Expression of desire to enroll in the CESU as a new partner institution/organization.

The Tucson Audubon Society (TA) is interested to join the Desert Southwest CESU as a new non-Federal partner organization. We have long-standing relationships, agreements, and collaborative efforts with many DSCESU partners including: NPS, FWS, USACE, UA (EEB, SNRE, Desert Research Laboratory on Tumamoc Hill), Pima County RFCD/NRPR/OSC, AZGFD, TNC, ASDM, SI, SIA, and NAU. We would also like to be able to partner with the DOD Barry M Goldwater Range and Luke AFB to extend some of our collaborative vegetation and soil mapping research and invasive species mapping/treatment/research, currently being done with NPS and Pima County, onto their lands.

Confirmation that the institution/organization has read the CESU agreement and agrees to support the CESU mission and goals and fulfill the roles and responsibilities of a nonfederal partner, as described in the CESU agreement.

Our team of directors has read the CESU agreement and agrees to support the DSCESU mission and goals and will fulfill the nonfederal partner responsibilities.

Description of the institution/organization, its mission, and the primary focus of collaborative activities to be supported through the CESU in the context of the CESU mission.

History and Mission: Tucson Audubon, founded 1949, is an organization with a mission to "inspire people to enjoy and protect birds through recreation, education, conservation, and restoration of the environment upon which we all depend." We primarily work throughout southeast Arizona to identify threats to birds and wildlife and their habitats, research the most effective approaches to reducing or eliminating those threats, and finally we take action to implement solutions – whether those be through ecosystem restoration, species-specific habitat restoration, or civic engagement. Our staff, however work well beyond southeast Arizona; both our Important Birds Areas program and In-lieu Fee Mitigation program are statewide and we regularly have staff working well beyond state boundaries throughout the Desert Southwest. We educate our members and community on the regional and worldwide problems and empower them to make an impact by providing concrete actions that they can take in response. TA is a fully independent chapter within the larger Audubon network.

We helped lead the effort to pass and implement the award-winning Sonoran Desert Conservation Plan. We have worked with our federal partners to help ensure responsible stewardship of our public lands and waters. We have fought irresponsible land use and development, and supported sustainable energy and infrastructure policies. We have leveraged thousands of volunteers to monitor regional bird populations, implement species-specific habitat restoration programs, and to advocate for practices that benefit birds, wildlife, and humans alike. We have restored hundreds of acres of retired agricultural lands, native grasslands, riparian zones, and upland desert habitats. And we continue to build our regional membership and community through ongoing outreach, education, and partner programs across Southeast Arizona.

Experiencing recent growth especially around our invasive plant control business license, we currently employ about 50 people. Our annual budget has increased annually from $1.36M in 2015 to $2.70M during the last 5 years. We implement all manner of restoration, conservation, research, invasive plant treatment, recreation, and outreach activities in our efforts to build an engaged public who actively work to protect birds at all scales – from back yards to landscapes. And, we run both the Mason Center for Ironwood Preservation and Environmental Education in northern Tucson and the internationally known birding destination Tucson Aubudon's Paton Center for Hummingbirds in Patagonia, AZ.

CESU Collaborative Activities: We would like to join the Desert Southwest CESU to more effectively accomplish our organizational aims that overlap with the CESU mission and the goals of CESU members especially in the following program areas – each with a short description of anticipated CESU collaborative efforts or recent efforts that would have been enhanced through CESU membership.

Inventory and Monitoring – We perform a wide variety of inventory and monitoring efforts with CESU partners that we anticipate will be ongoing long into the future. These efforts include updating multi-taxa species lists and species watchlists for wildlife refuges, national monuments, and national parks for FWS and NPS. We are currently party to a 3-way partnership between Pima County OSC and NPS-SODN for vegetation and soils monitoring across the region that will benefit from streamlined processing as a CESU member. We have worked with AZGFD as the co-lead for the Arizona Important Bird Areas program since its inception and have achieved the designation of many areas for specific species and for areas important for a wide range of species.

Exotic Plant Management – As the only conservation organization in southeast Arizona currently licensed to perform invasive plant management on contract, we bring a level of expertise with permanent and long-term employees to our projects exceeding what can be done with seasonal crews. We are currently finalizing a winter-active weed management plan for Luke Air Force Base in conjunction with Colorado State University's Center for the Ecological Management of Military Lands, our *Collaborative Inventory and Treatment Squad* works through a 5-year cooperating agreement with NPS / SNP / FWS to perform invasive plant treatment throughout the Desert Southwest, we are a member of the Sonoran Desert Cooperative Weed Management Area, and we are working on mapping and experimental treatment efforts with the UA Ag Extension, ASDM, and other organizations. We have also been trying to get all local land managers and other partners to adopt the same data collection and storage process using a GIS data schema that NPS has been using in the Sonoran Desert Network (and that is congruent with other NPS Networks to be able to address much larger questions in a streamlined fashion). So far Pima County has adopted this data collection format and we've used it on projects on the Coronado National Forest – as well as on our all other local and regional independent projects.

Avian Research and Conservation – For the last 4 years we have been partnering with the USFWS at Buenos Aires NWR on their Masked Bobwhite reintroduction efforts. We have supplied quail technicians and summer interns, including especially interns from indigenous communities through a partnership with the Friends of BANWR. We anticipate these efforts to continue long into the future as we have begun efforts to replicate the refuge's habitat restoration efforts on nearby lands. We are working with researchers from UA and NAU, and other academic institutions internationally, on efforts to learn basic life history information for the desert breeding subspecies of Purple Martin including information with potentially important conservation implications including migration pathways, exposure to and bioaccumulation of environmental toxins, natal site fidelity and dispersal, nest cavity fidelity, and nest site characteristics to potentially lead to artificial nesting cavities through a biomimicry approach. To accomplish this we have worked with AZGFD to develop novel survey techniques and to train project volunteers for permitted data collection. We are working with researchers from UA on population demography and site use by the cactus Ferruginous Pygmy-owl as it undergoes a review of its listing status, have worked with NPS on ongoing monitoring of the Burrowing Owl population at the Casa Grande Ruins National Monument, with researchers from UA to expand our research into the nest site characteristics and conservation efforts on Lucy's Warblers, among many other efforts.

Ecosystem and Habitat Restoration – We have worked on a wide variety of both ecosystem level and species-specific habitat restoration projects – many of these ongoing with DSCESU partners. We have had staff working with USFWS at Buenos Aires NWR on restoration for Masked Bobwhite, and are trying to expand those efforts to neighboring ranches as the bobwhite reintroduction process is gaining traction. We have worked with Pima County and Tonto National Monument on habitat restoration projects for cavity nesting species and anticipate these efforts expanding now that effective nestboxes are established for many bird species and the conservation benefits are realizable. We work with Pima County and numerous others on riparian restoration projects, and have implemented watershed

treatment/erosion control projects similar to projects frequently done by project partners on different landscapes. We will soon begin some larger post-burn desert upland and saguaro restoration projects with the USFS.

Climate Adaptation for Species and Habitats – We have been working with USFS-Rocky Mountain Research Station for a number of years on a project modeling future habitat within Arizona for threatened western Yellow-billed Cuckoos which will soon be presented at the 2021 The Wildlife Society meeting. We are also about to begin multiple projects, interacting with a very broad group of CESU partners, prioritizing efforts to protect saguaros and all the cavity-nesting species that depend on mature saguaros long into the future. This project will use modeling to predict areas that will remain habitat long into the future to prioritize areas to protect, as well as to model areas that are likely to become saguaro habitat where we can begin a process of facilitated migration to overcome the 80-150 year lag between when a saguaro sprouts and when it can successfully host cavity-nesting birds. This project can impact up to 14 species which currently nest primarily in saguaros and cardons.

Conservation Research / Management of Threatened and Endangered Species – A major goal of the above cuckoo project is to be able to prioritize areas to protect and focus on for habitat restoration / enhancement activities for the management of the species long-term. We're also working with USFWS, Pima County, and others on projects with Arizona eryngo, Huachuca water-umbel, Gila topminnow, and numerous grassland birds under threat. With funding from CESU partners we have produced a series of landowner habitat management guides including for riparian, and grassland areas; a third, desert uplands, is in production.

Urban Sustainability, Urban Habitats, and Environmental Justice – We have worked with the UA, Pima County, and others on efforts to determine the relative importance of different components of urban habitat throughout the Tucson Basin as well as measuring the impact of various sustainability approaches on wildlife. We have managed the Tucson Bird Count – the world's largest urban bird count – since we inherited the program from UA's EEB department. Our Habitat at Home program helps residential landowners, schools, and HOAs to make their yards more wildlife-friendly and has created a growing network of wildlife habitat throughout the city. We anticipate continuing this work partnering with academic efforts to identify the urban areas most vulnerable to increased heat and climate change and then working to identify the most effect solutions and implement them broadly.

Public Outreach, Education, and Engagement – We have had a Science Communicator based at the NSP Desert Learning Center for the last 4 years who travels the region doing presentations on regional ecology as well as the conservation and research efforts being done by local partners. While we have not had a formal internship program in the past, we have regularly hosted 1-2 interns, mostly UA ecology or GIS students, each year within different organizational departments. We will be formalizing our internships program in early 2022 and are working with partners at UA and with private donors to aim for having the majority be funded internships so that no one is excluded from these career development options by the need to have a paying job. We also anticipate interns seasonally bumping up the staffing of our invasive plant crews during the summer monsoon treatment season after going through a period of intense training on plant ID and safety. Early in the COVID-19 pandemic, we switched our community education efforts to a virtual format which allowed us to capture a much wider audience than we were previously achieving with in-person events. We host at least two talks each month dealing with our conservation efforts and have started including one talk each month highlighting the conservation work of various partners – most of them DSCESU members.

Ecotourism and Sustainable Economics – We are currently working with a coalition of organizations to produce, in conjunction with the UA, an economic impact study for nature-based tourism in Santa Cruz County AZ and had produced a similar study a decade ago. We are beginning projects with DSCESU partners that include intentional choices to provide employment opportunities for local people and youth, and that support local businesses, and are an alliance partner, along with many other CESU partners, of the Santa Cruz Valley National Heritage Area.

Community and Citizen Science - We formalized our long-term citizen-science efforts and academic partnerships in 2019 into our Community Science program and now have two staff within that program. Our Important Bird Areas program and various avian research efforts annually engage over 200 volunteers. We have added citizen science data collection efforts to a number of broader regional conservation efforts including the Heritage Waters project bringing effluent release to the downtown reach of the Santa Cruz and monitoring the changes to biodiversity along that stretch of the river including areas with and without flow. We are working with numerous partners on the Sonoita Creek to establish and maintain a rigorous water quality sampling effort for that locally impaired watershed. In addition, we continually seek to engage the academic community (students / staff researchers / professors / retired scientists) in our conservation efforts exploring ways that our existing or new conservation efforts may advance scientific understanding.

Inclusion, Diversity, Equity, and Access – In 2019 Tucson Audubon formalized our efforts to be more inclusive and diverse as an organization and have since embarked on efforts to increase access for differing groups to outdoor recreation. This has included joining the nationwide Birdability movement and increasing the number of field trips that we provide that can be joined by individuals with limited personal mobility. We have also begun leading local birding outings in areas of the community where people have less access to driving to "destination" sites and where we recognize a lower proportion of people spending time outside. In 2021 two program managers were given the freedom and encouragement to begin integrating our ecosystem restoration efforts into existing grassroots campaigns for environmental justice recognizing that we can be a major supporting role bringing implementation and ecological expertise without needing to be the leader. These efforts are an outgrowth of previous urban sustainability projects we led or joined in, including projects in west, central, and south-central Tucson.

Description or list of the primary programs, departments, or other institutional divisions of relevance to federal land management, environmental, and research agencies that will likely be engaged in CESU activities. Include website addresses for further information, as appropriate.

Our Conservation, Restoration, and Research departments will have primary interface with the DSCESU, as well as our Education and Engagement department. The first three departments work closely together with significant staff overlap and coordinated planning to achieve greater ends. Our Engagement and Education departments interact with a wide cross-section of the community providing online and in-person classes, trainings, and informative events and can increase the efficacy of efforts by attracting large numbers of volunteers and citizen scientists to research efforts. A more in-depth description of each program likely engaged in CESU activities follows.

Inventory and Monitoring –TA is has been directly involved in biological inventories and long-term monitoring, with DSCESU partners, for years. We are working with multiple partners to standardize invasive plant inventory and mapping protocols to meet needs across the board while maintaining the highest levels of data congruency building off the data collection schema used by the Sonoran Desert Network (NPS). We use that framework for new mapping projects on federal, local government, and privately owned lands.

Tucson Audubon has significant direct experience hiring and training staff to implement biotic inventories following a variety of protocols throughout the Southwest. Since 2017, we have provided half of the technical staff to execute biological inventory and monitoring for a joint project between NPS and Pima County's Office of Sustainability and Conservation. This project follows the Terrestrial Vegetation and Soil Monitoring Protocol (Hubbard, et al 2012) developed jointly by the Sonoran and Chihuahuan Desert Networks of the National Park Service, to accomplish surveys on both Park Service lands and on lands within the Pima County Conservation Lands System. This project, in year 5 of an initial 5-year contract, accomplishes both vegetation surveys and soil analysis and is becoming the

regional standard providing a uniform dataset tracking biodiversity on a broad suite of lands and make possible characterizations across an ever-increasing area of the Desert Southwest. We are in conversation with additional Dept of Defense installations to implement the same protocol on their lands in the next few years. From 2014-2016, our staff used these protocols to survey ~180 vegetation plots at Amistad National Recreation Area, Big Bend National Park, Carlsbad Caverns National Park, Fort Davis National Historic Site, Guadalupe Mountains National Park, and White Sands National Monument.

Beyond vegetation surveys, Tucson Audubon has employed both seasonal and long-term staff to create species lists and inventories for bird species throughout the Sonoran and Chihuahuan Desert Networks and numerous current staff members are listed on the organization's survey permit for Southwest Willow Flycatcher (4 staff); western DPS Yellow-billed Cuckoo (11 staff), and 3 are in process for being permitted to survey for the Mexican Spotted Owl. One person is permitted for Burrowing Owl clearance surveys. We also staff bat researchers that work on contract for Pima County's Office of Sustainability and that work on-assignment for the National Park Service, and are working with Pima County to determine the wintering status of a variety of bat species. The goal is to increase the knowledge of timing constraints and management practices for vegetative management of their roosting sites.

Since its inception, we have co-led the Arizona Important Bird Areas program (www.aziba.org) with Audubon Southwest (formerly Arizona Audubon) as part of the Arizona Bird Conservation Initiative. This program operates with the purpose of identifying a network of sites that maintain the long-term viability of wild bird populations while engaging the public to conserve those areas of critical habitat.

Exotic Plant Management – Controlling invasive species is frequently one of the first components that must be accomplished when managing habitat for the protection of birds and other wildlife. We hold licensure for invasive plant control work in both the agricultural and structural contexts (dba "Tucson Audubon"; License 10096) for Arizona with a Custom Applicator (CA 459) and Certified Qualified Applicator (QA 31895) on staff. At this moment we have 12 licensed or registered applicators on staff; we can be hired on contract to treat invasive plants anywhere in Arizona. Our applicators are parsed into two Invasive Plant Strike Teams – one focused on high-priority Federal lands, and the other working primarily on contract and on grant-funded projects. The strike teams have worked on wildlife refuges, national monuments, national parks, county and city open-space and preservation lands, HOA open space lands, golf courses, and urban riparian areas.

In 2019 we established a permanent crew, the Collaborative Audubon Inventory and Treatment Squad or "CoATIS", working with the park service's SouthWest Exotic Plant Management Team, Saguaro National Park, and the FWS under a 5-year cooperating agreement to treat invasive plants in high-priority areas managed by each participating federal agencies, and to participate in updating species watchlists for likely future invasives at numerous parks, monuments, and refuges. The CoATIS work throughout Arizona, New Mexico, and into Texas and Oklahoma.

Our invasive plant department now has 8 licensed applicators in addition to the CoATIS. This group does a wide range of invasive plant treatment including hazardous fuels removal. In 2021 we worked on projects at 3 HOAs, assisted other conservation groups by spraying on their projects, treated private residences, and worked on multiple grant-funded projects from the desert floor up into the mountains. We have written invasive plant management plans, both short and long-term, to help groups and landowners get their invasive plants under control and to be aware of what to look out for in the future. We use an integrated pest management approach utilizing mechanical removal, carbon starvation, chemical removal, solarization, and varied cultural practices with the approach selected at a given time being based on efficaciousness, physical and political site constraints, seasonal timing, available labor and training, and budget constraints.

We have just launched a major proactive project to prevent stinknet (*Oncosiphon pilulifer*) from becoming an entrenched invasive plant in the Tucson basin – it has already come to dominate the wildlands

landscape and urban open space areas in much of Maricopa and western Pinal counties. This project, with collaboration and input from many CESU partners, will be based on a major public information campaign leading, hopefully, to significant crowd-source information gathering. Then TA staff and volunteers will verify and treat, mostly manually due to the small anticipated size of early-stage infestations, sightings throughout the region. Most treatment will be at no cost to the landowner.

The organization is an official partner of the Sonoran Desert Cooperative Weed Management Area. We also manage a 300-acre conservation easement, 500+ acres of land that are part of or associated with a Clean Water Act 404 In-lieu Fee mitigation parcel, and numerous small projects for the control of invasive species.

Avian Research and Conservation – Tucson Audubon's research wing is relatively new to the organization and includes projects focused on: niche modelling; nestbox preference and suitability studies and life history research for Lucy's Warblers, desert Purple Martins; wintering-range studies with Chestnut-collared Longspurs and a suite of grassland sparrows; and wintering distribution of a variety of bat species.

Chestnut-collared Longspurs and a variety of listed or sensitive grassland sparrows (Baird's, Grasshopper, and Cassin's) are all declining due to a variety of factors, not least of which is habitat degradation due to the pervasive invasion of Lehmann's lovegrass (*Eragrostis lehmannii*) in the southwestern grasslands that are their wintering area. Lehmann's lovegrass seeds are energetically a loss for the birds to harvest and eat and as the invasion continues, the patches of larger-seeded native grasses are becoming fragmented and less common.

We have been working independently for a few years now on identifying nesting preferences for Lucy's Warblers (tucsonaudubon.org/lucys-warblers-and-nestboxes), a species not historically known to use human-crafted nestboxes even though, as an established cavity-limited secondary cavity nesting species, being a species with a very high likelihood of being able to have its population stabilized by artificial nesting cavities. In the process of making significant gains toward understanding their preferences and creating nestboxes that they'll use, we've also begun filling in the extensive gaps of knowledge about their basic biology and life history.

The Desert Purple Martin, a subspecies of Purple Martin that nests in the Sonoran Desert in saguaro and cardon cavities, is one of those rare cases where a near complete data gap in life history knowledge of its breeding and migratory habits still exists. In the spring of 2020, Tucson Audubon became a founding member of the Desert Purple Martin Working Group, also including NAU. That summer we began concerted efforts to begin compiling basic distribution and nesting phenology data to inform the planned research program on the subspecies. In 2021 we began collecting baseline information on saguaro cavities with nests to create parameters for the development of an artificial saguaro-cavity nestbox using a functional biomimicry approach. This project (tucsonaudubon.org/martinproject) is expanding with four grant proposals recently awarded that received letters of support from CESU partners and will benefit CESU partner lands. This will also include using geolocators and non-transmitting gps units to more accurately understand migration pathways, as well as working with NAU on ecotoxicological studies to understand full-lifecycle threats to the population.

We have worked closely with Dr Renee Duckworth (UA) and post-docs within her lab on bluebird research projects since 2015 including both the relatively understudied resident subspecies of Eastern Bluebird the "Azure Bluebird" and Western Bluebirds breeding in the mountains. We are working with Dr. Duckworth on permitting for banding-based studies for martins, bluebirds, and Lucy's Warblers.

We have funded and participated on research involving the cactus Ferruginous Pygmy-owl for over two decades, including providing funding in 2021 for UA staff researchers collecting distribution data

internationally. Our Bird Conservation Biologist is also a member of the Desert Thrasher Working Group.

Ecosystem and Habitat Restoration – Our Restoration Department plans restoration projects throughout Southeast Arizona. We implement riparian restoration projects through our In-Lieu Fee mitigation program for impacts to jurisdictional waters as regulated by the Clean Water Act and overseen by the US Army Corps of Engineers and have accomplished previous projects through the Arizona Water Protection Fund in both urban and rural settings. We also specialize in creating pollinator garden and bird/wildlife friendly habitat at a range of scales in the urban and suburban environments and have multiple staff involved with the Arizona Monarch Collaborative.

We have implemented restoration projects throughout southeastern Arizona including both ecosystem restoration (restoration of function) and habitat restoration (aimed at critical needs of target species). Much of our work has focused on revegetation of fallow agricultural fields in historic floodplain riparian corridors, now disconnected except for 50 year and greater flows. We have used traditional outplanting techniques including pole-planting, seeding, and container plants; regionally pioneered the local use of deep-pots for restoration nursery materials, imprinting and broadcast seeding, and drip-irrigated direct seeding to generate plants with undisturbed root systems where irrigation could be achieved, and have explored numerous novel and hybrid techniques for our arid environment. We have adapted existing and created new techniques for local functional improvements including a novel technique utilizing locally available dead/non-regenerative invasive species to material to create a bio-revetment for bank stabilization using ancient wattling architecture for structural integrity. We are also in the process of implementing a 20-acre watershed restoration treatment in the uplands of Saguaro-Ironwood habitat where two 200+year rainfall events in 2019 caused significant erosion, loss of organic material, and vegetative loss that addresses each of those aspects.

Habitat restoration efforts have ranged from species-specific planting mixes to installation of nestboxes for secondary cavity nesting birds for which a lack of appropriate nesting cavities is the demonstrated population limiting factor. We have researched and designed appropriate nestboxes, based on a biomimicry approach, for Lucy's Warblers which, until recently, were not known to utilize human-crafted nestboxes and are pursuing similar efforts with additional bird species that rely primarily on saguaro cactus seeking climate adaptation and functional habitat restoration after wildfires. This nestbox development work has then been followed upon with broader habitat restoration efforts deploying these nestboxes in areas where nesting cavities were the specific population limiting factor. We seasonally employ 2-3 quail technicians / habitat restoration technicians who work on-assignment with the Buenos Aires NWR on the Masked Bobwhite reintroduction process.

We have installed numerous pollinator gardens in community spaces and on private lands in coordination with groups working on monarch (and other butterfly) and bat conservation in the region, as well as working with golf courses (both active and defunct) to enhance habitat throughout.

Climate Adaptation for Species and Habitats – Intentional climate adaptation efforts are relatively new for Tucson Audubon, though we have focused on numerous projects historically that are aimed at increased sustainability and helping resist or slow the potential impacts of climate change within particular areas. Our Bringing Birds Home initiative has, for over a decade, integrated the recognition of human facilitated and maintained refugia and stopover points for numerous bird species (and other wildlife too). We are now scaling our climate adaptation efforts up to a landscape level with both regionally novel and research-driven projects.

With the support and coordination of numerous CESU partners we are launching a significant project to help saguaros adapt to anticipated climate change effects throughout the region and thereby proactively support all the species, especially cavity-nesting birds, which depend on them. This project will: 1) identify the most critical areas to protect and those areas most critical for Desert Martins and other

cavity nesting species; 2) control invasive plants in the designated high-priority areas; 3) identify where saguaros will likely migrate with climate change and plant saguaros in those locations; 4) plant saguaros in recently burned areas that are predicted to remain saguaro habitat to accelerate the regeneration of mature saguaros and all the benefits they provide to Sonoran Desert Upland as a keystone species; and 5) control invasive plants that might try to invade those extremely susceptible post-burn areas.

Working with the USFS, we are modelling habitat suitability in Arizona for the threatened western distinct population segment of the Yellow-billed Cuckoo (wYBCU). This effort builds upon previous work done on wYBCU in New Mexico and aims to validate previous predictions or nuance them using data from a different range, and then to also predict where future areas of suitable habitat may be based on climate models Our predictive niche modelling efforts for cuckoos under a range of future climate scenarios will help to regionally prioritize habitat protection, conservation, and restoration efforts. Much of cuckoo habitat, current and future, exists on lands managed by CESU partners. The conservation goal is to identify the most important areas to conserve as well as to identify important areas for habitat restoration that might augment the population into the future.

Conservation Research / Management of Threatened and Endangered Species – Our staff botanist has a history of working on vegetation and soils monitoring projects and has researched the distribution and demography of acuña cactus with USFWS. We are also working with USFWS on conservation projects for numerous other threatened or endangered species. We have a very long history of engagement with the listing of the cactus Ferruginous Pgymy-owl and are involved in supporting research at the UA to garner information in the current listing review process. We also work with landowners in the Altar Valley to increase their awareness of specific ranching management practices that can impact, or be used to augment the habitat for, pygmy-owls and Masked Bobwhites. We regularly consult with the Casa Grande Ruins National Monument on the status of the western Burrowing Owl and the impacts on their population that various management activities for other species on site might have.

Urban Sustainability, Urban Habitats, and Environmental Justice – Within our Urban Habitats Restoration program we have focused significant work on golf courses. We are actively engaged with helping courses minimize overall water use, increase habitat value throughout the course especially focusing on areas within the course that are not 'in play,' and aiming to utilize the resources and site conditions that are necessary for the course to support specific species. This includes participating in the Monarchs in the Rough initiative, using ponds and water traps as potential species refugia and regionally rare habitat, and installing nestboxes in trees throughout the course where there is appropriate vegetation for the particular cavity-nesting species. We are also working with defunct golf courses as they variously turn into public open space or other ends to maximize potential habitat in their future form. We work with developers to reduce the impacts of their developments once they're permitted, and with municipal governments to achieve habitat ends within their efforts to manage stormwater and public open space.

We recognize that there are wide disparities to accessible habitat and green space within our community – primarily driven by economics. Habitat and green space correlate closely, as well, with social climate vulnerability and the livability of spaces. To these ends we have been working with UA and numerous local groups on increasing sustainable green space within lower-income areas of our community, and supporting intra-urban wildlife migration corridors. We have a long history of working with schools to create wildlife gardens and implement rainwater harvesting practices, and have worked with UA on adding habitat features to the Agrivoltaics program that is rapidly gaining traction.

The Bringing Birds Home initiative includes a variety of specific conservation actions that people can do to make positive impacts on birds near them – very species-specific habitat restoration oriented actions. Included within this initiative is our Nestboxes for Desert Birds program which helps people to utilize nestboxes to support secondary cavity nesting species that are specifically shown to have a lack of

available nesting cavities as their population-limiting factor. The Habitat at Home program is also part of this initiative. Habitat at Home empowers people to create functional bird and wildlife habitat on their own property (or within their HOA and at schools) within the framework of a yard certification program. The program teaches people initial concepts for harvesting rainwater, the functional requirements of habitat, and basic ecological principles for designing a wildlife-friendly space. It also connects people to a broader community of people and provides resources to simplify and speed their work. We also have a long-standing set of Habitat Recipe Cards which are species or group-specific sets of recommendations for creating space for birds near residences. Over 20,000 of these recipe cards have been distributed.

Public Outreach, Education, and Engagement – Tucson Audubon staff members have presented on bird and habitat conservation at a wide variety of venues – from scientific conferences to Home Owners' Associations to elementary school groups. During the 2017-2018 school year, staff oversaw a team of volunteers that gave presentations on hummingbird ecology at many local elementary schools while also working with high school students in ecology clubs on nesting biology and the importance of nestboxes as a conservation tool for secondary cavity nesting species in the region. Our Habitat at Home program, now with 130+ participating households, integrates education of the local public with building capacity and agency among participants to make a difference on properties they manage or own for the benefit of wildlife especially focused on pollinators and birds.

Tucson Audubon has an extensive history of providing youth and adult education programs as well as public engagement opportunities for surrounding communities. Our offerings consistently provide insights into the natural history of the Sonoran Desert and surrounding Sky Island ecosystems, with an emphasis on bird life and biodiversity. At the same time, we engage the community in conservation actions with real-world outcomes, providing them with skills and knowledge they can apply in their own yards and neighborhoods.

Our experiential education series (Institute of Desert Ecology and Riparian Family Institute) immersed families in hands-on natural history learning experiences over the course of multiple days and in a variety of settings. Similarly, our Trekking Rattlers and River Pathways programs have educated youth at the middle and high-school age levels by transporting them to inspiring landscapes and involving them directly in both recreational and scientific activities that connect them directly with the natural world.

Two of our current conservation-learning programs with broad public support and participation are the Habitat at Home (tucsonaudubon.org/habitat-at-home) and Citizen Science programs (tucsonaudubon.org/citizen-science). Habitat at Home provides participants with the knowledge, resources, and skills to transform their yards and neighborhoods into urban landscapes that intentionally support a diversity of local wildlife by meeting their needs for food, water, shelter, and nesting/breeding opportunities. Meanwhile our Citizen Science Coordinator organizes bird surveys across Southeast Arizona in order to gather data on an array of vulnerable species. A host of survey volunteers are rigorously trained in appropriate scientific methods, identification techniques, and data-collection methods.

Similarly our popular Desert Nestbox program (tucsonaudubon.org/nestbox) engages the public in every aspect of implementing nestboxes as a research tool and conservation strategy for a number of vulnerable species. Volunteers have built thousands of boxes to spec, and then installed, monitored, and recorded data to support the program. Real world impacts of gathering scientific data and increasing the number of fledglings for vulnerable species such as Lucy's Warbler inspire further participation and a transformative sense of conservation agency in our participants.

We are proud to engage highschool and college youth in internships at the Buenos Aires National Wildlife Refuge, and to partner with students in the GIS program at the University of Arizona for both internships and thesis-project advising. We also partner with the UA's Ecology & Evolutionary Biology

Department for a 100% Engagement Program for ornithology students, providing them with firsthand research experiences. Our staff regularly present to the public in a variety of teaching capacities, including as guest instructors for graduate level courses and as advisors on public environmental signage.

Tucson Audubon employs a Science Communicator who works with the Sonoran Desert Learning Lab providing outreach to a wide variety of audiences via presentations and tabling as well as a Community Science Coordinator and Community Science Manager to streamline many of our data gathering effort harnessing the power of the public for our research goals and the goals of our partners.

Ecotourism and Sustainable Economics – Tucson Audubon has helped produce two economic impact studies, the first focused on the impact of wildlife viewing on the Arizona Economy (in cooperation with AZGFD's Heritage Fund) in 2013 and is working with a variety of groups to fund an economic study of ecotourism and ecologically regenerative efforts for Santa Cruz County – being produced by the UA. We have been participating since its inception with the statewide efforts to develop an Arizona Birding Trail – an effort that includes AZGFD and other CESU partners. Additionally, our Paton Center for Hummingbirds in Patagonia AZ is a major contributor to the number of tourists visiting Patagonia (20,000 visitors annually) and is the most popular attraction in town.

Community and Citizen Science – The Tucson Bird Count (www.tucsonbirds.org/), started within the Department of Ecology and Evolutionary Biology at the University of Arizona, is the world's largest and longest running urban bird count. In 2012 ongoing management of the TBC passed to Tucson Audubon and we have opened the data up to a variety of graduate students from multiple programs to address specific questions. The TBC dataset allows analysis to understand a variety of spatially tied trends across an urban-to-exurban gradient across a wide variety of species. One primary aim has been to determine the specific impacts of urban density to create best management practices within a Reconciliation Ecology framework. This dataset has provided research project opportunities to students in the UA GIS-certificate program multiple times.

We work with a diverse group of organizations and agencies to achieve a range of conservation-oriented citizen science driven data acquisition projects. Projects range from mapping invasive species to tracking the change in species presence pre/during/post projects. Citizen science gives members of the public an accessible mechanism to directly contribute to meaningful science and conservation outcomes. Volunteer bird surveyors, many who are expert birders, have helped make the Important Bird Area program so successful – the program has given purpose to their recreational activities. We are rapidly expanding our citizen science data acquisition efforts through partnerships with many other groups.

We continually seek to also make our conservation efforts more successful and have begun intentionally integrating each effort with the interests of members of the broader scientific community. Our work facilitates research; research makes our work more effective. This includes community-based science partnerships starting from elementary school kids all the way through to research occurring at R1 universities. We also seek to keep retired academics and agency ecologists inspired by providing them opportunities to get to continue their research efforts after their career, or to explore new opportunities working with us or advising us – as their interests dictate.

Inclusion, Diversity, Equity, and Access – the organization has set aside specific funds to ensure that our IDEA efforts, both internally and externally, are maintained into the future. Birdability – access for mobility-challenged individuals – was a highlight at our last two Southeast Arizona Birding Festivals (tucsonaudubon.org/festival). While many of our birding field trips are free, not everyone can travel to the locations where they have historically been held. To that end we are beginning a new effort of providing free birding events regularly throughout town at neighborhood parks so that travel is not an issue. Our IDEA efforts will tie in tightly, through time, with our newly intentional program of environmental justice within our Restoration Department.

WORKS CITED

Hubbard, J. A., C. L. McIntyre, S. E. Studd, T. Nauman, D. Angell, K. Beaupré, B. Vance, and M. K. Connor. 2012. Terrestrial vegetation and soils monitoring protocol and standard operating procedures: Sonoran Desert and Chihuahuan Desert networks, version 1.1. Natural Resource Report NPS/SODN/NRR—2012/509. National Park Service, Fort Collins, Colorado.

A list of and brief description of the staff or faculty with expertise in disciplines and subject areas of relevance to federal land management, environmental, and research agencies (do not submit CVs).

Jonathan Horst, M.S., Director of Conservation + Research is an ecologist primarily focused on climate adaptation, reconciliation ecology, and adaptive habitat restoration. His graduate work focused on community coexistence and plant demography at the UA(EEB) with a field site at the Desert Research Laboratory on Tumamoc Hill. During that time he also published on the anticipated spread of an invasive plant newly adventive to the western hemisphere, *Matthiola parviflora.* He's responsible for designing and planning many of Tucson Audubon's research and restoration efforts as well as overseeing the Conservation and Restoration departments. He's the lead for the organization's In-Lieu Fee Mitigation Program for Clean Water Act impacts and the organization's Carbon Offset and Habitat Offset programs. He's the primary liaison from Tucson with many research and project partners and is the organization's representative on the Sonoran Desert Cooperative Weed Management Area and Pima County Flood Control's Floodplain Management committee. He is a Certified Qualified Applicator in the state of Arizona and Tucson Audubon's Qualifying Party for invasive plant control and initiated Tucson Audubon's Invasive Plant Program. He also guides TA's research projects including collaborations with the USFS (mapping future niche suitability for western Yellow-billed Cuckoos under climate change predictions, facilitated migration of saguaros for the long-term protection of cavity-nesting birds that use saguaros as nesting substrate), the University of Arizona (saguaro climate adaptation, cactus Ferruginous Pygmy-owl population demographics, "Azure" Eastern Bluebird demographics, desert Purple Martin life history), Northern Arizona University (desert Purple Martins), Pima County's Office of Sustainability, and a variety of independent researchers (Montezuma Quail). He also co-founded the Desert Purple Martin Working Group and is leading our efforts to utilize the Motus wildlife tracking network in Arizona.

Erin Zylstra, Ph.D., Community Science Manager is a population ecologist interested in understanding the effects of climate, land use change, and other factors on wildlife populations. Much of her research has focused on the development and application of statistical models that can be used to inform conservation and management efforts for threatened species. She completed her graduate studies (M.S. Statistics; M.S. Wildlife Conservation and Management; Ph.D Wildlife Conservation and Management) at the University of Arizona where she worked with Saguaro National Park to understand the effects of drought and landscape structure on metapopulation dynamics of lowland leopard frogs in arid mountain canyons of southern Arizona. In her postdoctoral work she has seen been studying the population dynamics of monarch butterflies using data from several large-scale, volunteer-based monitoring programs to identify the relative importance of biotic and abiotic factors, including climate, forest cover, and herbicide use, in observed declines (Zylstra et al. 2021 Nature Ecology & Evolution) and then focused on forecasting monarch population responses to climate change impacts in the spring and summer breeding grounds. Erin is the primary point-person overseeing most of our federal agency agreements and partnerships, is formalizing our undergraduate internship program with the University of Arizona and local high schools, and enhancing our academic research partnerships.

Jennie MacFarland, B.Sc., Bird Conservation Biologist has lived in the bird conservation world since graduating from her undergraduate studies in the School of Natural Resources and the Environment at the University of Arizona. She has co-lead the Arizona Important Bird Areas program since 2011 securing the designation of 16 new IBAs in the state and upgrading 4 additional ones to being recognized as of global importance. She has also lead the partnership between Tucson Audubon and the Coronado National Forest surveying for Yellow-billed Cuckoos in the Sky Island ranges on Coronado NF lands, spearheaded TA's use of automated recording units for avian and bat monitoring including a new project funded by the Sonoran Joint Venture, and manages the Tucson Bird Count since it transitioned from EEB at the UA to TA. She is heavily involved with all field aspects of our avian conservation efforts and sits on numerous regional and state committees/working groups for species-specific, habitat-specific, and regional conservation efforts.

Tony Figueroa, BSc. Invasive Plant Program Manager served as the lead for Tucson Audubon's original federal agency-based Invasive Plant Strike Team and now leads our Invasive Plant Program which has increased from three to 10 permanent employees in 2021. His invasive plant knowledge spans the entire desert southwest having worked on updating the Early-Detection/Rapid-Response lists for USFWS refugues in the region as part of his duties on an agency-agreement. He holds the Custom Applicator license for Tucson Audubon allowing us to treat invasive plants, on contract, in an agricultural context including ranchlands, forests, environmental preserves, and farmlands.

Olya Phillips, BSc. Community Science Coordinator has been the lead person executing the wide variety of nestbox-driven conservation efforts and partnerships undertaken by Tucson Audubon. She's also been the lead on implementing and expanding out Bird Safe Buildings and Lights Out programs. In each case she has worked on all aspects of the projects: the conservation implementation side, public outreach (interviews/webinars/writing articles) and education (in-class nestbox building events and presentations), and field research (iButton dataloggers, observational research). She is permitted to survey for western Yellow-billed Cuckoos and southwestern Willow Flycatchers.

Saff Killingsworth, BSc. Restoration Project Manager | Botanist is one of the project managers focused on our environmental justice efforts and is our primary botanist on staff. She works with USFWS on acuña cactus research and will likely soon become our lead staff member on Arizona eryngo. She has worked multiple seasons on the joint soils-vegetation monitoring project that is a partnership between NPS and Pima County.

Jessica McGary, BSc. Wildlife Technician and Science Interpreter on-assignment with the National Park Service's Sonoran Desert Network works on a variety of National Park Service lands doing wildlife monitoring including experimental camera-based tracking of reptiles. She presents lectures to a wide variety of audiences and, in her role on-assignment with the NPS, has significant experience with research and monitoring on federal lands.

Description or list of facilities, equipment, centers, or institutes that would provide support to the research, technical assistance, or educational activities of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.

Mason Center for Environmental Education and Ironwood Preservation – Our Mason Center has been used for environmental education activities for the last two decades while also providing office space for staff. It is located in northwestern Tucson on a 20-acre parcel, 16-acres of which are under conservation easement for the preservation of old-growth ironwood trees, some dated at >800 years old. Various research activities have taken place on site, most recently nestbox temperature gain under various conditions, as well as filming for international nature documentaries. Before the end of 2021 the

Mason Center will have a Motus sensor station with a ~15 mile detection range providing data on any radio tagged birds or other taxa in the area.

Paton Center for Hummingbirds – Tucson Audubon took over management of the internationally known birding hotspot/back yard the "Paton's Birders Haven" in 2014. Since that time two adjacent parcels straddling the Sonoita Creek (5 acres and 5.5 acres) have been acquired and added to the Center bringing the total acreage of persevered riparian corridor to 11.9. Significant invasive species control and floodplain restoration has occurred at the Paton Center including a host of experimental revegetation and bank stabilization techniques. Numerous students from the University of Arizona have undertaken undergraduate research projects focused on birds on site as well as graduate students have used it as a field site for research on bats. Before the end of 2021 the Paton Center will have a Motus sensor station with a ~3 mile detection range providing data on any radio tagged birds or other taxa in the area. The Paton Center has site amenities that serve as refugia for multiple threatened and endangered taxa including Gila topminnow, Sonoran tiger salamander, Arizona eryngo, and Huachuca water-umbel.

Motus Sensor Stations – as noted each of our Centers is planned to have a functioning sensor station as part of the international Motus network (motus.org/). Each station will have antennas tuned to the two primary tag frequencies currently in use to record data from as many passing species as possible. We anticipate expanding this network with various partners throughout southern Arizona as funding becomes available, as well as utilizing these sensor stations to drive new data in local avian research.

Description or list of past research, technical assistance, and educational services supported through federal financial assistance awards that are of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.

Agency	Agreement number	Project title	Amount	Award Period
USFS (Coronado NF)	15-PA-11030500-018	Western Yellow-billed Cuckoo Surveys on Coronado National Forest	$101,000.00	5 Yrs
USFWS	F14AC00094	Inventory and Monitoring Of Ecosystems	$475,332.92	5 Yrs
USFWS (PFW)	F16AC00468	Tucson Audubon Society 2016 Cooperative Agreement:PFW	$47,000.00	5 Yrs
USFWS (BANWR)	F19AC00886	Increasing native quail populations on Buenos Aires National Wildlife Refuge	$215,000.00	2 Yrs
USFWS (SJV)	F19AP00866	Chestnut-collared longspur winter habitat land management	$8,600.00	3 Yrs
NPS	P16AC00027	**Master Coop Agreement: Inventory and Monitoring of Ecosystems**	$0.00	5 Yrs
NPS (SODN)	P19AC00282	Map validation at Organ Pipe Cactus National Monument	$40,908.00	1 Yr
NPS (SODN)	P19AC00551	Wildlife camera monitoring	$47,595.00	1 Yr
NPS (SOPN)	P19AC00582	Develop weed mapping application for Southern Plains parks	$48,535.00	1 Yr
NPS (SODN, CHDN,SOPN)	P19AC00801	Develop groundwater data portal for parks in the American southwest	$48,616.00	1 Yr
NPS (CHDN)	P19AC00808	Vegetation monitoring intern for Chihuahuan Desert parks	$49,769.00	2 Yrs
NPS (SODN)	P19AC00859	Aquatic resource monitoring in Sonoran Desert Network parks	$45,004.00	1 Yr
NPS (CHDN)	P19AC00861	Wildlife trends analysis for seven Chihuahuan Desert parks	$49,474.00	1 Yr
NPS (Tonto NM)	P20AC00515	Post Woodbury fire resources restoration intern for Tonto NM	$44,567.00	1 Yr
NPS (SOPN)	P20AC00788	Invasive species tool for Southern Plains parks	$48,520.00	1 Yr
NPS (CHDN)	P20AC00804	Geospatial design for invasive early-detection data at Chihuahuan Desert parks	$49,258.00	1 Yr
NPS (CHDN)	P20AC00900	Landbird, mammal and taxonomic data analysis for Chihuahuan Desert parks	$48,741.00	1 Yr

NPS (CHDN)	P20AC00904	CHDN vital signs: Graduate monitoring intern for the Chihuahuan Desert I&M Network	$49,669.00	1 Yr
NPS (SODN,CHDN)	P20AC00907	Mammal monitoring in parks of the American Southwest	$49,760.00	1 Yr
NPS (CHDN)	P20AC00936	Invasive plant control at Big Bend NP	$49,196.00	1 Yr
NPS (SODN)	P20AC00990	Wildlife and education intern program	$49,055.00	1 Yr
NPS (SODN,CHDN)	P20AC01009	Desert springs assessment	$45,536.00	1 Yr
NPS (SODN,CHDN)	P20AC01078	CHDN vital signs: Acoustic wildlife monitoring pilot for southwestern parks	$41,938.00	1 Yr

Description or list of current formal agreements and informal relationships with federal agencies that are of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.

Agency	Agreement number	Project title	Amount	Award Period
USFS (RMRS)	18-CO-11221632-183	Modeling Suitable Habitat for Western Yellow-billed Cuckoo in Arizona	-$11,500.00 TA funded project	undefined
USFWS (PFW)	F17AC00580	Tucson Audubon Society 2017 Cooperative Agreement:PRW	$18,000.00	5 Yrs
USFWS (PFW)	F20AC10538	Arizona Eryngo Wetland Improvement at La Cebadilla Estates	$5,000.00	5 Yrs
NPS (SOPN)	P19AC00335	Exotic plant monitoring in Southern Plains parks	$49,879.00	3 Yrs
NPS (CORO)	P19AC00704	White nose syndrome threat monitoring and detection in bat populations at Coronado NM	$16,088.00	5 Yrs
NPS (CORO)	P19AC00794	Population and nature study of the lesser long-nosed bat at Coronado NM	$16,922.00	5 Yrs
NPS	P19AC00887	Master Coop Agreement: Southern Arizona habitat conservation and eduation	$0.00	5 Yrs
NPS (SWEMPT)	P20AC00219	Southern Arizona habitat conservation and education (CoATIS)	$70,000.00	2 Yrs
NPS (SWEMPT)	P20AC00896	Southern Arizona habitat conservation and education	$327,000.00	3 Yrs
NPS (SOPN)	P20AC00920	SOPN vital signs: Fire effects on grasslands in Southern Plains parks	$49,250.00	2 Yrs
NPS (NCPN)	P20AC00975	Graduate monitoring interns for the Northern Colorado Plateau I&M Network	$103,481.00	3 Yrs
NPS (SODN, CHDN,SOPN)	P20AC01008	SOPN vital signs: Grassland data dashboard for Southern Plains parks	$118,237.00	3 Yrs
NPS (Tonto NM)	P21AC10039	Wildfire restoration internship at Tonto NM	$41,580.00	1 Yr
NPS (OPNM)	P21AC10083	Vegetation inventory at Organ Pipe Cacus NM	$60,493.40	2 Yrs
NPS (SODN,CHDN)	P21AC11164	Desert Research Learning Center internships to support wildlife monitoring	$80,227.00	2 Yrs
NPS (SODN,CHDN)	P21AC11178	Wildlife monitoring assessments for 18 Chihuahuan and Sonoran Desert parks	$114,089.00	1 Yr
NPS (CHDN)	P21AC11180	Exotic plant and vegetation monitoring	$43,062.00	1 Yr
NPS (SODN, CHDN,SOPN)	P21AC11197	Grassland and exotic plant monitoring in 11 Southern Plains parks	$33,046.00	1 Yr
NPS (SODN, CHDN,SOPN)	P21AC11349	Data science interns for southwest networks	$179,784.00	3 yrs

NPS/PiCo Soil/Veg project

The NPS and Pima County Office of Sustainability and Conservation have entered into an IGA to perform vegetation and soil surveys as described above. Tucson Audubon has a contract with Pima County (CT-SUS-18-010).

Confirmation of the institution's/organization's willingness to accept a limited overhead rate of 17.5% and cost items to which the rate is applicable for activities conducted through the CESU, including research, technical assistance, and educational services (this overhead rate applies to the entire institution/organization for CESU activities).

Tucson Audubon is willing to accept the CESU's overhead rate set at 17.5% for all future agreements with Federal Partners outside of existing agreements and for projects, research, technical assistance, and educational services.

Designation of a technical representative (with full contact information – name, title, full address, phone, fax, email) to serve on the CESU steering committee, participate in CESU annual/semi-annual partner meetings, and facilitate internal and external communication, promotion, and response to CESU correspondence and administrative actions (e.g., announcements, new member applications, processing agreements/amendments, five-year reviews).

The technical representative for Tucson Audubon will be:
Jonathan Horst
Director of Conservation + Research
Tucson Audubon
300 E University Blvd #120, Tucson AZ 85705
520.971.6238 (cell/office)
520.232.5477 (fax)
jhorst@tucsonaudubon.org

Agreement to relay agency-specific research, technical assistance, and educational needs and associated funding opportunities to other institutional/organizational members (e.g., faculty, students).

Tucson Audubon agrees to relay agency-specific research, technical assistance, and educational needs and associated funding opportunities to other institutional/organizational members (e.g., faculty, students).

Signature (or endorsement) from an appropriate official, with authority to commit institutional resources in a binding multi-year federal cooperative and joint venture agreement (e.g., president, executive director, chief financial officer, vice president for research, director of sponsored programs).

Jonathan Horst
Director of Conservation and Research
11/23/2021

Letter(s) of support from one or more CESU federal agency partners sponsoring the new partner's application, including a description of successful past collaborative work supported through federal financial assistance awards.