UNIVERSITY OF MICHIGAN, SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY

Capturing and Communicating the Story of Shiawassee National Wildlife Refuge

A project submitted in partial fulfillment
of the requirements for the degree of Master of Science
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EXECUTIVE SUMMARY

Shiawassee National Wildlife Refuge (SNWR), located near Saginaw, MI, protects wildlife habitat and provides a critical space for the public to engage with restoration projects and observe wetland ecosystems. In this report, we synthesize the sentiments of refuge staff aiming to form stronger connections with communities surrounding SNWR and to increase the educational value of the refuge for visitors. We also describe how we combined current refuge goals with past research on community perceptions of SNWR to create accessible educational materials. These educational materials are an Audio Tour, a StoryMap, and interpretive signage to be installed at refuge lookout locations. We detail our rationale for developing each product and include user guides to summarize the basic methods for using, monitoring, and updating each product for the refuge staff. Finally, we provide recommendations for future educational materials and future strategies for continued community engagement.

TABLE OF CONTENTS

INTRODUCTION

Established in 1953, Shiawassee National Wildlife Refuge (SNWR or the refuge) protects nearly 10,000 acres of wetland habitat and hosts almost 90,000 visitors annually. The refuge is close to several major Michigan cities, including the metropolitan areas of Saginaw, Bay City, Midland, and Flint. SNWR is only six miles from downtown Saginaw and well within walking distance of some of the city's southeast neighborhoods (Figure 1). The refuge is also located adjacent to rural farmland and low-density neighborhoods. This proximity to population centers presents a unique opportunity for the refuge to engage with and educate the public regarding the mission of the U.S. Fish and Wildlife Service (USFWS), its Wildlife Refuge program, and conservation initiatives more broadly.
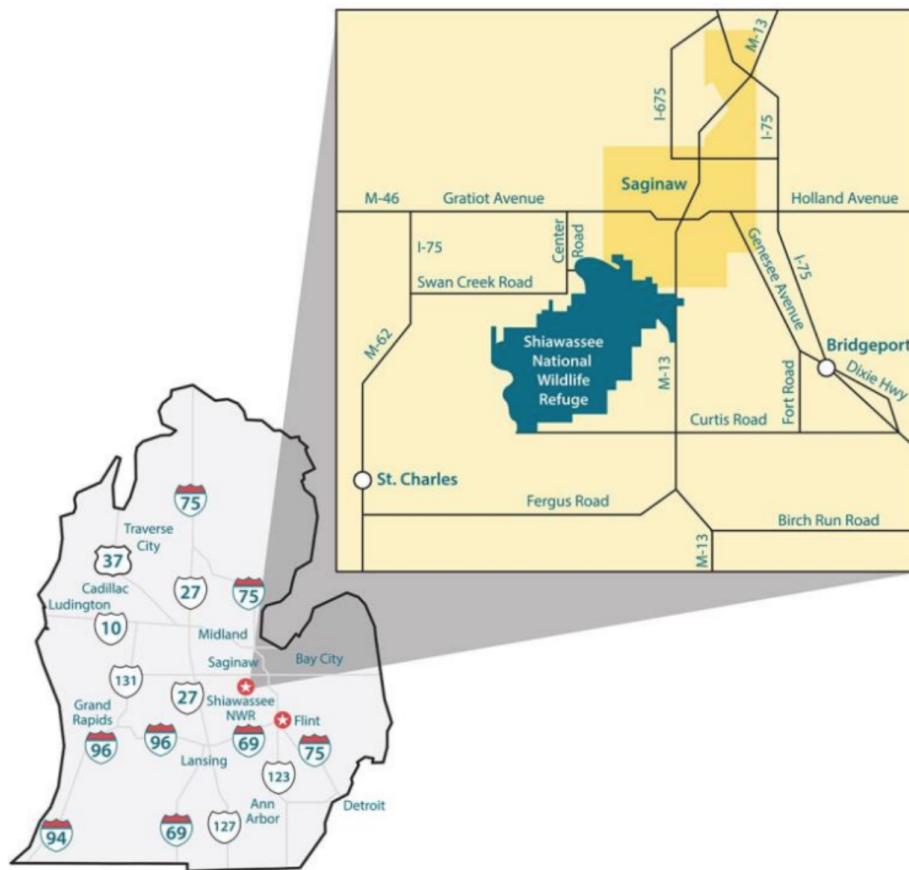
Figure 1: This map depicts the location of SNWR in the Lower Peninsula of Michigan. The expanded portion of the map depicts the major roads bordering the refuge, and highlights SNWR's proximity to the city of Saginaw.

Managerial staff at SNWR have indicated a desire to improve communications about the refuge's mission with the surrounding communities. They want to build community awareness of the importance of the wetland habitats SNWR helps to create and protect, as it provides critical services like flood water storage and recreation opportunities for the public. We worked with SNWR staff to create both engaging web-based communication materials and audio-visual interpretive content. These materials included an Audio Tour to guide visitors along the refuge's

Wildlife Drive, an Esri StoryMap to tell the refuge's story, and interpretive sign layouts for increased educational opportunities along the Wildlife Drive and trails. The Audio Tour and StoryMap were chosen as projects because users can engage with them remotely, which increases overall reach and accessibility. The Audio Tour is intended to be most impactful if the listener is on the Wildlife Drive, while the StoryMap is intended to connect with potential visitors before or at the beginning of their first visit to the refuge. The StoryMap is also an excellent resource for anyone wanting to learn more about the refuge's history, mission, and active programs. Our team pursued interpretive signs in response to requests by community members and USFWS staff (Nelson & Maisano 2019).

BACKGROUND AND PROJECT DEVELOPMENT

Defining Key Goals
We met with Eric Dunton, Lionel Grant, and Pamela Repp; the refuge's Wildlife Biologist, Visitor Services Manager, and Park Manager, respectively; to discuss the challenges and opportunities SNWR staff had identified regarding their relationship with the surrounding communities. Refuge staff cited a number of concerns. These include friction with some farmers in the area that believe SNWR to be the cause of annual flooding in their fields and a disconnect with and perceived lack of visitation from residents of the nearby city of Saginaw. With refuge staff, we determined the key concerns the refuge wanted to address were:

1. *Lack of awareness among the public about what SNWR does and if and how the public is able to visit.*
2. *Difficulty articulating the ecological importance of wetland ecosystems, particularly to farmers in the region.*
3. *Absence of interpretive and educational materials at the refuge for visitor engagement*

Regarding the first concern, SNWR is not alone. Across the U.S., many communities living near National Wildlife Refuges have expressed a lack of knowledge about their local refuge's basic offerings (Floyd et al. 2016). For the second concern, SNWR staff noted how the lack of farmer support for the refuge's activities hinders SNWR staff collaboration and relationship building within the local agricultural community. Though farmers had not had a direct impact on refuge management practices, refuge staff expressed a desire to improve relations with them, noting how the future of conservation depends on garnering community support (USFWS 2011). For the third challenge, refuge staff referenced a desire among community members for improved signage (Nelson & Maisano 2019). Interpretive signage, when designed and positioned effectively, has been shown to positively influence pro-conservation behavior amongst visitors who engage with the signs (Powell & Ham 2008).

In addition, the refuge has received millions of dollars over the last decade from the Great Lakes Restoration Initiative (GLRI), a federal program designed to address broad environmental issues throughout the Great Lakes. When the GLRI was launched in 2010, one of the initiative's main focuses was to address education, communication, and partnerships between Great Lakes conservation entities and communities (GLRI 2011). Refuge staff acknowledge that building a strong community foundation will help ensure the longevity and utility of this GLRI funding and is directly relevant to meeting the goals of the GLRI. The ecological restoration work at SNWR, as described, has not been effectively communicated to the surrounding communities.

Despite these challenges, refuge staff noted that they have strong relationships with certain user groups in the community and across the state. Some of SNWR's most supportive groups include hunters, anglers, birders, and wildlife watchers who frequently visit the refuge throughout the year. Local volunteers who assist the refuge during recreation or visitor events throughout the year are also very supportive of SNWR and its mission. Additionally, SNWR has some neighborhood residents who regularly use the refuge's hiking trails, Wildlife Drive, and observation towers. In the past, the refuge hosted school groups for field trip outings; however, field trips have mostly halted in recent years.

Creating a Vision from Refuge Assets
When we asked refuge staff to articulate a vision for improved community relations, they described a desire for the broader Saginaw community to be aware of the refuge, to know about its conservation and restoration work, and to understand what the refuge has to offer the community. From this vision, we collaborated to determine a realistic and achievable project objective: to learn about the refuge's story, synthesize key story elements into effective communications for the public, and help refuge staff more concisely and consistently articulate this story themselves. To meet this objective, we focused on creating three main products: an Audio Tour, a Story Map, and interpretive signs; all of which were collaboratively developed with refuge staff. We chose these products because they build off key assets already present at the refuge, amplify the educational potential of the refuge's highly visited Wildlife Drive and hiking trails, and utilize the refuge's strong web presence.

Due to the limitations caused by the COVID-19 pandemic, we decided not to pursue any public outreach or host events requiring in-person interaction. Instead, we focused on creating products that are accessible through virtual platforms.

PROJECT DELIVERABLES

Audio Tour
Our team developed an eight-episode Audio Tour to guide visitors along the 6.5 mile Wildlife Drive that traverses the dikes within SNWR. The Wildlife Drive is one of the refuge's most utilized visitor experiences and offers an excellent opportunity for visitors to view wildlife, take pictures, and stop to learn about the ecosystem at observation towers along the way. Since the Wildlife Drive sees the most visitor traffic within the refuge, we wanted to create an educational resource specifically for and particularly compatible with the Wildlife Drive. Audio Tour episodes are theme-based and can be played in any order, as they are not chronological. The Tour is crafted to guide visitors along the Wildlife Drive. It includes notes on rules for using the drive, and suggestions of ways for listeners to observe their surroundings and record their experiences while at the refuge. However, the tour is not so specific that it is inaccessible to listeners who are not on the Wildlife Drive. The information presented is general enough that it can be listened to from anywhere, regardless of whether the listener is at SNWR.

The tour is narrated by hosts and members of our project team, Jon Gorter and Anna Greenberg; members of SNWR staff Eric Dunton, Pamela Repp, Lionel Grant, and Eliza Lugten; and the Curator of Archaeology at the Castle Museum of Saginaw County History, Jeff Sommer. Episodes cover a variety of topics (Table 1.1) and range between two and ten minutes each. Our team drafted a script and went through an iterative editing process with SNWR staff and our project advisor. After the script was finalized, narrators separately recorded their sections and sent them to our team. We compiled each recording using Audacity and Adobe Audition software. We then reviewed and edited the compiled audio files to fix any sound quality issues or factual errors, and to generate the written transcript (Appendix I).

EPISODE	DESCRIPTION	NARRATORS	DURATION
1: Welcome to the Refuge	Welcome! We're happy you're joining us on this Audio Tour. This chapter includes an introduction from our refuge manager and important safety information for those of you listening from the wildlife drive.	Pamela Repp Jon Gorter Anna Greenberg	3 minutes, 49 seconds
2: Refuge History	A peak back through time; this chapter will introduce you to the natural history of this region and its vital role in supporting migratory birds. Hear from one of our biological technicians about why the refuge is managed in separate units and what we learn from this ecosystem every day.	Anna Greenberg Eliza Lugten	3 minutes, 46 seconds
3: Human Legacy and Archaeology	Learn about the human legacy in the region, from Paleo-Indian habitation over 10,000 years ago, to the Indigenous peoples of the Ojibwe, Odawa, and Potawatomi nations, gathered from present day archeological research. Hear from Jeff Sommer of the Castle Museum of Saginaw History about archeology at the refuge, and why this is a	Jon Gorter Jeff Sommer	5 minutes, 28 seconds

	unique place to study cultural artifacts.		
4: Birds	With over 270 species spotted here, Shiawassee is famous for its birds. The Shiawassee National Wildlife Refuge is a key stopping point for migratory birds that travel thousands of miles during migration. In this episode, you will learn about migratory birds, rare species that have visited the refuge, and how this refuge is part of a larger system of protected lands across the country.	Jon Gorter Eric Dunton	9 minutes, 24 seconds
5: Mammals, Reptiles, and Amphibians	It's a busy and diverse neighborhood here at the refuge. We discuss how this ecosystem serves as vital habitat to several once-endangered species. Plus, refine your observational skills and learn how to spot signs that charismatic critters, like the muskrat, are out and about along the Wildlife Drive.	Anna Greenberg Jon Gorter	6 minutes, 25 seconds
6: Zooming Out	If you have been listening to the previous sections wondering, "But, what is a wetland?", this is the section for you! Did you know wetlands can improve water quality? Did you know they act like big sponges during flooding events? Learn about these topics, and more, in this episode.	Anna Greenberg Eric Dunton	5 minutes, 26 seconds
7: Supporting the Refuge	The refuge belongs to you! This place is public land, and that makes Shiawassee a resource for all. In this episode, you can learn how to support the refuge in various ways. Whether you're on the Wildlife Drive or listening from another state, you can take the lessons you learn from this incredible ecosystem anywhere you go.	Jon Gorter Lionel Grant	5 minutes, 06 seconds
8: Thank You for Listening	Thank you for joining us on the wildlife drive! We encourage you to document what you've learned and observed and we hope you visit us and tune in again soon.	Anna Greenberg Jon Gorter Pamela Repp	1 minute, 54 seconds

Table 1.1: Breakdown of each Audio Tour episode, including description of episode content, narrators, and duration. Descriptions were written to serve as episode captions on the USFWS multimedia page.

The Audio Tour can be accessed through the USFWS SWNR multimedia page. Our team provided refuge staff with the audio files and transcript (Appendix I) for distribution and promotion. Additionally, we created sign templates (Appendix II) for refuge staff to adapt for installation at the start of the wildlife drive so visitors can download episodes before beginning their tour of the wildlife drive.

Story Map

To promote the ongoing restoration work and spread awareness of various recreational activities available to the public at SNWR, our team developed a Story Map through Esri software. This easily navigated and visually appealing interactive tool is intended to showcase all that SNWR has to offer residents of the greater Saginaw area, as well as anyone who may be thinking of visiting from farther away. The Story Map itself, entitled "Welcome to Shiawassee: Where Rivers, Wetlands, and People Meet," is divided into six thematic sections that visually and

narratively outline the wildlife, history, ecosystem services, and recreational activities offered at SNWR (Table 1.2).

SECTION	DESCRIPTION
1: A Haven for Wildlife	The first section of the story map aims to orient viewers to the purpose of the refuge as well as its uniquely situated location at the confluence of four rivers, allowing for such a thriving wetland system. This section also highlights examples of the unique wildlife that visitors may see at the refuge.
2: An Urban Refuge	This section highlights the refuge's close proximity to downtown Saginaw, as well as Bay City. This section aims to emphasize the fact that SNWR is meant for people and that the natural and human landscapes of the area are intrinsically connected.
3: A Look into the Past	Going back thousands of years, when glaciers covered the state of Michigan, this section aims to educate people on the history of the Saginaw Bay area. This section explores the physical processes that formed this fertile wetland area, an overview of the first humans who inhabited the area, and a look at recent human activities that have created the necessity for SNWR.
4: Refuge to the Rescue	Picking up in 1953, just after SNWR was established to remedy habitat destruction and extinction risks to various local species, this section highlights the early and current scientific research and restoration work that goes on at SNWR.
5: Saginaw's Sponge	Among the most important ecosystem services that SNWR provides to local residents is flood control and storage. This section explains in simple terms how wetlands help protect people from flood damages. Examples and historic photographs are provided from historic Saginaw River system floods in 1969 and 2020.
6: Plan Your Visit	This section provides examples of all of the recreational opportunities available to the public at SNWR including the Wildlife Drive, hiking trails, hunting, and fishing. Detailed descriptions of educational opportunities at the refuge's Greenpoint Environmental Learning Center are also provided. Finally, a map displaying all NWRs is embedded to emphasize the connectedness of Saginaw to similar areas within the region and across the country.

Table 1.2: Breakdown of the content of each Story Map section.

The Story Map can be accessed at the SNWR website and will be distributed through the refuge's social media platforms.

Interpretive Signage

Our team created signs in direct response to refuge staff and visitor requests for more educational signs placed around the refuge. We worked with SNWR staff to choose topics that were both relevant to the refuge and important for visitors to learn more about. We followed signage protocols outlined by the National Parks Service at the Harpers Ferry Center (2009). In total, we created three signs: one highlighting three unique and charismatic wildlife species at the refuge, one detailing the migratory journeys of birds, and one emphasizing the role the refuge plays in storing seasonal flood waters in the region (Appendix III). We created these signs using Adobe InDesign software, and sourced most images through Flickr, all licensed by Creative Commons.

USER GUIDES

Audio Tour

In order to encourage collaboration and group editing in the Audio Tour development process, our team utilized the approach described below. We recommend that any future additions to the Audio Tour follow a similar approach and that the Tour be updated regularly, particularly when refuge staff identify a new topic relevant to the public and refuge visitors.

First, we created a list of topics we believed would be engaging for visitors along the Wildlife Drive, like birds, mammals, and reptiles. We also included topics that highlighted elements of the refuge that visitors would not see and might not think about while on the Wildlife Drive, like the archeological digs at SNWR and the effects of occasional flooding at the refuge. Once we compiled this list of ideas, we conferred with refuge staff to determine which topics would be included in the final production of the Audio Tour.

We then wrote transcripts for each episode, after conducting background research and interviewing experts for each topic. These scripts were shared with refuge staff and underwent multiple rounds of editing, and we also asked refuge staff to write portions of the scripts. Once the script was finalized, we divided speaking parts among those involved, including refuge staff members, Jeff Sommer from the Castle Museum of Saginaw County History, and Anna Greenberg and Jon Gorter of the 2021 UM-Shiawassee Master's Project team. To assist the process of remotely making recordings, we created a recording guide, intended to help anyone who had never created an audio recording before and to ensure that each participating member generated an audio file in .mp3 format (Appendix IV).

Once recordings were finished for each episode, we assembled them into a unified file and edited the sound quality of each to match key elements like loudness, background noise, and quality. We tinkered with adding details like intro and outro music but settled on having intro music for only the first episode and outro music for every episode.

Story Map

Crafting a narrative was central to the development of the Story Map and should be critically considered by anyone looking to update the Story Map in the future. We wanted to showcase what the refuge has to offer, while also highlighting the context of human and ecological history that provides the backdrop for the refuge today. For future updates to the Story Map, we recommend defining the intended audience, crafting a narrative, and locating the primary graphics that will be used to best illustrate the key features and actors within that narrative. Future Story Maps could focus on various topics, inducing specific eras in Saginaw Area history and the role the Shiawassee Flats played in that history, the connection of agricultural land use and the downstream impacts of nutrient runoff, or the story of the restoration of the Maankiki

units at SNWR. To determine the focus of future Story Maps refuge staff could hold brainstorming sessions and could speak with local community members about which topics would be most impactful for the refuge to articulate to the public. The technical steps for navigating the update process through Esri can be found in Appendix V.

RECOMMENDATIONS

Establishing strong connections with local communities takes time, trust, and continued investment (Floyd et al. 2016). In order to connect with the communities surrounding SNWR, refuge staff must continue offering educational programming, increase their outreach into communities, and disseminate information about the refuge whenever possible. We recommend the following to build upon the products we created and to continue engaging with the greater Saginaw community in the future.

Distribute Existing Content
- Share links to the Audio Tour and Story Map in as many locations as possible. Consider adding links to email signatures, incorporating links to social media pages, and forwarding links to local and regional agencies like the Saginaw Children's Zoo, Saginaw Audubon, Ducks Unlimited, Audubon Society, and others.
- Publish materials on a larger platform whenever possible. For example, the Audio Tour currently exists on the refuge's multi-media page. Ideally, this content would also be available through podcasting platforms like Apple Podcasts or Spotify.
- Continue updating and maintaining the Audio Tour and Story Map.

Virtual Programming
- Refuge staff could consider hosting and livestreaming virtual programs at the refuge. For example, a 30-minute monthly or seasonal guided hike along the trails at Green Point would allow public interaction with refuge staff via the livestream chat feed and would spark public interest in the natural features of the refuge. Livestreaming through Facebook requires no time to upload video material, and the finished product would be accessible via the SNWR Facebook page.
- Continue reaching out to nearby schools to provide virtual field trips.
- Due to the COVID-19 pandemic, many people are now highly engaged in video streaming platforms and looking for ways to get involved with others without physically meeting in person.

Publish a Podcast
- Building off the Audio Tour format, the refuge should consider starting a podcast. The podcast could cover new topics centered around natural phenomena at the refuge and could include information regarding visitation guidelines, upcoming activities, and updates of construction or restoration projects.

- We recommend that a podcast be published at regular intervals (i.e., once per month).
- Coordinate podcast development and distribution with Midwest Region social media contacts to adhere to U.S. FWS regional standards.

Additional Signage
- Craft additional signage throughout the refuge that is place-based and enhances audience understanding of the landscape.
- Signage along the Wildlife Drive is exposed to intense sun and heat during the summer months, which can cause significant weathering damage to signs. To protect signs, the refuge should consider constructing a discrete yet sturdy awning that shades interpretive signs located on viewing platforms.

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APPENDIX I
Full transcript of the Audio Tour.

1. Welcome to the Refuge

[Intro music]

[Pam] Hello! My name is Pam Repp and I am the refuge manager. It is my pleasure to welcome you to the Shiawassee National Wildlife Refuge! Whether you're our neighbor in Saginaw, visiting us from elsewhere in Michigan, or are from out of state, I am excited to share this beautiful and unique place with you. You are about to embark on our Wildlife Drive, which winds its way through wetlands, floodplain forests, and moist soil units of the refuge.
This Audio Tour will help you understand the sights and sounds of the refuge, as well as highlight the natural and indigenous history of the region, the importance of the refuge to Saginaw Bay and the Great Lakes, and much more. In addition, this tour will offer suggestions for reflection and encourage you to relax and take in the surrounding landscape as a casual observer and as a scientist. I hope you enjoy your visit and come back again, as each visit will be different. I will now turn you over to your Audio Tour guides: Anna and Jon.

[Jon] Hi there! I'm Jon Gorter,

[Anna] and I'm Anna Greenberg,

[Jon] and we are graduate students at the University of Michigan School for Environment and Sustainability. It has been our pleasure to work alongside the Shiawassee National Wildlife Refuge to help create this Audio Tour. As you proceed, keep your eyes and ears open for wildlife both near and far. A pair of binoculars certainly comes in handy at the refuge, but you can still see plenty of wildlife without them. While scanning the wetlands and tree lines for eagles, pelicans, mink, and more, please remember to drive carefully and check that the road in front of you is clear of snakes, muskrats, birds, and people before proceeding. The speed limit along the entire drive is 15 MPH. This speed is set to minimize disturbances to both wildlife and other visitors.

[Anna] Along the drive, you'll notice pull-offs and parking areas. Please use these to stop and view wildlife and allow other visitors to pass you if necessary. We kindly ask that you refrain from stopping in the middle of the road if there are other visitors behind you. Additionally, there are several observation decks along the drive featuring educational signage and benches. These decks are the only locations along the drive where it is permissible for you to exit your vehicle. We know that sometimes the best views and photos of wildlife don't come from inside the car. However, it can be disruptive and dangerous to you, other visitors, and wildlife when people exit their vehicles outside the designated areas. We ask you to only leave your vehicles at the observation decks along the drive.

Are you visiting us today alongside a friend? A partner? Your family? Maybe you're visiting us to enjoy some solitude? Or, maybe you've joined us with a furry friend in the car. If this is the case, remember that your pet could appear like a threat to the wildlife here and the habitat along the drive, so please keep your pet in the vehicle at all times.

[Pam] Once again, we're excited to have you here with us on the Shiawassee National Wildlife Refuge. We hope this Audio Tour piques your interest in the history of the area, of its plants and animals, and the unique role the refuge plays in the Great Lakes and our quality of life. Enjoy!

[Outro music]

2. Refuge History

[Anna] The area around you has gone through many transformations. After the glaciers that used to cover Michigan retreated nearly 11,000 years ago, this land lay beneath Lake Huron, until that, too, retreated to its present-day boundaries. Wetlands and marshes, very similar to those you're seeing right now, dominated this area. Forests of beech and maple trees and swamps hosted over 270 species of birds annually. However, in the mid-1800s, the forests were cut down for lumber and the wetlands drained for agriculture. But land has memory. Right now, you are in one of the lowest parts of the entire state of Michigan, and the land around you was so accustomed and so well-suited to being full of water that establishing farmland was a challenging pursuit. Finally, in 1953, these 10,000 acres were designated as a National Wildlife Refuge, and our restoration work here began to recreate a place where wildlife can thrive. Shiawassee joined a network of refuges across the country that now number close to 600. The National Wildlife Refuge system is run by the US Fish and Wildlife Service which is focused on the conservation of specific groups of wildlife. Here at Shiawassee, our primary focus is migratory birds.

Our frequent visitors to the refuge include American white pelicans, double-crested cormorants, and terns, species that visit Shiawassee for months at a time during migration. These birds, plus numerous other species, rely on Shiawassee as an important pit-stop as they migrate between areas as distant as northern Canada and Central and South America. In order to provide the most productive, safe, and ecologically sound ecosystem for these travelers, we monitor freshwater insects, vegetation, and fish. If the birds' food sources do well, then the birds do well.

Now, I'll turn it over to Eliza, who's a biological technician here at the refuge to talk more about the history of this area.

[Eliza]

You may notice as you proceed along the Wildlife Drive that you are driving over a barrier separating one part of the refuge from another. You may notice other, similar barriers reaching out throughout the wetlands. These barriers are dikes, and they help us manage, study, and restore this environment. The Shiawassee National Wildlife Refuge is divided into separate units and connected through flow structures so we at the US Fish and Wildlife Service can control the water flowing in and out of each unit.

You may be wondering - "Why separate wetlands in this way?" It's a good question, and to answer it, we must recall the region's history. This area was drastically altered from the ecosystem that developed after Lake Huron's retreat, and we are still learning how to properly restore it. Managing each section of the refuge separately allows us to treat it like a giant science experiment as we learn what water temperatures, oxygen levels, vegetation types, and flooding patterns are the most beneficial to the fish, aquatic insects, plants, and birds the refuge was designated to protect. If you're visiting us in the summer, you may even see people out in the wetlands setting nets to catch and study fish, picking through trays of aquatic insects, or gathering water samples to investigate in a research lab. We are constantly learning from this incredible place and we're so happy you're here so we can share some of its secrets with you.

[Outro music]

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3. Human Legacy and Archeology

[Jon] While driving through the refuge, you might have noticed that even though there are so many types of wildlife living here, this landscape has been shaped and designed by humans. Like mentioned earlier, the Fish and Wildlife Service has protected this place to recreate

a natural wetland. Though the development you're seeing here first started during the refuge's creation in 1953, the human presence in this wetland area is not new; in fact, this area has been inhabited by humans for thousands of years, stretching back to the earliest days of human activity in Michigan! In this section, we'll cover the history of the area around you—including who lived here, what life was like, and why this place has been such a hotspot for human habitation for so long.

To start us off, I want to introduce Jeff Sommer, an archeologist from the Saginaw area who grew up coming to the Shiawassee National Wildlife Refuge as a kid, and who now studies the history of the refuge by uncovering artifacts from the past.

[Jeff Sommer] Hello, this is Jeff Sommer. I'm the curator of archaeology at the Castle Museum of Saginaw County History. For over two decades, the Castle Museum has partnered with the US Fish and Wildlife Service to identify and preserve the cultural resources of the Shiawassee National Wildlife Refuge. Nearly since the last ice age, the natural history and the cultural history of the region have intertwined, and nowhere is this more apparent than in the Shiawassee National Wildlife Refuge. Indeed, the area's rich archaeological record reveals that from the farmsteads and coal mines of the nineteenth and twentieth centuries, to the camps and dwelling places of the area's earlier inhabitants, the natural resources of the region have profoundly influenced the distribution and activities of local people. We are truly fortunate that the Shiawassee National Wildlife Refuge takes as its mission the protection, not only of the natural resources under its control, but also the irreplaceable cultural resources preserved within its boundaries.

[Jon] As mentioned earlier, this wildlife refuge sits at the meeting point of four major rivers: the Shiawassee, the Flint, the Cass, and the Tittabawassee. These rivers likely functioned as important navigational routes for trading, traveling, hunting, and fishing for as long as people have lived in Michigan, stretching back over 10,000 years. Locally, this low-lying area is known as the Shiawassee Flats, and even though you can't see Lake Huron from here, the flats are only a few feet above water levels in the lake. Large numbers of fish navigate back and forth between the Shiawassee Flats and Lake Huron. Today, this area still has thriving fish populations, making the area between the Flats and Lake Huron a popular destination for anglers.

The Ojibwe, Odawa, and Potawatomi people are regarded as the principal tribes living in Michigan throughout recorded history. These tribes, though distinct nations, spoke a common language and shared cultural traits. Together, they form the Council of Three Fires, a political alliance formed for common defense that scholars estimate dates back to around 800 AD. Today, these tribes still have a strong presence throughout Michigan and the Great Lakes region. Yet even before the Ojibwe, Odawa, and Potawatomi nations were here, Michigan was inhabited by Archaic Indians and Paleo-Indians, who hunted and farmed, created pottery and art, and had complex cultural systems themselves. Though not much is known about the activities of these earlier people groups in the Shiawassee Flats area, archaeological evidence suggests that they were also using the wetlands for transportation and sustenance. Since the Shiawassee Flats was, and is, such a productive ecosystem, it has served as a magnet for human activity in the Great Lakes region for thousands of years.

The Shiawassee Flats is a great place for archeological study. Throughout the refuge, there are pieces of pottery, tools, and signs of ancient habitation. Researchers have also

discovered middens, or mounds of discarded items, which give hints about how previous inhabitants lived, what they ate, and what they were doing here.

Since 1999, archeologists like Jeff Sommer from the Castle Museum of Saginaw County History have conducted research at the refuge to uncover clues about the region's human presence over time. Researchers have uncovered stone tools and jewelry and incorporated materials from Indiana and Ohio, indicating that the Shiawassee Flats was linked to regional trade. They've also excavated sites with scorched food items, like corn cobs, dating back to the Woodland period, which spans between 1000 BCE and 1650 AD. Scorched corn might not seem all that significant, but it suggests that early inhabitants might have used the surrounding landscape to grow crops. Signs of agriculture like this are particularly interesting, because they indicate that the flats were not only used for trade and travel, but also for settlements and farmland for extended periods of time.

[Outro music]

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4. Birds

[Jon] If there's one thing the Shiawassee National Wildlife Refuge is famous for, it's the birds. People come to this refuge from around the country to catch a glimpse of the birds here. One reason is the sheer number of birds that can be seen here. Often, there are hundreds of egrets, herons, ducks of all types, geese, cranes, and more, you can see at the refuge on a given day. Another reason is that some of the birds you'll find here are found in only a few other places in Michigan; and for some, like the prothonotary warbler, the Shiawassee Refuge is the one of the only places birders can find them in the whole state!

Over 270 bird species have been sighted at the refuge; that's over half of the total bird species that can be found throughout the entire state of Michigan. Large and beautiful species like the American white pelican, sandhill cranes, and bald eagles can be found sunbathing or soaring overhead. But while you're looking for the large birds, don't forget to look for the small, subtle birds as well. The refuge is home to many types of sparrows, orioles, kingfishers, and quick-moving, colorful warblers that are definitely worth spotting. Though they can be a challenge to locate, small, migratory songbirds can be stunning, like the prothonotary warbler, a bright golden-yellow bird that nests in dead trees in the flooded forest at the refuge.

One question you might be asking is: why are there so many birds here in the first place? What is it that brings all these birds to this refuge? This is a simple but great question, and scientists at the refuge are still trying to figure out the details.

But we do know part of the reason. The refuge has what the birds need. Two of the most important things birds need are food and a place to build a nest. Take the bald eagle. For one, bald eagles love fish, and we know from our research that these wetlands are full of fish. Eagles will also eat muskrats, and there are plenty of them around as well. But just because there is a lot of food here for eagles, that doesn't guarantee an eagle will make a nest here. In addition to food availability, eagles also prefer places with low disturbance from human activity, and with lots of trees where they can build nests. The refuge has all of these elements - plenty of food, plenty of trees, and low human noise.

The refuge was created for exactly this purpose: providing a place for wildlife to thrive. As we mentioned earlier, the refuge is about 10,000 acres of protected land. In addition, the refuge is strategically located next to the Shiawassee River State Game Area, another protected area for wildlife that is nearly 10,000 acres. Together, the federally managed Shiawassee

National Wildlife Refuge and the state managed Shiawassee River State Game Area form close to 20,000 acres of wildlife habitat.

That's a lot of space dedicated to wildlife. But, when you think about it, over 95% of the wetlands in Saginaw County have been changed in some way that make them uninhabitable by wildlife. In fact, around one hundred years ago, the Canada goose was nearly extinct from over-hunting and habitat loss. Now, thanks to places like the Shiawassee National Wildlife Refuge, waterfowl like Canada geese have rebounded significantly. Geese are pretty common today. Just step outside on a fall day, look up, and you have a good chance of spotting some geese flying over in a v-shaped formation. Actually, you'll probably hear their loud honking before you even see them! Imagine such a common bird being lost to extinction.

Many birds can be found in abundance at the refuge. Some of my personal favorites are the egrets and herons that patrol the shallow areas of pools looking primarily for fish and frogs to eat. In the summer, you can easily spot the great egret, a tall, slender, white bird with a yellow bill, walking around on its long black legs looking for fish and frogs to eat.

The great blue heron, another tall and slender bird, is a top predator at the refuge. Look for this fierce hunter wading in the water, motionless, scanning for fish and frogs swimming below, just like the egret. If you see one of these birds, take a minute to observe its behaviors — is it sitting still or moving? If it's still, does it appear to be sneaking up on its next meal, or just resting? How can you tell? If you watch long enough, you might be lucky to see the great blue heron locate its prey, strike, and snag itself a fish dinner. You can learn a lot about wildlife by simply watching them behave and asking questions about what they are doing.

Though egrets and herons might be old friends around the refuge, some birds are rare sightings. For example, the wood stork and the white-faced ibis are some uncommon birds that visited the Shiawassee National Wildlife Refuge during the summer of 2020. Rare birds like these can be exciting for bird watchers all over the country, especially considering that the wood stork, which typically lives far south in Florida and Georgia, was last in Michigan way back in 1975!

Rare or common, big or small, why should we care? Why does it matter if the Shiawassee Refuge is home to hundreds of birds or just a few? To answer this question, we can look back to the formation of the National Wildlife Refuge system back in 1903. At the time, bird populations were plummeting across the country. Wetland birds like herons and egrets in particular were being over-hunted for their long breeding feathers, or plumes, used for styling fashionable hats. In an effort to protect these birds, President Theodore Roosevelt designated Pelican Island, a small island off Florida's Atlantic Coast and a crucial roosting site for birds, as a federal bird reservation. It was the first federal area set aside specifically to protect wildlife, and the first of many protected areas which would grow to form the National Wildlife Refuge system we know today.

Over 500 national wildlife refuges exist throughout the US today. Not only do these refuges protect critical habitat for wildlife, but many are also strategically located along critical flyways for migratory birds, thereby protecting breeding grounds and the stopover points birds need to rest and refuel between their winter residences and their breeding grounds. Shiawassee National Wildlife Refuge is one of these highly important stopover sites for many birds, like Canada geese, swans, and ducks.

Now, I'll turn it over to Eric Dunton, wildlife biologist at the Shiawassee National Wildlife Refuge. As a refuge scientist, Eric pays close attention to the plants, wildlife, and water conditions at the refuge.

[Eric] We've come to know a lot about birds over the last few hundred years. We've observed their populations rise and fall, and our country has taken steps to protect birds through establishing the Migratory Bird Treaty Act in 1918. Though there's still a lot to learn, we know some things for certain, and that's that birds need habitat to thrive. They need places where they can feed, nest, and raise their young.

That's why the Shiawassee National Wildlife Refuge puts so much effort into restoring wetland habitat, for the sake of wildlife, and for future generations to have and enjoy wildlife for years to come.

We'll close this section with the words of the founder of the National Wildlife Refuge system, Teddy Roosevelt. "The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased; and not impaired in value."

[Outro music]

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5. Mammals, Reptiles, and Amphibians

[Anna] It's not just birds that call this refuge home. In fact, there are 29 types of mammals, 10 types of reptiles, 10 types of amphibians, 47 species of fish, and hundreds of species of insects. All of these creatures help form an ecological community of living things. Take for example, one of our most common mammal species at the refuge, the muskrat. They may not be as famous as their cousin the beaver, but muskrats are fantastic builders and love to burrow into the banks of our wetland pools. They eat plants like cattails, and in doing so, help clear spaces for waterfowl to swim and navigate through the marsh. In their burrows they raise their young, usually 6-8 kits.

Along your drive, look at the banks of the pools, or on the islands in the ponds—can you spot any muskrats? Maybe you'll spot one swimming and sticking its thin, scaly tail into the air as it dives. Or can you see any signs of muskrats, like piles of cattail or large holes in the ground?

If a muskrat abandons its burrow, these old lodgings become perfect dens for another species at the refuge: the eastern fox snake. The eastern fox snake is a threatened species in Michigan and can only be found in a few counties across the state. Inside old muskrat burrows, eastern fox snakes hide from predators like eagles and herons and raise a clutch of 7 to 29 eggs each year, which will hatch in the late summer. If you're on the wildlife drive in late summer, keep an eye out for these snakes — they can be a tannish green or orange, with big black or brown spots down their backs, and they have a brown head. Their young start out small when they hatch from their eggs, but they can grow to be up to 7 feet long.

Now, not everyone likes snakes, and that's ok, but we still want to protect them. Eastern fox snakes are protected because of their low population numbers, so consider yourself very lucky if you see one. You may ask "why worry about the eastern fox snake? Why protect them?" Well, think about their role in the ecosystem — by eating rodents, these snakes help lower the number of ticks and fleas significantly, which can help slow the spread of harmful, parasite-borne illnesses in wildlife and in humans. They also eat frogs and birds, which helps keep those populations in check. Ecosystems depend on a balance - too many of one species throws everything else off, including processes and resources that we humans rely on every single day. And the snakes themselves are food for numerous species, including bald eagles. By keeping the eastern fox snake around, we're helping to feed our eagles and to protect other wildlife, including us, from ticks.

Along the drive, keep a keen eye out for snakes on the roads. Remember, our speed limit is 15 mph, and going this speed can help you protect wildlife, like eastern fox snakes. Also, take a second to scan the waters in between the dikes—you might just see a snake swimming its way across the water. Eastern fox snakes are excellent swimmers!

[Jon] Another charismatic mammal at the refuge is the American mink. Measuring only about one to two feet long and staying close to the ground as it moves, the American mink can easily go unnoticed while weaving nimbly through tall grasses. Mink are largely crepuscular, which means they are most active at dawn and dusk, and they can be pretty secretive and difficult to find. But mink aren't confined to catching prey on land—they are highly skilled hunters in water as well. With sleek, waterproof fur, and a slender body, the American Mink is a perfectly equipped wetland predator. Mink are great swimmers and often hunt underwater for fish, amphibians, and crayfish. They will also catch ducks, mice, rabbits, snakes, frogs, voles, and even gorge on the occasional insect! In the past, mink populations plummeted due to hunting for their prized fur. Another threat to the American mink has been the steady loss of wetland habitat. Wetlands have been shrinking in size and number, and mink need a large area for hunting. But today, the American mink has been making a comeback.

Mink populations stabilized across Michigan due to hunting and trapping limits that controlled overharvesting. In addition, habitat restoration and wetland protections at the state and national level, like what we're doing here at Shiawassee, have helped save mink habitat. In the past, it was somewhat rare to encounter a mink at the Shiawassee National Wildlife Refuge, but today, refuge staff report spotting them regularly.

Along the drive, it might be difficult to find a mink, unless you arrive in the early morning or late evening. However, there are other signs of mink you can look for. Try to imagine where a mink might spend its time — where would it hunt, and what might it be hunting for? What kind of terrain would a mink hunt in: open water, or areas with lots of vegetation? Can you see some of the prey the mink might be hunting, like grasshoppers, frogs, birds, or other small mammals?

There are so many animals at the refuge to discover and learn about. Today, we've gone over just a few. While you continue along the drive, what other animals can you spot? Try to keep track of your sightings, either by sharing them outloud with your driving partners, or by writing them down in a notebook. When you see an unfamiliar critter, try to pay attention to what it's doing, and ask yourself why it might be doing that. Does this critter have fur, scales, a shell, or slimy looking skin? And why might it have that type of body? Be curious! And if you have a question about any animal you saw, stop by the refuge headquarters and ask anyone there — they would love to help you figure out what you've spotted. Stay vigilant, and stay curious!

[Outro music]

6. Zooming Out

[Anna] Let's take a step back. What is a wetland? And why restore them? (Aside from the birds, of course!) Wetlands are areas where water either completely covers the soil or is present at or near the surface of the soil. This water can be present year-round or at different times during the year. The plants and animals that live here are well-adapted to this type of ecosystem—not all trees can survive having their roots submerged year-round! Wetlands are separated into two main groups: coastal and inland wetlands. Though Shiawassee is nowhere

near the ocean, it is still considered an inland coastal wetland—coastal to the Great Lakes, that is.

Shiawassee Refuge is just upstream from Saginaw Bay and Lake Huron, and sits within the Saginaw Bay watershed. A watershed is an area of land that drains all of its water to the same point, which in our case is Saginaw Bay. The Saginaw Bay watershed drains just over 15% of the entire land area of Michigan! But it's not just water that drains into the bay. Fertilizers, pesticides, oils, plastics, trash, and other pollutants travel with rainwater and rivers through this watershed and into the Bay, and these can pose major human health and ecosystem threats. Luckily, the Shiawassee Refuge sits at the meeting point between 4 major rivers: the Shiawassee, the Flint, the Cass, and the Tittabawassee, and so it is well-poised to filter out many of the pollutants that would otherwise flow downstream.

How do wetlands filter the water? To answer this, consider how the land around you looks - flat as a pancake! For water quality, this is a very good thing. When water, loaded with nutrients, sediments, and pollutants enters these wetlands, it slows to a near standstill. The lack of current allows those suspended particles and pollutants to settle on the bottom of the wetlands. From there, microorganisms like bacteria and some plants absorb up these nutrients and even some harmful chemical pollutants. Removing excess nutrients from the water prevents them from entering Lake Huron and causing harmful algal blooms that can make water undrinkable for humans. Most pollutants get stuck in the wetland muck at the bottom of these pools and are trapped. Shiawassee, and wetlands in general, act as nature's built-in water filtration system.

Additionally, wetlands serve as the perfect nurseries for birds and fish. Nesting resources abound for birds to lay their eggs and there's plenty of food for them to raise their young. For fish, the wetland's still waters offer a safe haven for unhatched and juvenile fish that are poorly equipped to handle the current of fast-moving rivers. These wetlands offer a calm, resource-rich nursery for young fish to grow before they reenter the surrounding rivers in their later adult stages.

Wetlands may be excellent nurseries and filters, but they offer another notable service: flood storage. As the planet warms and climate patterns change, we here in Michigan can expect more frequent and heavier rain events. These intensive precipitation events will place immense pressure on human-built infrastructure like dams, bridges, roads, and levees - and natural infrastructure, like that provided by the Shiawassee Refuge wetlands, will grow in importance.

I'll turn it over to Eric, who's joining us again to talk about the flood storage here at the refuge.

[Eric] In May 2020, the failure of two dams on the upper portion of the Tittabawassee River, following several days of heavy rain, sent a rush of flood waters downstream towards Shiawassee. During that event, water levels here at the refuge rose 10 feet, and the wildlife drive you're driving on now was entirely underwater! Look out over the drive at where the water level is now; imagine just how far it would have to rise to submerge the drive. The flood storage provided by the refuge during this event prevented catastrophic flooding from occurring downstream.

Shiawassee, like all wetlands, acts like a sponge. The flat topography of the landscape forces floodwaters to slow and move across the floodplain, which allows more of it to permeate and be absorbed into the soil as groundwater. One acre of wetland can store up to one and a half million gallons of floodwater, and the refuge is 10,000 acres in size.

Shiawassee has an advantage when it comes to managing flood water and water levels within the wetlands. The refuge has infrastructure that can be opened to allow the wetlands to be

completely connected to the rivers and floodplains. Or the structures can be closed to keep water in the wetlands when there are lower water levels in the Great Lakes and rivers running through the refuge. This management capability allows the refuge to provide important wetland habitat under a wide variety of water levels and changing conditions.

[Outro music]

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7. Supporting the Refuge

[Jon] As you've navigated the wildlife drive, we hope you've gotten a sense of how special this place is — not just for wildlife, but also for you and I, and the people who live in this region today. As you've heard, this refuge supports many types of wildlife, from birds like the bald eagle, to mammals, whose populations are on the rise, like mink; from fish like walleye that need wetlands to spawn; to threatened reptiles like the eastern fox snake that need wetlands to raise their young. The refuge is home to many.

Now I'll turn it over to Lionel Grant, the Visitors Services Manager at the Shiawassee National Wildlife Refuge since 2012.

[Lionel] A National Wildlife Refuge is a unique place. It's not owned privately; you didn't have to pay a fee to come to the wildlife drive today. Instead, it's publicly owned and operated by the federal government — that means this land belongs to you, I, and every US citizen, and that we support it together through our taxes. Think about it: the refuge is like your own backyard, it's your land! Now, there are rules in place that help each of us protect it while we enjoy it, like staying in our car except at designated areas, and not littering along the drive. But at the same time, there's a sense of responsibility that comes with ownership. Since this land belongs to every US citizen, we have the responsibility to protect it while we're here; to treat animals, wildlife of all kinds with respect, and to pay attention to the road while we drive.

But let's ask the question: what if this sense of responsibility to protect water and wildlife didn't end as you left the gates of the drive? What if you could take some of the knowledge and experience you gained here today, and apply it at your own home? Well, you can! No matter where you live, there are things you can do to support the ecosystem and wildlife around you and around the world.

Spread the word about your experience. Share with others the story of the refuge and what you experienced on the wildlife drive while encouraging others to experience it, too. There are a number of ways to experience the refuge. Perhaps it is by discovering it for the first time, the coal mine shellings pile while hiking the historic Woodland Trail. Or maybe by wandering to the north-most area of the refuge for programming at Green Point Environmental Learning Center. The more you check out all the refuge has to offer, the more you can tell about it. In return, you advocate for the protection of this place and places like it.

Listen! Stay excited! Wherever you are, you can record your wildlife sightings. Websites like eBird and iNaturalist are great places to input observations of the different plants and animals you saw. You can make accounts on both the websites for free, and it's easy to use. If you're interested in the birds at the refuge, eBird is an excellent place to submit your bird sightings, but also check out what's been seen at the refuge in the past, and which birds have visited when. Biologists at the refuge record many of their bird sightings on eBird, and you'll be able to support their efforts with your own sightings by adding to the pool of data.

[Jon] Remember, you can take tangible steps to support wildlife even after you leave the refuge. There are so many ways you can support wildlife, from an action as simple as putting up a bird feeder in the winter, to something more active, like growing native plants in your yard.

You can also volunteer with local conservation groups to learn more about restoration projects, build community, and help wildlife at the same time. Many parks and watersheds have groups already dedicated to caring for habitat, and these are great organizations to connect with. If you are in the Saginaw area, consider connecting with the Saginaw Conservation District, the Saginaw Basin Land Conservancy, or the Saginaw Children's Zoo. If you're looking for opportunities elsewhere, check out groups with programs across the United States, like Outdoor Afro, Latino Outdoors, or your local Audubon Society.

Additionally, proceeds from hunting and fishing licenses provide significant support for wildlife conservation projects. By supporting 501c3 organizations like Ducks Unlimited and Trout Unlimited, you can help protect waterfowl and fish, and their habitat across the U.S.
[Outro music]

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8. Thank You for Listening

[Anna] And, you've made it! After seven miles of driving, we hope you enjoyed the landscape and spotted some memorable wildlife along the drive. Before you go, take a minute to think about what you saw and heard out here today. What surprised you about your visit to the refuge? Did you see anything that you had never noticed before — maybe a specific bird, or a large number of birds that you'd never seen? Did you learn anything new along your drive?

Maybe you have a journal or your phone with you; either will work. On the road ahead, take a second to pull off to the side and write down some highlights from your trip. You might make a sketch of a tree with a bald eagle nest in it, or jot down a quick description of a group of herons you saw feeding together or record another observation you made along the way.

[Jon] It has been our pleasure to host you on this Audio Tour at the Shiawassee National Wildlife Refuge. Once again, thank you for tuning in. Now, I'll turn it over to refuge Manager Pam Repp as we end our tour.

[Pam] Thank you for visiting the Shiawassee National Wildlife Refuge. We hope you enjoyed your tour and learned or saw something new today. As you experienced and learned, National Wildlife Refuges and other natural places are important to wildlife and people. Let's all work together to support these natural areas for healthy wildlife populations, enjoyable places to visit, and for their role in providing improved environmental conditions for future generations to come.

[Outro music]

APPENDIX II

Sign templates that our team provided SNWR staff to adapt and install along the wildlife drive to promote the Audio Tour.

Vertical sign layout

Horizontal sign layout

APPENDIX III

Interpretive sign layouts our team provided SNWR to use along the Wildlife Drive.

The "Magnificent Migrations" sign highlights waterfowl, songbird, and hummingbird migrations.

The "Flooding at Shiawassee" sign describes basic information of the flooding process and helps provide context and visuals to this natural phenomenon.

Life in the Wetland

Over 1,000 species of animals, plants, and fungi have been identified at the refuge, including 311 invertebrates, 47 fish, 10 amphibians, 10 reptiles, over 270 birds, and 29 mammals.

The American Mink, Prothonotary Warbler, and Eastern Fox Snake are just three of the amazing creatures that call Shiawassee National Wildlife Refuge home.

Each of these species has faced threats, whether due to habitat loss, over hunting, or other factors. Providing crucial habitat for these species, and so many others, is part of what makes this refuge so important.

Wetland Hunter

The American Mink is a perfectly equipped wetland predator. Its waterproof fur, sharp claws, and slender body help it hunt both in and out of the water with ease. Mink are great swimmers and often hunt underwater for fish, amphibians, and crayfish.

American Mink (Photo by tsaiproject | Flickr)

In the past, it was rare to encounter a mink at the refuge, but their populations have been making a comeback due to trapping regulations.

Woodpecker Nest Cavity

## Can I Borrow That Burrow?

Home Sweet Hole

When it comes to building a nest, Prothonotary Warblers seek out the abandoned holes, or cavities, made by woodpeckers. Due to deforestation, this warbler has only a few consistent nesting sites remaining in Michigan—and the Shiawassee National Wildlife Refuge is one of them.

Prothonotary Warbler

The Eastern Fox Snake is a threatened species in Michigan and can only be found in a few counties across the state. Inside old Muskrat burrows, Eastern Fox Snakes hide from predators like eagles and herons, and raise a clutch of 7 to 29 eggs each year, which will hatch in the late summer.
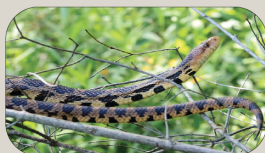
Eastern Fox Snake (Photo by Mark Nenadov | Flickr)

The "Life in the Wetland" sign highlights key animal species that live at the refuge, and pays special attention to the conservation stories surrounding these animals.

APPENDIX IV

Instructions and links for creating a voice recording:

1. **Review your section**
   a. Read over the sections you have been asked to record.
   b. Practice speaking it out loud a few times to get a feel for the words. If you'd like to change any wording, make edits and highlight them in the script.
   c. If you have been asked to speak more generally about a topic or add your own story, write down what you'd like to say.

2. **Find a quiet place**
   a. If possible, find a place away from windows, fans, and AC units.
   b. Bedrooms are good and closets are even better. Any small space with softer surfaces to absorb sound and reduce echo is good.
   c. Minimize risks of potential interruptions by letting others in your shared space know what you're up to.

3. **Recording**
   a. We'll be using the Online Voice Recorder found here: https://online-voice-recorder.com/ However, there are many other alternatives available online.
   b. Navigate to the site.
      i. When you are ready to start recording, select the red microphone button and recording will begin.
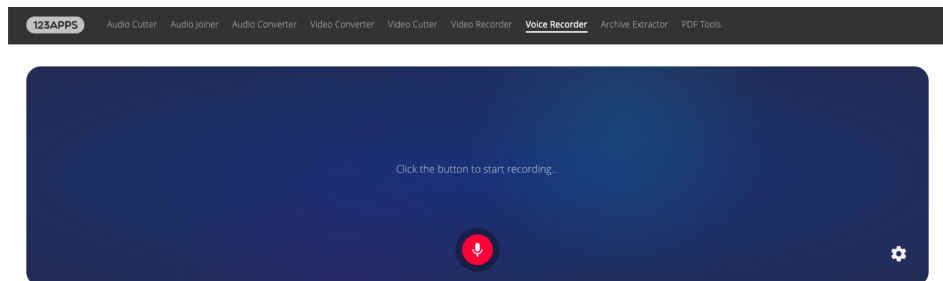
      ii. If you need to hold for a second, press the pause button. Press pause again to resume recording.
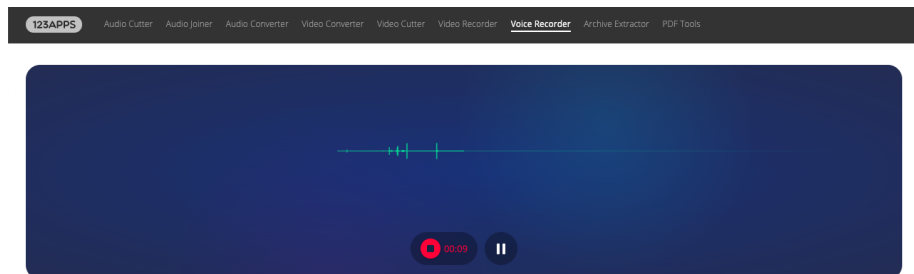
      iii. You may need to repeat your section a few times before you get it right. That's fine!

iv.   When you're satisfied with your recording, stop the process and select save
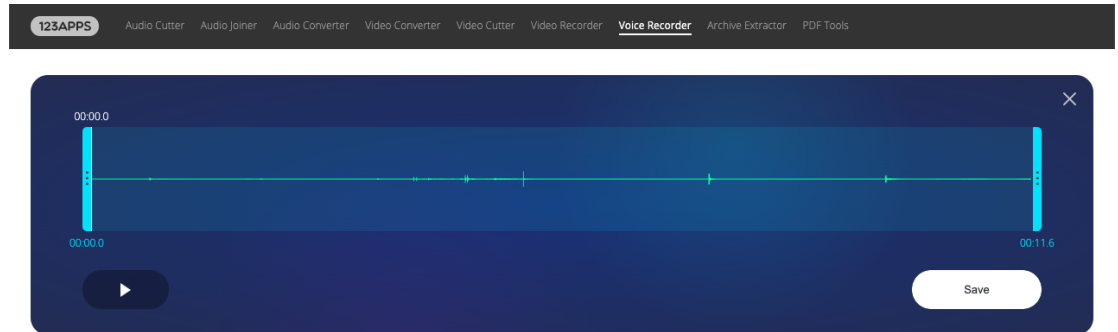
c. The file will automatically save to your computer as an mp3 file.
d. Rename the file with your name and general topic, and email it to the audio file editor.

APPENDIX V
Instructions for updating the Story Map.

1. Sign into storymaps.arcgis.com
2. Click on the "Welcome to Shiawassee" story icon
3. Click on the "Edit Story" button in the top right corner of the screen
4. To edit text:
    a. Click on the text box that you want to edit
    b. Start typing or deleting text
5. To change existing photos:
    a. Hover over the photo of interest
    b. Click "..." at the top of the image
    c. To change the image, click "Replace Image"
        i. If the photo is locally saved, select "Upload"
            1. A new window will pop-up, use this to navigate to the photo location
            2. Select "Open"- the photo will load in the "Replace Image" window
            3. Click "Replace" to add in the new image
        ii. If the photo is from a link online, select "Link"
            1. Copy the website link for the desired image
            2. Paste the link in the bar
            3. Click the "Replace" button to add in the new image
    d. To delete the image, select "Delete"
        i. A new window will appear asking if you want to remove the media
        ii. Select "Yes, delete"
    e. To add an attribution to the photo, hover over the image
        i. Two options should appear, a gear and an ellipsis - select the gear
        ii. In the pop-up, go to the "Display" tab and scroll down to "Attribution"
        iii. Enter the attribution in the designated bar
            1. Current attribution format:
               Photo Title | Photo by: Photographer
    f. To add alternative text, hover over the image
        i. Two options should appear, a gear and an ellipsis - select the gear
        ii. In the pop-up, go to the "Properties" tab
        iii. In the designated box, enter a description for the image. This is so screen readers and search engines that cannot load the image can still have an understanding of what should be displayed
6. To add content, go to the desired location within the story map and click on the "+" sign
    a. This will bring up a list of media options
    b. Find the desired option and click on it

       i.   Options include:
          1. Basic
              a. Text - text in different formats
              b. Button - a button that can link to a website or other media
              c. Separator - a divider between sections or general content
          2. Media
              a. Map - a customizable ESRI map
              b. Image - an image from a website or desktop
              c. Video - a video clip either from a website or desktop
              d. Audio - a sound byte for users to listen to from the web or desktop
              e. Embed - a web content such as social media posts, apps, etc.
              f. Swipe - a swiper to compare two maps or images
              g. Image Gallery- adds a showcase of up to 12 photos
          3. Immersive
              a. Slideshow - a click-through photo gallery with option to add text
              b. Sidecar - a combination of media and story narrative
              c. Map Tour - a map with media and descriptive text to give a "virtual tour" through an area

7. To move content around:
    a. Hover over a media item, map, separator, button, or an entire immersive block
    b. A handle icon will appear next to the object's upper left corner
    c. Click and drag the handle to the desired location
    d. Release the mouse and the item will reappear in its new location

8. To publish the updated story map:
    a. Click the "Publish" button in the top right corner
    b. It may take a moment to process

If there are no issues, it will say that the story was successfully published