perch trees females use long-limbed midstory trees Wayne Thogmartin
Cerulean warbler breeding season habitat correlations

Maria Isabel Moreno (and Salaman, Pashley, Hamel, Velasquez) - ProAves, American Conservancy, FWS, and others Cerulean Warbler in Latin America

702 records, 75% observation records, 67% since 1975 18% of data from specimens from 13 collections 4% of data from birds banded on non-breeding grounds (only ProAves) 1% from literature

Records from 11 countries - 6 CA stopover countries, 5 SA wintering countries 95% of wintering records from Col, Ven, Ec; Col, Ven most important

Wintering ground dates from early Aug to early May, mostly from late Aug to late Ap

Few fall CA records, spring CA records peak in April
peak records in SA from Sep to Ap Col peak in Sep, Ven peak in Nov spring peaks in Feb in both Col and Ven Ec data mostly from Oct-Mar (no more than 10-11 records/month) although some early records in Aug and Sep

Possibility in fall the species goes from Gulf coast at LA straight to Ecuador with no land stops in Honduras, elsewhere in CA In spring, apparently more likely to go through CA to arrive in breeding grounds in better condition

Occurs at high densities in favored areas (1-2 ind/ha) 1-3 ind per multi-species foraging flocks flocks of up to 3 indiv feeding on nectar sources forages primarily on outer foliage of subcanopy prefers broken canopy (like shade coffee plantation) strong assoc with Blackburnian W, American Redstart gleans inverts and also feeds on nectar

QA

You said wintering forested habitat (in Colombia) declined by 63% - is that why cerulean warbler have declined by 70% - narrator turns question away there's more habitat down the Andes - do you think the species doesn't go down there? she believes the birds really aren't there - good birds down there and are not submitting cerulean sightings. Rosenberg interjects there's a new project to get more data from Sam and may work with the habitat model she presented. Pashley indicates Bolivia looked in good habitat and didn't find any question about relative importance of territory drivers on fall and spring migration Pashley mentions stopover habitat studies in CA - not conclusion that all stop, but some birds do - effort only in spring - none in fall

Time-line exercise

Mark Nelson - USFS FIA data

inventories across US to assess forest resources national standards 20% eastern/10% western annual sample - in east, every 5 years sample every plot 5-year reports

Phase 1: remote sensing (follows phase 2 and 3) to post-stratify samples by landcover Phase 2: visit accessible forest and do traditional mensuration Phase 3: measure additional data related to health on a 1:16 proportion of plots

sampling intensity 1 plot/6000 acs, 2400 ha/hexagon small plot footprint. 48 ft diameter

circles, 4 circles: center and 3 satellite circles can't release true plot location coordinates now

release shapefiles with summary info for plots and generalized plot locations Spatial Data

Services can do work with real coordinates for clients Discussion of use of FIA - 50 trees/8 sq
mi

Jason Jones - Vassar College
Demographic Analysis - Ontario

Queens University biological station - 7000 ac of near-contiguous property, 95%
second-growth sugar-maple-dominated forest (a bit of hemlock and beaver
openings)

nest sites sign diff from random in the ?general vicinity? (Jones and Robertson 2001 Auk
18:727-735)

nest sites nsd from habitat available in the female's territory

males have restricted activity within territory - use specific areas within territory, not
whole territory. cores often song posts

males 15-20% bigamous (one example of trigamy)

females will double brood but not yet observed to be successful on 2nd try

core composition mostly late phenology (late-leaving) trees (bitternut hickory and white ash)
leaf out about 3 wks later than most trees

song degrades to nothing by 75 m - songs poorly adapted for forests!

minimum convex polygons tend to overestimate area used (40%) male
MCPs overlap, but male use areas do not overlap

1997 ice storm

1998 had nests closer to gaps, but everything was a gap; nests failed all over the place. in
1999 nests shifted higher into higher trees in different cover and got back to reasonable
success rates.

estimates of return rates: 0.49 +/-0.05 these are not survival estimates coffee
plantation users stay put for much of nonbreeding season and seem to have
some site fidelity in successive years. body condition unk

they estimate lambda in non-icestorm years as 0.80 with ice storm, lambda=0.73 assume
immatures breeding at 80% of adults rates fecundity estimates probably low (54%) genetic
data - hint of gene flow from north to south (Veit et al. 2005 cons ggen 6:159

1740 parasite data - 33% of adult males
infected with *Haemoproteus paruli* prevalence
and parasite load higher in south adult-

dominated population in the north, juvenile-dominated populations in the south

population structure (Girvan et al. in review Condor) - showed that molting location of previous year is NOT necessarily the same as breeding location in the capture year. Adults moving after successful and after unsuccessful breeding seasons - far higher than known for any other migratory wood warbler. Higher than expected site fidelity for juveniles, lower than expected for adults. ON and TN were more site faithful than central-range birds.

there seems to be a Bergmann's rule thing going on with body size and dry temp - N birds bigger than S birds. for a migratory bird ought to be free of temp-dependent pressure on body size - never experience winter in N or in S. (vm - but they are so small they must still be sensitive to difference between Ontario and WV). How is this maintained in a migratory species, if individuals are mixing in nonbreeding season Things birds from N are wintering in Ven, birds in Miss are wintering in Ecuador - or maybe it's all due to signals from the overwintering grounds where they spend more time!

probably can't do a range-wide conservation plan given gender habitat diffs, probable regional habitat diffs ...

QA

- canopy cover after the ice storm?

75% before 34% after - 50% or so reduction. most pop nesting tree in 1999 - the recovery year - was broken American elm that sprouted these masses of shoots at the break point - big dense stuff and the birds nested in the middle of it, not at the end of some long branch

where's the balance on the genetic info in terms of degree of N-S mixing of birds body size and isotope data suggest better N-S (in US) separation

- regarding appropriateness of return rates for survival estimate?

At his study site, the 49% survival estimate is probably not bad, but for a range-wide number, not good (I'm not sure I followed this right)

Paul Hamel had ice storms on his site and had worse damage. Subcanopy trees - the more likely nesting trees ??? breeding failure and birds disappeared for 5 years.

David Buehler and James Giocomo - Univ of Tenn
Demographic models of cerulean warbler populations

Jim does the math, Dave asks the questions, he says!

Deterministic Leslie matrices and stochastic models

building models from demographic data not count data

lambda as a function of adult survival, adult fecundity and juv survival. Female based

fecundity related to many things

Cerulean generally single-brooded, but will reneest after a failure, so have to add success of however many attempts. But we just heard double brooding might be possible

Assumptions - 100% pairing success, immigration and emigration offsetting no age or sex-related differences in parameters all breeding AHY constant average annual rates of everything

models do not equal reality

modeling does not address habitat loss on the breeding grounds - data come from adequate habitat and cannot show mortality or failed breeding due to habitat loss. habitat loss on wintering grounds will affect survival rate estimates and so is indirectly reflected

sensitivity analysis using low, medium, high parameter values for nest success, brood size, adult survival, reneesting rate, max number of attempts, juv survival ratio as a fraction of adult survival ratio

nice graphs showing (among other things) known params over stability params

young/nest against nest success: IN-Big Oaks and Miss Alluvial Valley and Ontario are not good. TN and OH are not as bad, but still below 0.968 Need to increase young/nest or increase both nest success and young/nest (these are the only two params on this graph)

he suggests that the estimates of young/nest are likely to be a bit low due to visibility - could count post-fledge but don't at this time. ON nests aren't so high, might be correct. but TN and OH might be low, and if come up one young/nest, would be OK. but ON decreasing at 20%/year (what the graph suggests if ON estimates are right) seems unlikely to him juvenile survival:

if juveniles survival is 0.64 survival (not as a ratio - 64% survival) then TN and OH are fine even without increasing young/nest and ON is ok with increased young/nest. With adjusting young/nest, 0.59 will get you over $\lambda=1$. if as low as 0.54, everyone is too low.

if use high param estimates (good estimates) for everything, all populations OK, if use low param estimates, no one is OK. If use overage, the TN and OH are OK with adjusted young/nest.

in TN, nest success varied, but estimated brood size didn't much

Mississippi Alluvial Valley study sites have variable but low young/nest and dismal and not too variable nest success

Ontario has high nest success, but slightly low young/year

IN has low, variable nest success, with slightly low young/year

Ohio - intermed nest success with 2.5 young/year (intermed)

Now let's look at stochastic modeling

variability in nest success, brood size, and adult survival permitted, using average variance ratio from the field (excluding ice storm years)

looking at probability of 90% decline given lambda of 0.968

reducing variability delays probability of 90% decline. what will climate change do?

In summary:

need better info on brood size, survival, immigration/emigration

some populations (Miss Alluv Valley and IN) may be sinks

core populations (OH, TN) may be sources in "good" years

increasing variability likely to reduce time to "extinction" - implications of climate change?

QA

- ON shows up under the lines, but population seems to be increasing - what gives?

Jason Jones answers - it's his population. He says the ON population seems to have stabilized at about 3000 pairs in the whole province. Wayne says - but all the dots are under the lines. David says it may be the fixed parameter values in the model which include survival - if survival is a bit bigger and young/nest is a bit bigger, that would fix the issue. Also, Jason only has one sample for all of ON

Rosenberg - maybe work backwards - if core pops are still here, maybe assume they have at least $\lambda=1$ and work backwards to likely survival values David says

they've done that, and get believable survival rates. Jason reminds us that the study sites are not the regions. David comments imm and emigration aren't in the model at all. Miss Alluv Valley is in everyone's flyway and may stick around because of emigration - still a sink, but a sink with inputs Pat Keyser Mead Westvaco, chair of working group Global Timber Trends: Implications for the US Forest Products Sector

actually a compilation of several forest products presentation that covers world and all of US

rapid increase in non-native plantation area in Latin America - doubling from 1990-2010

US newsprint consumption has dropped drastically since 2000

Southern softwood stumpage prices has stagnated stumpage prices for pulp, chip-nsaw and sawtimber prices

moved away from plywood to chipboard (oriented-strand board OSB)

plywood requires large, high-value trees. OSB relies on hardwoods of any diameter

softwood sawtimber demand stays on a slightly downward trend, highest in south. partly a result of Canada timber

Pulp production has been nearly level since the 90s, but paper and paperboard

production is up, reflecting outsourcing to Latin America and Australia where can grow fiber faster so that shipping prices still worthwhile
US pulpwood demand remains pretty flat, but pulp still 5-6 times OSB in the near future (to 2020ish)
Latin America and Oceania have 71% of growth in pulpwood production. Down 2% in Nam
increasingly global markets in forest products, demand shifting to developing markets. new technology coming on
trade is all over the place, in all directions
demand is shifting - increasing in eastern europe, china, asia, Latin America, Africa, dropping in the mature markets of developed world
production growth is shifting, but N Am and WEur still >50% in 2015; eastern Europe, Asia, Latin America take over but N Am doesn't go up.
pulp prices noisy but declining

2nd presentation

American mfging is sliding downhill, including forest products
World industrial roundwood production essentially flat from 1979 to 1999 for conifer and nonconifer and total
More efficient use of raw sood, nonwood substitutes, recycling, aging population in much of wood-using industrial world, decreased wood productio as centrally planned economies move to efficient markets (e.g., Russian prduction/consumption decline)
According to the FAO, in 2000, 34% of the world's industrial wood came from planted forest. in 1950, planted forests made up a negligible portion of industrial wood.

Global harvest shifting to tree cropping, massive areas of plantation primarily in subtropical areas, tree improvement by traditional and genetic engineering, increasing participation of N Am and Eur firms in subtropical plantations.

Global demand continues relatively weak while supply sources grow
new supply will come from intensively managed plantations outside us with genetically improved material
continued relative deterioration in the position of us as wood producer
tax and certification considerations provide incentives for US firms to divest forestlands in the uS
longterm weak dollar could help some
overall expect US industry to continue moving aggressively offshore while reducing and restructuring domestic timberland holdings.e

3rd presentation - southern forest resource assessment: David Wear - 2003

southern forests dominated by private - 69%, 11% in public ownership (this isn't all of the cerulean range!)
degradation not as much an issue as loss to urbanization/pop growth
planted pine plantations are up, natural pine is down, upland hardwood up a bit, lowland hardwood almost flat since 1970, oak-pine roughly stable

Southern Appalachians - pop growth and fragmentation due to parcelization

4th presentation - Hardwood timber inventory

From 1953 to 2005, increased hardwood inventory in Appalachians. PA, TN, VA on top
`1991 - 10.6 mbf lumber production, 1997 13.3, 2005 11.0

US furniture has lost about 50% of capacity, remaining mills using 50% less lumber (part due to efficiency) lots of timber coming in from outside

Overhead costs are ridiculous - workman's comp, trees less available, logs exported to China to be turned into furniture

TIMO's are largest private landowners (the investing folks, I think vm) little clearcutting - little oak or cherry regen deer browse significant problem for regen logger certification and restrictions make recruiting new forest workers tough

QA

Most of the plantations in S Am going in nonCerulean habitat - Argentina, Bolivia - subtropics

Most remaining Appal timber harvest will probably move to high-grading for logs for export - cherry, red oak, sugar maple

Footprint of disturbance may be reduced - OSB production moving offshore, too, and pulp mills shutting down

Deer populations in Appal bother him - regen

What about chip production for ethanol? Industry would like to see it, but he sees it as premature to think about in next 5%. if it happens, would change the picture he's shown us

what are forests likely to look like under these scenarios? beech/birch forests - highgrading removes early succ species and can't get those back. Thinks fernvaccinium may come to dominate because deer won't let trees grow - thinks very slowly will go to heaths.

whose buying the timberlands? investors due to perverse incentives. 15 yr ownership horizon. they see the land as the asset. in 15 years will sell appreciated land for reasonable profit to developers. Ohio land used for cerulean study was sold recently, and resold twice in less than 5 years as speculation Cindy Tibbott - FWS Mountain-top mining

form of strip mining in which overburden scraped into valleys

about 1000 mi of streams already buried

reclamation is required - steep forested ridgetops turned into rolling herbaceous cover with scattered plantings of black locust, pine, autumn olive

reclaimed areas are very stable over time - don't want landslides, etc. so use very aggressive herbaceous species, compact the soil severely to prevent erosion and also invasion of tree species

study of mines of different ages - upland unmined area adjacent to mined areas - even mines 25 years old show no invasion by native hardwoods onto adjacent recovered areas.

can be up to a few square miles in size (largest 5 sq miles). visible in satellite imagery

area at the intersection of KY, WV, VA and into TN by the Cumberland Gap and spots a bit further south

Total forest loss 1,408,372 acres (estimated in 2002 for 2012) over area about the size of Delaware in total.

radical changes to reclamation might help - less compaction, reestablish forested areas. but nothing so far concern that even if reforestation is encouraged as post-mining land use, plantations may be more popular than native forests (altho last talk doesn't suggest it - vm) current reclaimed landscapes do not include intact forest and do not support forest interior birds well except in fragmented forests, a bit. 28% of fragmented forests had ceruleans. 40% of points in intact forests had ceruleans.

0.7 territories/ha in fragmented, 4.6/ha in intact forest fragmented forests in this study tended to have stripmines on 3 sides

some overlap with earlier talk by Randy Dettmers - same slides

snag density, canopy cover >6-12 m and >24 m predicted greater density of territories

QA

What % of hardwood forests is that 1.4 million acres. Either 7 or 12% - not sure if mountain-top mining beyond 2012, and likely to be, then what? they didn't have any certainty in predictions beyond that - could look at permits issued in last 3 years - maybe exceeding predictions due to incr in coal prices. Charlie says governor of state with all the coal mining disasters suggested more mountaintop removal as safer for miners.

Wayne - no database that catalogs location and extent of mines. companies get to decide whether or not to show it. WV now shows it. Coal distribution is not mapped - proprietary data. Her data were generated using satellite imagery because states don't track permit locations, etc.

what did EIS do? mitigation is possible, agencies will encourage coal companies "to do the right thing?" Randy - TN doesn't get valley fill because of the way its mined there, but coal and ceruleans overlap nearly perfectly. about 25% of cerulean population would be affected by TVA coal mine planning over next 10 years. what does displacement do to the birds? mining doesn't kill the birds outright, so hard to say what happens to them.

what's likelihood to OSM or state regulatory agencies make reforestation in reclamation a requirement? OSM attorneys say the law doesn't let them tell landowners what the postmining landcover must be - very broad latitude. Have to encourage companies - may be cheaper to reclaim by reforestation - less compacting, less diesel fuel use ...

what do landowners use for these reclaimed lands? no real answer

Brett Butler - USFS Northern Research Station, FIA
Social context of forests in the eastern US

modest forest increase since 1910 forest rarely reconverts to forest after converted away from forest

projected changes in forests - not much in northeastern US forest types not changing, but getting older, volumes increasing biggest problem is lack of early successional habitat - not a cerulean issue

Lake states- decrease in aspen-birch, not a problem for ceruleans Plain states - no big states South Central states - big decrease in upland hardwoods (40% from 2000 to 2050) with increases in planted pine, and urbanization eastern forests primarily private, unlike western forests Eastern US is 57% family&indiv, 25% business (south and ME), 9% federal, 7% state, 2% local

In the US, 11 million family forest owners, 83% with some college, average age 66 years, 60% retired. >20% of land owned by people 75 or older.

parcelization goes along with ownership conversion 50% of forest holdings in 1-9 ac, but most forest in larger holdings as size of forest holdings decreases, so does timber mgt especially timber harvesting ownership objectives (Butler and Leatherberry 2004) are legacy, aesthetics and

biodiversity, home, farm and privacy (all >60% of owners), recreation (55ish%), land investment (35%ish), timber production (15%ish) In next 5 years, 68%ish have no plans, 40% firewood, 20% heirs - many of them don't know they have forest land (inherited land)

real-estate investment trusts - Plum Creek, e.g. - and timber investment management organizations (TIMOs) - John Hancock these folks hold land and sell after it appreciates - 15 years or so. Don't convert to subdivisions - too much of it. are interested in timber, but ...

2nd homes and moving further away into the woods (virtual commuting) increasing

population growth in eastern US (to Ohio) up 2.5 times 1900-2000

QA

Wayne - I heard US growth up 66% by end of century? is that real? megalopolises? Doesn't expect that kind of development in Appalachia

• Pat - southern hardwoods decrease and planted pine increase probably modeled on financial incentives that are 5 yrs old - current incentives much flatter. in western ____ logging and sawmills declining, fire and silviculture are being lost as tools.

Brett surprised by flat demand - he expected declines

David - southern Appalachians have high development pressure - western NC Carolina - 2nd homes. Not urbanization, but 2nd homes and retirement.

Randy - I didn't mention an aspect of breeding habitat selection - post fledging habitat use. Not much data, but anecdotal information that once young fledge from nests, ceruleans and other interior forest birds seem attracted to early successional habitats - increased cover and maybe food availability, probably.

Maria Isabel Moreno - Pro Aves Non-breeding season habitat trends

prefers primary forest, mature shade coffee plantations with broken canopy

shaded monocultures are an appropriate habitat due to similarity to primary forest

Coffee cultivation and cerulean range overlap a lot. most population is in the Andes, not in the rainforest (I think vm)

Shade coffee good, sun coffee bad.

Easy to study bird in shade coffee than in forest. Forests remaining in the Andes are on steep areas that would be hard to convert, also hard to study

highest densities (up 1-2 indiv per ha) in sheltered humid intermontane valleys within the Andes, elev 800-1700 m, primary canopy or shade coffee. but very few areas with forest that look like this.

positive relationships between wintering records and temp variation, prefers 16-24 C, low rainfall (but not dry forest or desert)

Actively uses canopy and subcanopy at heights 8.6 +/- 2.84 m (n=36).

threats

not equally distributed, specializes in habitat type, few core areas available - little suitable habitat left.

ProAves identified 2 key areas, both with severe pressure from shade and sun coffee conversion. What habitat remains is fragmented and threatened from deforestation
what size patches are ceruleans using on overwintering grounds?

Coffee price falling, and banana becoming more desirable. ?banana/shade coffee?

Humid intermontane subtropical forest very poorly represented in national protected area network.

suitable areas also ideal for coffee and cocoa, with cool climate, moderate rainfall, rich soils
Coca largely grown below 500 m and opium above 2000 m so these are not threats.

Believe species is a habitat specialist underprotected and at risk.

Habitat loss in core wintering areas could be hampering survival/recovery.

Primary forest cover has decreased more than 70% (Renjifo et al. 2002)

management - easements with coffee growers, specialist coffees to encourage growers to protect shade coffee

Pro Aves has established 500 ac of native forests surrounded by shade coffee and cocoa plantations

also have a migratory bird festival

Grupo Ceruleo

QA

Wendy - are your numbers for SA or just for Colombia - habitat info, etc. Model built in Colombia, but using all avlbi data from SA

Jason - explain about taxes? All the owners have to pay land taxes. People with large lands with forest in mountains has to pay taxes for forest. If spend more money on forest, then pay less taxes

will use fragmented habitat in S AM? didn't understand answer

in picture with open hillsides - what do they use them for. Cows - grazing.

remaining forests are very steep - is anyone surveying there? are densities there higher than in shade plantation? are remaining birds all in shade plantation? vm - seems little work done in remaining forest. Jason - equivalent densities in remaining forests, but have to rappel in some of them - need to monitor with microphones left in the forests!

Evening discussion of threats

Randy - windtowers. growing and continuing to grow. trying to evaluate what real risk might be for this kind of species. where are they likely to go up that they would pose a threat, probably particularly migration, but maybe during residence period.

Wayne - aren't they thinking of putting them on Appalachian ridgetops? that would be a problem.

Charlie - Appalachians maybe a big target due to steady winds - a conglomerate/company is interested.

Sue - paper on Mt. Storm - fairly neutral on that site

Dave - study on Cumberlands in heart of cerulean country - TVA has a site. monitored for a couple of years, bird and bat. At that site - good migration corridor for passerines. But miniscule # of birds picked up. Lots of bats.

Wayne - critics suggest scavengers pick up carcasses

Dave - there's a correction factor for how long they've been out there ... Peak power generation is often in August and that's also when most bats are being killed. You'd think birds passing through would be vulnerable but seems not.

Wayne - in my area, are extending blades which is supposed to make them slower ...

Dave - argument is longer blade, slower they go

Ken - it looks like they go slower. but this is an issue for all migrants. if cerw concentrate on particular flyways, maybe could get things sited in other places, but we aren't there yet.

Steve - anything about life history or migratory routes that would make them particularly susceptible?

Ken - yes, if they do long-distance overwater migration and stage in Belize, then offshore windtowers could be an issue.

?? - how high do they migrate

Ken - usually high, but could get all your mortality on an occasional night, or even on an occasional night on an occasional year when ceiling is low and birds ...

What about lights

Yes, lights can be more dangerous than blades

In WV have provided recommendations re both lighting and siting. Currently we have 1 active site with approximately 40 turbines on a wooded ridgetop. One under construction - 150 turbines sprinkled thruout wooded ridgetops and old mines. Then 3 other projects iwth betw 50-125 turbines proposed all on wooded ridgetops. Lighting issue has been looked at fairly closely, recommendations made, industry willing to change FAA red light to one that is not deemed to attract birds. Concerned not only with birds but also bats, particularly on wooded ridegtops, altho mortality of birds has been fairly small. Still recommend postmortality studies. All sites currently in WV industry has been agreeable - ? 1 year pre construction ? and 3 years post-construction

Steve - any studies on surrogate species for cerw or any bird - any studies quantifying risks of these kinds of installations?

Ken - lots of studies. highly variable. no signs of high risks disproportionately for different kinds of birds. we just don't know. What about Kennesaw Mt (GA) - might be another Belize kind of place. Want to keep an eye out for concentration points. Don't know if there are other species - lots of warblers are killed by these things. Lots probably hit buildings.

Steve - other kinds of aerial collisions?

Randy - buildings

Ken - along coastlines

Randy - any reason to suspect cerw to be more susceptible?

Dave - coming back to wind turbines. Given we know these birds migrate along ridges - you put in a few turbines and get no effect - is there some threshold where you put enough in and there's no safe path down the Appalachinans and you start to get elevated mortality.

Ken - definitely an issue, not disproportionate for cerw

Steve - other collisions - powerlines, cell towers?

Randy - powerlines not an issue for songbirds. Cell towers could be. Doubt they're more susceptible to it than typical neotrop migrant. Do we have any sense that cumulatively, these towers and turbines and buildings add up to where we'd be concerned about cumulative impacts across migratory pathways.

Ken - internationally - Mexico is planning huge projects across Isthmus of Tehuantepec on ridges where all the migratory birds go ...

Randy - catastrophic events don't happen often, but if the timing is just right, pulse of birds, bad weather, 150 wind turbines - what's the impact of that? How often does that happen?

Brett - are you talking about 10s of birds? 1000s of birds

Randy - highest incidents are 10s of thousands of birds

Jason - Long Pt lighthouse - 4 to 6,000 birds killed in one night in 1960s, almost all warblers

Wayne - is cerw differentially more susceptible, but if you think of Heath Hen - it wasn't that it was more susceptible to stuff it was a cumulation of small things that drove it extinct. At low numbers, everything is additive.

Ken - one tower killed a Kirtland's warbler - it's only one bird, but ...

Dave - a new 1% factor or 3 new 1%factors can be the difference betw stability and

decline

Steve - ton of studies on this kind of thing - any individual pub studies ever provided insights to really turn on the light bulb more than just average study at one site?

Ken - 24 Bachman's warbler killed on a TV tower in one night in FL I suspect Paul summarized that in the BNA account

Jason - lighting - switching from FAA red light to strobe birds aren't attracted by strobes at all - constancy, rather than color matters most. Fact that FAA is willing to consider strobes as warning lights may obviate a lot of concern. I think buildings are going to be the big problem. Chicago had a lights out night in 2002. The result was staggering in terms of reducing mortality. Fatal light attraction program in Toronto picks up ceruleans ?every night?

Ken - if that's true that's the first thing I know of that showed an impact on cerw

Jason - daily may be an exaggeration - but regularly

Ken - Paul's account has nothing on towers for ceruleans

Donna - I heard recently about a window that they've recently built an entire bldg out of - has very fine wires in the window - invisible to folks valuing view, but birds can detect - is this viable Vicky - not at night, probably

Ken - they're working on all kinds of ways to minimize impact - as Dave was saying it's a growing cumulative impact on all kinds of birds

Donna - I thought I heard them say it was one of the more serious sources of mortality

Jason - I think it's the lights more than the building - the exhaustion of fluttering at the lights.

Steve - contaminants - cumulation of icky stuff in food chains and in birds - also effects on prey base. never had privilege to talk to group of warbler experts - does this topic come up very much? is there anything about range variation in performance? pesticides, Hg, other things that can build in food chains

Wayne - some of what I was doing in Appal with acid rain and soils - was talking with folks who work with Hg contamination - it seems like an unexplored area. Don't know anyone whos thought about cewa and Hg but seems to be a correlation betw acid rain and Hg - could be hard to to tease out, don't know if it's even an issue.

Ken - high elevation, anaerobic conditions, fog shrouded ridges, saltmarshes, too. Bicknell's thrush shows it.

?? - Is it a fitness issue.

Vicky - no safe level in humans?

Jason - but whether cerw are particularly susceptible - obviously all this stuff affects cerw - hard to pinpoint things for which cerw are the species that's affected by these things

Steve - other warblers aren't experiencing declines for many of these things ...

Wayne - mixed species flocks with Am redstarts and Blackburnian warblers - I don't know what there current trends are?

Ken - both pretty stable

Wayne - do they co-occur - do cerw occurring in a confined area relative to these other species

Ken - yes, they're more widespread there and on breeding grounds

Wayne - trying to see if similarity helps explain things

Ken - there is a set of birds that overwinters at midelev in Andes that are all declining, but in my mind pretty strong connection, not published on, but I think it makes them a group - co-occur on breeding ground, too. Most of the birds that overwinter of slopes of Andes are in steep decline

TJ - from fragmentation

? - Yes

TJ - wanted to ask about ag in Andes - are there pest species - pesticide applications assoc with coffee at that elev?

Maria Isabel - they are applying pesticides, I think

Jason - less in shade coffee, but still applications, and we don't know what they are

Maria Isabel - fumigation for coca crops - interdiction spraying - no overlap with cerw

Ken - I'll have to stop saying that, then

TJ - would want to know about organophosphates in pesticides

Charlie - what about pests in the US?

Steve - what about silviculture - spraying for that?

Brett - when establishing, not in mature - Roundup, Arsenal, to release from competition

Pat - No spraying in range of cerw - some in pine plantations, but little of that in range

Brett - what about ferns

Pat - only in PA - gypsy moth spraying

TJ - not spraying as much as they used to?

Pat - in Virginia, MD very little spraying for last 5 years

Steve - herbicides and insecticides?

TJ - gypsy moths - insecticides

missing a couple of comments

Charlie - other insects affected by bt and other gypsy moth counters

Wayne - unk green caterpillars? is there anybody doing indices of green caterpillars?

Vicky - Shuey communicated stuff on caterpillars in oak hickory vs beech maple

Ken - but every bird eats them - if anything was hurting them, we'd see all species declining

Jason - got a few stomach contents - very high diversity - nonreliance on green caterpillars was amazing - never find anything but green caterpillars fed to young, but adults feed on anything - makes sense given broad diet on overwintering sites

Wayne - acid rain - reduces CA - broken egg shells - does that make sense with this species

Ken - happening in Europe with some species, long ways from seeing it in N Am, first evidence is at highest elevation where acid rain is worst - are seeing some prey reduction in soils in that areas but doesn't seem like cerw is good candidate for that

Dave - looking at it in the Smokies, pretty good evidence in the spruce fir - good evidence that Ca is being disrupted but not shown yet that birds expressing it - not to say it's not there

Ken - there is a connection between Ca cycles and Hg - some of the prey concentrate Hg - spiders and isopods -TJ - could map that pretty easily - when calcium carbonate in single digits get problems

Dave - places with biggest problems with acid deposition are not really core cerw

habitats

Wayne - is that cause and effect?

Dave - no - cerw weren't abundant in acid rain areas in 1930s

Ken - will become a big issue for birds at some point

TJ - in loons its a big deal

Vicky - estrogen mimics

nothing in response

Tony - oil pits - surveys in the Daniel Boone - pits are inactive but we fill with the rising prices of petroleum might see them increasing in activity - have been a problem for bats in w KY but in e KY could see some strandings and acute effects

Steve - describe oil pits

Tony - resemble pool of water - if dip down or are wading, might see insect if there's more than an eighth of an inch that's crude oil and they'll be taken down immediately

Steve - any sense of overlap

Ken - no known effect on songbirds

? - law enforcements did work on oil pits - can probably get records - ducks Ken - don't think it would affect forest birds

? - not a lot of them, but some in D. Boone - were there before feds bought the land - We've pulled lots of small birds and bats out. we can find out what they were

Steve - want to make time for climate change - connections are many - I realize in groups as yourselves, climate change doesn't mean the same thing to everyone - since probably be talking about this - express how you mean it - want to spend a little time on it - both forest experts and cerw experts - open it up

Pat - important what it does to particular forest cover - Iverson

Vicky - Mladenoff

Steve - what does it do

Brett - general shift north, but some issues on how species are going to move

Dave - iverson and prasad a few years ago oak hickory is shifting probably 300 mi n in theory, many types shifting out of US

Steve - what kinds of rates of change can these hardwood forest in a noticeable way in 20-40 years? - what do we know about rates of change - something that can give us some sideboard on oak-hickory - are we talking 100 years? 40 years? we could go out and be in a fundamentally different forest

Pat - more likely 100 yrs than 40 yrs

Wayne - but no regen

Ken - but not going to have a new forest

Wayne - if no regen, then no forest

Dave - if disturbance removes overstory then can get change, otherwise 80-100 yrs

Wayne - along Miss have maples reaching senescence and are going to have grasslands ?because maples aren't regen

Ken - if oak hickory goes north, that's good for cerw - get out of coal

Pat - and into acid rain

Brett - trees may not march north - light seeded trees might make it easier than heavy-seeded

Dave - if you look at modeling relative to bird distributions - good correlations with temp gradients and if warming pushes gradients further north, climate producing habitat goes north, and birds will have to go north - decades for htis

Ken - and maybe it's happening already

Dave - but in my mind the climate change that is most relevant is variability in drought and moisture in both ends and catastrophe events - I think it's right here right now affecting us - affecting the birds - more likely to have immediate impacts than marching northwards

Steve - general increase in risk from wider oscillations?

Dave - affects prey base, especially on wintering ground, migration, on repro side, had a cold, wet season had cerw with nestlings 7-9 days in the nest starving. doesn't happen every year, but

Steve - could short-term cycles change in their own right

Dave - El Nino and La Nina and Atlantic Oscillation could be linked to cerw and have been linked to warming effects

Ken - and hurricanes - if birds are doing long overwater passages, hurricanes could disproportionately nail cerw

Steve - since they have long migration in both directions, would "march" going to lengthen the trip?

Ken - it could

Jason - they're not going much further north than Toronto?

Ken - no, that wouldn't change - gulf doesn't get bigger

Steve - if forest type is moving north

Ken - on migration they're using other habitat for stopover - that won't be affected by oak-hickory moving north

Charlie - what about oak mottes on Gulf Coast - have to move further in to rest

Ken - that's well known - I thought they were doing something ...

Charlie - they're trying to save it, but they're still losing it

Brett - *missed it*

Charlie - BBS data maybe can tell if climate variability has increased and is there a similar variability in birds?

Ken - all seems to be smoothing

Dave - wouldn't you think CV would be getting greater if variability is increasing?

Ken - wouldn't look in BBS but in long-term studies where aren't expecting a trend per se

Jason - sites in White Mtns - effects on winter climate (not getting all this) - some negative effect on overwintering larvae and egg masses. also, any parallels in terms of marching of habitat and alteration of phenology of interest to cerw as in pied flycatcher - are we going to see that same disconnect? Do see in northern locations higher seasonality - higher fluctuation in Ontario vs TN.

Dave - this year in TN - earliest leaf development ever. This year 2 wks earlier. and insect flush peaks after leaf emergence, so this year was a 2 wk disconnect.

Jason - if not just following bug clutches north (i think), might see effects

Dave - it's all leafed out, ought to be in Gulf and ought to be able to figure it out and be up here

Vicky - studies seem to show longer migrants can't do it, altho shorter distance migrants can

Jason - why they're not flexible is interesting conjecture

Steve - last thoughts on climate? this is the time to get things out ... different species that never used to live in range of cerw ... and the forest - new things that might be changing for good or bad

Mark - whole issue of invasives and exotics is big, bigger than climate change in next 15-

20 years - Dutch elm, Asian longhorn, EAB ... Damage from invasives will probably exceed wildfire damage some people predict. very rapidly could have not change in distribution of tree species, but change in (missed it)

Steve - winter and breeding range?

Ken - artificially high deer densities

Wayne - why disproportionate on cerw

Ken - if it eliminates oak hickory and they wink out and cerw are restricted to oak

hickory - they're basically tied to it. if that starts disappearing we're in trouble

Brett - could change structural diversity, too Brett - what about intro of pathogen that would affect the bird?

rehash of parasite stuff from earlier - not at levels that seems on average to be troublesome

Randy - what about avian diseases that make the news

Ken - haven't screened well, no indication they affect small passerines, and certainly not disproportionately

Steve - other species

Vicky - tree of heaven

Paul - confirms tree of heaven, deer (I'm missing this) and in Gulf - chinese tallow can take over potential stopover sites - easy to keep adding these up - not sure if it's useful. winds - when Hurricane Katrina came across Keys, winds were ideal for taking off from Gulf coast and birds would have been dead, sucked into gyre. spring and phenological advance and insect flushes missed ... - what if wind conditions in gulf are affected that are opposite to way that phenology - could have more trouble getting north and find less to eat when they arrive. but that's just what if what if stuff - all live topics

Sue - lot of these things that you've been talking about, but that list of abstract addresses a lot of these things ...

Dave - thing that strikes me about climate issues - when I look at news, warmest hottest weather ever, wettest weather ever, most hurricanes ever - we don't have the data to clearly understand what those implications are, but if I had to bet, I'd bet that there are some. We are on the extreme for a lot of these parameters and they're likely to have effects on a lot of these species we're interested in

Steve - re time line - Ken's and Wayne's talks and Dave's - all this stuff has happened - massive clearing in the past, regrowth, another wave of habitat loss - there forests, the kinds of trees they like are pretty old - are there legacy signals? are the population levels now responsive not to ongoing logging and stuff, but past logging - when it got better, probably got better differently than it was before - are legacies of past changes to forests on your minds?

Ken - can turn it around - we've done everything we can to screw up the continent and lots of things are doing pretty well - may be more flexible than we think. reason they're in the places they are today is because they've been there for thousands of year, not because of management. A lot of what we see today is a relict of past events.

Steve - sometimes when we get involved in species that have declined lots worse than cerw - things we thought were habitat for a species really weren't a good representation of what they used when there were more of them - they were in last refuges and we found out those refuges weren't really where they wanted to live. is our perception of primetime what it would have been if we were here 200 years ago?

Paul - should I start with the yes part and go to the no part? 200 yrs ago lots of burning

everywhere and anywhere. horse was main mode of transportation, lots more chestnut, lots more elm, esp in the western part - lower Ohio and into midwest. early studies talk about finding nests in s IN - all the nests were in the open - loss of "elm" might be problem - see how the birds use the trees - I couldn't detect any diff between use and avail of elm - is that because elm has been reduced - maybe. And when Jay says after one growing season, elm produced all these little sprouts and boom nests were in there - we have nests in elm in the Lower Miss and smart foresters try to reduce elm in the forest because it's not a good timber tree unless you ask them to leave it. In our area, elm and box elder are not so good. So yes, there could be legacy effect.

Jason - if we say there have been changes, does that change what we would do?

Ken - has come up with ivory-billed - used to be pine species - doesn't help us very much, have to work with what we have

Dave - when look at Appal clearing and soil loss - basic forest productivity has undoubtedly gone down significantly. if that has affected bird populations because of less high-quality sites than we once had, equation might be harder to solve because of basic changes in core of the range.

Ken - every species will have different threshold and maybe for cerw have hit a combination of factors that affects it earlier

Brett - when did decline start?

Dave - before 1960s

Jason - not in Ontario

Ken - know it used to be abundant in Miss drainage - early 1800s

Paul - 1907 - that's where that statement came from. Wilson maybe said it was the most abundant bird when settlers came in across the Ohio valley.

Brett - so 1910 to 1960s

Ken - can infer from loss of forest that bird has been declining for 200 yrs just from habitat loss

Paul - don't think Lewis and Clark said anything - bird not named until 1811. Business about site productivity - think you're on to something. When we look at nest trees and roost trees - always too tall for their diameters - has to be some kind of site conditions or management conditions for trees at 99%ile of height for diameter. When I look at spots birds like in LAV - in low abundance, so can pick their spots - they're the high productivity sites which are most likely to be cleared for ag. Look at trees that they're using, maybe use FIA - are these run-of-the-mill trees or special trees? how tall should these trees be?

Dave - recent studies with other warblers, people have supplemented food during breeding season and showed significant impacts on productivity. So whatever may limit prey availbly does link to repro output, at least for other warblers

Jason - laura's work on black-throated blue - argument was - was she actually incr food availbly or decreasing energetic costs of gathering it since it's right there by nest. Most birds are not producing at physiol capability

Mark - Paul, in the Ohio plot -densities lowest in 1940s and highest in 1960s - can we learn something from that?

Paul - that was BBS data - I don't know - would need to go back to data, just reminded me of something - data exist as published field notes - some veg data, and some of those plots may still exist