

The Road to Recovery for the western Yellow-billed Cuckoo presented by Peter Marra

The 2019 Science paper on the decline of the North American avifauna represented a watershed moment in bird conservation. Bringing back the abundance and safeguarding the diversity of the North American avifauna will require a coordinated, strategic, and deliberate effort in both science and conservation action. One of the game-changing opportunities that has emerged in bird conservation today is provided by advances in ornithological science, especially technological and methodological advances that enable us to determine the specific causes of population declines. This needs to happen on a species-by-species basis – because even species in the same habitat have different biology and are under different threats throughout their annual cycle. Even within a single species, sub-populations that are linked across the full annual cycle may be limited by different demographic rates or during different times of year. Here, I will describe the systematic approach for recovering North America's birds we have developed and outline the process for advancing species towards population recovery.

Pete Marra earned a Ph.D. from Dartmouth College in 1998 and an M.S. from Louisiana State University in 1989 and is Director of the Georgetown Environmental Initiative, Laudato Si' Professor in Biology and the Environment, and Professor in the McCourt School of Public Policy. Marra recently moved to Georgetown University after a 20-year career at the Smithsonian Institution, most recently as Director of the Migratory Bird Center.



Pete's research in conservation ecology is both fundamental and applied, and emphasizes connecting events throughout the annual and life cycles of animals to understand how complex interactions drive the ecology, evolution and conservation of species. Marra has authored over 250 papers including a recent widely-discussed study in Science magazine on the loss of nearly one third of bird populations (2.9 billion birds) in North America over the last 50 years. Marra also co-edited the frequently cited book, Birds of Two Worlds, and recently published a second book, Cat Wars: The Devastating Consequences of Cuddly Killer.

USFWS ESA status of the western Yellow-billed Cuckoo presented by Jenny Davis and Meaghan Conway, US Fish and Wildlife Service

Following the finalization of western Yellow-billed Cuckoo critical habitat in May 2021, the USFWS is launching a Species Status Assessment (SSA) for the cuckoo in late fall 2021 as one of the first steps in the recovery planning and implementation process. The goal of the SSA is to summarize data on the species' life history, habitat needs, threats, historical and current population status, and to project future population viability. The information and analyses included in the SSA will provide a valuable tool for developing and prioritizing conservation and management strategies and setting criteria for species recovery. Following the SSA, the Service will begin work on a Recovery Plan that will provide a path to achieving recovery. Recovery plans are unique to each species and serve as central organizing tools that provide important guidance on methods of minimizing threats to listed species, such as restoring and acquiring habitat, removing introduced predators or invasive species, conducting surveys, monitoring individual populations, and breeding species in captivity and releasing them into their historical range. Recovery plans identify measurable and objective criteria against which progress toward recovery of a species can be tracked over time.

Meaghan Conway is the national lead biologist and Jennifer Davis is the New Mexico lead biologist for the western Yellow-billed Cuckoo for the U.S. Fish and Wildlife Service.

Lower Colorado River restoration – Ch-ch-change is good for Yellow-billed Cuckoos on the lower Colorado River by Barbara Raulston presented by Cari Lynn Squibb

The western distinct population of the Yellow-billed Cuckoo (*Coccyzus americanus*) is most often associated in the literature with riparian habitat consisting of mature cottonwood (*Populus* spp.) and willow (*Salix* spp.). Prior to dam construction and other development, riparian forests within such a dynamic system as the lower Colorado River (LCR) would have been a mosaic of tree ages and sizes. These large, naturally established forests have disappeared on the LCR. In the mid-2000s the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) began large-scale planting of cottonwood (*P. fremontii*), willow (*S. gooddingii*, *S. exigua*) and mesquite (*Prosopis glandulosa*), mainly through conversion of agricultural fields. Between 10-100 ha are planted each year at multiple sites. Cuckoos move into newly planted phases within the first 1-3 years after planting. As trees age, detections of cuckoos decline in the older stands and increase in more recent plantings. We encourage others to look at stand age and structure during surveys and monitoring of

cuckoos. Understanding this relationship can guide habitat management in systems where flooding and scouring processes are absent.

Cari Lynn first became passionate about ornithology during her childhood in rural southwest Virginia. She went on to earn B.S. degrees in Wildlife Science and Biological Sciences from Virginia Tech in 2012. She first worked for SSRS in 2013 on the LCR YBCU project and wound up returning for nearly every field season thereafter. After years of fieldwork in Hawaii, she transitioned to working on the LCR YBCU project full-time as a data steward and field supervisor in 2020.



Western Yellow-billed Cuckoo habitat use on the middle Rio Grande, New Mexico presented by Kristen G. Dillon

Over 100 Yellow-billed Cuckoo territories are documented annually in the Middle Rio Grande floodplain between Los Lunas, NM and Elephant Butte Dam. The riparian habitat in this 130-river-mile corridor varies considerably in size, structure, composition, and surrounding land use. Likewise, cuckoo territories are unevenly distributed throughout the river corridor. We combined radio telemetry, presence/absence survey, and vegetation mapping data to analyze the characteristics of occupied vs. unoccupied cuckoo habitat and develop a set of minimum suitable habitat requirements. We found consistent trends in some territory characteristics that suggested a set of general basic requirements, as well as variation in other characteristics that suggested availability-dependent flexibility in more specific habitat characteristics.

Kristen is a Biologist with the Bureau of Reclamation's Technical Service Center in Denver, CO. Her team researches and monitors Threatened and Endangered riparian-breeding avian species and their habitat on behalf of the Bureau of Reclamation's Albuquerque Area Office and other partners in New Mexico.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) habitat use in the lower Rio Grande, New Mexico by S. David Moore

The Lower Rio Grande floodplain between Elephant Butte Dam in New Mexico and El Paso, Texas has produced an annual average of 24 Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*, hereafter YBCU) territories since surveys began in 2014. Riparian habitat in this river reach can be classified into two different types. Habitat in the Caballo Reservoir delta, where the greatest proportion of territories is annually located, is expansive, primarily native, and relatively unmanaged. The other class of

riparian habitat, located downstream of Caballo Dam, is narrow, linear, less native, and heavily managed. Through a combination of survey detections, territory delineation, nest locations, and habitat mapping, we are able to determine use versus non-use of habitat in both sections of the Lower Rio Grande. Habitat utilized by YBCUs in the Caballo delta is similar to that used in occupied reaches of the Middle Rio Grande – large expanses of native mid-aged Goodding’s willow (*Salix gooddingii*) with a native dominated understory. Downstream of Caballo, habitat is very atypical of occupied Rio Grande YBCU habitat. It is comprised of smaller, narrower strips of habitat dominated by a mix of coyote willow (*Salix exigua*), saltcedar (*Tamarix* sp.), mesquite (*Prosopis* sp.), and other less common native and non-native riparian species. This habitat type is likely utilized out of necessity versus preference and should not be a goal of YBCU-oriented habitat restoration.

Dave is a Biologist with the Bureau of Reclamation’s Technical Service Center in Denver, CO. His team researches and monitors Threatened and Endangered riparian-breeding avian species and their habitat on behalf of the Bureau of Reclamation’s Albuquerque Area Office and other partners in New Mexico.

Restoration guidelines for western Yellow-billed Cuckoos presented by Patti Wohner. *Coauthors Steve Laymon, Jenna Stanek, Sammy King, and Robert Cooper* Although varying hypotheses exist for recent cuckoo decline, alternative management practices have not been sufficiently explored to rule out breeding ground habitat quality as a major contributing factor. In the absence of flooding and gap-forming disturbance, planted forests often senesce without further young tree recruitment. Therefore, local habitat-scale features may be missing in landscapes of predominantly mature riparian forest that may need to be specifically managed for nesting. Few intensive Cuckoo datasets exist to test hypotheses about nesting habitat quality due to extremely low populations in the remaining occupied sites. Therefore, we used historical (1986–1996) datasets from the South Fork Kern River Valley, CA to identify important nest site features that may be missing in current riparian forests. We found that increased canopy cover and vertical structure at all levels in the canopy greatly increased the probability of Cuckoo nesting. With smaller estimated effect sizes, the probability of Cuckoo nesting increased with increasing willows and forbs and smaller mean tree dbh. Cuckoos selected plots with disproportionately high percent willow cover relative to availability plots regardless of whether sites had low or high percent willow available. Overall 17-day nest success was high (0.86, LCI = 0.71, UCI = 0.93). In the absence of natural processes that create early successional stage forest, specific management for early successional stage forest is needed to increase the probability of Cuckoo nesting and nest productivity. We provide ideas for restoring mature forest with little vertical structure.

Patti Wohner is a post-doctoral researcher in the Fisheries and Wildlife department at Oregon State University in Corvallis, Oregon where she is focusing on conservation decision analysis via modeling and structured decision making. While she is currently working with endangered fish in the Central Valley of California, she has spent numerous years working on threatened and endangered bird species dependent on riparian dynamics. Patti developed a passion for the recovery of western Yellow-billed Cuckoos while working as a restoration manager in the Kern River Valley of California. She left her heart there in an upland field with a damaged irrigation pump. Patti earned her PhD from the Warnell School of Forestry at the University of Georgia where she studied Rusty Blackbird habitat use during breeding and wintering. She believes conservation research should be focused on answering questions that will result in specific guidelines for species recovery.



Identifying and restoring vital fueling stops for globe-trotting cuckoos – tales from South America presented by Nick Bayly

Yellow-billed and Black-billed Cuckoos undergo one of the longest migrations of all Neotropical migratory birds and where they spend the non-breeding period has been consistently misunderstood for decades. Even less well known is where these species attain the resources to fuel their marathon migrations and the role these “stopovers” might play in averting or contributing to population declines. The Neotropical Flyways project set out to answer these questions by combining broadscale occupancy surveys across five Neotropical countries with intensive studies in focal regions. Remarkable abundances of Yellow-billed Cuckoos were discovered in dry and transitional tropical forest in the Caribbean lowlands of Colombia, where stopovers last up to 16 days based on automated telemetry with Motus technology. Estimated flight ranges suggested some birds could fly direct to North America on leaving stopover sites. Worryingly, around 92% of the dry forest habitat in this region has been lost and urgent efforts are required to restore and enhance critical habitat. To this end, a restoration project was initiated in 2019 and has resulted in the planting of over 8,000, with a special focus on trees sustaining high foraging rates in cuckoos. In a parallel effort, a spring stopover site was identified for Black-billed Cuckoos in south-western Ecuador in spring 2021.

Nick is a founding member of the Colombian NGO SELVA, where he has led a successfully migratory bird research program over the last 12 years. He has worked on a wide range of species, including Gray-cheeked Thrushes, Blackpoll Warblers and Canada Warblers, to name a few, and under SELVA’s flagship project, the Neotropical

Flyways project, he has designed and led studies on stopover use by Yellow-billed and Black-billed Cuckoos in South America. Nick has trained teams of biologists throughout Central America and Colombia, and currently manages several conservation projects aimed at creating and enhancing habitat for migratory birds in priority regions of Colombia.



Western Yellow-billed Cuckoo nest-site selection and nest success in restored and natural riparian forests presented by Jenna Stanek. Coauthors include Shannon McNeil, Diane Tracy, John Stanek, Jeff Manning, and Murrelet Halterman

The western distinct population segment of Yellow-billed Cuckoo has been extirpated from most of its former breeding range in the United States largely due to widespread loss and degradation of riparian cottonwood-willow forests. Restoration and management of breeding habitat is important to the recovery of this federally threatened species, and identification of high-quality breeding habitat can help improve the success of recovery. In 2005, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was established to maintain and create wildlife habitat within the historical floodplain of the lower Colorado River (LCR) for federally endangered and threatened species, including western cuckoos. We conducted an empirical, multi-scale field investigation from 2008–2012 to identify habitat characteristics selected by nesting western cuckoos along the LCR. Results revealed that western cuckoos selected nest-sites characterized by increased densities of small native, early successional trees measuring 8–23 cm diameter at breast height (dbh), and lower diurnal temperature compared to available habitat in both restoration and natural forests. Nesting cuckoos selected sites with increased percent canopy closure, which was also important for nest success in restoration sites along the LCR. Our results show habitat components selected by nesting western cuckoos in restoration and natural riparian forests and can help guide the creation, enhancement, and management of riparian forests with desired habitat conditions necessary to promote nesting of this federally threatened species.

Jenna has worked as an Ecologist with the Environmental Protection and Compliance Division for the Los Alamos National Laboratory since 2018. Prior to that she worked as a Wildlife Biologist for the Southern Sierra Research Station for 8 years. She earned her M.S. in Wildlife and Fisheries Biology from Clemson University, a B.S. in Biology and Ecology from Western State Colorado University, and a B.A. in Environmental Policy and Spanish at Albright College. She has worked on an assortment of projects for various special status species including Yellow-billed Cuckoos.



Cicadas and Yellow-billed Cuckoos in restored and natural riparian forests presented by John Stanek. *Coauthors include Shannon McNeil, Diane Tracy, Jenna Stanek, Eli Rose, and Murrelet Halterman*

Resource availability, in particular food availability, factors highly in affecting the distribution of all species. Knowledge of a species' food resources is invaluable to conservation biologists; it is a vital yardstick to understand a species current habitat use and future use under a changing environment. Research in the lower Colorado River (LCR) region has uncovered cursory relationships between Yellow-billed Cuckoos and Apache cicadas (*Diceroprocta apache*). Similar to observations by Rosenberg et al. (1982) we saw that cuckoo fledging is timed to the temporal peak in cicada abundance, and research conducted by SSRS revealed relationships between cicada abundance and the number of cuckoo survey detections and estimated pairs at a site. However, these cuckoo-cicada relationships are apparent at natural areas only and were not observed at LCR restoration sites, indicating that Cuckoos are dependent on other large invertebrate prey.



John is a wildlife biologist with the Southern Sierra Research Station (SSRS). He earned his Master's degree from the University of Wyoming in 2009 researching rosy-finches in Colorado. His SSRS work has focused on Yellow-billed Cuckoos and desert avian communities in southern California and Arizona, and more recently Pinyon Jays and PJ Woodland communities in New Mexico.

Songs of Yellow-billed Cuckoos presented by Shannon McNeil

Who coos, and why? are questions about Yellow-billed Cuckoos that have puzzled many of us for years. More than a decade of banding, resighting, and nest monitoring of cuckoos on the lower Colorado River and South Fork Kern River has shed more light on the unusual mating system of this species.

After many seasons surveying for cuckoos, I spent 12 long, hot years monitoring the response of cuckoos to riparian forest restoration on the lower Colorado River. I am now an Environmental Scientist for California State Parks – Colorado Desert District, where my focus has shifted to other critters such as least Bell's vireos and flat-tailed horned lizards, but my heart remains with the cuckoos.



Identifying western Yellow-billed Cuckoo breeding habitat with a dual modelling approach presented by Matthew J. Johnson. Coauthors include James R. Hatten, Jennifer A. Holmes, and Patrick B. Shafroth

Yellow-billed cuckoo conservation efforts require the identification of features and area requirements associated with high quality, riparian forest habitat at spatial scales that range from nest microhabitat to landscape, as well as lower-suitability areas that can be enhanced or restored. Spatially explicit models inform conservation efforts by increasing ecological understanding of a target species, especially at landscape scales. Previous, Yellow-billed Cuckoo modelling efforts derived plant-community maps from aerial photography, an expensive and oftentimes inconsistent approach. Satellite models can remotely map vegetation features (e.g., vegetation density, heterogeneity in vegetation density or structure) across large areas with near perfect repeatability, but they usually cannot identify plant communities. We used aerial photos and satellite imagery, and a hierarchical spatial scale approach, to identify Yellow-billed Cuckoo breeding habitat along the lower Colorado River and its tributaries. Aerial-photo and satellite models identified several key features associated with Yellow-billed Cuckoo breeding locations: (1) a 4.5 ha core area of dense cottonwood-willow vegetation, (2) a large native, heterogeneously dense forest (72 ha) around the core area, and (3) moderately rough topography. The odds of Yellow-billed Cuckoo occurrence decreased rapidly as the amount of tamarisk cover increased or when cottonwood-willow vegetation was limited. We achieved model accuracies of 75 - 80% in the project area the following year after updating the imagery and location data. The two model types had very similar probability maps, largely predicting the same areas as high quality habitat. While each model provided unique information, a dual-modelling approach provided a more

complete picture of Yellow-billed Cuckoo habitat requirements and will be useful for management and conservation activities.

Matt is a Senior Research Associate with the Colorado Plateau Research Station in Flagstaff, AZ. Matt earned his Master's of Science in Biology from Northern Arizona University with an emphasis in avian ecology. He has 30 years of experience studying of avian populations and behavior. His primary research interests include avian ecology, avian inventory, population monitoring, and population studies of at-risk species (Southwestern Willow Flycatcher, Yellow-billed Cuckoo, Common Black-hawk and, Mexican Spotted Owl and Gray Hawk). The majority of his work has concentrated on studies of riparian bird populations and communities in relation to habitat along the lower Colorado River, San Pedro, Virgin, Gila and Verde Rivers. Most recently, Matthew has been studying the tamarisk leaf beetle and the effects this biocontrol agent may have on avian populations.



Yellow-billed Cuckoo surveys and research in Idaho presented by Stephanie Coates

At a northern limit to their range, Idaho is home to a small number of migrating and potentially breeding Yellow-billed Cuckoos. The Intermountain Bird Observatory (IBO) has conducted cuckoo surveys across riparian habitat for the last five years, focused on Designated Critical Habitat, locations with historic cuckoo detections, and other habitat that may be suitable for cuckoos. Our efforts are coordinated with sponsoring agencies (Idaho Department of Fish and Game and the Bureau of Land Management) and their information needs, as well as with other organizations and entities including the Shoshone-Bannock Tribe. Our results suggest an estimated state population of less than 20 individuals during a given season, with fluctuations in the number of estimated breeding pairs vs. migrating or dispersing individuals. Some implementations of cuckoo research, including habitat restoration, is underway, and there is further potential as habitat association models are tuned to data collected in Idaho. To better understand cuckoo ecology in Idaho, we see a need for long-term surveys, assessment of habitat adjacent to riparian corridors, prey surveys, and coordinated monitoring at a broader, regional scale.

Stephanie is a Research Biologist and Yellow-billed Cuckoo project lead at the Intermountain Bird Observatory. For the last three years, she has led IBO's research surveying for cuckoos, collecting habitat data, and developing pilot projects to enhance the project and cuckoo



conservation. She co-leads Idaho's USFWS-sanctioned Yellow-billed Cuckoo Survey Training, and coordinates field efforts with collaborators, sponsors, and other organizations. She is always learning more about the dynamic world of cuckoos.

Factors affecting detection of western Yellow-billed Cuckoos during standardized surveys presented by John Stanek

The western yellow-billed cuckoo (*Coccyzus americanus*) population has declined dramatically over the past century following extensive riparian habitat loss. Identifying causes of decline and evaluating habitat management actions requires accurate estimates of cuckoo abundance and population trends. Yet, cuckoos are notoriously difficult to monitor. They are furtive by nature, call infrequently, and often evade detection. Surveyors use call broadcasts to increase cuckoo detection probability. At the fine spatial scale of the survey point, we used logistic regression mixed effects models to evaluate factors that could potentially affect the probability of a cuckoo to respond to broadcast calls and of a surveyor to detect responsive cuckoos. Cuckoo response probability was inversely related to surveyor distance and affected by breeding stage. The probability to detect a cuckoo was affected by distance, and response type. Second, at the habitat patch scale, we examined factors that could potentially affect the probability of detecting breeding cuckoos within the habitat patch. Cuckoo detection was highest during the nesting period and increased with density and asynchronous breeding. At habitat patches with nesting cuckoos, on average, cuckoos were detected on three of the five survey visits. The results of this study can aid in future survey design. While additional data from other regions are needed, it appears that optimal timing of surveys may vary with regional differences in breeding phenology.

Development and assessment of targeted signal classifiers for passive acoustic monitoring of birds presented by Nick Beauregard. Coauthor Dr. Tad Theimer

In recent years, passive acoustic monitoring of avian species using autonomous recording units (ARUs) has gained considerable popularity among wildlife researchers and managers. Rapid advances in recording and data storage technology allow for the collection of large acoustic dataset, and several software programs and packages have been developed for semi-automated data processing and classification of target signals and vocalizations. However, software "classifiers" have shown mixed results across species and processing programs, often with high rates of false negative and false positive detections. Moreover, major inconsistencies between studies in the data and metrics used to assess classifier performance hinder effective comparison between studies. For species that are rare or vocalize infrequently, such lack of appropriate guidance literature can prevent the effective application of ARU monitoring methods. We reviewed the literature on a popular acoustic analysis program (Kaleidoscope Pro) to evaluate the methods used to develop, test, and assess single-species classifiers, and to synthesize key classifier

metrics necessary for meaningful classifier assessment. We then apply the findings of our review to demonstrate a methodical approach for the development of a classifier for the federally threatened Western Yellow-billed Cuckoo, a cryptic species with low vocalization rates. Results of our review show little consistency in classifier development and highlight potential consequences of using inappropriate methods for calculating performance metrics. Results of our classifier demonstration suggest targeted signal parameters and multiple classifier training iterations increase both precision and recall. We provide general recommendations for future studies using single-species classifiers.

Verification and extent of breeding by Yellow-billed Cuckoos outside of mature cottonwood-willow habitat in southeastern Arizona presented by Nick Beauregard.

Coauthor Dr. Tad Theimer

The federally threatened western distinct population segment (DPS) of the Yellow-billed Cuckoo has experienced significant population declines due to altered hydrology and loss of riparian habitat. Typically considered riparian obligate, recent surveys in southeast Arizona have documented cuckoos using xero- and non-riparian habitat in ephemeral and intermittent drainages. This habitat typically experiences short bursts of monsoon-influenced productivity which may briefly provide suitable conditions for nesting. However, breeding status and geographic extent of such habitat use has not yet been thoroughly evaluated. We conducted intensive nest searching to test whether data collected using existing survey protocols accurately reflect actual occupancy and breeding status within a subset of field sites. We then compiled previously collected survey data to produce a new map of regional distribution and to evaluate patterns in inter-annual variation in occupancy. Our results confirmed widespread breeding in ephemeral and intermittent drainages dominated by xero- and non-riparian habitat and indicate high confidence in existing survey protocol methods for estimating site occupancy. However, high inter-annual variation in occupancy suggests some sites may not be consistently occupied and geographic gaps in survey data prevent broader evaluation of distribution. These results are consistent with the hypothesis that monsoon-induced productivity may influence cuckoo occupancy in non-riparian habitat, but additional research is needed to further investigate this relationship. We discuss management and conservation implications and present recommendations for future surveys and habitat modeling efforts.

Nick is a PhD student at Northern Arizona University in Flagstaff AZ. His dissertation research focuses on the Western Yellow-billed Cuckoo in southeastern Arizona, using autonomous recording units, habitat modeling, and intensive survey efforts to develop new conservation and research applications. In collaboration with multiple federal and state agencies, non-profits, and community scientist volunteers, his research has provided new insights into cuckoo distribution and habitat use in Arizona, with implications for species recovery efforts. Nick's research and conservation interests stem from his passions for outdoor pursuits such as birding, fly fishing, river rafting, and backpacking.



Tracking Cuckoos: Determining when and where populations are limited across the annual cycle presented by Dr. Calandra Stanley.

Yellow-billed Cuckoo populations are declining across the species' range but where and when we should prioritize conservation efforts remains unknown. To identify the factors causing population decline we deployed satellite transmitters across eight breeding range to identify (1) linked populations and (2) at which points in the annual cycle linked populations are limited. By integrating data collected from satellite transmitters, broad-scale monitoring projects and remote sensing data we hope to identify the limiting factors driving population declines for Yellow-billed Cuckoos across their range. I will share preliminary results assessing range-wide migratory connectivity and differences in migratory movements between eastern and western Yellow-billed Cuckoo populations.

Calandra Stanley, Ph.D. is a postdoctoral researcher at Georgetown University. Her research focuses on the behavioral ecology and conservation of migratory birds and aims to understand how migratory birds interact with their environment throughout their annual cycle. She earned her BSc and MSc in biology from York University, Canada, and her Ph.D. in biological sciences at the University of Maryland, College Park. Her graduate research focused on studying the non-breeding ecology of Wood Thrush. For her postdoctoral research she is using satellite transmitters to better understand the full-annual cycle ecology of Yellow-billed Cuckoos.



Habitat and conservation status of migration stopover sites and wintering grounds of western Yellow-billed Cuckoos revealed by GPS and satellite tags presented by Diane Tracy.

Recent developments in tracking technology have begun to reveal the migratory movements of western cuckoos through Central and South America to their wintering grounds in Argentina, Bolivia, and Paraguay. Through ground truthing and Google Earth we identify habitat types outside the breeding grounds, as well as their conservation status.

Diane has worked with Yellow-billed Cuckoos since 2002 starting as a field tech for the Southern Sierra Research Station. She is now the Project Lead on the Bureau of Reclamation's Multi-species Conservation Program long-term cuckoo monitoring project on the lower Colorado River. She is also a volunteer on cuckoo research in southeast AZ and CA with the Smithsonian Conservation Biology Institute Migratory Bird Center.



Abundance and occupancy of the Western Yellow-billed Cuckoo (*Coccyzus americanus*) in Sonora, Mexico presented by Alberto Macías-Duarte. Coauthors Edwin Juárez, Eduardo Sánchez Murrieta, E. Leonel Perales-Hoeffler, and J. Andrés Alvarado-Castro.

The abundant center model states that the abundance of a species declines towards the periphery of the species' distribution, where the species meets with a suboptimal environment. Therefore, the extirpation of a given species at the core of its distribution may leave limited conservation opportunities for protecting edge populations. For instance, the Western Distinct Population (as defined by the U.S. Fish and Wildlife Service) of the Yellow-billed Cuckoo (*Coccyzus americanus*) has disappeared in most of the species' range across western United States and southwestern Canada but little is known about the conservation status at the southern edge of its breeding distribution in Mexico. To fill this information gap, we estimated abundance and occupancy rates of Yellow-billed Cuckoos using a standard broadcast call survey protocol. We used Bayesian hierarchical models to estimate the effects of geography, climate, and vegetation on occupancy rates while accounting for imperfect detection. Mean cuckoo count per transect for all sites was $\bar{C} = 9.00 \pm 0.45$ cuckoos. Overall Yellow-billed Cuckoo occupancy in Sonora was $\bar{\psi} = 0.538$ (95%CrI(ψ) = 0.544–0.600 from intercept-only model) but showed strong geographic variation. The best occupancy model included longitude, latitude, elevation, and date as significant predictors. We also observed a steep

decline in cuckoo detection probability during survey time. Relatively high occupancy levels suggest Yellow-billed Cuckoo populations in Sonora may be robust but they are largely reliant on high-tree cover, currently a diminishing resource due to logging, land use change, and buffelgrass encroachment.

*Dr. Alberto Macías-Duarte is currently a research professor at Sonora State University in Hermosillo, Mexico. Dr. Macías-Duarte has a BSc degree in Ecological Engineering at Sonora State University, a MSc degree in Natural Resources at the Autonomous University of Chihuahua and a Ph.D. in Wildlife and Fisheries Sciences at the University of Arizona. His research work focuses on population ecology and wildlife conservation in arid environments. He has conducted research on the reproductive biology and habitat of the Aplomado Falcon (*Falco femoralis septentrionalis*); abundance,*



*survival and habitat selection in grassland birds in the Chihuahuan Desert; population genetics and migratory behavior in the Western Burrowing Owl (*Athene cunicularia hypugaea*), nesting phenology of passerines in the Sonoran Desert; occupancy of Yellow-billed Cuckoos (*Coccyzus americanus*) in riparian areas of Sonora; winter diet of Montezuma Quail (*Cyrtonyx montezumae*) in Arizona and New Mexico; and natal dispersal in Golden Eagles (*Aquila chrysaetos*). He is interested in using population parameters and life history characteristics in birds as early indicators of climate change in North American deserts using modern quantitative methods.*

The western Yellow-billed Cuckoo range-wide occupancy assessment project presented by Edwin Juárez. Coauthors include Russell Norvell, Avian Conservation Program Coordinator, Utah Division of Wildlife Resources and Neil Clipperton, Statewide Coordinator for Bird Conservation, California Department of Fish and Wildlife.

The Arizona Game and Fish Department coordinated with 12 state wildlife agencies including those of the Pacific Flyway to develop a project to conduct a western Yellow-billed Cuckoo range-wide occupancy assessment. The project has three linked objectives: 1) develop a western DPS rangewide Species Distribution Model (SDM), 2) implement a western DPS range-wide survey, and 3) investigate use of autonomous recording units (ARUs) as an alternate survey method. The lack of knowledge about the species' current distribution across the west is a major impediment to evaluating conservation concerns and targeting needed on-the-ground conservation action to help recover the species. The

project will bring together multiple states and other partners to address this knowledge gap by implementing several objectives, including a unified regional survey (in 2022).

Edwin Juárez is the AZ Bird Conservation Initiative (ABCI) Coordinator for the Arizona Game and Fish Department. He is a migratory bird biologist with 16 years of experience developing, implementing, coordinating, and supporting conservation strategies for Arizona's priority bird species. He leads ABCI by engaging partners in voluntary and collaborative conservation actions. These often involve multiple partners and across different geographies (e.g., statewide, Western US, or Northwest Mexico). Besides leading ABCI, he is also active in multiple projects in collaboration with the Sonoran Joint Venture (SJV), Partners in Flight and other regional and national initiatives.

