

>>Christy Johnson-Hughes: HELLO AND WELCOME TO OUR FIFTH AND FINAL WIND ENERGY BROADCAST THAT IS COMING TO YOU FROM THE NATIONAL CONSERVATION TRAINING CENTER STUDIO. AS YOU KNOW, I'M CHRISTY JOHNSON-HUGHES WITH THE U.S. FISH AND WILDLIFE SERVICE AND I HAVE BEEN YOUR HOST FOR THE PREVIOUS WIND ENERGY BROADCAST AND I WILL BE YOUR -- AND WE ARE TALKING ABOUT RESEARCH TODAY.

BUT BEFORE WE GET INTO THAT, I'D LIKE TO REMIND YOU WHERE WE WERE BEFORE.

WE'VE SPENT A LOT OF TIME TALKING ABOUT THE WIND ENERGY GUIDELINES, THE SERVICES LAND-BASED WIND ENERGY GUIDELINES AND THE TIERED APPROACH AND HOW TO TALK ABOUT PRECONCEPTION SURVEYS, POST- CONSTRUCTION SURVEYS, MITIGATION, LONG CONSIDERATIONS.

-- LAW ENFORCEMENT CONSIDERATIONS.

WE'VE COVERED ALL OF THAT IN THE PREVIOUS BROADCAST AND NOW WE ARE WINDING UP WITH THE TRAINING SERIES WITH THE DISCUSSION OF THE LATEST RESEARCH ASSOCIATED WITH WIND ENERGY.

AND TODAY WE HAVE THREE RESEARCHERS WHO ARE IN THE FOREFRONT OF RESEARCH ON BATS AND SONGBIRDS AND PRAIRIE CHICKENS AND SAGE GROUSE.

SO WHAT I WOULD LIKE TO DO IS INTRODUCE YOU TO OUR FIRST PRESENTER WHO IS DR. CRIS HEIN AND CRIS IS WITH BAT CONSERVATION INTERNATIONAL AND HE IS THE BAT AND WIND PROGRAM COORDINATOR AND HE IS ALSO THE PROGRAM COORDINATOR FOR THE BAT AND WIND ENERGY COOPERATIVE. HE HAS RECEIVED HIS MASTERS FROM TEXAS STATE UNIVERSITY AND HIS PH.D IN FORESTRY AND NATURAL RESOURCES FROM THE UNIVERSITY OF GEORGIA.

AND HE HAS BEEN STUDYING BAT BEHAVIOR AND ECOLOGY FOR 14 YEARS AND BAT WIND ENERGY YEARS -- ISSUES FOR FOUR YEARS. WE HAVE WORKED TOGETHER QUITE A BIT ON ISSUES ASSOCIATED WITH BATS AND WIND.

SO WHAT I WOULD LIKE TO DO IS TURN IT OVER TO CRIS.

WELCOME AND I'M GLAD YOU COULD JOIN US.

>>Cris Hein: IT'S A GREAT PLEASURE TO BE BACK ON THE BROADCAST. TODAY I WANT TO TALK ABOUT RESEARCH WE'VE BEEN DOING OVER THE PAST SEVERAL YEARS ON WAYS TO REDUCE BAT FATALITIES AT WIND ENERGY FACILITIES.

THIS FIGURE HERE SHOWS WIND DEVELOPMENT FROM 2001-2013.

WE CAN SEE ON THE LIGHT BLUE BARS THE CUMULATIVE INSTALLED CAPACITY.

AND THE RED LINE REPRESENTS WHEN WE FIRST BECAME CONCERNED ABOUT BATS AND WIND ENERGY DEVELOPMENT AND WE'VE BEEN SAYING THIS FOR THE PAST DECADE AND AS YOU CAN SEE, WE WENT

FROM JUST OVER 6,000 MEGAWATTS OF INSTALLED CAPACITY WHEN WE FIRST LEARNED OF THE ISSUE OF BATS AND WIND ENERGY AND NOW WE HAVE OVER 61,000 MEGAWATTS OF INSTALLED CAPACITY. THERE HAVE BEEN SEVERAL CUMULATIVE ESTIMATES OF BAT FATALITIES AT WIND ENERGY FACILITIES IN THESE NUMBERS REPRESENT THE MOST CONSERVATIVE OF -- ESTIMATES. THEY WERE DEVELOPED AND WHAT WE SEE IS FROM 2000-2011 BETWEEN 840,000-1.7 MILLION BATS WERE ESTIMATED TO HAVE BEEN KILLED AND IN 2012 ALONE, CLOSE TO 200,000-400,000 BATS WERE ESTIMATED TO BE KILLED.

THE VAST MAJORITY OF THE FATALITIES COME FROM MIGRATORY TREE RESTING BATS, 78 PERCENT FROM HOARY BATS, EASTERN RED BATS AND SILVER HAired BATS AND YOU CAN SEE THE PERCENTAGES THERE.

BUT WE SEE FATALITY FROM ROUGHLY OVER HALF THE SPECIES IN THE UNITED STATES AND CANADA.

THESE FATALITIES ARE ALSO COMPOUNDED BY BATS THAT ARE AFFECTED BY A WHITE NOSE SYNDROME, WHICH IS A FUNGUS AFFECTING THE EASTERN HIBERNATING BATS.

WE JUST LEARNED THAT TWO ADDITIONAL STATES ARE CONFIRMED WITH WHITE NOSE THAN HALF THE STATES IN THE COUNTRY OF WHITE NOSE SYNDROME AND THE POPULATION DECLINES FROM BATS HAVE EXCEEDED 5-6 MILLION INDIVIDUALS.

WITH RESPECT TO WIND ENERGY SOME SPECIES ON AVERAGE REPRESENT ONLY A SMALL PROPORTION OF FATALITIES SUCH AS LITTLE BROWN AND BATS AND TRICOLORED BATS ROUGHLY 6 PERCENT BUT AT SPECIFIC FACILITIES THEIR FATALITIES CAN BE AS HIGH AS 60 PERCENT FOR LITTLE BROWN BAT AND 25 PERCENT FOR TRICOLORED BATS.

UNFORTUNATELY WE HAVE VERY LITTLE DATA ON BAT POPULATIONS AND THIS MAKES RESOLVING THIS ISSUE DIFFICULT.

IT'S HARD TO PUT THESE FATALITIES INTO CONTEXT AND WHAT LEVEL OF MINIMIZATION WE NEED IN ORDER TO KEEP THESE BATS AND THESE POPULATIONS SUSTAINABLE.

WE DO KNOW THAT BATS ARE LONG-LIVED AND HAVE LOW REPRODUCTIVE RATES.

THE POPULATIONS ARE NOT ABLE TO RECOVER QUICKLY FROM LARGE SCALE DECLINES.

IF YOU TALK TO ANY BAT BIOLOGIST OR ANYONE ASSOCIATED WITH THIS ISSUE, THEY WILL TELL YOU THAT DESPITE HAVING THE POPULATION DATA, A RESPONSE IS NEEDED IN ORDER TO PROTECT OUR BATS AND STILL HAVE WIND ENERGY.

SO ONE OF THE STRATEGIES THAT WE BEGAN WORKING ON BACK IN 2008 IS CHANGING THE OPERATIONS OF WIND TURBINES, WHEN BATS ARE AT HIGHEST RISK.

WE LEARNED EARLY ON THAT BAT FATALITIES OCCUR OVER SEVERAL MONTHS IN THE FALL FROM ROUGHLY MID JULY THROUGH MID-OCTOBER UNDER LOW WIND CONDITIONS.

SO IF WE CHANGE THE TURBINE OPERATIONS WE CAN REDUCE BAT FATALITIES AND A NUMBER OF STUDIES HAVE LOOKED AT THIS AND THERE ARE SEVERAL ONGOING.

INVESTIGATING RAISING THE TURBINE SPEED AND SETTING THE LIGHTS BELOW THAT TO REDUCE BAT FATALITIES.

WE SEE A SIGNIFICANT PATTERN OF SIGNIFICANT REDUCTIONS IN BAT FATALITIES FOR RELATIVELY LITTLE LOSS IN OPERATING TIME, BUT THE CHANGES IN OPERATIONS WILL VARY ACCORDING TO LATITUDE, TURBINES, WIND REGIME, ETC.

BUT IF WE LOOK AT A SUMMARY OF THE STUDIES THAT HAVE BEEN CONDUCTED, WE SEE A CONSISTENT PATTERN IN MEAN A REDUCTION IN BAT FATALITIES.

GREATER THAN 50 PERCENT IN MOST CASES AS YOU LOOK AT THESE DIFFERENT SPEEDS AND WHAT WE SEE IS AS WE GET HIGHER, HIGHER AND HIGHER CUT IN SPEEDS, OUR RETURN ON THE INVESTMENT PRETTY MUCH LEVELS OFF AS YOU GET ABOUT FIVE, 5 1/2, 6 METERS PER SECOND.

ONE THING THAT WE ARE INTERESTED IN SEEING IS THE INDUSTRY IMPLEMENT FEATHERING THEIR BLADES BELOW THE MANUFACTURERS CUT IN SPEEDS BECAUSE THIS IS A PERIOD OF TIME WHEN THE TURBINES ARE NOT GENERATING ANY ELECTRICITY.

IN BASED ON THE INFORMATION WE HAVE NOW, I FEATHERING THE BLADES BELOW 3 1/2 METERS OR 4 METERS PER SECOND, WHATEVER THE MANUFACTURER RECOMMENDATION IS IT WOULD REDUCE BAT FATALITIES BY 30 PERCENT OR HIGHER.

THE OTHER THING WE ARE INTERESTED IN DOING IS INCORPORATING ADDITIONAL WEATHER VARIABLES INTO THIS STRATEGY.

WE KNOW THAT BATS REACT TO WEATHER VARIABLES OTHER THAN WIND SPEED SO IF WE CAN INCORPORATE TEMPERATURE, HUMIDITY, PARTICIPATION, -- PRECIPITATION, WE MIGHT FIND -- REFINED THE STRATEGY.

SO ULTIMATELY WHAT WE WOULD LIKE TO SEE IF BAT FRIENDLY TURBINES AND SOFTWARE SYSTEMS THAT SELF REGULATE BASED ON SEVERAL VARIABLES.

AS MENTIONED BEFORE, WE KNOW THE TIME DATE, WE KNOW WE ONLY HAVE TO CHANGE THESE OPERATIONS AT NIGHT WHEN BATS ARE ACTIVE.

WE KNOW BATS ARE ACTIVE AT LOWER WIND SPEEDS, HIGHER TEMPERATURES AND SO FORTH SO WE MIGHT BE ABLE TO OPTIMIZE THE STRATEGY.

AND THERE ARE LIMITATIONS TO THIS STRATEGY FROM THE INDUSTRY PERSPECTIVE.

THERE IS AN ECONOMIC LOSS ASSOCIATED WITH CHANGING TURBINE OPERATIONS.

WE ALSO DON'T KNOW WHAT THE LONG-TERM IMPACT OF ALTERING THE OPERATIONS OF TURBINES AND THE WEAR AND TEAR THAT THESE TURBINES MIGHT EXPERIENCE OVER THE LIFE OF THE PROJECT.

FROM THE CONSERVATION SIDE, OPERATION AND MINIMIZATION IS NOT GOING TO BE APPLICABLE IN THE AREAS WHERE THERE ARE LOW WIND CONDITIONS AND AS THE TURBINE TECHNOLOGY ADVANCES AND TURBINES ARE ABLE TO GENERATE ELECTRICITY AT LOW OR LOWER WIND SPEEDS, WE ARE NOT GOING TO BE ABLE TO APPLY THIS STRATEGY IN THOSE AREAS.

WE ALSO DON'T KNOW IF THE STRATEGY IS EFFECTIVE FOR ALL SPECIES.

THERE IS SOME EVIDENCE THAT FOR CERTAIN SPECIES IN THE SOUTHWEST THAT BREEZING CUT IN SPEEDS DOES NOT PRODUCE ANY SIGNIFICANT REDUCTION IN THOSE FATALITIES FOR THAT SPECIES.

SO WHAT WE NEED IS AN ALTERNATIVE STRATEGY THAT'S MUTUALLY BENEFICIAL TO THE INDUSTRY, CONSERVATION AND HAVE ANOTHER TOOL IN OUR TOOLBOX.

THE STRATEGY THAT HAS BEEN TESTED AND WE ARE CONTINUING TO WORK ON IT IS THE USE OF ULTRASONIC ACOUSTIC DETERRENCE.

HERE THE IDEA IS TO CREATE AND I'M COMFORTABLE AIRSPACE LIMITING THE BATS ABILITY TO ORIENT OR FORAGE.

SO IT'S NOT AN ALLOWING LOUD NOISE FOR THE BATS, IT ACTUALLY INTERFERES WITH THEIR ECHOLOCATION.

AND THIS IS A MORE COST-EFFECTIVE APPROACH, THERE WILL BE COSTS TO PURCHASE THE DETERRENENTS AND INSTALL THEM AND HOPEFULLY LIMITED MAINTENANCE COSTS ASSOCIATED WITH IT.

HOWEVER, IT IS STILL AN UNPROVEN TECHNOLOGY.

THERE'S ONLY ONE PUBLISHED STUDY AND WE ARE NEVER GOING TO BE ABLE TO EXTEND THE BROAD DETERRENT OUT TO THE TIPS OF THE BLADES DUE TO THE ATTENUATION OF HIGH-FREQUENCY SOUND.

SO JUST TO GIVE YOU A LITTLE HISTORY ON ACOUSTIC DETERRENCE, WHAT THE BAT AND WIND ENERGY COOPERATION HAS DONE IS WE BEGAN TESTING THESE DEVICES IN 2006 WITH PRELIMINARY LAB AND FIELD TRIALS.

WE CONDUCTED THE FIRST-EVER STUDY AT A WIND FACILITY IN 2009-2010.

AND THAT STUDY WAS PUBLISHED IN 2012.

BETWEEN 2010 AND 2013 LITTLE WAS DONE IN ADVANCING THE TECHNOLOGY.

BUT TO -- IN THE SPRING OF 2013 THE COOPERATIVE HELD A WEBINAR AND LATER IN THE YEAR A WORKSHOP TO DISCUSS OUR CURRENT STATE OF KNOWLEDGE AND DEVELOP NEXT STEPS FOR TESTING AND RESEARCH AND DEVELOPMENT.

AND FROM THERE, WE HAVE TESTED A SLIGHTLY MODIFIED DEVICE TO ENSURE THAT WE ARE STILL PROGRESSING ON ITS ABILITY TO DETER BATS AND WE'VE CONTINUED THIS YEAR WITH ADVANCING AND OPTIMIZING THE DEVICE, TESTING NEW STRATEGIES FOR FREQUENCY TRANSMISSION, WEATHERPROOFING THE DEVICE AND SO ON. WHEN WE FIRST STARTED USING THE DEVICE AND THE DEVICE HAS EVOLVED OVER THE YEARS.

IT'S NOT THE SAME DEVICE THAT IT ONCE WAS.

THE FIRST THING WE DID WAS BEFORE TRYING TO INSTALL THESE ON TURBINES OR EVEN OPERATE THESE OUTSIDE IN A NATURAL ENVIRONMENT, WE TESTED THEM IN THE LAB AND WE FOUND THAT WITH THE DETERRENT DEVICE ON, BATS WERE NOT ABLE TO CAPTURE THEIR INSECT PREY.

IN PRELIMINARY FIELD TESTS, WE TOOK THESE ABOUT 2 POUNDS WHERE BATS ARE ACTIVE, AND WE FOUND THERE WAS A 90 PERCENT REDUCTION IN BAT ACTIVITY WHERE THE SITES WERE BATS NORMALLY DRINK AND FORAGE.

WE OBSERVED THAT A SUSTAINED EFFECT OVER THE PONDS DURING THE SHORT TERM ANYWAY OVER SEVERAL NIGHTS SUCH THAT THERE'S NO INDICATION THAT THESE BATS ARE HABITUATED TO THE TRANSMISSION.

THE NEXT STUDY LOOKED AT USING THERMAL IMAGING OF BATS AS THEY ARE INTERACTING WITH TURBINES WITH DETERMINES MOUNTED ON THE TOWER.

THE RESULTS FROM THIS WERE RATHER MIXED.

ONE EXPERIMENT SHOWED A SIGNIFICANT REDUCTION IN BAT ACTIVITY AND THE OTHER DID NOT.

BUT IT WAS ENOUGH TO GO ON ALL THESE ELEMENTARY TRIALS TO TEST IT IN OPERATIONAL FACILITY.

AND IN 2009, WE INSTALLED A SERIES OF DETERRENCE ON OPERATIONAL WIND TURBINES.

YOU WILL SEE HERE ON THE BOTTOM RIGHT A DETERRENT DEVICE THAT HAS A FOUR BY FOUR SPEAKER ARRAY AND THESE ARE ENVIRONMENTAL GRADE TRANSDUCERS AT 1 METER THEY ARE PRODUCING 122 DECIBELS OF SOUND, THAT'S EQUIVALENT TO A JET ENGINE OR A ROCK CONCERT SO A POWERFUL NOISE.

THEY PRODUCE A FREQUENCY RANGE BETWEEN 20-100 KILOHERTZ AND THIS IS THE ENTIRE FREQUENCY RANGE FOR BATS WE HAVE IN NORTH AMERICA.

WE INSTALLED EIGHT DEVICES PER TURBINE.

WE PICKED 25 TURBINES FOR OUR STUDY AND WE RANDOMLY SELECTED 15 FOR OUR CONTROL AND TEN FOR OUR DETERRENT OR OUR TREATMENT TURBANS AND WE CONDUCTED DAILY SEARCHES. IN BETWEEN THE TWO YEARS, IT WAS DECIDED THAT WE SHOULD TEST WHETHER THERE'S AN INHERENT VARIATION AMONG OUR RANDOMLY

SELECTED TURBINES SO WE DID THIS, WE DID A PRETREATMENT TEST BETWEEN MAY AND JULY AND THEN DID OUR EXPERIMENT IN 2010 IN JULY THROUGH OCTOBER.

AND DURING THAT PERIOD WE DID FIND A 9 PERCENT INHERENT VARIATION BETWEEN OUR CONTROL AND TREATMENT TURBINES. ALTHOUGH THIS WAS INSIGNIFICANT WE DECIDED TO APPLY THOSE RESULTS TO OUR 2010 DATA.

AND THIS IS JUST A QUICK SCHEMATIC SHOWING YOU THE PLACEMENT AND ORIENTATION OF OUR DETERRENT DEVICES.

WE HAD THREE ON EITHER SIDE OF THE CELL POINTING TOWARD THE BLADE, STRAIGHT DOWN, AND AWAY FROM ON THE LEEWARD SIDE OF THE CELL AND TO AN TOP POINTING TOWARD THE BLADE AND FOR THE BACK OF THE CELL.

OUR 2009 RESULTS SHOWED A 21-51 PERCENT REDUCTION IN FATALITIES AT THE TURBINE.

IN 2010 WE FOUND VERY SIMILAR RESULTS, 18-62 PERCENT FEWER FATALITIES AT OUR DETERRENT TO QUICK TURBINES.

WHEN WE APPLY THAT 9 PERCENT INHERENT VARIATION, IT WIDENED OUR INTERVAL AND PRODUCED RESULTS THAT SHOWED ANYWHERE BETWEEN 2 PERCENT-64 PERCENT FEWER FATALITIES OCCURRED AT A TREATMENT TURBINES.

WE DID SEE SPECIES SPECIFIC EFFECTS.

IN 2009, WE FOUND A SIGNIFICANT REDUCTION IN HOARY BAT FATALITIES AND IN 2010 A SIGNIFICANT REDUCTION IN OR A BAT AND SILVER HAIR BAT REDUCTIONS.

THIS MIGHT BE DUE TO THE FACT THAT BOTH HOARY BATS AND SOBER HAired BATS ARE LOW FREQUENCY AND THE LOW-FREQUENCY SOUND TRAVELS FARTHER SO THEY MAY PICK UP THE DETERRENT BETTER THAN OUR OTHER SPECIES.

SO FROM THE STUDY AND THE WORKSHOP AND WEBINARS THAT WERE HELD AND A NUMBER OF CONVERSATIONS WE FOUND WAYS TO OPTIMIZE THE DEVICE AND COMPANION STUDIES SHOWING THAT ACTIVITIES AND THERMAL CAMERAS HAS GIVEN US INSIGHT INTO WHERE WE WANT TO PLACE THE DEVICE TO DETER BATS COMING TOWARD THE TURBINES THEMSELVES.

WE HAVE INVESTIGATED DIFFERENT TRANSDUCER TECHNOLOGIES OVER THE YEARS, WE'VE IMPROVED THE WEATHERPROOFING OF THE DEVICES AND SOME OF THE MORE INTERESTING THINGS THAT WE'VE DONE IS WE HAVE INCORPORATED DIFFERENT FREQUENCY PATTERNS AND FREQUENCY RANGES THAT YOU CAN PROGRAM INTO THE DEVICE. SO WE CAN CREATE A BROADBAND NOISE OF 20-100 KILOHERTZ AND YOU CAN SET IT FOR ANY INDIVIDUAL FREQUENCY.

YOU CAN HAVE FREQUENCY SWEEPS, YOU CANNOT INTERPOSE FREQUENCIES AND ALL OF THESE THINGS WE'VE ADDED TO THE TRANSMISSION MAY HAVE A MORE CONFUSING EFFECT ON THE BATS

AND MAY HELP IN DETERRING THEM FROM THE WIND TURBINES. SO IF WE LOOK AT THESE TWO STRATEGIES IN COMPARISON, I WILL KIND OF SUMMARIZE OPERATIONAL MINIMIZATION FIRST. WITH A NUMBER OF STUDIES THAT SHOW CONSISTENT PATTERNS IN REDUCTION, ANYWHERE BETWEEN 44-93 PERCENT REDUCTION IN FATALITIES BY RAISING THE CUT IN SPEED ABOUT THE MANUFACTURERS CUT IN SPEED. WE STILL HAVE QUESTIONS ON THE IMPACT TO THE TURBINES, PARTICULARLY LONG-TERM. THERE'S GOING TO BE A DIFFERENCE IN TRYING TO IMPLEMENT THIS STRATEGY FOR NEW FACILITIES THAT CAN PLAN FOR THESE COSTS AND THOSE FACILITIES THAT ARE EXISTING THAT ARE ALREADY LOCKED INTO POWER PURCHASING AGREEMENTS. IT'S STILL UNSURE WHAT THE SPECIES SPECIFIC EFFECTS OF THE STRATEGY ARE, AT WHAT HIGHER CUT IN SPEEDS CAN WE RULE OUT FATALITIES, DOES THIS WORK FOR SPECIES SUCH AS BRAZILIAN FREE TAIL BATS THAT ARE CAPABLE OF FLYING AT HIGHER AND HIGHER WIND SPEEDS. BUT WHERE WE CAN, IT IS RECOMMENDED TO BEGIN IMPLEMENTING THE STRATEGY AND BEGIN THE CONSERVATION THAT'S NEEDED FOR THESE BATS PARTICULARLY FEATHERING BLADES UP TO THE MANUFACTURERS CUT IN SPEED. WHILE DOING SO, WE CAN LOOK AT OTHER WEATHER VARIABLES TO OPTIMIZE THEM OR FIND THIS STRATEGY. WHEN WE COMPARE THIS WITH WHAT WE KNOW ABOUT ACOUSTIC DETERRENCE, THERE IS ONLY ONE PUBLISHED STUDY THAT SHOWS RESULTS ON THIS STRATEGY. THE RESULTS ARE SOMEWHAT INCONCLUSIVE, ANYWHERE BETWEEN 2 PERCENT MORE BATS-64 PERCENT FEWER BATS, BUT HOWEVER, REMEMBER, THIS IS A CONSERVATIVE RESULT. WE ADDED THAT INSIGNIFICANT INHERENT VARIATION FACTOR AND WE DON'T KNOW WHAT THE MAINTENANCE COSTS WILL BE FOR THESE DEVICES LONG-TERM AND HOPEFULLY THEY WILL BE MINIMIZED AND HOPEFULLY THIS IS A LOWER COST STRATEGY. MOST OF THE COST WILL BE UP FRONT AND CAN BE PLANNED FOR. AGAIN FOR SPECIES SPECIFIC EFFECTS, WE KNOW VERY LITTLE. WE STILL DON'T KNOW HOW THIS WILL IMPACT MYOTIS SPECIES OR OTHER SPECIES WERE IT'S NOT BEEN TESTED AND WHERE WE ARE TODAY WE CERTAINLY NEED MORE RESEARCH AND DEVELOPMENT AND TESTING SOME OF THESE TRANSITION PATTERNS AND FREQUENCY SWEEPS AND TESTING THE OPTIMAL PLACEMENT AND ORIENTATION OF THESE DEVICES TO MAXIMIZE FATALITY REDUCTIONS. WITH THAT I WANT TO THANK EVERYONE WHO'S BEEN INVOLVED IN THESE RESEARCH PROJECTS, ALL OF OUR COOPERATORS WITHIN THE BATS AND WIND ENERGY COOPERATIVE AND WITH THAT, I WILL TURN IT

OVER TO CHRISTY.

>>Christy Johnson-Hughes: ALL RIGHT.

THANK YOU M. CRIS.

I APPRECIATE THIS PRESENTATION AND I THINK IT'S VERY IMPORTANT WE TALK ABOUT SOME NEW THINGS COMING UP, ACOUSTIC DETERRENCE ARE STILL IN DEVELOPMENT AND THERE IS STILL A LOT WE ARE LEARNING ABOUT BATS AND HOW THEY MAY OR MAY NOT REACT TO THESE DEVICES AND WHAT I THINK IT'S SO IMPORTANT IS WE ARE STILL LOOKING.

WE HAVE NOT STOPPED AT CURTAILMENT OR CUT IN SPEED MITIGATION.

BUT WE ARE LOOKING FOR A VARIETY OF OTHER MITIGATION ELEMENTS TO HELP REDUCE THE IMPACTS TO BATS.

AND I HAVE HEARD THAT LIKE GE HAS ALSO PROPOSED AN TURBINE TYPE OF DEVICE WITH I DON'T HAVE ANY INFORMATION ON AND THEY ARE LOOKING AT A VARIETY OF DEVICES, USGS IS EXPLORING SOME TYPE OF ULTRAVIOLET TYPE OF DEVICE AND THIS IS SOMETHING THAT IS UP-AND-COMING AND WE WILL BE WATCHING THIS VERY CLOSELY, CERTAINLY I KNOW THE FISH AND WILDLIFE SERVICE IS ALWAYS LOOKING FOR NEW MEASURES TO REDUCE THOSE IMPACTS TO BATS. AND AS YOU KNOW, RIGHT NOW, OUR NUMBER ONE GO TO IS THE CUT IN SPEED AND JUST BECAUSE WE HAVE DEMONSTRATED THAT OUT IN THE FIELD AND IT'S USEFUL IN A LARGE NUMBER OF CIRCUMSTANCES BUT LIKE I SAID, IF THERE IS WIND DEVELOPMENT IN THE SOUTHEAST, THOSE ARE LOWER WIND SPEEDS, LARGER MACHINES AND THIS MAY NOT BE A USEFUL MITIGATION OPTION IN THOSE CIRCUMSTANCES. SO I THINK THIS IS HELPFUL TO HAVE THIS DISCUSSION SO THANK YOU MUCH.

AND I DO HAVE ONE QUESTION I KNOW THE AUDIENCE WILL ASK, WHEN THIS SOUND IS PROJECTED, CAN HUMANS HEAR THE SOUND WITHIN OUR RANGE OF HEARING?

>>Cris Hein: IT CAN BE PROGRAMMED TO BE ABOVE ARE SOUNDS. HUMANS CAN HEAR UP TO ABOUT 20 KILOHERTZ.

AS YOU GET OLDER YOU LOSE THE HIGHER FREQUENCIES AND WHEN WE HAD THE ORIGINAL DEVICE UPON THE TURBINE YOU COULD HEAR FROM THE BASE OF THE TURBINE BUT BEYOND THAT YOU COULD NOT HEAR IT SO IT'S LIKELY NOT GOING TO ADD TO ANY SORT OF NOISE CONCERNS THAT ANYONE MIGHT HAVE.

>>Christy Johnson-Hughes: OKAY I KNOW THERE HAVE BEEN QUESTIONS NOT ONLY ABOUT HUMAN BUT OTHER WILDLIFE'S. AND THE SOUNDS GENERATED BY THE TURBINES THEMSELVES SO THAT IS GOOD TO KNOW THAT THAT WOULD NOT EXTEND BEYOND THE TURBINE AND THE MANUFACTURERS ARE CONSIDERING.

>>Cris Hein: LIKE I MENTIONED, THE TURBINE BLADES ARE SO LONG IN THESE TOWERS ARE SO HIGH NOW, 80-100 METERS, THAT WE CANNOT

EXTEND THE RANGE OF THESE HIGH FREQUENCIES OUT TO THE TIPS OR THE BASE SELLS.

SO THEY SHOULD NOT BE CONCERNED.

WE DON'T KNOW WHAT THE EFFECTS MIGHT BE ON OTHER WILDLIFE BUT ANYTHING UNDERGROUND SHOULD NOT BE IMPACTED BY IT.

>>Christy Johnson-Hughes: THANK YOU VERY MUCH, CRIS.

I APPRECIATE THAT.

WE HAVE ANOTHER RESEARCHER WHO WILL BE JOINING US TO TALK ABOUT BIRDS AND SOME OF THE RESEARCH ASSOCIATED WITH THE IMPACTS OF WIND ENERGY ON BIRDS.

I WOULD LIKE TO MOVE TO OUR NEXT PRESENTER.

I AM HERE WITH OUR SECOND GUEST, MR. WALLY ERICKSON FROM WEST.

AND WALLY HAS BEEN WORKING ON RESEARCH ASSOCIATED WITH SONGBIRDS AND WIND ENERGY FACILITIES.

WALLY IS A SENIOR STATISTICIAN AND CHIEF OPERATING OFFICER WITH WEST INC. WHICH IS LOCATED IN WYOMING.

HE HAS HIS MASTERS IN STATISTICS FROM THE UNIVERSITY OF WYOMING AND A BACHELOR'S IN MATH AND STATISTICS FROM WINONA STATE UNIVERSITY.

HE HAS BEEN WITH WEST SINCE 1991 AND HAS BEEN INVOLVED IN A WIND AND WILDLIFE MONITORING AND RESEARCH SINCE THE MID- '90s. HE'S WRITTEN SEVERAL PUBLICATIONS ON THE IMPACTS OF WIND AND WILDLIFE MANY OF WHICH MANY OF US HAVE USED IN THE PAST TO BETTER UNDERSTAND IMPACTS OF WIND ENERGY ON SONGBIRDS AND OTHER ANIMALS.

SO WELCOME TO THE WIND ENERGY BROADCAST.

>>Wally Erickson: I APPRECIATE THE INVITATION.

TODAY I WILL TALK ABOUT OUR CURRENT RESEARCH ON WIND IMPACT TO BIRDS AND SPECIFICALLY I'M GOING TO TALK ABOUT A COMPREHENSIVE META- ANALYSIS WE CONDUCTED TO LOOK AT THE IMPACTS OF WIND SPECIFICALLY ON SONGBIRDS AND WE WANT TO THANK THE AMERICAN WIND WILDLIFE INSTITUTION FOR FUNDING THIS WORK AND I ALSO WANT TO ACKNOWLEDGE MY CO-AUTHORS, DR. JOELLE GÖRING WITH THE FCC, MELISSA WOLF AND KIM DAE WITH WEST AND SEVERAL OTHERS THAT HAVE HELPED PUT THIS TOGETHER. MANY OF YOU GUYS ARE FAMILIAR WITH WHAT A PASSERINE IS BUT FOR THOSE THAT AREN'T WE ARE REFERRING TO PASSERINES WERE PERCHING BIRDS OFTEN REFERRED TO AS SONGBIRDS.

WE FOCUS ON THESE SO WE ARE EXCLUDING LARGER SUCH AS CROWS AND RAVENS AND MAGPIES.

WE EXCLUDED THOSE TO FOCUS ON THE SMALLER BIRDS AND SOME OF OUR METHODS WILL GO THROUGH SCAVENGING BIASES AND THOSE LARGER BIRDS HAVE DIFFERENT BIASES FROM STUDIES.

THIS GROUP IS ONE OF THE MORE ABUNDANT BIRD GROUPS IN THE

UNITED STATES AND CANADA AND ALSO ONE OF THE MOST COMMON FATALITIES FROM COLLISIONS WITH SOURCES INCLUDING BUILDINGS, COMMUNICATION TOWERS VEHICLES AND OTHER SOURCES AND THEY ARE PROBABLY ONE OF THE MORE COMMON FATALITIES DUE TO NOT ONLY BE ONE OF THE MORE ABUNDANT BIRDS BUT ALSO DUE TO THEIR MIGRATORY BEHAVIOR.

AND MOST OF THE SPECIES THAT WE WILL BE TALKING ABOUT TO RECEIVE PROTECTION UNDER THE MIGRATORY BIRD TREATY ACT. I'M FOCUSED ON TALKING ABOUT POTENTIAL WIND TURBINE AFFECTS ON THEIR POPULATION AND NOT TALKING ABOUT IMPACTS TO INDIVIDUAL BIRDS.

AGAIN, JUST PROBABLY A REMINDER, FOR MANY OF YOU BUT SMALL PASSERINES ARE SHORT-LIVED, TYPICAL AVERAGE LIFESPAN OF 1-3 YEARS.

THERE ARE SOME EXCEPTIONS TO THAT BUT ON AVERAGE 1-3 YEARS. THEY HAVE HIGH REPRODUCTION.

OFTEN 2-5 EGGS AND SOMETIMES MULTIPLE CLUTCHES IN A YEAR. AND THEY ARE SUBJECTED TO PRETTY HIGH ANNUAL MORTALITY RATES.

TYPICALLY IN THE RANGE OF 30-60 PERCENT ANNUALLY.

AGAIN THERE ARE EXCEPTIONS TO THIS BUT THERE IS NOT NECESSARILY A LOT OF GOOD INFORMATION ON SONGBIRD SURVIVAL RATES.

I MENTIONED THEY ARE SUBJECT TO NUMEROUS SOURCES OF MORTALITY, BOTH ANTHROPOGENIC AND OTHER SOURCES OF MORTALITY.

SOME OF THE BIGGEST THREAT DUE TO ANTHROPOGENIC SOURCES ARE HABITAT LOSS AND CLIMATE CHANGE AND COLLISION WITH MAN-MADE STRUCTURES, BUILDINGS, WINDOWS, VEHICLES, WIND TURBINES, OTHER TALL STRUCTURES.

CATS IS PROBABLY THE LARGEST SOURCE OF SONGBIRD MORTALITY IN NORTH AMERICA.

AND CONTAMINANTS AND OTHER SOURCES, FOR EXAMPLE, LAST OCTOBER THERE WAS A LARGE INCIDENT OF SONGBIRD MORTALITY AND GAS PLAYERS IN CANADA FROM ENERGY DEVELOPMENT.

OTHER NATURAL SOURCES OF MORTALITY INCLUDE NATURAL PREDATORS, NATURAL DISASTERS SUCH AS TORNADOES AND HURRICANES, STORMS, DISEASE CAN BE A LARGE SOURCE AND SOME BIRDS DIE OF OLD AGE.

THE GOAL OF THIS RESEARCH HERE WAS TO TAKE INFORMATION FROM A LOT OF WIND TURBINE FATALITY STUDIES CONDUCTED OVER THE PAST 20 YEARS AND USE THAT TO COME UP WITH ESTIMATES OF SONGBIRD MORTALITY AS A WHOLE AND THEN LOOKING AT SONG BIRD MORTALITY FOR INDIVIDUAL SPECIES.

THESE STEPS WE FOLLOWED WAS TO DEVELOP SOME CRITERIA FOR

WHAT STUDIES SHOULD BE INCLUDED BASED ON THE RIGORS THIS OF THE STUDIES AND WE ALSO NEEDED TO LOOK AT THOSE ESTIMATES AND THE ESTIMATORS USED AND SOME OF THE OLDER ESTIMATORS ARE BIASED FOR VARIOUS REASONS SO WE DEVELOPED METHODOLOGY TO CORRECT THOSE ESTIMATORS OR ESTIMATES FOR ESTIMATOR BIAS.

WE CAME UP WITH REGIONAL OR STRATIFIED ESTIMATES OF SONGBIRD MORTALITY AND WE APPLIED SPECIES COMPOSITION DATA TO THOSE ESTIMATES TO COME UP WITH INDIVIDUAL SPECIES ESTIMATES.

AFTER THAT, WE CAME UP -- AFTER WE CAME UP WITH THE ESTIMATES WE THEN APPLIED THOSE ESTIMATES AND COMPARED THEM TO POPULATION ESTIMATES FOR SONGBIRDS ACROSS NORTH AMERICA FROM BBS OR BREEDING BIRD SURVEY DATA.

I'M GOING TO GO INTO MORE DETAIL INTO EACH OF THESE STEPS TO SHOW WHAT METHODS WE USE.

WE HAD A LARGE NUMBER OF REPORTS WE WENT THROUGH AND THE REPORTS NEEDED TO INCLUDE SEARCH OR EFFICIENCY REMOVAL AND STANDARDIZED TO A METRIC EITHER PER TURBINE PER YEAR OR PER METRIC MEGAWATT PER YEAR AND WE TOOK ALL THE DATA AND CONVERTED IT OR STANDARDIZED IT TO NUMBER OF FATALITIES FOR NAME PLATE MEGAWATT PER YEAR.

SOME STUDIES THAT WERE NOT SELECTED INCLUDED STUDIES THAT LACKED ANY SORT OF STANDARDIZATION.

THEY DID NOT COME UP WITH AN ESTIMATE FOR THE TIME PERIOD OF STUDY, THEY WERE ONLY CONDUCTED ONE OR TWO SEASONS OR THEY HAD OTHER POOR METHODS OF STUDY, FOR EXAMPLE, VERY LARGE SEARCH INTERVALS COMPARED TO THEIR CARCASS PERSISTENCE RATES.

AND RESULTING IN VERY POOR ESTIMATES.

AFTER GOING THROUGH THE SCREENING, AND THE MINIMUM CRITERIA WERE EVALUATED FOR EACH OF THE STUDIES, WE ENDED UP WITH 116 STUDIES AT OVER 70 WIND ENERGY FACILITIES OUT ACROSS NORTH AMERICA.

WE DID STRATIFY THE ANALYSIS BY SIX DIFFERENT STRATA.

WE USED THESE BIOMES, THE PACIFIC BIOME, SOUTHWEST, THE INTERMOUNTAIN WEST, THE PRAIRIES, THE EASTERN, AND THE NORTHERN FOREST BIOMES.

35 OUT OF THE 116 STUDIES ONLY HAD ALL BIRD FATALITY ESTIMATES. AGAIN WE WERE FOCUSED ON ESTIMATING SONGBIRD MORTALITY ESTIMATES.

SO WE HAD TO COME UP WITH A SONGBIRD ESTIMATE.

INITIALLY WE LOOKED AT SPECIES COMPOSITION OF SONGBIRDS COMPARED TO THE OVERALL NUMBER OF BIRDS FOUND BUT BY JUST MAKING THAT CORRECTION WE WOULD HAVE UNDERESTIMATED THE SONGBIRD MORTALITY BECAUSE SMALL BIRDS SUCH AS SONGBIRDS

TEND TO BE DETECTED LESS FREQUENTLY, HAVE A LOWER PROBABILITY OF DETECTION IN THE FIELD COMPARED WITH LARGER BIRDS AND SCAVENGERS TEND TO REMOVE THEM QUICKER THAN LARGER BIRDS.

SO WE HAD TO ULTIMATELY ADJUST THE SPECIES COMPOSITION DATA FOR THE DIFFERENCE IN DETECTION RATES FOR LARGE COMPARED TO SMALL BIRDS.

AND THEN WE ALSO HAD A CORRECTION FOR ESTIMATOR BIAS AND THIS IS ONE OF THE ADVANCES IN THIS RESEARCH.

WE LOOKED AT STUDIES OVER THE PAST 20 YEARS ROUGHLY, AND SOME OF THE EARLIER STUDIES USED A VERY BIAS ESTIMATORS AND WE DEVELOPED A METHODOLOGY THROUGH SIMULATION TO COME UP WITH ADJUSTMENTS FOR ESTIMATOR BIAS AND THOSE BIASES FOR THAT ADJUSTMENT RANGED FROM AROUND .4-3.

SO IN SOME CASES THE RECORDED ESTIMATE WAS VERY LOW, 1/3 OF WHAT IT SHOULD BE.

SOME CASES, THE ESTIMATORS CAN LEAD TO AN OVERESTIMATE AND THAT RESULTS IN US ADJUSTING THOSE ESTIMATES DOWN.

SO THIS IS AN ILLUSTRATION OF THOSE ADJUSTMENTS.

THE ESTIMATOR BIAS FACTOR HAD SOME UNCERTAINTY IN IT AND WE USE SOME CONSERVATIVE AND LESS CONSERVATIVE ASSUMPTIONS FOR THAT ESTIMATOR BIAS.

AND THIS GRAPH REPRESENTS CORRECTION FACTORS FOR THE EASTERN BIOME FATALITY ESTIMATES FOR SMALL PASSERINES.

THE GREEN BARS REPRESENT THE LEAST CONSERVATIVE ADJUSTMENTS AND THE BLUE EXTENSION REPRESENTS THE MOST CONSERVATIVE AND WE PRESENT DATA THROUGHOUT THAT USES BOTH ASSUMPTIONS TO PROVIDE SOME INDICATION OF VARIATION DUE TO ESTIMATOR BIAS.

YOU CAN SEE THE SIZE OF THE BLUE BAR IS ROUGHLY 20-40 PERCENT OF THE OVERALL ESTIMATE.

SO WE DID THIS FOR EVERY ONE OF THE 116 STUDIES TO COME UP WITH BIAS CORRECTED ESTIMATES FOR THOSE STUDIES.

EACH OF THOSE ESTIMATES HAD SEARCHER EFFICIENCY AND SCAVENGERY CONDUCTED AT THAT PROJECT.

SO WITH THOSE ADJUSTED FATALITY RATES FOR EACH PROJECT, WE COULD CALCULATE OVERALL FATALITY RATES FOR EACH OF THE SIX BIOMES.

THIS TABLE SHOWS THE NUMBER OF STUDIES THAT MET OUR MINIMUM CRITERIA FOR EACH OF THE BIOMES AND YOU CAN SEE THE INTERMOUNTAIN WEST AND THE PRAIRIE BIOMES WERE THE MOST REPRESENTED STRATA AND THE SOUTHWEST BIOME ONLY HAD ONE STUDY WHEN WE DID THIS ANALYSIS.

WE ENDED UP COMBINING THAT BIOME AND THAT STRATA WITH THE PACIFIC BIOME TO HAVE A BETTER -- TO COME UP WITH BETTER

ESTIMATES FOR THOSE TWO BIOMES.

-- 2 BIOMES.

THE LAST STEP TO COMING UP WITH SPECIES ESTIMATES WAS TO LOOK AT THE SPECIES COMPOSITION DATA AND WE LOOKED AT THAT FOR EACH BIOME AND THIS TABLE REPRESENTS ACTUALLY CUMULATIVE ACROSS ALL OF THE STRATA, BUT WE APPLIED THE SPECIES COMPOSITION VALUES BY BIOME TO THE BIOME RATES TO COME UP WITH INDIVIDUAL SPECIES ESTIMATES.

THESE HAPPEN TO BE I BELIEVE THE NINE MOST COMMON SPECIES FOUND IN OUR DATABASE.

AND I WILL TALK MORE ABOUT THESE INDIVIDUAL SPECIES WHEN WE TALK ABOUT THE FINDINGS.

NOW FINALLY, WE HAVE THE SPECIES ESTIMATES AND WE WANT TO CONTRAST THAT TO POPULATION SIZES FOR NERDS AMERICA.

AND WE USE THE PARTNERS IN FLIGHT POPULATION ESTIMATE DATABASE.

WE ACCESSED IT ON DECEMBER 31, 2013.

I BELIEVE IT WAS MELISSA, SHE WAS WORKING ON NEW YEAR'S EVE DAY.

AND WE USED THIS INFORMATION AGAIN TO CONTRASTED TO THE FATALITY RATES BY SPECIES.

I WILL TALK ABOUT FINDINGS.

THIS TABLE SHOWS THE INDIVIDUAL BIOME OR STRATA ESTIMATES THAT WE CAME UP WITH FOR SMALL PASSERINES.

THE LOWEST AVERAGE WAS IN THE NORTHERN FOREST WITH AN ESTIMATE OF 1-1.4 OF BIRDS PER MEGAWATT.

THE HIGHEST ESTIMATE HAPPENED IN THE PRAIRIE BIOME, 2.12 ARE GROUND FOR BIRDS PER MEGAWATT.

-- 2.12 AROUND 4 BIRDS PER MEGAWATT.

THIS IS THE ESTIMATE IN THOSE STRATUS AND IT INCLUDES BOTH CANADA AND THE U.S.

THE PRAIRIE STRATA HAD 37,000 MEGAWATTS WHEN YOU TAKE A 37,000 MEGAWATTS APPLY TO OUR MOST AND LEAST CONSERVATIVE ESTIMATES FOR SONGBIRDS IN THAT STRATA, WE COME UP WITH AROUND 80,000-146,000 WIND BIRD FATALITIES FROM WIND.

CUMULATIVELY, WE HAD 15 PERCENT OF THE CONTINENTAL OPERATING WIND FACILITIES REPRESENTED IN OUR STUDIES SO IT'S A REASONABLE SAMPLE GIVEN ESPECIALLY WHEN YOU COMPARE TO OTHER SOURCES OF MENTALITY.

IT'S A GOOD SAMPLE AND WELL REPRESENTED ACROSS THE CONTINENT.

WHEN WE LOOK AT THE CONTINENTAL RATE AND THIS IS A WEIGHTED AVERAGE AMONG THE BIOMES TO ACCOUNT FOR SOME OF THE STRATA HAVING MORE ENERGY THAN OTHERS.

WE GET 2-3.4 SONGBIRDS PER MEGAWATT PER YEAR.

AND WE TAKE THAT NUMBER AND APPLY IT TO THE ROUGHLY 63 MEGAWATTS THAT WERE IN CANADA AND THE U.S. INSTALLED BY THE END OF 2012 AND WE GET THE SONGBIRD FATALITIES PER YEAR. AND WHEN WE BREAK THAT INFORMATION DOWN BY FAMILY, THE SPECIES COMPOSITION WE SEE GRASSLAND BIRDS AND SPARROWS REPRESENT ABOUT 20 PERCENT OF THE OVERALL BIRD COMPOSITION. THAT DOES INCLUDE NOT ONLY SONGBIRD FATALITIES, BUT OTHER GROUPS OF BIRDS SUCH AS RAPTORS SO IT'S 20 PERCENT OF ALL FATALITIES OBSERVED.

WARBLERS WERE SECOND, VIREOS THIRD, BLACKBIRDS FOURTH AND KINGLETS FIFTH.

HORN LARKS MADE UP APPROXIMATELY 70 PERCENT OF THE GRASSLAND SPARROWS CARCASS RECORDS AND RED EYED BIRDS MADE UP 90 PERCENT.

WHEN WE LOOK AT INDIVIDUAL SPECIES, HORNLIKE WERE THE MOST COMMON CARCASS AT WIND FACILITIES AND AROUND 22 PERCENT OF THE TOTAL FATALITIES.

HORN MARKS A WESTERN GRASSLAND SPECIES.

IN CONTRAST REDEYE VIREO MADE UP ABOUT 9 PERCENT OF THE RECORDED FATALITIES AND YOU CAN SEE THE OTHER SPECIES LISTED, EUROPEAN STARLING LISTED IN THIS TABLE AND WE DID INCLUDE EUROPEAN STARLING AND REMOVE BIRDS THAT WERE NOT PROTECTED UNDER THE MIGRATORY BIRD TREATY ACT AND A COUPLE OF -- AIM MIXTURE OF MIGRANT AND RESIDENT BIRDS.

GOLDEN CROWNED KINGLET THE MOST FORTH COMMON SPECIES.

AND WE SEE THAT FOUND THAT A LOT OF DIFFERENT PROJECTS THROUGHOUT THE U.S. AND THEY TEND TO ONLY BE FOUND IN THE FALL, DURING MIGRATION AND NOT DURING THE SPRING MIGRATION. AND WE HAVE LOOKED AT THE TEMPORAL PATTERN IN FATALITIES FOR SONGBIRDS AND WE DO SEE HIGHER NUMBERS IN THE FALL AND THAT COULD BE A FUNCTION OF FALL MIGRATION AND DIFFERENCES IN BEHAVIOR AND ALSO A FUNCTION OF THE FACT THAT IS WHEN THE POPULATION TENDS TO BE AT ITS HIGHEST.

YOU ALSO SEE SOME WARBLER SPECIES REPRESENTED ON THIS LIST. THERE WAS A TOTAL OF 156 SPECIES OF BIRDS OVERALL REPRESENTED IN THIS META-ANALYSIS AS CARCASSES IN THIS PROJECT.

PART OF THE ANALYSIS WAS TO LOOK AT THE SPECIES FATALITY ESTIMATES FOR THE CONTINENT AND COMPARE THAT TO POPULATION SIZE ESTIMATES FROM THE BREEDING BIRD SURVEY DATA AND THE PARTNERS IN FLIGHT DATABASE AND ANALYSIS TO MAKE EXTRAPOLATIONS.

AND THIS IS A LIST OF SPECIES THAT HAD THE HIGHEST PROPORTION OF POPULATION EFFECTS BASED ON OUR ESTIMATES.

BLACK THROATED BLUE WARBLER WAS THE ONE IMPACTED THE MOST

ACCORDING TO OUR ANALYSIS AND WITH ABOUT .043 PERCENT AS THE MOST CONSERVATIVE ESTIMATE OUT OF THE 2.1 MILLION BLACK THROATED BLUE WARBLER'S ESTIMATED AS A POPULATION IN THE NORTH AMERICA.

AND THE RANGE THAT WAS DOCUMENTED FOR PASSERINES WAS ROUGHLY ZERO TO 0.43 PERCENT OF THEIR POPULATION.

AS FAR AS OTHER SPECIES ON THIS LIST, HORNED LARK YOU SEE. A VERY ABUNDANT BIRD BASED ON THE POPULATION ESTIMATES AROUND 0.38 PERCENT.

WE DID LOOK AT SPECIES OF CONSERVATION CONCERNS SO U.S. FISH AND WILDLIFE SERVICE CONCERNS AND HERE WERE SOME FATALITIES THAT WERE PART OF OUR SPECIES COMPOSITION DATABASE FOR FATALITIES AT WIND FACILITIES.

WHEN WE LOOK AT OUR ESTIMATES OF TOTAL FATALITY FOR THE SPECIES AND COMPARED TO THE POPULATION, THE LARGEST ESTIMATE WAS .016 PERCENT OR 1.6 PER 10,000 BIRDS IN THE POPULATION IMPACTED BY WIND.

THAT IS AGAIN BASED ON THE LEVEL OF DEVELOPMENT THAT OCCURRED AND HAD BEEN INSTALLED AT THE END OF 2012.

TO TRULY UNDERSTAND IMPACTS OF WIND AND OTHER SOURCES ON BIRDS, LIGHTING HAS PLAYED A BIG ROLE.

AND THE STUDY IN 2010 LOOKED AT FATALITY RATES FOR LIT WIND TURBINES AND ON LIT TURBANS AND COMPARED THEM TO SEE IF THERE WAS ANY INDICATION THAT THE LIGHTING WAS INFLUENZA IN FATALITIES AND THERE WAS NO DIFFERENT DOCUMENTED.

MOST OF THE LIGHTS THAT ARE INSTALLED ON WIND TURBINES ARE BLINKING LIGHTS WHETHER IT'S WHITE LIGHTS OR RED LIGHTS.

ANOTHER PIECE OF INFORMATION FROM WIND TURBINES IS THERE'S BEEN VERY FEW WHAT I CONSIDER LARGE MORTALITY EVENTS.

THESE ARE AGAIN, IT'S A LOOSE DEFINITION BUT MORE THAN 30 BIRDS FOUND AT THE TURBINE AFTER A STORM OR SAY MORE THAN 50 BIRDS OR 100 BIRDS FOUND ON A PROJECT ON A GIVEN DAY.

AND THE THREE RELATIVELY LARGE EVENT AT WIND FARMS THAT I'M AWARE OF WERE TIED TO SUBSTATION LIGHTING AND POOR WEATHER CONDITIONS.

SO IN ONE CASE THERE APPEARED TO BE AN ATTRACTION TO A BRIGHT LIT SUBSTATION AND THERE WAS MORTALITY OF SONGBIRDS ASSOCIATED WITH NEARBY TURBINES AND IN ANOTHER CASE A CELL LIGHT WAS LEFT ON AND IT LOOKED LIKE THERE MIGHT HAVE BEEN A LARGER EVENT DUE TO THAT ATTRACTION TO THAT PARTICULAR LIGHTING.

DR. GEHRING IS A CO-AUTHOR ON OUR WORK AND SHE HAS DONE A LOT OF WORK IN MICHIGAN LOOKING AT THE IMPACT OF LIGHTING ON COMMUNICATION TOWERS AND THE IMPACT OF LIGHTS ON ATTRACTING BIRDS TO COMMUNICATION TOWERS AND HER WORK, WHICH HAS BEEN

PUBLIC SHOWS SIGNIFICANT LOWER FATALITIES FOR BLINKING LIGHTS COMPARED TO SOLID LIGHTS AND SO THAT COOPERATE SOME OF THE INFORMATION THAT'S BEEN OBSERVED AT WIND TURBINES.

WE ALSO NOTE THAT HER RESEARCH SHOWED SIGNIFICANTLY LOWER LIVE BIRD DETECTION RATES AT TOWERS, COMMUNICATION TOWERS WITH BLINKING LIGHTS COMPARED TO NON-BLINKING LIGHTS.

SO THIS INFORMATION SUGGESTS THE ATTRACTION TO SOLID RED LIGHTING ESPECIALLY DURING POOR WEATHER.

I WANT TO POINT OUT THIS RESEARCH THAT DR. GEHRING DID WAS ALSO -- DR. GEHRING DID, OTHERS WERE ALSO INVOLVED.

SO SOME OF THE BEST AVOIDANCE MEASURES WE CAN TAKE FROM SOME OF THIS LIGHTING RESEARCH IS MOST OF THE LARGE FATALITY EVENTS OF SMALL PASSERINES CAN BE AVOIDED BY MINIMIZING LIGHTING ON TURBINES AND USING NON-SOLID LIGHTS, AVOID SUBSTATION LIGHTING OR MAKE SURE YOUR SUBSTATION LIGHTING THAT'S REQUIRED IS DOWN LET'S AND NOT AN ATTRACTION AND MAKE SURE WHOEVER LEADS LAST TURNS THE LIGHTS OFF IN THE CELL.

OTHER MEASURES THAT HAVE BEEN SHOWN TO REDUCE MORTALITY INCLUDE USING UNGUIDED PERMANENT MET TOWERS.

AND WE HAVE SEEN COMPARISONS OF COMMUNICATION TOWERS COMPARED WITH WIND TURBINES AND WE DO SEE GUIDE WIRES ARE A SIGNIFICANT FACTOR IN HIGHER MORTALITY RATES.

WE HAVE MADE COMPARISONS AND CALCULATIONS OF ALL BIRD MORTALITIES FROM OUR RESEARCH AND WE ESTIMATE 210 AROUND 370,000 BIRDS PER YEAR FROM WIND TURBINES.

AGAIN THAT'S BASED ON THE LEVELS INSTALLED AFTER 2012 AND WE CONTRAST THAT TO COMMUNICATION TOWERS WHERE THE ESTIMATE IS ABOUT 6.8 MILLION.

THE ESTIMATES FOR CATS ALONE IS 1.4-3.7 BILLION.

AND VEHICLES, WE KNOW IS A SIGNIFICANT SOURCE ALTHOUGH THE STUDIES ARE NOT VERY -- THEY ARE FAIRLY LIMITED BUT THE ESTIMATE WAS 60-80 MILLION BUILDINGS FOR EXAMPLE, ALSO HAVE A PRETTY HIGH ESTIMATES AND AGAIN NOT A LOT OF STANDARDIZED STUDIES, BUT THE ESTIMATES WE'VE SEEN IS 100-1 BILLION BIRDS A YEAR DUE TO COLLISIONS WITH WILTED -- WINDOWS IN BUILDINGS.

LONG CORD TO THE STUDY IN 2013 SIMILAR TO THE STUDY WE DID AND I WANTED TO CONTRAST SOME OF THE RESULTS THEY SAW WITH COMMUNICATION TOWERS TO WHAT WE'VE SEEN WITH THE META-ANALYSIS ON WIND TURBINES.

ONE OF THE MOST COMMON SPECIES FOUND AND WHEN YOU COMPARE TO ITS POPULATION SIZE AS ONE OF THE LARGEST PROPORTIONS OF THEIR POPULATION TAKEN IF BLACK THROATED BLUE WARBLER WORSE THROUGH WIND TURBINES AND COMMUNICATION TOWERS.

5 PERCENT OF THE POPULATION IS ESTIMATED TO BE TAKEN FROM COMMUNICATION TOWERS BASED ON OUR STUDIES.

MORE GRASSLAND BIRDS ARE FOUND AT WIND TURBINES COMPARED TO COMMUNICATION TOWERS, 20 PERCENT COMPARED WITH 6 PERCENT.

I WOULD SAY THAT'S PROBABLY A FUNCTION OF MANY THINGS INCLUDING WHERE WIND TURBINES ARE, WHERE THEY HAVE BEEN STUDIED AND WHERE COMMUNICATION TOWERS HAVE BEEN STUDIED SO THERE MAY BE SOME METHOD BIAS THERE THAT WE WOULD HAVE TO LOOK INTO IN MORE DETAIL.

THERE'S BEEN A LOT MORE WARBLERS FOUND A COMMUNICATION TOWERS COMPARED WITH WIND TURBINES AND THAT MIGHT BE A FUNCTION OF LIGHTING OR A FUNCTION OF LOCATION OR A FUNCTION OF HEIGHT.

SO OVERALL CONCLUSIONS, THERE IS A LOT MORE INFORMATION AVAILABLE FOR UNDERSTANDING BIRD IMPACTS FROM WIND ENERGY THEN OTHER SOURCES.

WE HAVE 15 PERCENT ROUGHLY SAMPLE OF THE WIND ENERGY THAT'S INSTALLED IN NORTH AMERICA.

THAT'S A PRETTY GOOD SAMPLE SIZE COMPARED TO WHAT WE SEE FROM OTHER SOURCES.

THE RATES DO VARY AMONG THE STRATA WE LOOKED AT.

NOT A LOT BUT THERE IS VARIATION AND WE INCORPORATED THAT INTO THE ANALYSIS.

THE PROPORTION OF THE CONTINENTAL POPULATION AFFECTED BY COLLISIONS WITH WOULD -- WIND TURBINES AT THE CURRENT LEVEL OF DEVELOPMENT SEEMS SMALL.

THE LARGEST VALUE IS 0.43 PERCENT BASED ON OUR STUDY.

RECOGNIZING THAT THE CUMULATIVE IMPACTS OF ALL SOURCES ON SONGBIRDS IS STILL A CONCERN.

MANY OF THE SONG BIRD POPULATIONS ARE DECLINING AND CUMULATIVELY THERE IS A CONCERN OVER ALL SOURCES OF MORTALITY ON SONGBIRDS.

AS FAR AS MANAGEMENT IMPLICATIONS THE NEXT STEPS, AS THIS META-ANALYSIS HOPEFULLY WILL BE USEFUL TO HELP FOLKS UNDERSTAND WHAT THE IMPACTS ARE ON SONGBIRDS FROM WIND, I WOULD THROW OUT THERE THAT GIVEN THIS INFORMATION FROM THIS STUDY, AND INFORMATION THAT CRIS PRESENTED ON BATS AND INFORMATION ON CONCERNS OVER RAPTORS, I THINK WE CAN START TO THINK ABOUT FOCUSING MONITORING EFFORTS AND RESEARCH ON SOME OF THESE MAYBE MORE UNANSWERED QUESTIONS OR QUESTIONS THAT HAVE MORE UNCERTAINTY ASSOCIATED WITH IT.

IT WOULD BE GREAT IF A MONITORING PROGRAM COULD BE DESIGNED THAT WAS IDEAL FOR SONGBIRDS, IDEAL FOR RAPTORS AND IDEAL FOR BATS, BUT UNFORTUNATELY, THAT'S NOT THE CASE.

A MONITORING PROGRAM FOR RAPTORS IS NOT NECESSARILY IDEAL FOR SONGBIRDS AND IT MAY NOT BE IDEAL FOR BATS.

SO ONE TAKE AWAY MESSAGES WITH INFORMATION LIKE THIS, HOPEFULLY WE CAN START TO ANSWER SOME OF THESE QUESTIONS ON SONGBIRDS AND BEGIN TO FOCUS MORE OF OUR EFFORTS OF THESE OTHER SPECIES OR GROUPS THAT ARE MORE CONCERNED. WE ARE GOING TO USE THIS APPROACH TO ESTIMATE OVERALL CONTINENTAL WIDE MORTALITY FOR OTHER GROUPS SUCH AS RAPTORS AND WATER BIRDS, WATER FOWL AND OTHER GROUPS OF BIRDS.

THANK YOU, CHRISTY.

>>Christy Johnson-Hughes: THANK YOU WALLY.

I APPRECIATE YOUR PRESENTATION AND IT'S GOOD TO KEEP IN MIND THE LARGER CONTEXT OF MIGRATORY BIRDS IMPACT AND AS YOU MENTIONED, WIND IS ONE OF MANY SOURCES OF MORTALITY FOR MIGRATORY BIRDS AND MAYBE THIS JUSTIFIES A LARGER LANDSCAPE SCALE TYPE OF CONSIDERATION.

AS YOU MENTIONED, THE CUMULATIVE IMPACTS ARE STILL UNKNOWN AND ARE OF CONCERN AND THE SECRETARY OF THE INTERIOR MENTIONED LANDSCAPE LEVEL MITIGATION.

THIS MIGHT FIT IN WITH THAT TYPE OF OPPORTUNITY WHERE WE CAN LOOK AT THE LARGER SCALE AND LOOK ACROSS HOLISTICALLY AT ALL OF THE IMPACTS TO MIGRATORY BIRDS ACROSS THE LANDSCAPE AND ADDRESS IT WITH A VARIETY OF EFFORTS AND NOT JUST FOCUSING ON WIND, BUT ON A VARIETY OF IMPACTS THAT ARE AFFECTING THE POPULATION.

>>Wally Erickson: I AGREE COMPLETELY.

IF WE ARE ABLE TO COLLECTIVELY POOL RESOURCES AND THINKING ABOUT IT HOLISTICALLY, I THINK SOME OF THE AVOIDANCE MEASURES, MITIGATION MEASURES AND SOME OF THE THINGS THAT CAN BE USED TO BE IMPLEMENTED ACROSS THE BOARD, MIGHT BE BEST THAT WE THINK ABOUT IT HOLISTICALLY AND POOL THOSE RESEARCH AND RESOURCES TO GET THE BEST BANG FOR THE BUCK, SO TO SPEAK.

>>Christy Johnson-Hughes: THANK YOU WALLY.

WHAT WE WOULD LIKE TO DO NOW IS MOVE TO A FIVE-MINUTE BREAK AND AFTER THE BREAK WE WILL COME BACK TO OUR THIRD GUEST AND THEN TO THE QUESTION AND ANSWER SESSION.

(FIVE MINUTE BREAK).

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>>Christy Johnson-Hughes: WELCOME BACK TO THE WIND ENERGY BROADCAST.

I WOULD LIKE TO INTRODUCE YOU TO OUR THIRD GUEST TODAY AND THIS IS MR. CHAD LEBEAU AND HE'S ALSO WITH WEST INC.

HE IS A RESEARCH BIOLOGIST.

HE RECEIVED HIS BACHELORS AND WILDLIFE MANAGEMENT AND ENVIRONMENT AND NATURAL RESOURCES AT THE UNIVERSITY OF WYOMING AND HE RECEIVED HIS MASTERS AT THE UNIVERSITY OF WYOMING STUDYING THE IMPACTS OF WIND ENERGY DEVELOPMENT ON GREATER SAGE GROUSE.

HE HAS OVER SEVEN YEARS OF EXPERIENCE CONDUCTING AND EVALUATING STUDIES AND LOOKED AT SAGE BROUGHT ECOSYSTEM SO WELCOME.

>>Chad LeBeau: , THANK YOU FOR LETTING ME BE HERE TODAY.

I WOULD LIKE TO PRESENT SOME OF THE CURRENT RESEARCH REGARDING CURRY GROSSE AND THE IMPACTS OF WIND ENERGY DEVELOPMENT.

I WOULD LIKE TO FIRST START OFF WITH A LITTLE BIT OF BACKGROUND ABOUT PRAIRIE GROUSE SPECIES AND WIND ENERGY DEVELOPMENT.

WE ALL KNOW PRAIRIE GROUSE IS A GROUSE SPECIES THAT HAS EVOLVED IN A RELATIVELY LOW CANOPY LANDSCAPE AND THE THOUGHT OF PLACING WIND TURBINES, 100 METERS ABOVE THE LANDSCAPE MAY IMPACT THESE SPECIES SO WIND ENERGY REPRESENTS A NEW FORM OF DEVELOPMENT UNLIKE OIL AND GAS DEVELOPMENT WHERE WE HAVE A LOT OF INFORMATION REGARDING THE IMPACTS TO PRAIRIE GROUSE SPECIES SUCH AS GREATER SAGE GROUSE, LESSER AND GREATER PRAIRIE CHICKENS AND SHARP TAILED GROUSE, THERE'S NOT MUCH INFORMATION ON THE IMPACTS FROM WIND ENERGY DEVELOPMENT.

CURRENTLY, OR RECENTLY A FEW STUDIES HAVE BEEN PUBLISHED DOCUMENTING SOME OF THE INITIAL IMPACTS FROM WIND ENERGY DEVELOPMENT TO GREATER SAGE GROUSE AND GREATER PRAIRIE CHICKENS.

AND TODAY I'M GOING TO TALK A LITTLE BIT ABOUT MORE IN DEPTH WITH THESE STUDIES AND PROVIDE YOU WITH A LITTLE BIT MORE INFORMATION ON THE INITIAL STUDY RESULTS WE ARE SEEING.

SO IN THE GENERAL SUMMARY FEMALE GREATER SAGE GROUSE SELECTION WAS NOT INFLUENCED BY THE PRESENCE OF WIND TURBINE BUT NEST AND BROOD SURVIVAL DECREASED IN CLOSE PROXIMITY TO WIND TURBINES.

IN GREATER PRAIRIE CHICKENS FEMALE GREATER PRAIRIE CHICKEN NEST SELECTION AND A SURVIVAL WAS NOT INFLUENCED BY WIND TURBINES AND THE DEVELOPMENT OF A WIND ENERGY FACILITY HAD NO NEGATIVE EFFECT ON A FEMALE SURVIVAL.

LASTLY A GREATER FEMALE PRAIRIE CHICKEN AVOIDED WIND TURBINES DURING BREEDING SEASONS.

SO NOW I WOULD LIKE TO LOOK AT EACH ONE OF THE STUDIES A LITTLE BIT MORE IN THE FIRST ONE I WILL TALK ABOUT IS THE GREATER SAGE GROUSE STUDY AND THIS WAS LOCATED IN SOUTHEASTERN WYOMING NEAR THE TOWN OF MEDICINE BOW.

IT WAS 7-MILE HILL WIND ENERGY FACILITY THAT CONTAINED 79 1.5-MEGAWATT TURBINES AND IT BECAME OPERATIONAL IN DECEMBER 2008 AND WE BEGAN MONITORING 116 FEMALE SAGE GROUSE FROM APRIL 2009-OCTOBER 2010.

WE MONITORED FOR APPROXIMATELY TWO YEARS AND FOUND THAT PROXIMITY TO THE WIND TURBINES DID NOT INFLUENCED NEST OR RUDE SELECTION AND THE RELATIVE PROBABILITY OF HABITAT SELECTION INCREASED IN HABITATS CLOSER TO WIND TURBINES. WE SEE A NON-DISPLACEMENT IMPACT TWO YEARS FOLLOWING THE CONSTRUCTION OF THIS FACILITY.

IF WE LOOKED AT ANOTHER ASPECT WE LOOKED AT HOUSES AND POPULATION DEMOGRAPHICS RESPONDING TO THIS AND WE FOUND THAT THE RISK OF NEST AND BROOD FAILING DECREASED BY 7.1 PERCENT AND ALSO 38.1 PERCENT RESPECTIVELY WITH EVERY 1 KILOMETER INCREASE IN DISTANCE TO WIND TURBINES.

WE'VE FOUND THAT SURVIVAL WAS NOT IMPACTED BY APPROXIMATELY TWO TURBINES THAT DETECTED THE VARIED ABILITY OF SURVIVAL. THE FIGURES ON THE LEFT SHOWS YOU THE RELATIVE RISK OF BROOD FAILURE.

THE DARK RED COLORS INDICATE AREAS OF HIGHER RISK AND THE YELLOW COLORS INDICATE LOWER RISK SO WE ARE ABLE TO TAKE OUR MODELS AND PREDICT ON THE LANDSCAPE OF WHERE WE THINK THE HIGHEST RISK TO NEST AND BROOD SURVIVAL WAS.

AND THE GRAPH ON THE BOTTOM RIGHT INDICATES, AS DISTANCE INCREASES, THE RELATIVE RISK OF A NEST OR A BROOD FAILING DECREASES SO WE ARE SEEING SOME IMPACT TO THE PARAMETERS CLOSEST TO TURBINES.

SO IN DISCUSSING THIS STUDY WE THOUGHT IT DECREASED SURVIVAL AND THIS MIGHT BE WHERE PREDATORS ARE ATTRACTED TO MORE EDGE FX.

AND IT MIGHT BE WHERE IT LOOKS HIGH PRODUCTIVE BUT IN FACT, IT IS REALLY LOW PRODUCTIVE.

SUBSIDIZE PREDATORS, THE WIND TURBINES MAY INCREASE SCAVENGING OPPORTUNITIES FOR PREDATORS, WHICH THEN IN TURN ARE OPPORTUNISTIC AND PREY ON SAGE GROUSE AND ALSO THE PROBABILITY OF COMPROMISE DEFENSE MECHANISM THE NOISE OF THE TURBINE MAY BE LIMITING THE SAGE GROUSE IN SOME WAY AND THEIR RESPONSE TO PREDATION OR PREDATORS IN THE AREA.

WE SAW THAT HABITAT SELECTION WAS NOT INFLUENCED DURING THE

STUDY PERIOD AND THIS IS LIKELY THE RESULT OF THE PREVIOUS SELECTED HABITATS PRIOR TO THE WIND DEVELOPMENT. WE DID NOT HAVE ANY PRECONSTRUCTION DATA BUT THE POST- CONSTRUCTION DATA SHOWS THAT MAYBE THE SAGE GROUSE USE THE HABITAT PRIOR TO DEVELOPMENT AND CONTINUED THROUGH THE POST- DEVELOPMENT PERIOD.

I WOULD LIKE TO POINT OUT THIS IS THE FIRST TWO STUDIES HERE ARE PRESENTED ON AND IN THIS STUDY IT'S PART OF A LARGER FIVE-YEAR STUDY EFFORT UNDERNEATH THE NATIONAL WIND COORDINATING COMMITTEE AND I HOPE TO HAVE THE RESULTS ANALYZED OF THIS LARGER FIVE-YEAR STUDY EARLY 2015 AND I'VE PROVIDED A LINK BELOW IF YOU WANTED MORE INFORMATION ABOUT THIS FUTURE STUDY.

SO IF WE SHIFT GEARS A LITTLE BIT TO GREATER PRAIRIE CHICKENS THE OTHER SPECIES THAT HAS BEEN STUDIED INTENSIVELY LATELY. THE STUDY AREA IS LOCATED IN NORTH-CENTRAL KANSAS AND THIS WORK WAS DONE BY KANSAS STATE UNIVERSITY IN BED LIKE TO RECOGNIZE THE AUTHORS LISTED THERE.

IT WAS THE MERIDIAN WAY WIND ENERGY FACILITY IT CONTAINED 67 3-MEGAWATT TURBINES AND BECAME OPERATIONAL IN DECEMBER 2008.

IT WAS A BEFORE AND AFTER CONTROL IMPACT STUDY DESIGN WHERE THE RESEARCHERS WENT OUT TWO YEARS PRIOR TO CONSTRUCTION AND COLLECTED DATA AND CONTINUED COLLECTING DATA FOR YEARS AFTER THE FACILITY BECAME OPERATIONAL PROVIDING A BEFORE AND AFTER COMPARISON, WHICH IS A PRETTY STRONG STUDY DESIGN. THESE FIGURES SHOW THE USE OF LOCATIONS BY THE DOTS AND THE TURBINES ARE INTERMIXED IN THERE WITH THE POST- CONSTRUCTION PERIOD.

SO SUMMARIZING THE RESULTS OF THESE THREE STUDIES, VEGETATION FEATURES WERE IMPORTANT FOR NEST SURVIVAL AND NEST SITE SELECTION ON THE PROXIMITY TO WIND TURBINES WAS NOT INFLUENCING THESE PARAMETERS.

IT WAS MORE HOW THE LANDSCAPE WAS OR THE HABITAT FEATURES ASSOCIATED WITH THE AREA.

ADULT FEMALE SURVIVOR INCREASE FROM THE PRECONSTRUCTION PERIOD, .32 TO THE POST- CONSTRUCTION FROM .57, WHICH WAS A SIGNIFICANT DIFFERENCE.

THE FIGURES ON THE LEFT SHOW THE SURVIVAL CURVES OF THE PRECONSTRUCTION TO THE POST- CONSTRUCTION PERIOD.

THE POST- CONSTRUCTION BEING THE DARK COLORS AND INDIVIDUAL YEARS ON THE TOP END THEN THE AVERAGE OF THE PRE- AND POST- CONSTRUCTION ON THE BOTTOM AND THE ASSOCIATED CONFIDENCY INTERVALS SO WE SEE A SIGNIFICANT DIFFERENCE FROM SURVIVAL RATES IN THE PRECONSTRUCTION TO THE

POST- CONSTRUCTION.

THESE RESEARCHERS ALSO DOCUMENTED THAT FEMALES AVOIDED WIND TURBINES IN THEIR HOME RANGE SIZE INCREASE FROM THE PRECONSTRUCTION TO THE POST- CONSTRUCTION PERIOD SHOWING SOME DISPLACEMENT EFFECTS ONCE THE DEVELOPMENT WAS IN PLACE AND OPERATIONAL.

THIS FIGURE SHOWS THE PREDICTED USE AREAS FROM THE BREEDING PERIOD FROM THE PRECONSTRUCTION PERIOD TO THE POST- CONSTRUCTION PERIOD AND THE DARKER COLORS MEAN AREAS OF HIGHER PREDICTED USE SO YOU CAN SEE A SHIFT FROM THE BREEDING PERIOD PRECONSTRUCTION TO POST- CONSTRUCTION PERIOD.

SO IN DISCUSSION OF THIS LARGER STUDY, THE NEST SITE SELECTION, NEST SITE SELECTION WAS NOT IMPACTED BY THE WIND ENERGY DEVELOPMENT IT WAS INFLUENCED MORE BY HOW THE HABITAT CHARACTERISTICS WERE MANAGED AND OVER TIME.

SO IT WAS NOT NECESSARILY THE PROXIMITY TO THE WIND TURBINES THAT WERE INFLUENCING THESE DEMOGRAPHICS AND PARAMETERS.

OTHER FORMS OF ENERGY EXPERIENCE THE OPPOSITE IMPACTS.

THIS DISCREPANCY IS LIKELY THE RESULT OF INFRASTRUCTURE ASSOCIATED WITH THE DIFFERENT DEVELOPMENT TYPES.

WE HAVE OIL AND GAS DEVELOPMENT AND IT GIVES YOU A NUMBER OF OPPORTUNITIES FOR RAPTORS TO PERCH ON AND WHERE AS WIND TURBINES DON'T HAVE MUCH RAPTOR PERCHING SO THAT COULD BE A DIFFERENCE BETWEEN THE TWO.

FEMALE GREATER PRAIRIE CHICKENS AVOIDED WIND TURBINES BUT THERE WAS NO NEGATIVE IMPACTS ON DEMOGRAPHIC PERFORMANCE. WE DID SEE SOME DISPLACEMENT AFFECTS HOWEVER, THEY CONTINUE TO HAVE HIGH PRODUCTIVITY AND SURVIVAL RATES.

SO THESE ARE TWO DIFFERENT SPECIES AND OCCUPY TWO DIFFERENT ECOSYSTEMS, WE CAN SHED SOME LIGHT ONTO THE CUMULATIVE ASSESSMENT BUT EACH ECOSYSTEM AND EACH STUDY AREA IS LIKELY DIFFERENT AND THESE PARAMETERS COULD SHIFT FROM STUDY AREA TO STUDY AREA AND ESSENTIALLY THESE ARE THE ONLY TWO STUDIES OUT THERE WE HAVE TO GO ON.

BUT I SUMMARIZED THE PARAMETERS AND THEIR IMPACTS WITH THE DIFFERENT SPECIES AND YOU CAN SEE NEST SURVIVAL AND BROOD SURVIVAL FOR GREATER SAGE GROUSE AND ALSO FEMALE BREEDING SELECTION WAS POSITIVELY AFFECTED FOR THE GREATER SAGE GROUSE OR NOT LISTED AS AN IMPACT OR AN AVOIDANCE.

GREATER PRAIRIE CHICKENS AGAINST FEMALE BREEDING SELECTION WAS NEGATIVELY AFFECTED SHOWING THAT DISPLACEMENT IN THEIR HOME RANGE SIZES.

LIKE I MENTIONED BEFORE, THERE ARE TWO DIFFERENT UNIQUE GROUSE SPECIES BUT THERE ARE SOME SIMILARITIES.

PREDATION IS A MAIN SOURCE OF NEST AND BROOD FAILURE AND FEMALE MORTALITY FOR BOTH GROUSE SPECIES.

GREATER SAGE GROUSE NEST AND BROOD SURVIVAL DECREASED IN CLOSE PROXIMITY TO WIND TURBINES BUT NO AFFECT ESTIMATED FOR GREATER PRAIRIE CHICKEN NEST SURVIVAL.

THIS IS LIKELY DUE TO THE UNIQUE ECOSYSTEMS AND THE VARYING LEVELS OF DEGREE OF HABITAT FRAGMENTATION ASSOCIATED WITH THE SAGE GROUSE ECOSYSTEMS AND THE MIXED GROUSE PRAIRIE ECOSYSTEMS OF THE PRAIRIE CHICKENS.

GREATER SAGE GROUSE RANGELAND IS RELATIVELY UNFRAGMENTED. YOU HAVE PRAIRIE CHICKENS -- COMPARED TO THAT WHERE THEY HAVE A HIGHLY FRAGMENTED LANDSCAPE AND THIS COULD BE THE RESULT OF PREDATORS BEING MORE ATTRACTED TO THE UNFRAGMENTED LANDSCAPE COMPARED TO THE HIGHLY FRAGMENTED PRAIRIE CHICKEN HABITAT.

SO THERE IS THE UNIQUE ECOSYSTEM AND THEN THERE IS ALSO THE DIFFERENT RANGE LAND MANAGEMENT PRACTICES THAT ARE GOING ON BETWEEN THESE TWO ECOSYSTEMS.

THE SAGEBRUSH ECOSYSTEM YOU HAVE THE OPEN RANGE, FREE RANGING CATTLE WITH LITTLE INFLUENCE.

AND IN THE MIXED GROUSE SHORT GRASS PRAIRIES, YOU HAVE CONTROLLED BURNING, YOU HAVE DIFFERENT GRAZING INTENSITIES, WHICH ALL INCREASE HUMAN ACTIVITY AND MAY BE INFLUENCING THE PREDATOR PREY DYNAMIC.

THERE HAS BEEN SOME STUDIES OUT THERE WHERE IT SUGGESTS COYOTES ARE AVOIDING THESE WIND ENERGY FACILITIES LIKELY DUE TO THE REIGNED LAND MANAGEMENT AND THE INFLUENCES OF THE WIND FACILITY.

GREATER SAGE GROUSE FEMALE SURVIVAL WAS NOT AFFECTED AND WE ARE NOT SEEING AN IMPACT IN ADULT SURVIVAL IN THE LANDSCAPE OF THESE TWO STUDY AREAS.

THE LIKELY SOURCE OF FEMALE MORTALITY OR ADULT MORTALITY IS AVIAN PREDATION AND BOTH SPECIES SO YOU COULD SEE SOME SORT OF AVIAN PREDATOR AVOIDANCE WITH THE WIND ENERGY FACILITIES WHERE THEY ARE REDUCING THE RISK OF MORTALITY IN CLOSE PROXIMITY TO TURBINES.

FEMALE GREATER PRAIRIE CHICKENS AVOIDED TURBINES WHERE AS GREATER SAGE GROUSE SELECTED HABITAT IN CLOSER PROXIMITY AND THIS IS LIKELY DUE TO THE FACT THAT SAGE GROUSE USE THE SAME HABITAT YEAR-AFTER-YEAR AND THE SAME NESTING AND BREEDING AND WINTER RANGES.

YEAR-AFTER-YEAR.

SO THE SITE FIDELITY IS LIKELY THE EFFECT OF SAGE GROUSE USE THE HABITAT ONCE AND CONTINUE TO USE IT AFTER DEVELOPMENT.

IT'S UNFORTUNATE WE DON'T HAVE ANY PRECONSTRUCTION DATA ON

THE SAGE GROUSE STUDY TO DETERMINE HOW THEY WERE RESPONDING PRIOR TO DEVELOPMENT, BUT WE CAN GET A GOOD SENSE ON WHY THE SAGE GROUSE ARE SELECTING HABITATS IN CLOSE PROXIMITY DUE TO THE STRONG SITE FIDELITY.

MANY OIL AND GAS STUDIES HAVE DETERMINED THERE IS A LAG EFFECT ASSOCIATED WITH DEVELOPMENT TYPES AND WE COULD SEE THE SAME LAG EFFECT IN GREATER SAGE GROUSE IN WIND ENERGY DEVELOPMENT WHERE INDIVIDUALS BECOME RECRUITED TO THE POPULATION SUCH AS JUVENILES AND START SELECTING HABITATS DIFFERENTLY THAN THE ADULTS THAT WERE THERE PRIOR TO THE DEVELOPMENT SITE.

SO THE LARGER STUDY EFFORTS SIMILAR TO THE GREATER PRAIRIE CHICKENS STUDY WILL GET AT THIS LAKE AFFECTS TWO-SEAT IF WE ARE SEEING THAT.

SO FOR THE MITIGATION AND FUTURE RESEARCH, THERE'S A COUPLE OF POINTS THAT I'D LIKE TO TALK ABOUT AND IMPLEMENTING SITE SPECIFIC MANAGEMENT PRACTICES IS LIKELY THE BEST TOOL FOR INCREASING PRODUCTIVITY AND SUSTAINABILITY OF THE GREATER PRAIRIE CHICKEN POPULATION IN THE DEVELOPMENT AREA.

IT FOUND THAT MANAGEMENT PRACTICE MORE IMPORTANT TO SURVIVAL AND SELECTION THAN THE ACTUAL PLACEMENT OF PROXIMITY TO TURBINES SO FOR MANAGING THOSE HABITAT FEATURES IMPORTANT TO THE GREATER PRAIRIE CHICKENS IT WILL LIKELY BE BENEFICIAL TO THE VIABILITY OF THAT POPULATION.

I WOULD LIKE TO POINT OUT THIS IS ONLY TWO STUDIES AND TO DIFFERENT ECOSYSTEMS BUT ADDITIONAL LONG-TERM BEFORE AND AFTER CONTROL IMPACT STUDY DESIGNS ESTIMATING IMPACT TO THE PRAIRIE GROSS SPECIES NEEDS TO OCCUR AND NEEDS TO OCCUR AT DIFFERENT ECOSYSTEMS SO A CURRENT ASSESSMENT CAN BE MADE. THE UNIQUENESS OF THE SPECIES MAY NOT BE ABLE TO MAKE AND A CUMULATIVE ASSESSMENT, BUT WE CAN HAVE SOME SIMILARITIES BETWEEN THE TWO SO ADDITIONAL LONG-TERM BEFORE AND AFTER CONTROL IMPACT STUDY DESIGNS WILL STRENGTHEN THE KNOWLEDGE OF WHERE WE ARE GOING WITH WIND ENERGY DEVELOPMENT.

AND THEN INVESTIGATION INTO THE MECHANISMS THAT ARE AFFECTING SAGE GROUSE NEST AND BROOD SURVIVAL ARE AN IMPORTANT STEP TO UNDERSTANDING WHY WE ARE SEEING A DECREASE IN NEST AND BROOD SURVIVAL IN CLOSE PROXIMITY TO WIND TURBINES.

WE KNOW THE WIND TURBINES ARE NOT ACTUALLY DECREASING THE SURVIVAL OF THESE PARAMETERS BUT IT'S SOMETHING GOING ON IN THE LANDSCAPE AND LIKELY A PREDATOR PREY DYNAMIC THAT NEEDS TO BE INVESTIGATED.

IF WE CAN FIGURE OUT WHAT IS GOING ON WITH THAT, WE CAN BETTER

HELP MITIGATE THESE ISSUES.

AND THE FIGURE ON THE RIGHT IS WHERE WE ARE GOING -- WHERE I'M GOING WITH THIS STUDY.

THE SAGE GROUSE STUDY IS LOOKING AT PREDATOR/PREY DENSITIES IN RELATION TO SURVIVAL PARAMETERS.

SO WE HOPE TO INCORPORATE A PREDATOR/PREY DYNAMIC TO HELP UNDERSTAND WHY WE ARE SEEING A DECREASE IN NEST AND BROOD SURVIVAL.

SOME OF THE OTHER MITIGATION FEATURES ARE EMERGING HABITAT CONSERVATION BANKS WHERE A DEVELOPER CAN PURCHASE HABITAT CONSERVATION CREDITS AND HELP MITIGATE FURTHER IMPACTS FROM THEIR DEVELOPMENT ON THEIR SITES AND THESE ARE BECOMING MORE AND MORE PREVALENT AND THEY ARE LIKELY THE FUTURE OF HELPING TO CONSERVE SAGE GROUSE POPULATIONS.

AND LASTLY, THE CORE AREA MODELS.

ORIGINALLY ADAPTED BY THE WYOMING GAME AND FISH AND THE GOVERNOR OF WYOMING, HAS NOW BEEN IMPLEMENTED AND ADOPTED IN MOST STATES IN THE SAGE GROUSE RANGE.

THESE CORE AREA MODELS ALLOW MANAGEMENT AGENCIES TO MANAGE THEIR SAGE GROUSE POPULATIONS BY CREATING DEVELOPMENT REQUIREMENTS, TIMING RESTRICTIONS AND OVERALL HABITAT DISTURBANCES STIPULATIONS.

SO THERE IS AN EFFORT TO CONSERVE SAGE GROUSE AND INDIVIDUAL POPULATIONS AND ARE LIKELY IMPLEMENTED ACROSS THE STATES AND SAGE GROUSE RANGE.

AND I WOULD LIKE TO ACKNOWLEDGE THESE AUTHORS AND I APPRECIATE THE OPPORTUNITY CHRISTY.

THANK YOU.

>>Christy Johnson-Hughes: I AM GLAD YOU COULD JOIN US.

AND I FOUND YOUR PRESENTATION VERY INTERESTING BECAUSE THESE ARE SPECIES THAT ARE NOT FLYING INTO THE TURBINES.

THESE ARE MORE INDIRECT EFFECTS VERSUS DIRECT MORTALITY.

AND AS YOU MENTIONED, WE ARE STILL AT THE VERY BEGINNING OF LEARNING ABOUT HOW THESE SPECIES REACT TO THE FACILITIES.

I THINK IT'S VERY INTERESTING THAT YOU MENTIONED, IT'S THE LANDSCAPE LEVEL MANAGEMENT OF THE VEGETATION, THE AMOUNT OF HUMAN ACTIVITY OUT THERE THAT IS HEAVILY INFLUENCING THESE SPECIES.

SO I LOOK FORWARD TO HEARING MORE ABOUT THAT AND I REALIZE THAT CONSERVATION EFFORTS ARE PART OF THIS BUT WOULDN'T IT BE GREAT IF WE ALSO PUT TOGETHER LAND MANAGEMENT PLANS WITH THE OWNERS AND THE LEASERS OF THESE SITES SO WE COULD PROMOTE THE SPECIES WHERE THEY ARE ALREADY LOCATED AND THEY DON'T SEEM TO BE NECESSARILY AS FAR AS WE KNOW YET MOVING THAT FAR AWAY FROM THE TURBINES.

THANK YOU AND AGAIN.

WHAT I WOULD LIKE TO DO NOW IS MOVED TO OUR QUESTION AND ANSWER SESSION.

SO GET READY TO TYPE IN YOUR QUESTIONS IN THE CHAT BOX AND WE WILL RECONVENE OVER AT THE ROUNDTABLE WITH ALL OF OUR RESEARCHERS TO ANSWER YOUR QUESTIONS ABOUT THEIR RESEARCH PRESENTATIONS TODAY.

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>>Christy Johnson-Hughes: AND WELCOME TO OUR PANEL DISCUSSION HERE, OUR LIVE Q&A SESSION OF OUR WIND ENERGY BROADCAST AND I HAVE OUR THREE GUESTS WITH ME, CRIS HEIN, WALLY ERICKSON AND CHAD LEBEAU.

AND WHAT WE WOULD LIKE TO DO IS START OFF WITH A COUPLE OF DISCUSSION QUESTIONS THAT WE THOUGHT WOULD BE VERY HELPFUL TO THE AUDIENCE AND IN THE MEANTIME, PLEASE TYPE YOUR QUESTION INTO THE CHAT BOX.

ONE OF THE THINGS WE TALKED ABOUT IN PAST BROADCAST IS THE NEED TO COMMUNICATE AND ALSO WE ARE TALKING ABOUT COMMUNICATIONS AMONGST THE AGENCIES AND WITH DEVELOPERS AND WITH CONSULTANTS AND TAKING THAT STEP FURTHER FOR THE RESEARCH DISCUSSION IS THE DISSEMINATION OF INFORMATION GENERATED BY THE RESEARCHERS SUCH AS THOUGH SITTING HERE AT THE TABLE AND EVERYONE ELSE WHO IS CONDUCTING RESEARCH AT THIS POINT IN TIME.

KRIS, I THOUGHT YOU HAD SOME GOOD THOUGHTS ABOUT THAT EARLIER.

>>Cris Hein: DISSEMINATION OF ALL RESEARCH IS IMPORTANT SO WE CAN BUILD ON IT AND LEARN FROM WHAT OTHERS HAVE DONE BUT THESE RESEARCH SPECIFIC STUDIES WHERE WE ARE TRYING TO FIND A CUMULATIVE IMPACTS, THESE ARE IMPORTANT FOR THE ENTIRE INDUSTRY AND FOR ALL CONSERVATION FOR THE DIFFERENT SPECIES SO IT'S IMPORTANT TO DISSEMINATE THAT BE WHEN ABSOLUTELY. AND AS U.S. FISH AND WILDLIFE SERVICE WE NEED THIS INFORMATION TO HELP MAKE CONSERVATION RECOMMENDATIONS AND OTHER MANAGEMENT DECISIONS FOR THESE SPECIES.

AND THEN WE ALSO TALKED A BIT ABOUT BIRDS AND LANDSCAPE CONSERVATION OF BIRDS AFTER WALLY'S PRESENTATION.

AND I WANTED TO REVISIT THAT PARTICULAR CONCEPT BECAUSE IT SOUNDED TO ME LIKE WITH MIGRATORY BIRDS, THERE IS SO MUCH GOING ON WITH MIGRATORY BIRDS OUT THERE THAT THIS IS AN OPPORTUNITY TO LOOK AT A VARIETY OF METHODS TO HELP CONSERVE THESE SPECIES.

WHAT ARE YOUR THOUGHTS ON THAT WALLY?

>>Wally Erickson: I AGREE.

IF WE CAN TAKE INFORMATION LIKE THIS STUDY THAT I TALKED ABOUT

TODAY AND OTHER STUDIES LIKE THE LONG COURSE STUDY AND USE INFORMATION FROM THE STUDY ON CATS AND OTHER SOURCES, IT HELPS US TO TARGET THE SOURCES AND THE SPECIES AND THE CONSERVATION THINGS THAT CAN BE DONE THAT COULD GIVE US THE BEST BENEFIT AND NOT JUST THINKING ABOUT WIND IN ITS OWN LITTLE VACUUM AND COMMUNICATION TOWERS IN ITS OWN VACUUM, THINKING HOLISTICALLY ABOUT ALL THE SOURCES AND HOW WE CAN BEST CONSERVE THE SPECIES.

>>Christy Johnson-Hughes: THANK YOU.

I THINK THAT IS SOMETHING WE ALL STRUGGLE WITH BECAUSE I KNOW IN MY AGENCY, WE LOOK AT EVERYTHING ON A PROJECT BY PROJECT BASIS BUT SOMETIMES IT REALLY HELPS TO TAKE A STEP BACK AND SAY WHAT IS THE LARGER PICTURE HERE, HOW CAN WE BEST REACH OUR CONSERVATION GOALS FOR THESE SPECIES.

>>Wally Erickson: I WOULD ADD SOME OF THE SOLUTIONS, SOLUTIONS ARE NOT NECESSARILY FOR COMMUNICATION TOWER IMPACT MAY BE DOING SOMETHING ELSE OR IF THE IMPACTS ARE HABITAT RELATED IT MIGHT BE DOING SOMETHING ELSE THAT CAN BASICALLY GET YOUR BEST BANG FOR THE BUCK IN TERMS OF CONSERVATION OF THE SPECIES BEING IMPACTED BECAUSE A LOT OF THE SPECIES ARE BEING AFFECTED BY MULTIPLE SOURCES.

>>Christy Johnson-Hughes: THANK YOU.

LET'S GO AHEAD TO SOME OF THE QUESTIONS FROM OUR AUDIENCE AND THE FIRST QUESTION WE WANT TO GET TO IS DO THE ACOUSTIC DETERRENT DEVICES USE MORE POWER THEN THE TURBINES ARE PRODUCING?

AND CRIS OLSON, I WILL TURN THAT OVER TO YOU.

>>Cris Hein: I DON'T HAVE THE ACTUAL NUMBERS ON THE TOP OF MY HEAD, BUT IT'S A SMALL FRACTION OF WHAT THE TURBINES ARE GENERATING.

>>Christy Johnson-Hughes: THESE TURBINES ARE POWERING MULTITUDES OF HOMES AND BUSINESSES AND THERE'S A CONSIDERABLE AMOUNT OF GENERATION AT THIS POINT IN TIME. IT'S GOOD TO KNOW DEVICES ARE MINIMAL HERE TO THE OUTPUT. AND THE INDUSTRY HAS THE EXACT FIGURES.

>>Cris Hein: THE MANUFACTURERS OF THE DEVICES WE USED, WE HAVE THAT INFORMATION.

I JUST DON'T HAVE IT OFF THE TOP OF MY HEAD, BUT THAT'S MINOR.

>>Christy Johnson-Hughes: THANK YOU.

LET'S GO TO ANOTHER QUESTION.

WALLY, THIS ONE IS FOR YOU.

YOU MENTIONED THE SINGLE LARGE MORTALITY EVENT AT A GAS FACILITY LEISURE WHEN OVER 9,000 BIRDS WERE KILLED IN A SINGLE NIGHT.

HOW DOES THIS COMPARE TO EVENTS AT WIND FARMS?

>>Wally Erickson: THE THREE EVENTS THAT HAVE OCCURRED AT WIND FARMS HAVE BEEN RELATIVELY SMALL, DIRTY BIRDS AFTER A WEATHER EVENT TIED TO SUBSTATION IN THE ONE CASE WE SAW LIGHTING AND IN ANOTHER CASE THE EVENT IN CANADA WAS I BELIEVE 7500 BIRDS FOUND AFTER ONE NIGHT.

A LOT OF THE COMMUNICATION TOWER EVENTS THAT HAVE BEEN LARGE HAVE BEEN HUNDREDS TO THOUSANDS OF BIRDS AFTER AN EVENT.

I THINK IT GETS TIED TO THE ATTRACTION QUESTION.

IF THE LIGHTS ARE NOT BEING ATTRACTED I THINK THOSE LARGE EVENTS ARE PROBABLY NOT LIKELY TO OCCUR AT ANY FACILITY.

>>Christy Johnson-Hughes: RIGHT.

I BELIEVE THE EVENT IN CANADA WAS WITH A GAS FLARE, WHICH IS AN ACTUAL STANDARD INDUSTRY PRACTICE AT THIS POINT IN TIME IN GENERAL FOR OIL AND GAS.

THEY NEED TO SAFELY REMOVE THAT GAS AND FLARING IS A TYPICAL WAY OF DOING THAT.

I THINK WHAT YOU ARE SAYING IS SOMEONE ACCIDENTALLY LEFT THE LIGHT ON AT A FACILITY AND THERE IS A SLIGHT DIFFERENCE IN THAT AND I KNOW ONE OF OUR BIG CONSERVATION RECOMMENDATIONS IS MAKE SURE ALL OF THE LIGHTS ARE TURNED OFF AT NIGHT WHEN YOU LEAVE EXCEPT FOR THE FAA LIGHTING WHICH AS WE TALKED ABOUT DOES NOT SEEM TO HAVE AN EFFECT ON THE BIRDS.

BUT THE BLINKING RED LIGHTS.

SO THERE'S ALSO A DIFFERENCE IN ANTICIPATED FREQUENCY OF THESE EVENTS BETWEEN GAS FLARING AND ACCIDENTAL LIGHTS AT WIND FACILITIES.

>>Wally Erickson: THERE ARE BEST MANAGEMENT PRACTICES THAT CAN BE USED TO AVOID THE EVENTS THAT HAVE OCCURRED AT WIND PROJECTS.

I WOULD SAY, YOU KNOW, GIVEN THE AMOUNT OF STUDY THAT HAS BEEN DONE IN THE AMOUNT OF EFFORT THAT'S BEEN DONE AT WIND EFFORTS -- WIND PROJECTS, IT HAS BEEN A VERY RARE EVENT GIVEN THE AMOUNT OF EFFORT THAT'S BEEN PUT INTO LOOK FOR BIRDS.

>>Christy Johnson-Hughes: THANK YOU.

LET'S MOVE ONTO ANOTHER QUESTION, RECENTLY DATA SEEMS TO INDICATE THAT CROSS OR MORE NEGATIVELY AFFECTED BY SOUND SUCH AS THAT ASSOCIATED WITH PUMP JACKS AND ROADS THAN TALL STRUCTURES.

CAN YOU SPEAK TO THIS.

SO CHAD, THIS IS IN YOUR DIRECTION.

>>Chad LeBeau: THERE HAS BEEN SOME RECENT RESEARCH REGARDING NOISE AND IMPACTS TO SAGE GROUSE AND RECENT REGULATIONS HAVE BEEN ENACTED TO HELP PROTECT SAGE GROUSE BECAUSE OF THE NOISE PROBLEM.

AS IT RELATES TO TALL STRUCTURES, LIKE WE SEE AND WHAT I PRESENTED, THERE ARE SOME CONFLICTING REPORTS ON IMPACTS FROM TALL STRUCTURES.

NUMEROUS STUDIES HAVE BEEN CONDUCTED ON TRANSMISSION LINES AND ROADS AND OTHER TALL STRUCTURES, BUT THERE ARE SOME CONFLICTING REPORTS, BUT WE ARE SEEING SOME IMPACT OF NOISE TO GREATER SAGE GROUSE AND THE NESTING AND BROOD PERIOD SO WE ARE SAYING THAT IMPACT.

>>Christy Johnson-Hughes: I'M GOING TO INTERJECT A QUESTION IN HERE, I KNOW ONE OF THE OTHER QUESTIONS I HEAR QUITE A BIT IS FREQUENCY.

FREQUENCY OF HUMAN ACTIVITY AT TURBINES AND NOISE ASSOCIATED WITH THAT, TRUCKS VERSUS FREQUENCY OF MAINTENANCE AND STUFF THAT PUMP JACKS.

HAVE YOU SEEN ANYTHING LIKE THAT WITH HUMAN ACTIVITY AND NOISE WITH THE BIRDS OUT THERE?

>>Chad LeBeau: THEY ARE TWO DIFFERENT DEVELOPMENT TYPES IN THE PROBLEMS ASSOCIATE WITH THEM ARE DIFFERENT.

SOME REPORTED 1800 TRACK VISITS TO OPERATING COMPARED WITH TURBINE VISITS, WHICH IS MAYBE THREE TIMES A YEAR FOR MAINTENANCE PURPOSES SO THERE IS A DISCREPANCY OF ACTUAL HUMAN INFLUENCES AT THESE DEVELOPMENT TYPES.

PART OF THE RESEARCH NEEDS TO START EXPLORING IS THIS HUMAN INFLUENCE AT THE FACILITY DIFFERENT THAN OIL AND GAS AND I HOPE WE START GOING THAT WAY.

>>Christy Johnson-Hughes: THANK YOU VERY MUCH.

LET'S GO TO ANOTHER QUESTION FROM THE AUDIENCE.

HOW FAR DOES THE SOUND FROM AN ACOUSTIC DETERRENT PROJECT FROM THE TURBINE?

>>Cris Hein: THAT VARIES BY A NUMBER OF FACTORS THE FREQUENCY OF THE SOUND AND THE ATMOSPHERIC CONDITIONS SO HUMIDITY CAN AFFECT THE PROJECTIONS SOUND QUITE A BIT.

ROUGHLY HIGHER HUMIDITY DAMPENS THE SOUND.

AND THEN HIGHER FREQUENCY NOISES ATTENUATE FASTER THAN LOWER FREQUENCY NOISES.

SO WE ESTIMATED THAT GIVEN LOW HUMIDITY CONDITIONS, AROUND 10 PERCENT AND ALL OTHER FACTORS BEING EQUAL THE PROJECTION REACHED OUT TO ABOUT 40 METERS WITH HIGHER HUMIDITY LEVELS AROUND 80 PERCENT THAT PROJECTION MAY HAVE ONLY BEEN ABOUT 20 METERS SO CUT IN HALF.

AND WHEN I TALK ABOUT THESE DISTANCES, THIS IS BASED ON THE DECIBEL LEVEL OF NOISE THAT WE THINK WILL BE POWERFUL ENOUGH TO DETER AND INTERFERE WITH THEIR ECHOLOCATION.

SO THAT COULD VARY, WE DON'T HAVE A LOT OF INFORMATION ON

WHAT LEVEL MIGHT DETER BATS OVER ANOTHER LEVEL.

>>Christy Johnson-Hughes: OKAY.

NOW AT 20 METERS OR 40 METERS, HOW DOES THAT COMPARE TO THE LINK?

>>Cris Hein: LAND BASED BLADES ARE 40-50 METERS SO AT BEST WE ARE EXTENDING OUT TOWARD THE TIPS, BUT, YOU KNOW, WE ARE NOT GOING TO GET ALL THE WAY OUT THERE WITH THESE DEVICES. HOWEVER, THE NOISE IS PROJECTED.

BUT WHAT WE CAN DO IS LEARN FROM STUDIES THAT ARE LOOKING AT HOW BATS ARE INTERACTING WITH THE TURBINES, WHICH WAY THEY APPROACH THEM FROM WHAT DIRECTION OR ANGLE AND FOCUS OUR TRANSMISSIONS IN THOSE AREAS TO GET THEM BEFORE THEY EVEN COME IN CLOSE CONTACT WITH THE CELL TOWER AND TURBINE BLADES.

>>Christy Johnson-Hughes: GREAT, THANK YOU.

ANOTHER QUESTION, IS THERE A SPECIES IN A BIOME SHOWING A SIGNIFICANT DOWNWARD POPULATION TREND THAT ALSO EXPERIENCES RELATIVELY HIGH MORTALITY FROM WIND TURBINES. WALLY, THIS SOUNDS LIKE YOURS.

>>Wally Erickson: THANKS, CHRISTY.

I DON'T HAVE A GREAT ANSWER BECAUSE WE'VE NOT LOOKED SPECIFICALLY AT THAT QUESTION.

THAT'S A GREAT QUESTION AND IT'S SOMETHING WE SHOULD LOOK INTO AND WE HAVE ESTIMATES FOR THE DIFFERENT SPECIES AND WE SHOULD TAKE A LOOK AT THE POPULATION TRAJECTORY IN THOSE REGIONS TO SEE IF SOME SPECIES ARE BEING IMPACTED ARE ALSO ASSOCIATED WITH DOWNWARD TRENDS.

GIVEN THE LEVEL OF MORTALITY FOR SONGBIRDS, I ANTICIPATE THE NUMBERS ARE PRETTY LOW FOR FATALITY COMPARED TO THOSE POPULATION NUMBERS.

SO I'M GUESSING IT'S PROBABLY NOT A BIG FACTOR, BUT WE NEED TO LOOK AT THAT.

>>Christy Johnson-Hughes: THANK YOU.

ANOTHER QUESTION, HAS A COST COMPARISON BETWEEN BAT FATALITY MINIMIZATION STRATEGIES BEEN CONDUCTED.

CRIS, I GUESS THIS WOULD BE THE CURTAILMENT AND THE ACOUSTIC DETERRENT.

>>Cris Hein: THE SHORT ANSWER IS NO.

THERE'S A LOT THAT GOES INTO ESTIMATING THESE COSTS.

WE HAVE VERY LITTLE INFORMATION ON WHAT OPTIMIZATION MINIMIZATION WORKS FOR A FACILITY.

IT DEPENDS ON THE CUT IN SPEED, THE WIND REGIME.

THE STUDY THAT WAS CONDUCTED AT CASTLEMAN IN 2008-2009, LESS THAN AN ANNUAL PRODUCTION LOSS OF 1 PERCENT BUT THAT WILL VARY FROM SITE TO SITE.

ON THE OTHER HAND, WITH ACOUSTIC DETERRENCE, WE HAD AN ESTIMATE FOR THE DEVICE THAT WE ORIGINALLY USED BUT THAT'S CHANGED QUITE A BIT.

SO IT WILL DEPEND ON WHAT THE R&D TELLS US AND HOW WE OPTIMIZE THAT DEVICE AND THAT WILL DEPEND ON HOW MANY TURBINES YOU WANT TO EQUIP AND HOW BIG YOUR FACILITY AS AND THINGS LIKE THAT.

I THINK IT WILL ALSO DEPEND ON WHAT LEVEL OF CONSERVATION YOU WANT TO HAVE AND WHAT KIND OF COST-BENEFIT ANALYSIS STRATEGY MAY BE MORE EXPENSIVE, BUT IT GIVES YOU A HIGHER CONSERVATION VALUE SO THAT HAS TO BE FACTORED IN AS WELL.

>>Christy Johnson-Hughes: THANK YOU.

I'VE GOT ANOTHER QUESTION HERE, MITIGATION COST PER THE CHAT MODEL ARE TOO EXPENSIVE FOR WIND PROTECTING THOSE AREAS BUT WOULD YOU SAY WIND COULD BE COMPATIBLE IN THESE AREAS? WHAT WOULD APPROPRIATE MITIGATION BE IF DEVELOPING AN IMPORTANT HABITAT.

[INAUDIBLE] DO YOU HAVE ANYTHING YOU WANT TO --

>>Chad LeBeau: I CAN TACKLE THAT.

IT'S DIFFICULT FOR ME TO SAY DEPENDING ON HOW WELL THE WIND IS IN THAT AREA.

BUT I COULD SPEAK ON THE MITIGATION IMPROVING HABITAT THAT IS IMPORTANT TO US WITH PRAIRIE CHICKENS, LESSER PRAIRIE CHICKENS ARE AS WE ALL KNOW RECENTLY LISTED AND THEIR HABITATS ARE VERY PARTICULAR AND VERY SENSITIVE SO PROBABLY INCREASING OR IMPLEMENTING RANGE LAND MANAGEMENT PRACTICES THAT WOULD BENEFIT LESSER PRAIRIE CHICKENS WOULD BE A GOOD MITIGATION STRATEGY.

>>Christy Johnson-Hughes: DO YOU WANT TO TALK A LITTLE BIT ABOUT WHAT CHAT MEANS.

THE PERSON WHO ASKED THE QUESTION KNOWS WHAT THAT MEAN, BUT COULD YOU DISCUSS THAT FURTHER.

>>Chad LeBeau: THE CHAT TOOL HAS BEEN DEVELOPED FOR A WHILE BUT IT'S RECENTLY BEEN IMPLEMENTED UNDER THE WESTERN AGENCY FISH AND WILDLIFE AND IT IS A TOOL TO CALCULATE IMPACTS OF THE DEVELOPMENT AND LESSER PRAIRIE CHICKEN HABITATS.

YOU HAVE DIFFERENT VARYING LEVELS OF DEGREE OF HABITAT FROM HIGH TO A LOW AND THE DISTURBANCES CALCULATED USING THIS TOOL AND THEN PROVIDING A MITIGATION CREDIT OR A COST OF DEVELOPING THIS AREA.

SO IT'S AN ONLINE TOOL THAT HAS BEEN RECENTLY IMPLEMENTED AND IT COULD BE VERY EFFECTIVE FOR CONSERVATION OF LESSER PRAIRIE CHICKENS.

>>Christy Johnson-Hughes: A CRUCIAL HABITAT ASSESSMENT TOOL AND I BELIEVE ALSO THE WESTERN GOVERNORS ASSOCIATION HAS A LINK

TO THAT AS WELL.

WE WILL PUT THAT LINK UP ON OUR RESOURCES WHEN WE PUT THIS BROADCAST ONTO OUR WEBSITE ALONG WITH ALL OF THE OTHER INFORMATION.

YOU WILL SEE A VARIETY OF LINKS.

WE'VE DONE THAT FOR PREVIOUS BROADCASTS AND WE CAN INCLUDE THE LINK TO THE CHAT AND THE WESTERN GOVERNORS ASSOCIATION AS WELL.

SO BACK TO THE QUESTIONS.

HOW WERE THE NATIONWIDE POPULATION NUMBERS ESTIMATED?

WALLY THAT IS FOR YOU.

>>Wally Erickson: I ASSUME THE QUESTION IS DIRECTED TOWARD POPULATION SIZE, NOT RELATED TO FATALITY NUMBERS.

WE USED AN EXISTING MODEL AND A DATABASE THAT ALLOWS YOU TO DO THIS.

THERE ARE PUBLICATIONS OUT THERE AND HOW TO APPLY THAT AND YOU CAN DO IT FOR BIOMES OR FOUR REGIONS OR FOUR STATES OR FOR THE NATION.

AND THAT'S WHAT WE ENDED UP USING.

>>Christy Johnson-Hughes: WHAT ARE BCRS.

>>Wally Erickson: BIRD CONSERVATION REGIONS.

>>Christy Johnson-Hughes: THANK YOU VERY MUCH.

GIVEN THAT GREATER SAGE GRASS ARE KNOWN TO BE STRONG FLIERS ARE YOU AWARE OF REPORTS OF MORTALITY TO THE SPECIES FROM WIND TURBINES TRACTS?

>>Cris Hein: ONE DOCUMENTED FATALITY, WE DON'T KNOW IF IT'S RELATED BUT IT WAS REPORT BACK IN THE '90s AND ESPECIALLY AT THIS FACILITY WITH INTENSIVE CARCASS SEARCHING AND WE DID NOT SEE ANY STRIKES AS A RESULT OF THE TURBINES.

SO WE'VE BEEN MONITORING AT THIS SITE SINCE INCEPTION, SINCE 2009 SO WE HAVE ABOUT SIX YEARS OF DATA.

>>Christy Johnson-Hughes: GREAT.

THANK YOU.

ALL RIGHT, ANOTHER QUESTION, ARE THERE FURTHER STUDIES BEING UNDERTAKEN AND ANY IDEA WHEN THEY MAY BECOME COMMERCIALY AVAILABLE?

CRIS, I WILL SEND THIS OVER TO YOU.

>>Cris Hein: GE HAS DEVELOPED THEIR OWN ACOUSTIC DETERRENT DEVICES THAT THEY BEGAN TESTING IN AN OPERATIONAL FACILITY LAST YEAR.

THEY PRESENTED THEIR ORIGINAL FINDINGS AT A CONFERENCE A MONTH AGO.

AS FAR AS WHEN ANY OF THESE DEVICES MIGHT BE COMMERCIALY AVAILABLE, I THINK FURTHER TESTING IS NEEDED.

GE IS GOING TO DO ANOTHER COUPLE OF YEARS FOR THEIR DEVICE AT

A FACILITY.

WE HAVE TO TEST OUR REDESIGNED DEVICE, AND THE MORE SITES WE DO THIS PER YEAR, THE FASTER IT WILL BECOME COMMERCIALY AVAILABLE ASSUMING IT'S EFFECTIVE AND MEET THE GOALS WE HAVE FOR IT.

WE ARE STILL A LITTLE BIT OFF FROM THAT.

WE NEED TO COLLECT MORE INFORMATION.

>>Christy Johnson-Hughes: OKAY THANK YOU.

OUTSIDE OF THE ACOUSTIC, WE ALSO MENTIONED TODAY THE US GEOLOGICAL SURVEY IS LOOKING AT OTHER TYPES OF DETERRENT DEVICES.

SO THERE MIGHT BE SOMETHING ELSE OUT THERE THAT INVOLVES THE LIGHTING SPECTRUM OR SOMETHING ELSE.

IN THIS CASE A UV TYPE SITUATIONS SO HOPEFULLY WE HAVE MORE PEOPLE WHO ARE INTERESTED IN EXAMINING THIS AND LOOKING FOR SOLUTIONS.

>>Cris Hein: ABSOLUTELY.

I THINK THE DOOR IS WIDE OPEN FOR DEVELOPING TECHNOLOGY TO HELP SOLVE THIS ISSUE.

>>Christy Johnson-Hughes: THANK YOU.

ANOTHER QUESTION, ALL RIGHT WALLY, THIS IS FOR YOU AGAIN.

IN AREAS OF CONCENTRATED NOCTURNAL MIGRATION, ARE YOU SEEING WIND COMPATIBLE WITH NOCTURNAL MIGRATION.

FOR EXAMPLE, WITH AVOIDING STAGING AREAS BE IMPORTANT AND WHAT AVOIDANCE MEASURES SHOULD BE PRUDENT IN SUCH AREAS?

>>Wally Erickson: THANK YOU, CHRISTY.

OUR ANALYSIS WAS A META-ANALYSIS LOOKING AT ALL SONGBIRD MORTALITY FROM EXISTING WIND FACILITIES.

I THINK IT'S IMPORTANT TO LOOK AT CITING CAN SITUATIONS FOR INDIVIDUAL PROJECTS AND TAKE INTO ACCOUNT STUDIES IN THE AREA RELATIVE TO WIND AND STILL USING THE GUIDANCE ON INVESTIGATING THE RESOURCES IN THE AREA, THE CONCERNS IN THE AREA AND DOING APPROPRIATE STUDIES TO MAKE SURE THE RISKS ARE LOW ENOUGH.

>>Christy Johnson-Hughes: WE HAVE NOT REALLY TALKED ABOUT THAT IN THIS PARTICULAR BROADCAST BECAUSE THAT IS PART OF THE TIERED APPROACH, THE CITING CONSIDERATIONS, PRECONSTRUCTION, THIS IS THE BROADER RESEARCH THAT WE ARE TALKING ABOUT IN THIS BROADCAST.

SO FOR FURTHER DISCUSSION ABOUT CITING CONSIDERATIONS, YOU CAN GO BACK TO ONE OF OUR PREVIOUS BROADCASTS OR LOOK AT THE SERVICES LAND-BASED WIND ENERGY GUIDELINES AND WE TALK ABOUT CITING IS VERY IMPORTANT AND CRITICAL FOR ALL THESE THINGS WE ARE TALKING ABOUT HERE.

GREAT, WE HAVE ANOTHER QUESTION.

HAS THERE BEEN ANY DISCUSSION ON THE BEST WAY TO IMPLEMENT ACOUSTIC DETERRENT FOR BATS?

FOR EXAMPLE, WHAT TRIGGERS WOULD NEED TO OCCUR FOR ACOUSTIC APPLICATIONS?

>>Wally Erickson: I WOULD RECOMMEND THESE DEVICES OPERATE WHEN THAT ARE ACTIVE SO THROUGHOUT THE ENTIRE SEASON DEPENDING ON LATITUDE AND SPECIES, ALL NIGHT LONG AND I DON'T THINK YOU HAVE TO TIME THIS WITH WEATHER CONDITIONS OR ANYTHING LIKE THAT.

AS MENTIONED BEFORE, THERE'S VERY LITTLE POWER DRAW FROM THESE THINGS SO THEY WILL NOT AFFECT OPERATIONS.

AND THE DECREASED WEAR AND TEAR YOU MAY WANT TO TAKE THIS AND IN THE WINTERTIME IF YOU ARE IN THE NORTHERN CLIMATE WHERE THERE MIGHT BE SNOW AND FREEZING RAIN AND THINGS LIKE THAT, BUT I WOULD THINK TO OPERATE THEM AT NIGHT WHEN BATS ARE ACTIVE WOULD BE APPROPRIATE.

>>Christy Johnson-Hughes: AGAIN THAT IS SOMETHING THAT WOULD BE WORKED OUT AS PART OF THE BEST MANAGEMENT PRACTICES SO THERE MIGHT BE SOME SPECIFICATIONS THAT THE FISH AND WILDLIFE SERVICE AND STATE WILDLIFE AGENCIES MAY DEVELOP IN COORDINATION WITH THE OPERATOR OF THE FACILITY FOR WHEN IT WOULD BE APPROPRIATE TO USE THE DEVICES AND WHAT TIME OF YEAR, FOR HOW LONG, ETC.

MAINTENANCE SCHEDULES AND THINGS LIKE THAT.

I WANT TO GO BACK TO A COUPLE OF THINGS WE DISCUSSED HERE THAT I THOUGHT WOULD BE OF INTEREST AND THE LARGER PICTURE PARTICULARLY ABOUT CUMULATIVE IMPACTS AND THE NEED FOR MORE META-ANALYSIS.

THE PROJECTS THAT WE HAVE BEEN TALKING ABOUT, SOME OF THEM ARE VERY SPECIFIC, THE ACOUSTIC DETERRENT PARTICULAR LOCATIONS, PARTICULAR TYPE OF DEVICE, EVEN WITH THE GROUSE DISCUSSION LOOKING AT A VERY SPECIFIC AREA, BUT WE ARE STARTING TO GET A LITTLE BROADER WITH THE USE OF SOME OF THIS INFORMATION.

WE ARE STARTING TO TAKE A LOOK AT THIS AT A MORE LANDSCAPE TYPE OF CONVERSATION AND I KNOW WALLY, YOU HAD MENTIONED PULLING OUT PATTERNS, AND CRIS, THE TWO OF YOU HAVE MENTIONED PULLING OUT PATTERNS FROM THESE LARGER SCALE STUDIES WHERE YOU TAKE A LOOK AT A VARIETY OF INDEPENDENT TYPES OF STUDIES AND THEN PUTTING THEM TO OTHER -- TOGETHER LOOKING FOR TRENDS.

COULD YOU TALK MORE ABOUT THAT AND I WILL HAND IT OVER TO CRIS AND THEN TO WALLY.

>>Cris Hein: AS YOU MENTIONED, WE ARE JUST NOW GETTING ENOUGH INFORMATION THAT'S AVAILABLE TO US TO LOOK AT THESE

LARGER LANDSCAPE LEVEL ANALYSES AS OPPOSED TO JUST FACILITY BY FACILITY.

SO I THINK WITH RESPECT TO BATS, WE HAVE A GOOD IDEA OF THE PATTERNS THAT FATALITIES OCCUR, LOW WIND CONDITIONS, WARMER NIGHTS AND IN ASSOCIATION WITH WEATHER FRONTS AND SO ONE. BUT WHAT ARE THE BROADER IMPACTS FOR A REGION ACROSS THE COUNTRY WOULD BE IMPORTANT TO LOOK AT WITH RESPECT TO BATS. AND AS WE ARE DOING THIS, WE DON'T HAVE THIS INFORMATION YET BUT AS WE ARE LOOKING AT THE CUMULATIVE IMPACTS, ALSO LOOKING AT WHAT ARE THESE POPULATIONS, DEVELOPING METHODS OF FINDING OUT HOW MANY BATS ARE OUT THERE ON THE LANDSCAPE IN A GIVEN AREA SO WE CAN PUT THIS ALL INTO CONTEXT.

>>Christy Johnson-Hughes: WALLY, DID YOU WANT TO --

>>Wally Erickson: I WOULD ADD THAT THESE TYPES OF STUDIES, IT'S GREAT THAT THE WIND INDUSTRY AND OTHER AGENCIES HAVE DEVELOPED THE GUIDELINES IN THESE DATA ARE AVAILABLE AND I THINK THERE IS A LOT OF INFORMATION WHEN YOU START PULLING INFORMATION, AND INDIVIDUAL STUDY CAN'T ANSWER ALL QUESTIONS BECAUSE THOSE FOLKS KNOW THAT WORK IN THE FIELD THERE'S LOTS OF UNCERTAINTIES ASSOCIATE WITH THE INDIVIDUAL STUDIES, BUT WE ARE STARTING TO SEE PATTERNS THAT ANALYSIS LIKE WE DID HERE, EXTENDING IT TO OTHER BIRD SPECIES, EXTENDING IT TO OTHER DATA SOURCES COMMUNICATION TOWER DATA AND INFORMATION ON OTHER BUILDINGS TO CONTRAST THE TWO AND COMPARE THEM AND I THINK WE WILL START TO HOPEFULLY DIRECT RESOURCES IN THE RIGHT DIRECTION.

I THINK -- WE'VE ALSO DONE THIS.

WE LOOKED AT THIS NATIONWIDE FOR SONGBIRDS, BUT WE ARE DOING ANALYSIS AND REGIONS.

THE SPECIFIC -- THE PACIFIC NORTHWEST WHERE THERE'S BEEN DEVELOPMENT WHAT ARE THE IMPACTS OF WIND AND OTHER THINGS ON RAPTORS OR BAT POPULATIONS AND THERE'S REAL VALUE IN THAT. AGAIN ONE STUDY BY ITSELF IS REALLY HARD TO MAKE A BROAD CONCLUSION.

>>Chad LeBeau: I'D LIKE TO ADD TO THAT WE ONLY HAVE TO STUDY LOCATIONS WHERE WERE ESTIMATING THE IMPACT OF WINDS AND PRAIRIE GRASS SO THERE NEEDS TO BE MORE RESEARCH AND FOR LONGER PERIODS TO TRY TO GET THE CUMULATIVE ASSESSMENT AND IT'S DIFFICULT TO FIND, BUT WE HOPE TO GET THERE.

>> I'D LIKE TO ADD PART OF THIS GOES BACK TO DISSEMINATION OF RESEARCH AND MAKING THIS DATA PUBLICLY AVAILABLE BUT ONE OF THE THINGS I'M LOOKING FORWARD TO IS THE DATABASE AND IF PEOPLE CAN START ENTERING IN DATA INTO THAT SYSTEM WHERE THERE IS A LEVEL OF CONFIDENTIALITY, WE WILL HAVE A RESOURCE WE CAN USE, A DATABASE FOR LARGE DATA SETS AND LOOK AT SOME

OF THESE LARGER ISSUES.

>>Christy Johnson-Hughes: THAT IS THE AMERICAN WAY AND WILDLIFE INSTITUTE.

AND THEY ARE IN THE PROCESS OF DEVELOPING A DATABASE.

THEY HAVE THE LANDSCAPE DATABASE TOOL, BUT THEY ARE IN THE PROCESS OF DEVELOPING A DATABASE WHICH INDUSTRY CAN ENTER DATA INTO AND HELP US TO IDENTIFY TRENDS AND GATHER SOME OF THAT CUMULATIVE INFORMATION.

I AGREE, I THINK THAT WILL BE A GREAT TOOL AND WALLY, DID YOU HAVE ANYTHING?

>>Wally Erickson: I THINK THOSE SORT OF ANALYSES WHAT THEY HOPEFULLY DO IS FOCUS THE QUESTIONS AND I TALKED A LOT ABOUT SONGBIRDS TODAY AND IN THIS ANALYSIS OR AN ANALYSIS OF AWWI DATA CAN CHECK OFF THOSE QUESTIONS WITH ANSWERS ON ON WE COULD AGAIN FOCUS ON THINGS LIKE BATS AND RAPTORS AND THINGS WE HAVE LESS CERTAINTY ON OR MORE CONCERN OVER AND NOT TO SAY WE STILL WON'T HAVE INFORMATION.

WE HAVE A LOT OF INFORMATION ON THE IMPACT THAT IT MIGHT TAKE LIMITED RESOURCES TO DO THE MONITORING OF RESOURCE WITH THESE OTHER THINGS.

>>Christy Johnson-Hughes: THAT'S AN INTERESTING POINT AND A LOT OF PEOPLE WANT EVERY SINGLE DATA POINT FOR EVERY SINGLE SPECIES OUT THERE.

AND IT IS DIFFICULT TO DO AT THIS POINT IN TIME BECAUSE THERE IS A COST ASSOCIATED WITH IT AND AS CRIS MENTIONED AS WELL, THERE IS ALWAYS THAT RISK AS WELL AS COST THAT THE WIND OWNER, OPERATOR HAS TO CONSIDER.

THE MORE INFORMATION WE HAVE WE CAN REDUCE THE RISK, BUT THE COST TO GET THAT INFORMATION SO HOW CAN WE BEST USE THOSE RESOURCES AVAILABLE TO DO THE PRE- AND POST- CONSTRUCTION AND FOCUS THEM WHERE THEY ARE NEEDED SO WE GAIN THE UNDERSTANDING WHERE WE HAVE THE GREATEST RISK.

SO I THINK THAT'S A VERY IMPORTANT QUESTION THERE.

ANOTHER THING WE WANTED TO TOUCH ON BRIEFLY WAS WHERE IS THE RESEARCH LEADING US?

SO WE HAVE SOME INFORMATION OUT THERE AND CHAD, YOU MENTIONED ALREADY, THERE IS RESEARCH OUT THERE AND I KNOW FISH AND WILDLIFE SERVICE AND USGS AND TO VARIOUS GROUPS TO TRY AND FIGURE OUT WHAT OUR RESEARCH NEEDS ARE BUT FOR THIS GROUP, WHAT WOULD YOU SEE AND HOW WOULD YOU SEE MOVING FORWARD WITH THE RESEARCH RIGHT NOW?

CHAD, DO YOU HAVE ANY THOUGHTS?

YOU MENTIONED A COUPLE ALREADY BUT WHERE WOULD YOU LIKE TO GO WITH THE RESEARCH RIGHT NOW.

>>Chad LeBeau: PERSONALLY, LOOKING AT WHAT IS AFFECTING SAGE

GROUSE, WE ARE SEEING IN DECREASED SURVIVAL AT THIS FACILITY SO WHETHER IT'S DIFFERENT TYPES OF PREY OR WE NEED TO KNOW WHAT IS DRIVING THIS SITUATION AND IF WE START INVESTIGATING SOME OF THESE PREDATOR/PREY MECHANISMS, WE MIGHT BE ABLE TO GET THAT MITIGATION MEASURES FOR WIND DEVELOPMENT HABITAT AND ADDITIONAL STUDIES WOULD ALSO BENEFIT, AGAIN THIS IS ONE INSTANCE.

WE COULD GO DOWN THE ROAD AND HAVE A DIFFERENT DYNAMIC OF WHAT IS GOING ON AND THE STUDY OF THE GREATER PRAIRIE CHICKEN WAS VALUABLE AND IT WAS A BEFORE AND AFTER CONTROL DESIGNED SO WE HAVE THE KNOWLEDGE THEY WILL BE IN PLACE PRIOR WE CAN GO OUT THERE AND COLLECT DATA PRIOR TO DEVELOPMENT AND ASSESS CHANGES POST- CONSTRUCTION, WHICH IS REALLY VALUABLE IN THE RESEARCH NEEDS SO I GUESS MULTIPLE STUDIES AND PREDATOR/PREY MECHANISMS.

>>Christy Johnson-Hughes: THANK YOU.
CRIS, WHAT ABOUT YOU?

>>Cris Hein: WITH RESPECT TO MINIMIZATION STRATEGIES WE LOOK AT OPERATIONAL MINIMIZATION WE HAVE A GOOD HANDLE OF JUST LOOKING AT WIND SPEED AND HOW IT CAN REDUCE BY CHANGING THAT AND REDUCE FATALITIES.

WE NEED TO TAKE PREDICTIVE MODELS AND TEST THOSE SO YOU ARE AT A SITE, YOU LOOKED AT YOUR FATALITY IN COME UP WITH SOME MODELS BASED ON WEATHER CONDITIONS AND WHEN YOU MIGHT PREDICT THAT FATALITIES, TEST THAT WITH SHUTTING OFF TURBINES OR RAISING CUT IN FEEDS UNDER THOSE CONDITIONS AT INCORPORATING THE OTHER VARIABLES WE TALKED ABOUT WOULD BE HELPFUL AND WITH RESPECT TO DETERRENCE THAT'S IN ITS INFANCY RIGHT NOW SO THERE'S A LOT OF ROOM TO MOVE ON THAT. THESE FREQUENCY PATTERNS THAT I TALKED ABOUT AS OPPOSED TO A BROADBAND FREQUENCY, WHERE TO PLACE THESE ON THE TURBINES, DO WE NEED TO HAVE THEM ON THE CELL OR THE TOWER AS WELL, CAN WE MOVE THESE DEVICES OUT ON THE BLADES? THAT WILL BE INTERESTING TO SEE IF THE TECHNOLOGY ADVANCES THAT FAR.

>>Christy Johnson-Hughes: WALLY, WHAT ABOUT WHAT YOU SEE?

>>Wally Erickson: A COUPLE OF AREAS THAT NEED SOME WORK OR SOME SHIFTING IS ON POST- CONSTRUCTION MONITORING. WE TEND TO TAKE THE SHOTGUN APPROACH SOMETIME SOMEONE TO ANSWER IT ALL WITH THE MONITORING PLAN. BUT IF STUDIES LIKE THIS ONE RELATIVE TO SONGBIRDS MAY BE IN REGIONS WHERE WE HAVE A LOT OF INFORMATION, NOT NECESSARILY NEEDING TO COME UP WITH PRECISE ESTIMATE OF SONGBIRDS MORTALITY AND BEING ABLE TO DESIGN AN OPTIMUM MONITORING PLAN FOR THE RAPTORS THAT ARE CONCERNED IN THE AREA OR BATS

AND GETTING AWAY FROM TRYING TO DO IT ALL WITH THE MONITORING PLAN AND DEVELOP A MORE IDEAL MONITORING PLAN FOR RAPTORS AND BATS WOULD BE ONE THING.

ANOTHER THING WITH THE AWWI RESEARCH AND INFORMATION SYSTEM OR OTHER THINGS TO LOOK AT DATA HOLISTICALLY, I THINK WE CAN START TO GAIN SOME PATTERNS ON HOW BEST TO MICRO- SITE TURBINES, HOW BEST TO CITE TURBINES.

YOU START TO SEE A LOT OF THESE STUDIES MAY NOT HAVE INDIVIDUAL PROJECTS MAY NOT HAVE A LOT OF INDIVIDUAL MORTALITY OF SPECIES BUT IF YOU START TO SEE PATTERNS ACROSS MULTIPLE STUDIES ON WHERE FATALITIES ARE OCCURRING, WE MIGHT BE ABLE TO USE THAT INFORMATION TO HELP INCITING, A MICRO- CITING AND MACRO CITING.

>>Christy Johnson-Hughes: THAT'S VERY USEFUL.

AND ONE THING I KNOW I HAVE HEARD IN THE PAST IS ABOUT BEHAVIOR AND THAT IS SOMETHING THAT WE ARE STILL LEARNING A GREAT DEAL ABOUT.

I DON'T KNOW THAT WE HAVE REACHED ANY SORT OF FINAL IDEA OF WHY BATS ARE GOING TOWARD TURBINES.

BUT ANY THOUGHTS ON THAT BEHAVIOR RESEARCH AT THIS POINT?

>>Cris Hein: USGS HAS REALLY TAKEN THE LEAD ON THIS LATELY AND USING DIFFERENT TYPES OF THERMAL IMAGING.

AND WE ARE SEEING INDICATIONS THAT BATS ARE ATTRACTED TO THE TURBINES OR CHANGING THEIR FLIGHT PATTERNS TOWARD THE TURBINES AT LEAST ON A SMALL-SCALE AND WE ARE SEEING PATTERNS OF HOW THEY MIGHT BE APPROACHING.

SO IF WE LOOK AT REAL-TIME DATA OF BATS INTERACTING WE GET MORE SPECIFIC INFORMATION ON THE CONDITIONS IN WHICH THEY ARE AROUND THE TURBINES AND COLLIDE WITH THE TURBINES WHICH WILL HELP MINIMIZATION STRATEGIES.

AND WHERE THEY ARE INTERACTING WITH THE TURBINES WILL DETERMINE PLACEMENT.

SO THESE CAMERAS ARE GREAT.

THEY PROVIDE A LOT OF INSIGHT BUT IT'S STILL VERY DIFFICULT TO TRACK A 10-GRAM ANIMAL FROM 100 METERS AWAY WHERE YOU POSITION THESE CAMERAS SO THEY ARE USEFUL TOOLS AND I LOOK FORWARD TO THE TECHNOLOGY ADVANCING IN HELPING US OUT FOR FUTURE RESEARCH.

>>Christy Johnson-Hughes: THANK YOU.

WE ARE NEARING THE END OF OUR WIND ENERGY BROADCAST AND I WOULD LIKE TO THANK EVERYONE FOR JOINING US AND AS YOU KNOW, WE WILL BE PLACING THIS INFORMATION, THESE PRESENTATIONS AS WELL AS OUR BASIC LEARNING POINTS AND REFERENCES ON THE FISH AND WILDLIFE SERVICE WIND ENERGY PAGE AND IT TAKES US A LITTLE WHILE TO GET THIS ALL POSTED SO WE WILL GET THAT TO YOU AS

SOON AS POSSIBLE.
THANK YOU VERY MUCH.

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