

Golden Eagle Study Camera Trap Protocol

Version 11/20/24



Photo by Dave Brandes

Thank you for agreeing to participate in the Maine Golden Eagle Study. We hope to raise awareness of Golden Eagles in Maine, increase participation in conservation efforts, and address knowledge gaps to inform management actions. Through camera trapping and GPS tracking, our statewide collaborative team of community scientists, hunters, and partners will provide vital information to better understand this elusive species' presence, habitat use, and movements.

To accomplish this goal, we developed this protocol to ensure everyone collects data consistently. If you can follow this protocol, your camera trap observations will be included in regional camera trap monitoring efforts. We want this project to be fun and exciting. For more information about the study, visit our webpage. Please contact Erynn Call, Maine Depart. of Inland Fisheries & Wildlife State Raptor Specialist, erynn.call@maine.gov with any questions.

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1. **Testing your trail cam.** The first thing you should do is to test your camera. Make sure the darn thing is working. Put it in your backyard or somewhere else where you are moderately sure you can get a few pictures and where it won't get stolen. Then go back in a few days to check it.
2. **Site selection.** Next, to attract and photograph Golden Eagles you need to locate a suitable accessible site. Keep in mind that it is required by law to obtain written permission (e.g., via email, text, or paper) before setting up a baited game camera site on any property that is not your own. Pick an isolated, unvisited forested area, or hilltop for your photo-trapping site. Check out Figure 1 (page 4) and Appendix 1 (page 12) to see where Goldens were observed over the past 10 years as well as historic nesting regions (intentionally not distinguished to help keep the nesting areas private). These are areas where you may be more likely to observe Goldens or where we are particularly interested in documenting their use. Considering Goldens travel far and wide and may have gone undetected, camera sites outside these highlighted areas are still of great value!
 - a. **Accessibility.** You will need to get there every 2-5 days (depending on how long your bait lasts and what type of game camera you are using). Know your area and what site will be accessible year-round. You also need to get bait there (avoid lead-shot animals, see page 10 for more information), so a drive-in site is generally best – unless you like a good workout! Make sure the site is one you can regularly drive to safely.
 - b. **Small clearings.** Eastern Golden Eagles seem to prefer small clearings – smaller than you'd expect. Even a 30–60-foot diameter is suitable, but a 500-foot diameter is probably too large. Goldens prefer to perch in large trees near a carcass and watch it for a while before coming in, so it's good if there are a few big trees around the bait site. Place the carcass about 10-30 feet from the edge of the trees, but not in the center of the clearing.

- c. Elevation. Golden Eagles come in more readily to areas that are higher than the surrounding area and seem less willing to visit low-lying areas. If the latter is your only choice, give it a try!
- d. Timing – winter. We want to maintain sites with continuously available bait between January 1st through February. If Golden Eagles are not detected after two weeks (camera trap with bait maintained), the camera can be moved to another site and maintained with bait. This can continue during the winter in the hopes of finding suitable locations for detecting Golden Eagles.
- e. Timing – nonwinter. At sites where Golden Eagles were consistently present during winter or if they are close to historic nesting eyries (we will let you know if your site is close), camera traps can be run from April through December. However, bait should only be replenished once per month to last about a week. By only replenishing once per month, we expect that the bait will only attract local eagles and not lead to long-term occupancy by migrants. If after two months, no Golden Eagles are detected a new camera trap site can be selected and maintained. Please let us know if there are questions about the timing of sampling at your site.
- f. Mapping. Once you've selected your site, please make sure to send the GPS coordinates. Please document the location of all sites, regardless of Golden Eagle's presence.

3. **Camera setup.** Once you've chosen your site, there are a couple of key elements to setting up the camera (see some of the Golden Eagle photos on bait in the identification section).
- a. The bait. Deer carcasses work well for eagles, but any animal will do. However please do not use domestic or wild bird species or animals smaller than a beaver as bait. Birds could spread Avian Influenza to eagles and small animals will not persist. Ideally, the bait lasts for at least a week. If you are getting lots of eagles, ravens, and other scavengers, you may need many carcasses throughout the study period; the exact number you need will be determined by how quickly they disappear. Make sure that all carcasses, no matter what type of animal, are lead-free (i.e., not harvested or dispatched with lead ammunition).

You can get in touch with nearby slaughter and meat processing facilities (find lists online such as [here](#) or [here](#)) to ask if they have renderings that are from animals that were harvested without the use of lead ammunition or chemical euthanasia (e.g., barbiturates). Reach out to a local trapper for potential opportunities for lead-free carcasses (join Facebook groups such as Maine Trappers Association, and Maine Fur Trappers. Beavers may be a good option. You can contact the nearest Maine Warden Service dispatch center (e.g., Augusta 1-800-452-4664, Bangor 1-800-432-7381, Houlton 1-800-924-2261), local law enforcement, or your [MDOT Regional office](#), to request to be on a list for opportunities to collect or receive roadkill in your area. Feel free to provide contact information for the Golden Eagle Study if that is helpful. If you want to collect a roadkill item yourself, contact [Maine State Police](#) and they will connect you with a Game Warden who will provide permission if appropriate by issuing a possession permit number. If you can follow the camera trap protocol, pursue the above options, and still need help finding consistent bait, contact erynn.call@maine.gov to determine if other sources are available in your area.

- i. Wire the carcasses to a rebar stake or two, if possible, otherwise coyotes and eagles may drag it out of the field of view of the camera. Wrapping a wire around a foreleg and one around a hind limb stretching those out a bit and staking them tends to be effective.
- ii. It is usually a good idea to make a single cut to open the carcass, along the back, neck, or hind leg to provide easier access for ravens and other birds. Many times ravens alert

eagles to the presence of a carcass, so it is good to have a raven going back and forth to a carcass. Don't open it up too much as the bait will last longer with only a single cut.

b. The camera - location. The camera should be attached to a small tree or a sturdy metal or wooden stake about 6 feet from the deer carcass, with the camera lens about 18-24" from the ground (or above the snow). This is the perfect picture angle and height for identification. We had good luck putting the camera on a wooden stake and putting the stake in the middle of a cinderblock or two to stabilize it and the camera. If possible, orient the camera to the NORTH – this ensures that the sun is to the side or behind the camera; south-facing cameras often produce washed-out pictures. Make sure it's sturdy enough that if a bird lands on the camera (or the stake), it will not fall over or change the field of view.

c. The camera – settings. For your camera trap observations to be included in the regional camera trap monitoring of Golden Eagles, **please follow the settings and the overall camera trap protocol, as consistency facilitates analysis of these data**. The camera should be set to take a picture in response to motion with a minimum interval of **1 minute**, 24 hours/day, 7 days/week. Although Golden Eagles won't scavenge at night, we can learn about the links between mammalian scavengers and eagles. This interval provides multiple pictures of single individuals without \filling up the memory cards too quickly. A burst of 2-3 photos may be beneficial instead of 1.

d. Batteries. Lithium batteries work much better in cold weather than regular alkaline.

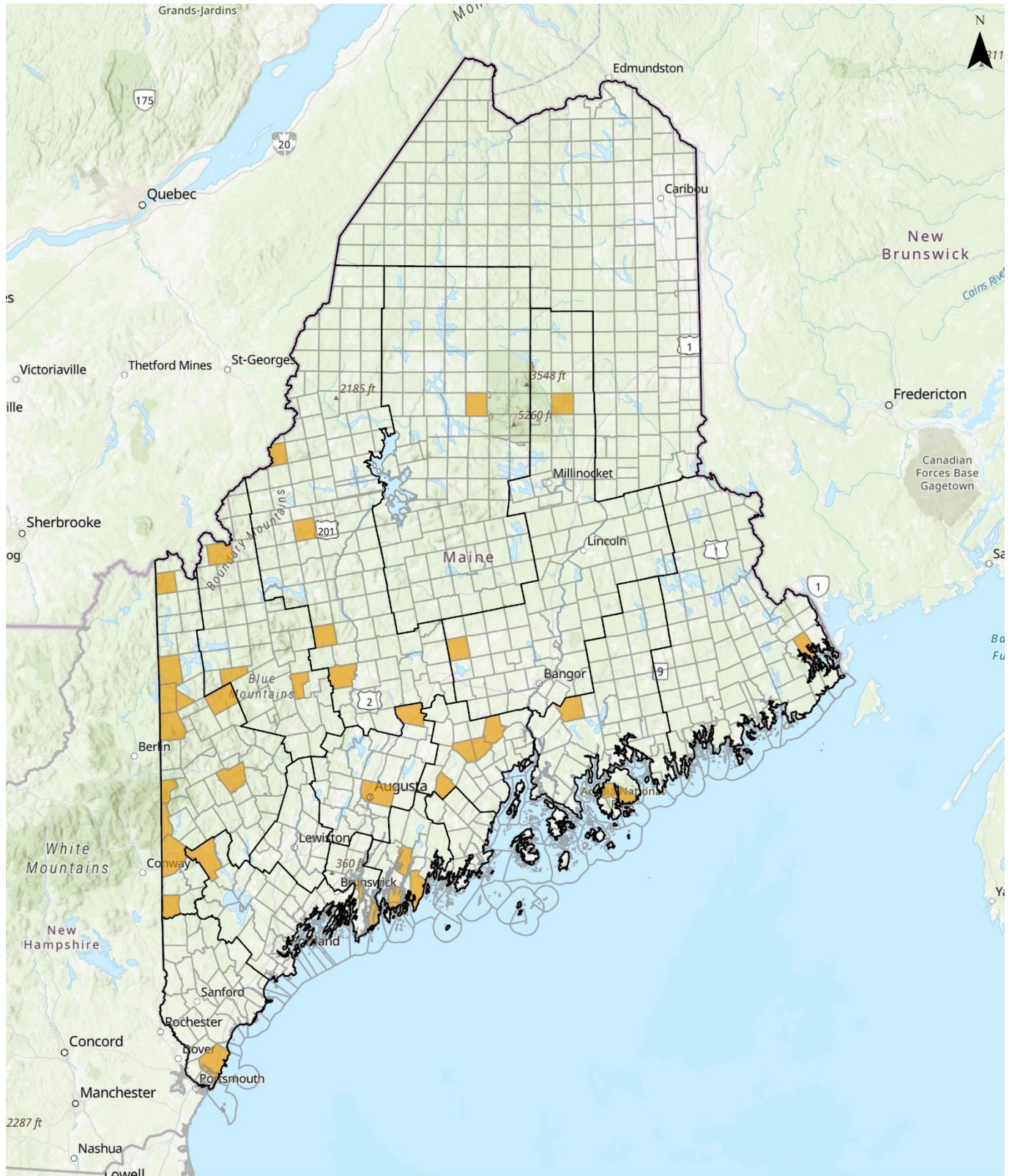
e. Contact information, signs. Always place your name and contact information on the game camera and make sure to have written permission from the landowner.

4. **Checking the camera site**. How often you visit your site will depend on how quickly the bait disappears and needs to be replenished, the style of the game camera, and how you will share your photos. You can switch out memory cards when they are close to full or download/share them from cell camera apps/websites. Keep in mind the following:

- a. Check the battery level and change batteries if needed.
- b. Swap out the memory card and download pictures on-site if possible.
- c. Check the positioning and condition and camera software settings.
- d. Make sure you have enough bait to feed eagles! A small carcass can disappear in a day.

5. **Saving and sharing photos**. To maximize the value of your photos to the study, whether you have a cell or regular game camera, please download, and share every photo taken (e.g., 24 hours/day, 7 days/week), whether a Golden was present or not (see section 3c above as to why this is important). We hope you can share all photos (please reach out with any questions as to how to do this), however, as a second option, you can share every photo (with time and date stamp) where an eagle (including Bald) was present, and as a last option, every photo where you identified a Golden. The latter two options will fall under incidental observations and while not part of the camera trap regional analysis, will still document the presence of Golden Eagles, the duration they were present, and different angles show plumage details that help age and distinguish individuals. Email (erynn.call@maine.gov) to receive a link to a private folder where you will share your photos. Each camera trap site will have a folder, as some participants will have multiple sites. Within each site folder, create subfolders for each date you downloaded photos. Give the folder a name with the site name and the data download date, where the date is written as YearMonthDay, e.g., 20241101 for November 1, 2024. So, a site name could be "Nate Mountain_20240121". If you need assistance with photo sharing or have any questions, feel free to reach out.

Figure 1. Maine Golden Eagles observations 2013 – 2023 and historic breeding regions. Map courtesy of Trish Miller, Conservation Science Global.



Credits: World Topographic Map; Province of New Brunswick, Esri Canada, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, NRCan, Parks Canada

Golden Eagle Identification

Distinguishing Bald & Golden Eagles – learn more at [Cornell All About Birds, Golden Eagle](#)

Size – Golden vs. Bald Eagle

Golden Eagles and Bald Eagles are about the same size. Female eagles are 30% larger than males. Eagles from northern regions are larger than eagles from southern regions and both can be found in Maine. Young eagles with new feathers that are not worn over time, can appear longer and thus even bigger. Because of the common size misconception and similar color plumage (see next page), juvenile Bald Eagles are often mistakenly identified as Golden Eagles.



Adult Bald Eagles. Photo by Laura Zamfirescu



Juvenile Bald Eagle. Photo by Deb Powers

Left photo above: The adult female Bald Eagle (left) is larger than the adult male (right).
Right photo above: Juvenile Bald Eagles are often mistaken for Golden Eagles. Photo below: Golden and Bald Eagles are about the same size.



Golden Eagle. Photo by Randy Flament

Juvenile Plumage – Golden vs. Bald Eagle

Bald Eagles do not have a completely white head and tail until they are five years old. As they develop, they have varying amounts of white feathers on their wings and bodies. The white mottling is not specific to patches as in the case of the Golden Eagle.

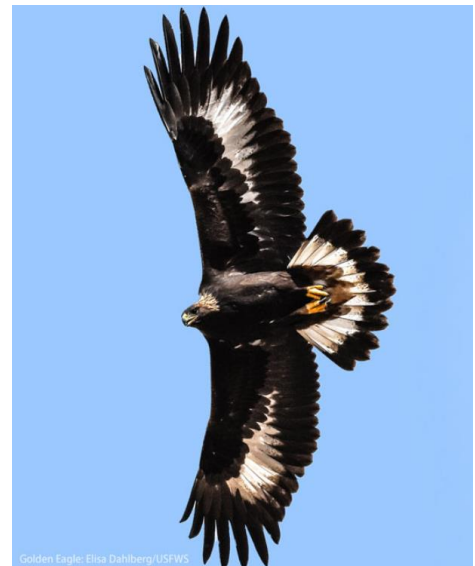
Goldens do not develop their adult plumage until four to five years of age. Both juveniles and adults have a golden hue on their heads and nape. Juvenile Goldens have white patches on their wings and a broad white band on their tail that changes to dark brown as they mature.



Juvenile Golden Eagle left, sub-adult Bald Eagle right. Note distinct white and black banded tail of the Golden and mottle appearance of the Bald Eagle. Photo by Avianreport.com



Juvenile Golden Eagle at a camera trap site, note the uniform chocolate brown color and wide white tail band. Photo by Albert Ladd



Juvenile Bald Eagle top with white mottling in the underwing versus juvenile Golden Eagle below with distinct white patches on the wings and a distinct wide white tail band. Photos by Benjamin Hack (above) and Elisa Dahlberg (below)

Juvenile Plumage – Golden Eagle



Two sub-adults (left) and an adult (right). Sub-adult wings are more adult-like, but they continue to show white in some of the tail feathers, which is generally absent in adults. Photos by the Eastern Golden Eagle Working Group



Juvenile Golden Eagle, note the white wing patches on the underwing (left) and bicolored tail (right). Photos by Laura Zamfirescu



Sub-adult Golden Eagles, note the white band on the tail. Photos by Chris Martin (left) and Albert Ladd (right)

Adult Plumage – Golden Eagle

Juveniles and adults have light-colored golden feathers on the head and nape. The white tail and wing patches of the juvenile Golden change to dark brown as they mature at 4 to 5 years of age. Adult Goldens can appear similar to a juvenile Bald Eagle (see them side-by-side in the bottom left photo below, and two Goldens side-by-side in the bottom right photo).



Adult Golden Eagles have light gold plumage on the head and nape. Most adults completely lack the white in the wing or tail, although old, faded feathers may appear white. Photos by (top to bottom, left to right), Randy Flament, Mike Lanzone, Todd Katzner/Eastern Golden Eagle Working Group, Don Dunbar, Dana Valleau, and Chris Martin

Feet – Golden vs. Bald Eagle

Although it may be difficult to distinguish as the eagle's legs and feet may not be visible, Golden Eagles' legs are feathered to the foot whereas Bald Eagles are not.



Golden Eagles have feathers down to the toes (above) and Bald Eagles do not (below). Photos by Randy Flament, Tricia Miller (above left and right), Blair Dudeck, Tricia Miller (below left and right)



Head and beak – Bald vs. Golden Eagles

Another feature that may be difficult to distinguish in camera trap images is the overall small head size and beak of the Golden Eagle versus the Bald Eagle.



Bald Eagles have a relatively larger head and beak (left) than a Golden Eagle (right). Photos by Tricia Miller

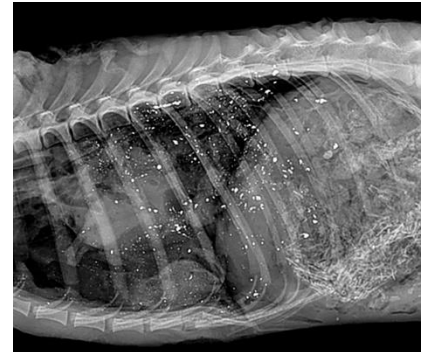
Eagles and Lead Ammunition

Commonly asked questions and additional resources

How are eagles exposed to lead ammunition?

When an animal is shot with lead ammunition, up to a third or more of the bullet's weight can potentially fragment into thousands of tiny pieces that remain inside the animal's body, as much as 18 inches from the wound channel (Leontowich et al. 2022). Some of these lead fragments are so small that they cannot be seen by the naked eye but are visible in X-rays (right photo). A lead fragment the size of a grain of rice can kill an eagle.

When gut piles or whole carcasses are left in the field, lead fragments can be accidentally eaten by scavengers such as eagles as they consume the remains. When eagles eat lead fragments, the lead is absorbed in their blood, tissue, and bones and can be fatal.



Radiograph of a rifle-killed coyote with lead ammunition fragments dispersed. Photo by Hunter-Ed

If the bullet passes through the animal, are lead fragments still a concern?

Yes, lead bullets begin fragmenting just after impact and continue to shed fragments as they pass through the animal. Rates of fragmentation vary depending on bullet construction, but any amount of lead can unnecessarily, and unintentionally impact scavenging wildlife like eagles.

Could eagles be exposed from other sources besides lead ammunition such as lead fishing tackle?

Decades of research and a multitude of studies have concluded that lead fragments in gut piles and animals dispatched with lead ammunition are the primary source of lead poisoning for birds of prey. Check out the links below to learn more.

Aren't eagle populations doing well, why is this a concern?

Bald Eagle populations are increasing, and Golden Eagles in the eastern US are suspected to be at best stable, however, the opportunity to use non-lead ammunition or remove the remains of leaded carcasses demonstrates our commitment to a long history of wildlife stewardship that is crucial to our future. Eagles are regularly admitted to avian rehabilitators in Maine (Avian Haven) with elevated concentrations of lead in their blood. Lead exposure has suppressed the population growth of Bald and Golden eagles (Slabe et al. 2022).

What about other animals' exposure to lead ammunition, why are eagles an issue?

Compared to other animals, avian scavengers such as eagles are particularly susceptible due to the high acidity in their stomachs which break down the lead fragments, exposing them to potentially toxic levels of lead.



Golden Eagle scavenging a deer carcass. Photo by Randy Flament

If I hunt with lead ammunition or place bait for hunting, how can I avoid exposure to eagles?

If you are unable to use non-lead ammo, avoid leaving gut piles or carcasses of animals harvested with lead ammo in the field, at the very least don't leave it in forest openings or a field. Any carcasses used as bait should be lead-free such as roadkill, trapping, or farm animals dispatched without lead ammo. Below is a link to various online non-lead ammo retailers.

<https://huntersforeagleconservation.org/new-york/find-non-lead-ammo/>

Where can I learn more about non-lead ammunition?

The best way to learn about switching to non-lead ammunition is from other successful hunters who have done so. They can share their experiences and advice on choosing the right ammunition for your needs, sighting your firearm, and using non-lead ammunition effectively in the field. Check out the links below.

Learn more:

<https://huntingwithnonlead.org/>

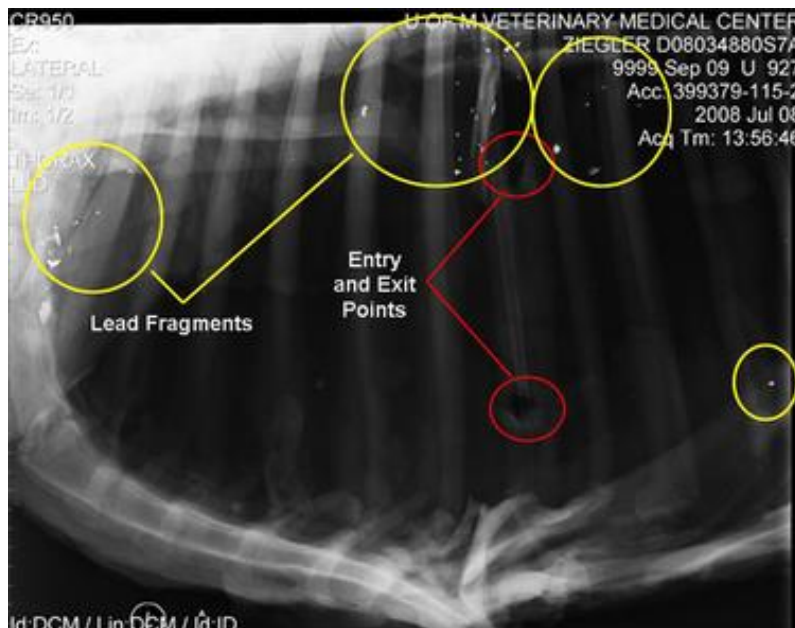
<https://nonleadpartnership.org/>

<https://www.sportingleadfree.org/>

<https://huntersforeagleconservation.org/>

<http://www.wildlifecenter.org/lead-toxicity-raptors>

<https://www.maine.gov/ifw/hunting-trapping/hunting/nonlead-ammunition.html>



Radiograph of the chest cavity of a deer illustrating lead fragmentation of a ballistic tip rifle bullet.

Image by Minnesota Department of Natural Resources



300 win mag solid copper (left) 300 win mag lead core with copper jacket (right). Photo by Mike McTee

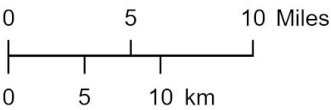
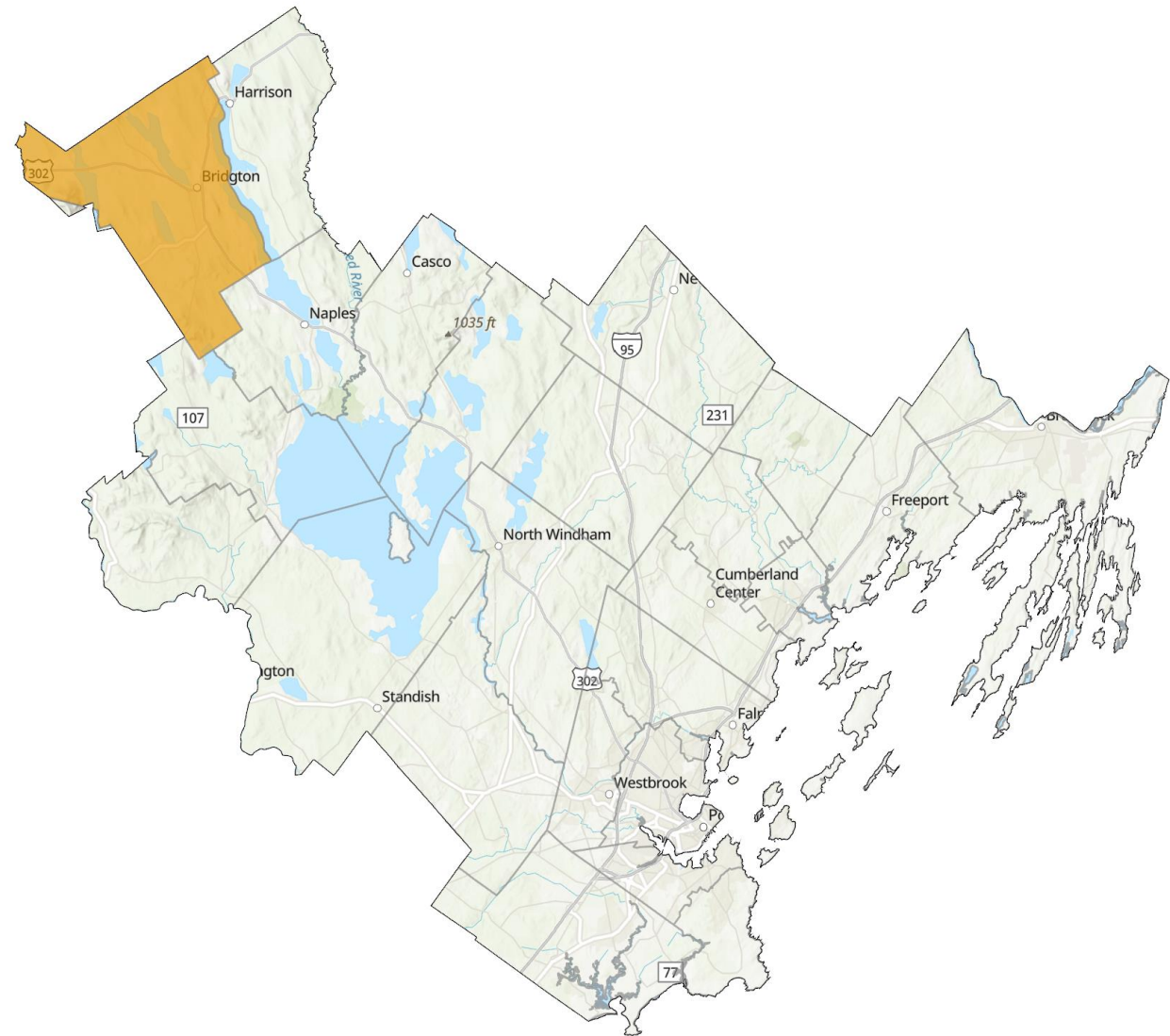
Literature

Vincent A. Slabe *et al.* 2022. Demographic implications of lead poisoning for eagles across North America. *Science*. **375**,779-782. DOI:[10.1126/science.abj3068](https://doi.org/10.1126/science.abj3068)

Leontowich, G., Panahifar, A., & Ostrowski, R. 2022. Fragmentation of hunting bullets observed with synchrotron radiation: Lighting up the source of a lesser-known lead exposure pathway. *PLOS ONE*, 17(8), e0271987. <https://doi.org/10.1371/journal.pone.0271987>

Appendix 1. Maine Golden Eagle observations 2013 -2023 and historic breeding regions by county (note Androscoggin, Aroostook, and Knox do not have observations or evidence of historic breeding). Maps courtesy of Trish Miller, Conservation Science Global.

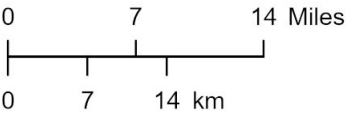
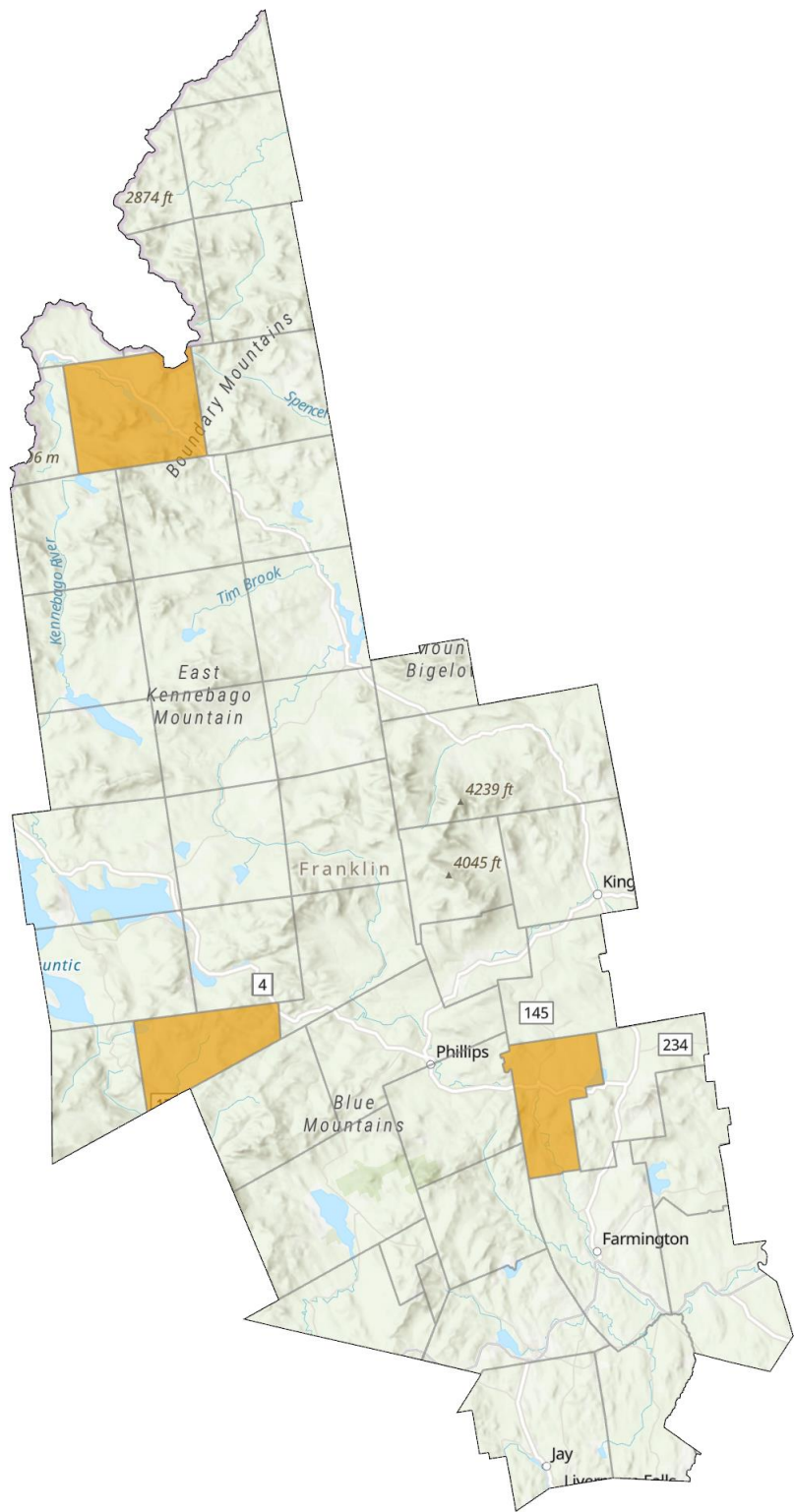
Cumberland



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

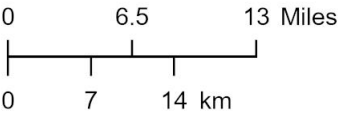
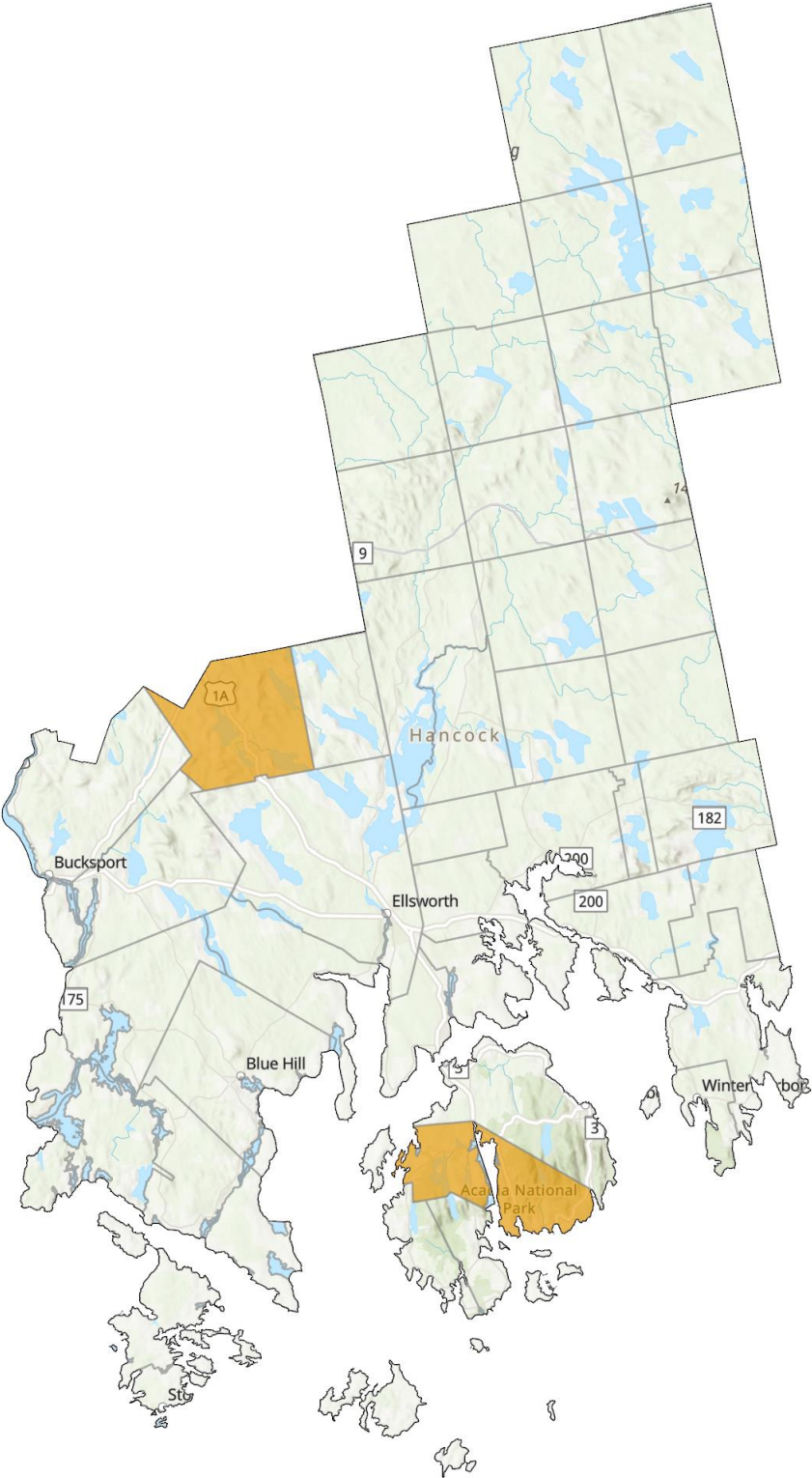
Franklin



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|------------------------------|-------------------|
| Maine | Towns & Townships |
| Townships with Golden Eagles | County |

Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, EPA, NPS, NRCan, Parks Canada

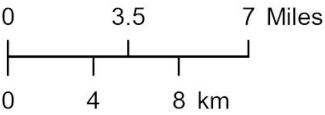
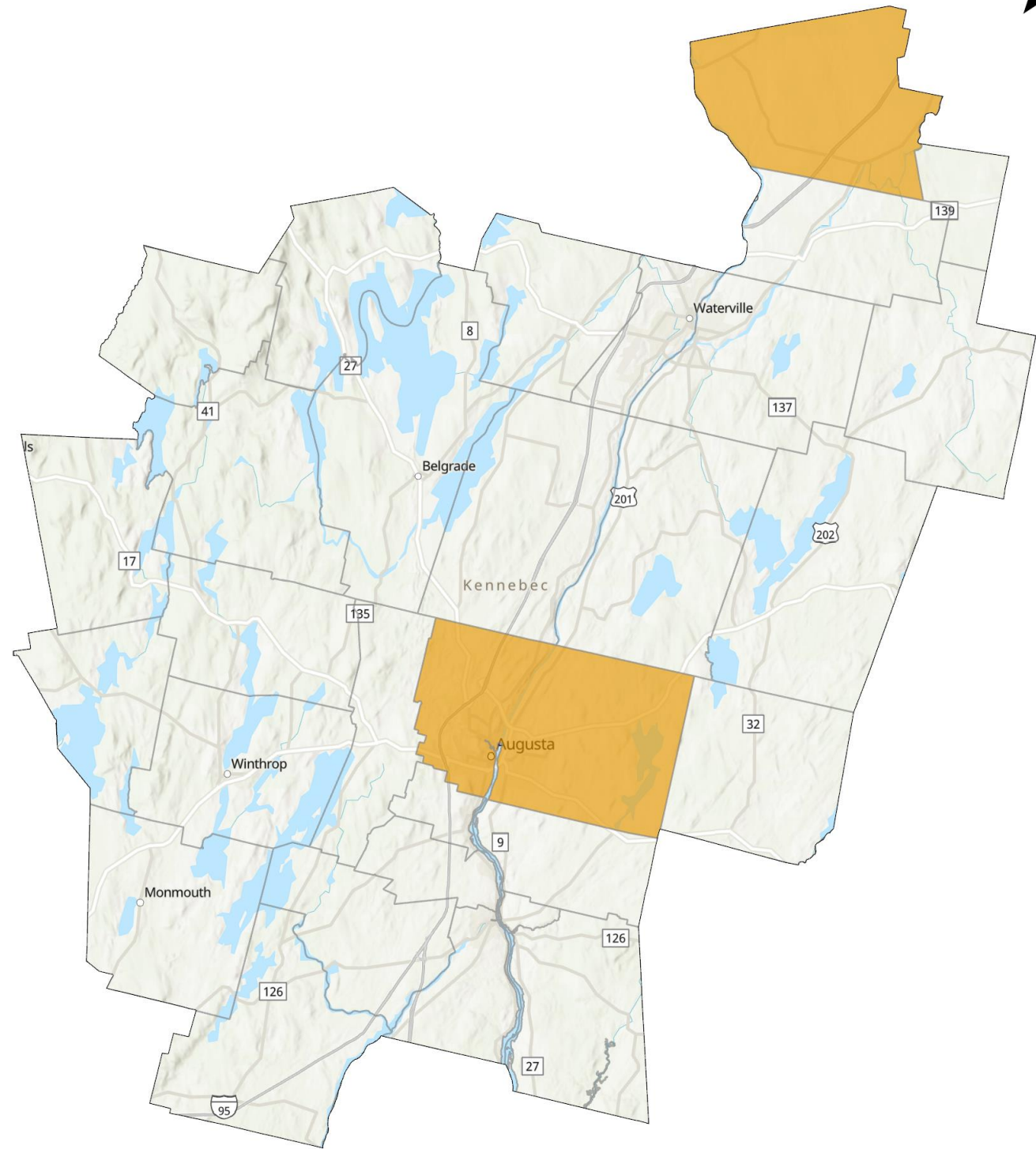
Hancock



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|------------------------------|-------------------|
| Maine | Towns & Townships |
| Townships with Golden Eagles | County |

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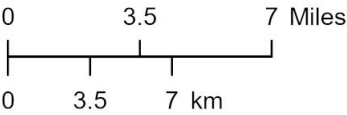
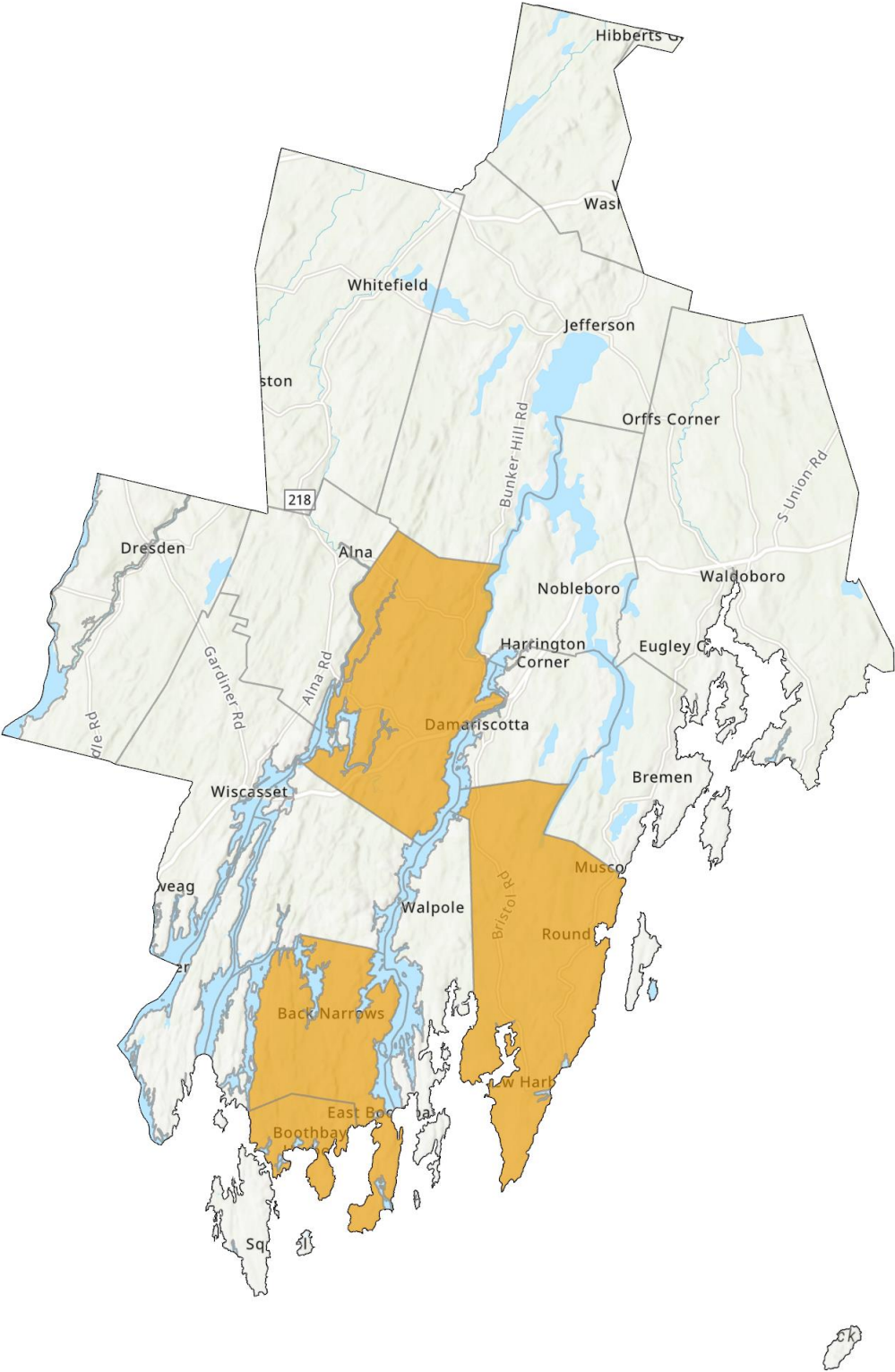
Kennebec



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

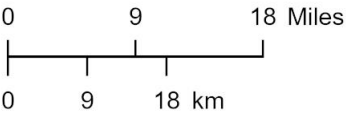
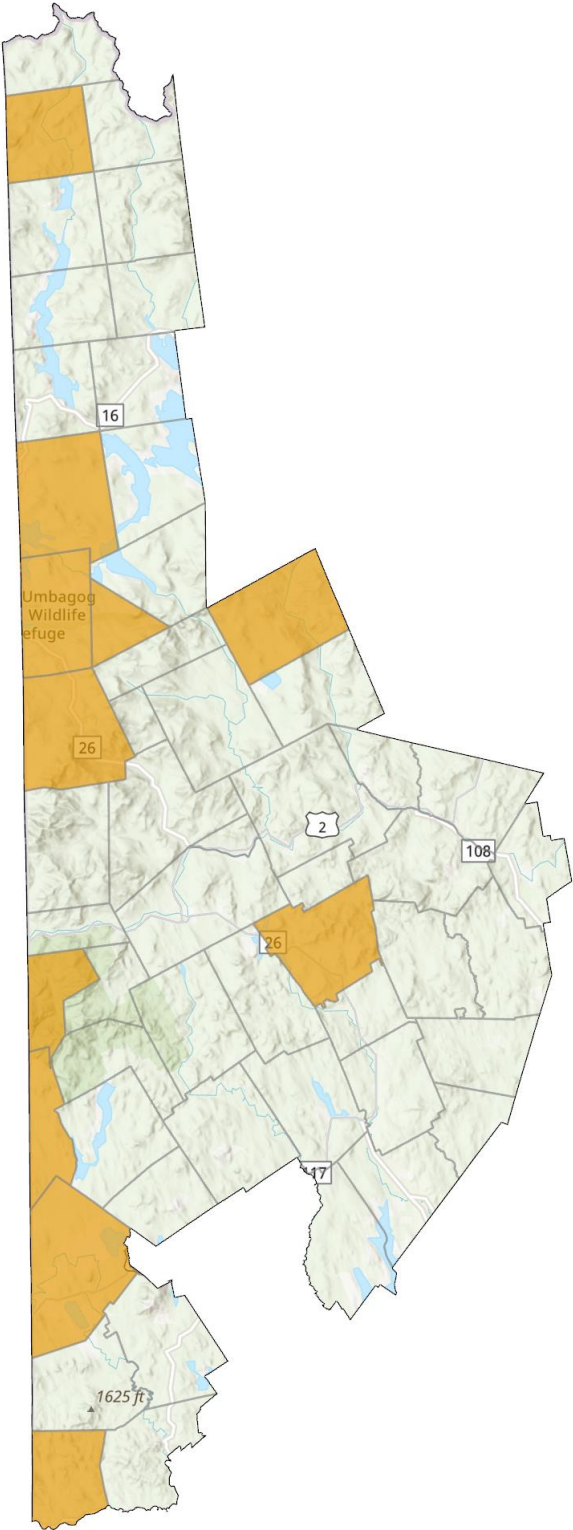
Lincoln



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

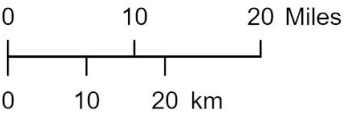
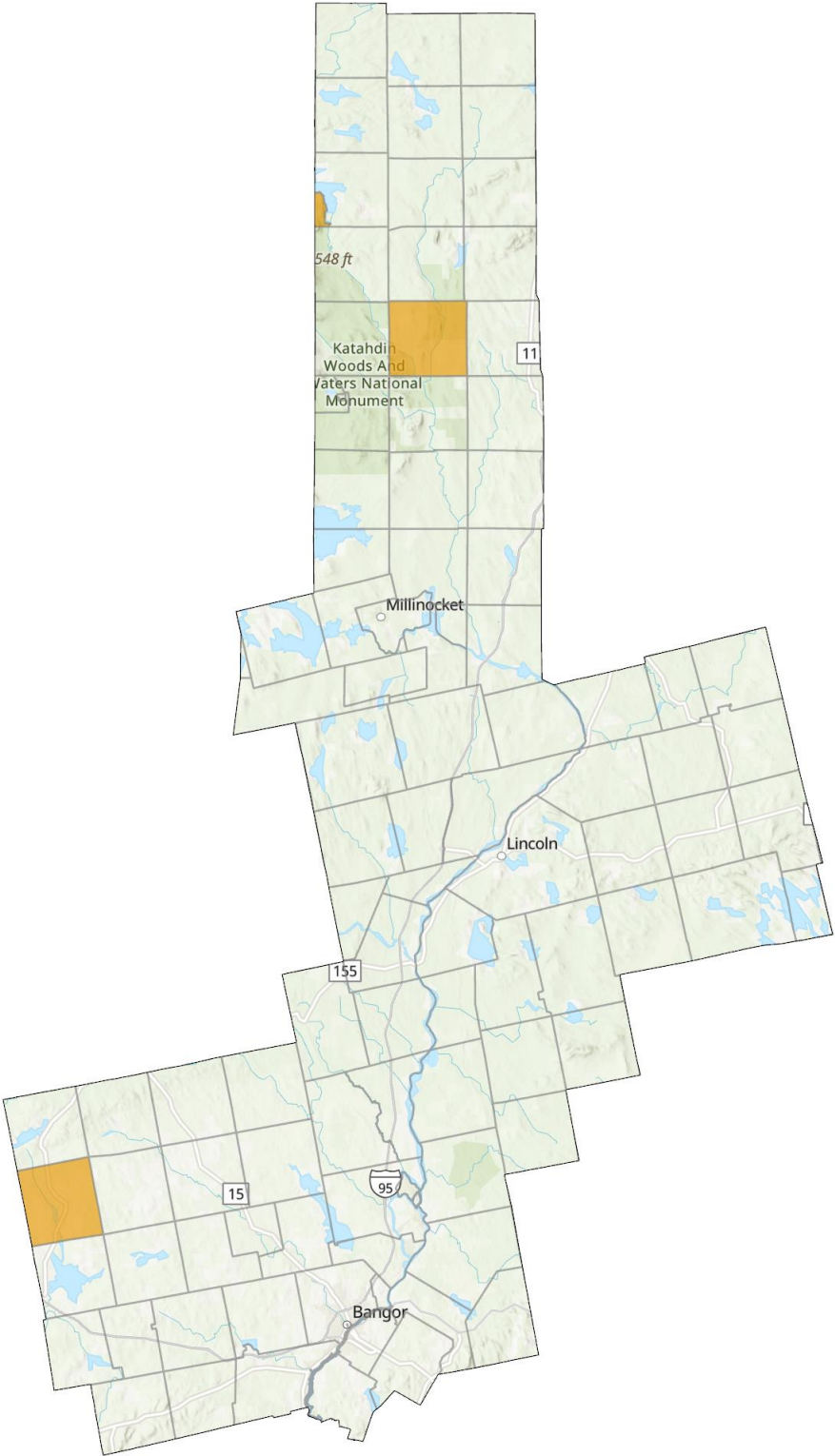
Oxford



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

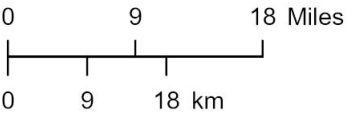
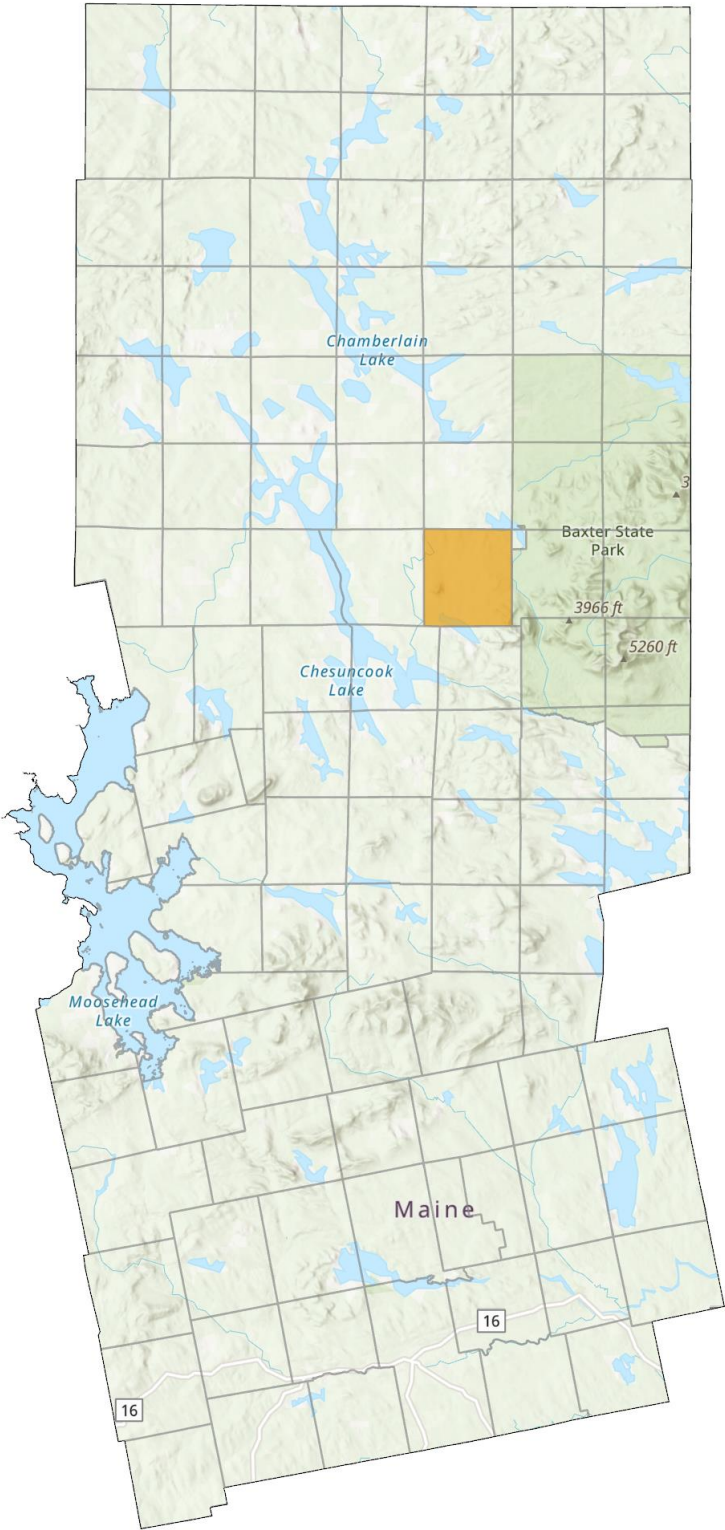
Penobscot



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Province of New Brunswick, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada

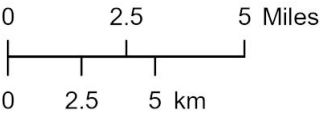
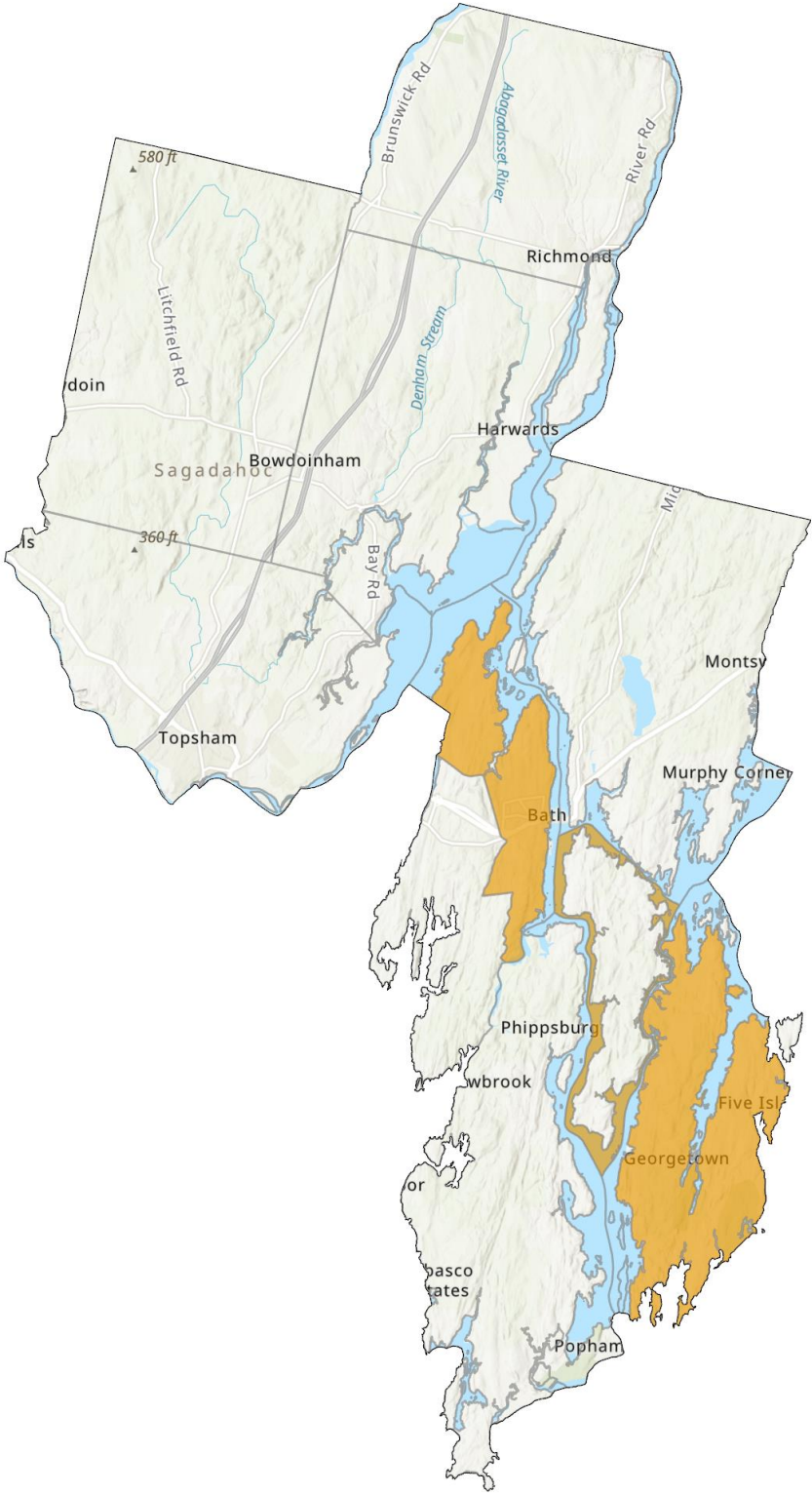
Piscataquis



- | | |
|------------------------------|-------------------|
| Maine | Towns & Townships |
| Townships with Golden Eagles | County |

Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, EPA, NPS, NRCan, Parks Canada

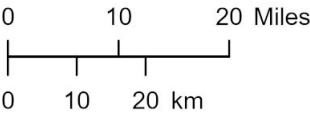
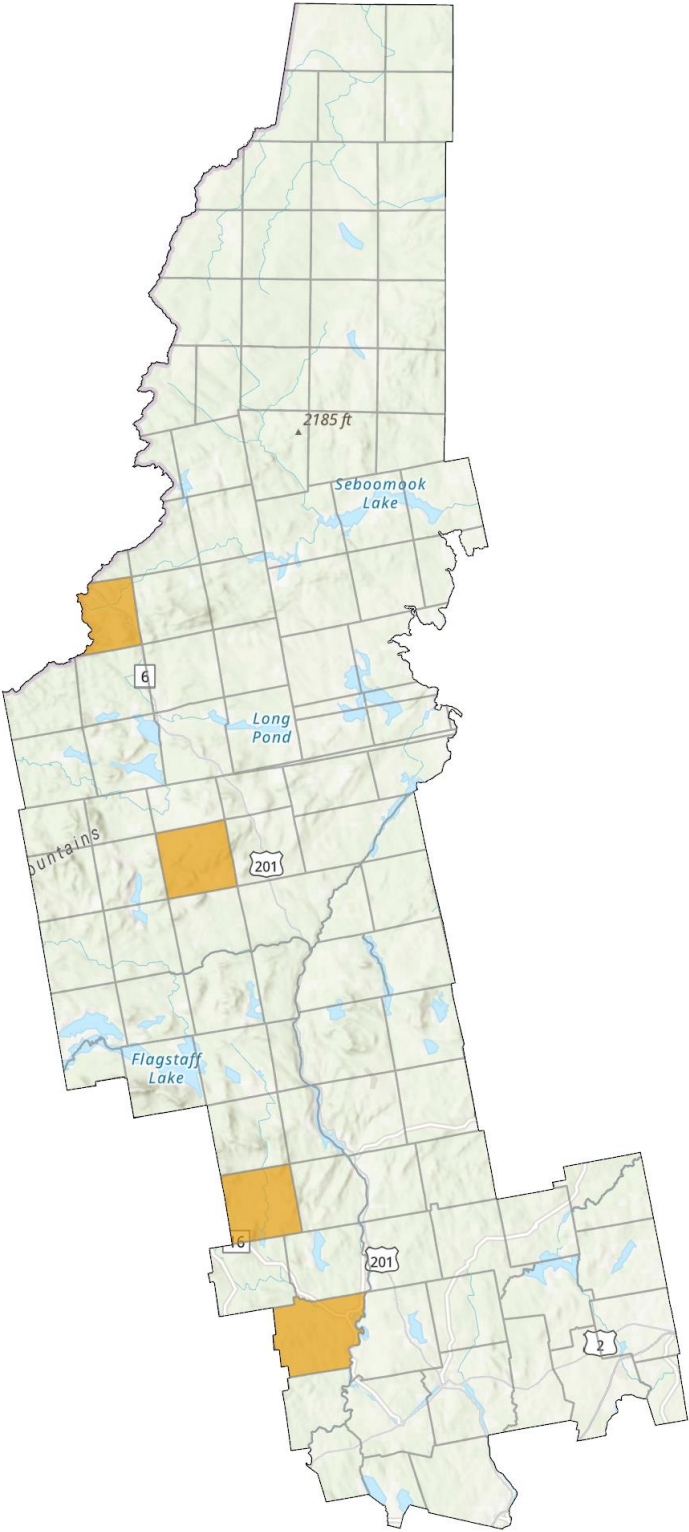
Sagadahoc



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

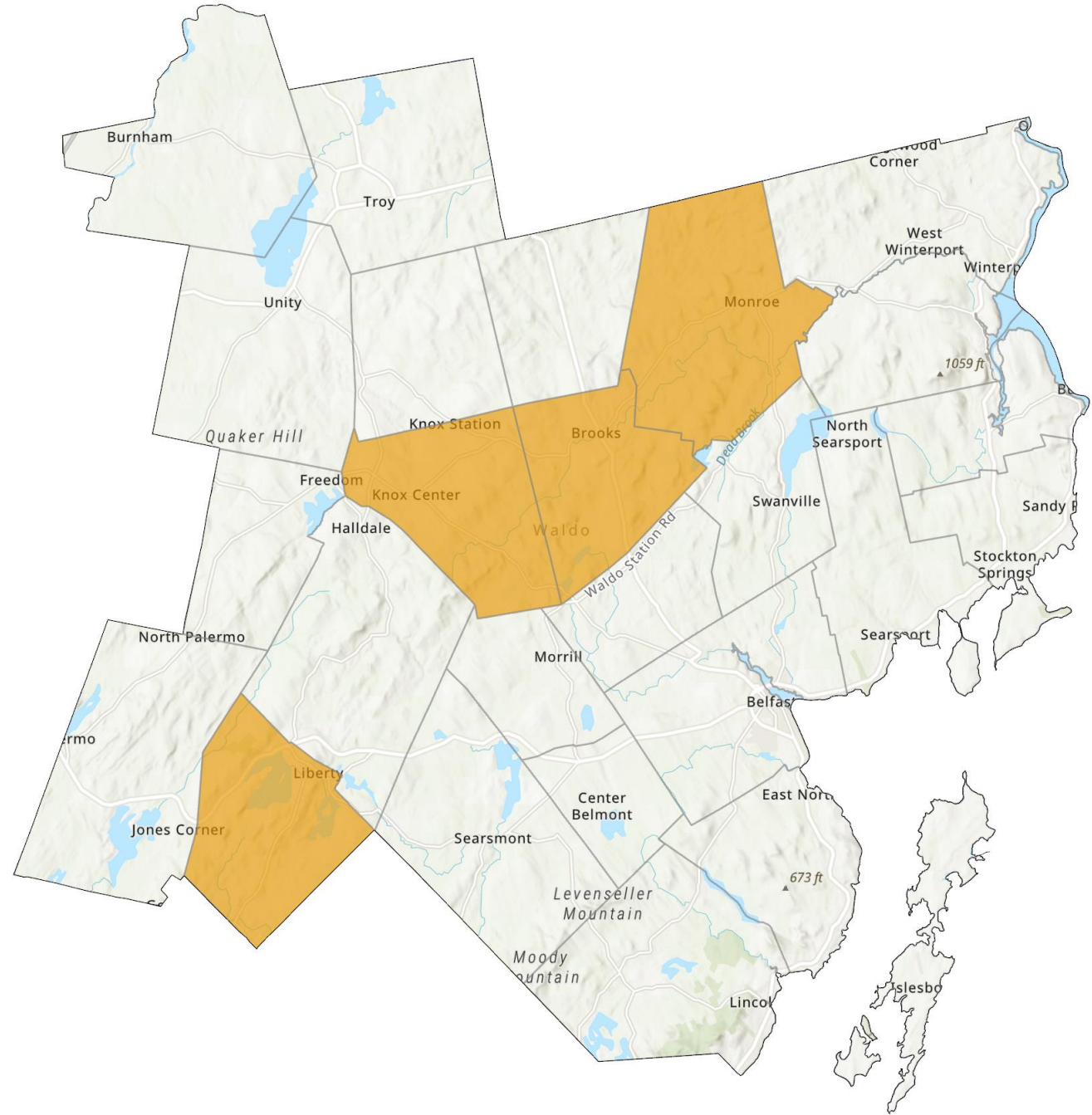
Somerset



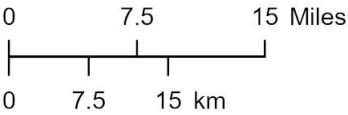
- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, EPA, NPS, NRCan, Parks Canada

Waldo



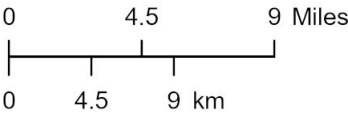
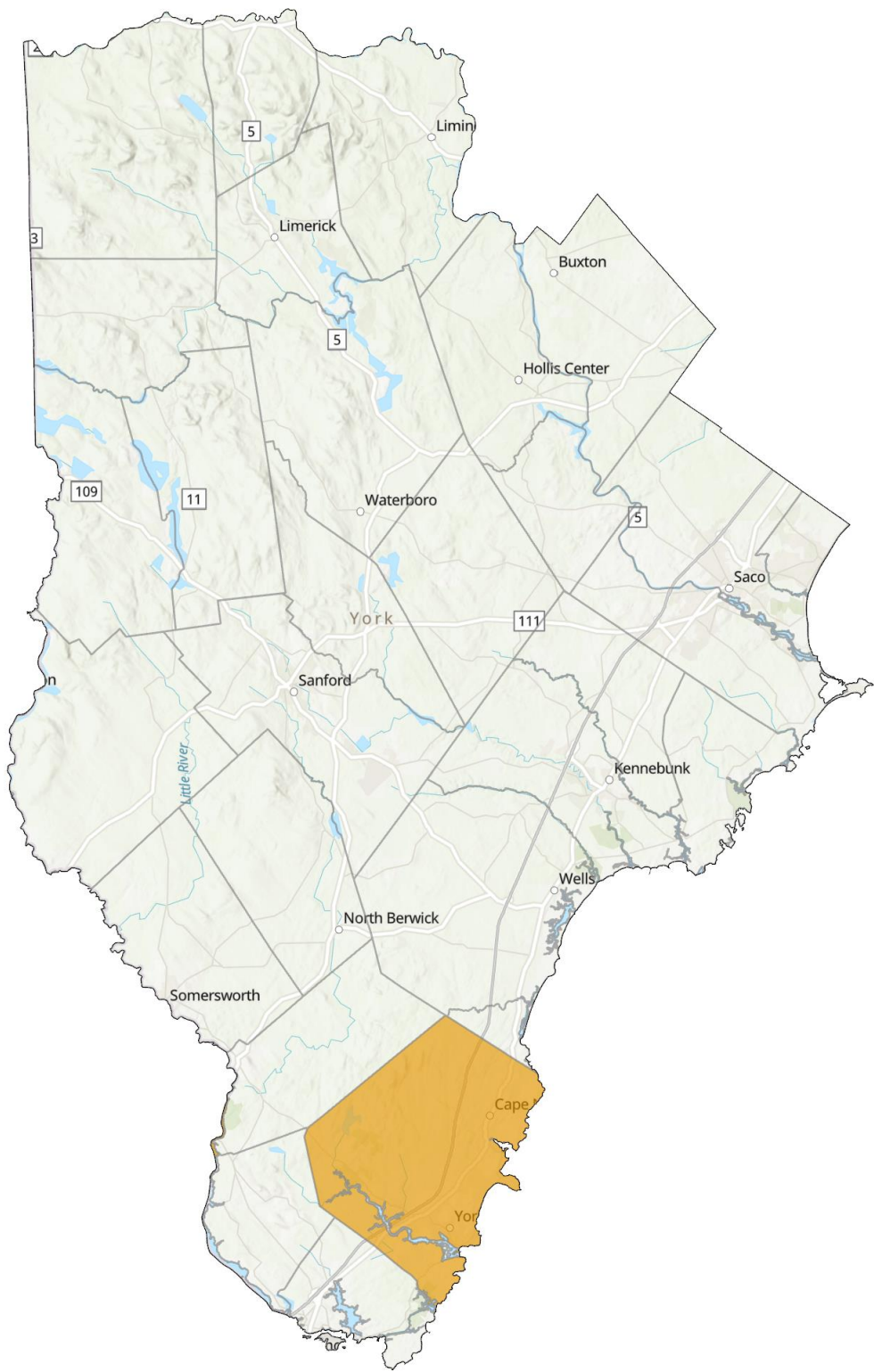
Washington



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Province of New Brunswick, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada

York



- Maine
- Towns & Townships
- Townships with Golden Eagles
- County

Credits: World Topographic Map: Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS