Organic Native Ecosystem Application and Verification Toolkit[1,2]

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[1] Written by Tony Fleming, Naturalist, Geologist and former Organic Inspector, and Jo Ann Baumgartner, ED at Wild Farm Alliance; with contributions by Pat Comer, Chief Ecologist at NatureServe; and Marie Burcham, Policy Director, Cornucopia.

[2] This is a living document that will be updated as necessary.

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A. Introduction and How to Use this Toolkit

Organic operators, certifiers and inspectors need to be able to identify native ecosystems so that their practices are compliant with the new National Organic Program (NOP) native ecosystem regulations in 7 CFR §205.200. This toolkit explains what tools and resources are available to producers applying for organic certification and certifiers verifying compliance with the native ecosystem provisions, and provides examples illustrating how these tools can be used in a variety of certification scenarios and ecosystem types.

Most new or added-acreage applications will be for land transitioning from conventional production, thus a native ecosystem will not have been present for the previous 10 years. When this is the case, the operator can typically submit aerial or satellite images of the land, taken 10 years apart and obtained while at their desk, visually demonstrating that a native ecosystem has been absent for this 10-year period. As long as each photo is clearly dated, the certifier can use the same imagery for verification. Absent available imagery, the applicant may submit photos showing the vegetation of the parcel along with a prior land-use (PLU) declaration or an affidavit from a disinterested party with specific knowledge of the land and time period in question. A model PLU declaration for native ecosystems appears in Section F.

Most kinds of cultivated land, especially those with a regular geometric pattern such as row-cropped fields, orchards, vineyards, and tree plantations, are readily recognizable without formal training in aerial and satellite photo interpretation, as are many broad ecosystem categories (forest, scrub/chaparral, wetlands, etc.). Aerial and satellite photos will usually provide a clear visual indication of whether a native ecosystem may have been present within ten years of a field or site being proposed for organic certification or, conversely, whether the site has been under cultivation or in other cultural land use throughout the prior decade.

In some situations, however, imagery alone won't be definitive. For example, it can be hard to tell the difference between a native grassland and cultural grasslands, such as a pasture or haymeadow. In such cases, other tools (e.g., ecosystem maps) may be helpful, if not always definitive, for making a determination. If 'gray areas' of determination come up at the desk, they can usually be resolved during a site visit by a knowledgeable inspector.

Sometimes a native ecosystem is present. Depending on the type of ecosystem and the proposed use, it may be used in organic production while being conserved. Even when a native ecosystem is not used in production, it will add value to the organic farming operation if it is adjacent to cultivated areas or simply by its presence within the larger landscape, because its conservation supports many types of environmental services and species beneficial to the farm, the Earth, and the marketing integrity of the organic label.

Operating Instructions: A Roadmap to Using this Toolkit

The concept of native ecosystems and their role in the organic farm landscape may be familiar to many persons and organizations working in the organic certification space. In fact, we have yet to meet anyone with a genuine commitment to consuming, producing, or certifying organic food who thinks native ecosystems have no role on organic farms; indeed, many consumers assume and expect organic farms to operate in harmony with nature and their local native ecosystems. But meeting this expectation in a practical sense is very different from simply endorsing it. Exactly what constitutes a native ecosystem, and what actions fall within the definition of conserving one, are often in the eye of the beholder. Much like soils, animal health, and many other technical aspects of organic agriculture, the science of native ecosystems can seem complex and obscure to the uninitiated. All of these subjects have their own distinctive sets of foundational concepts, observational criteria, and terminology that present their own unique learning curves. Native ecosystems are no exception in this regard, and determining which aspects of the science are relevant to certification, and more importantly, how to apply them at a practical level, can seem like a large task.

Bridging the Gap

This toolkit was created specifically to bridge that gap, by distilling the massive amount of available information on the subject down to the essential concepts, terms, observational criteria, and resources needed to effectively and consistently implement the native ecosystems regulation across the diverse suite of NOP-certified operations located among an even more diverse group of countries, eco-regions, and local landscapes.

This toolkit is designed to serve as a companion to the NOP native ecosystems regulations and guidance (number here) by supporting all levels in the certification chain in complying with the regulations. Different actors in this chain – new applicants, existing NOP operations, consultants, certifiers, and inspectors – have different needs with regard to the kinds of information they seek as they attempt to comply with the regulation. Thus, the toolkit and its component parts are designed to be used in several different ways to meet these needs. In its entirety, the toolkit can serve as a useful primer and general reference on ecosystem identification and verification. But few people will have time to read it from "cover-to-cover" at first, and most will be looking for guidance specific to their particular site, situation, or station in the certification system. We have anticipated this by dividing the toolkit into several sections, each of which can stand alone, while also being part of a larger narrative. We offer the following "roadmap" as a general guide to help acquaint you with the resources the toolkit has to offer.

Section B. Native Ecosystems and Organic Farming provides a concise but wide-ranging look at the crucial linkage between native ecosystems and organic agriculture. If you are new to organic farming and certification, or wondering why this subject matters, this section is for you.

Section C. Tools Used from a Desk provides an overview of the tools and resources available to gather site-specific information, assess an ecosystem, and verify compliance with the regulation, and when to use them. Most of these are relatively new online tools, and most are specific to the U.S. or the Western Hemisphere. However, we also provide examples of non-digital options for those who do not use the internet, as well as several online counterparts with coverage for regions outside of the U.S. and Western Hemisphere. We particularly highlight about a half dozen web resources that we feel will be of the greatest utility for identifying native ecosystems and verifying conditions at specific locations in the Western Hemisphere, where at the time of this writing, more than 83% of NOP-certified production operations reside. All of these tools are hosted on GIS-based platforms with the same basic suite of user controls to perform operations. Still, they are sufficiently different that each tool has a learning curve, albeit most are not steep.

We recommend learning the tools in the following order, based on their expected relevance and utility:
1) USGS Earth Explorer: Aerial and satellite imagery is far and away the most widely applicable tool, and *Earth Explorer* is the most comprehensive archival collection of such imagery available in the U.S.;
2) Google Earth Pro: This application essentially acts like *Earth Explorer* for the entire planet. It is especially useful for sites in countries lacking a systematized archive of imagery;
3) NatureServe Explorer: The ability to identify and describe a native ecosystem is crucial, and this tool is the ultimate comprehensive resource for ecosystem classification and description;
4) USGS Terrestrial Ecosystems Viewer: Being able to determine whether a native ecosystem may be present without performing a site visit is priceless, and this is the application to do that for domestic sites;
5) Data Basin-Ecosystems of the Western Hemisphere: Same comment as 4), except *Data Basin* covers the Western Hemisphere and offers useful ecosystem visualizations that 4) does not;
6) USFWS Wetlands Mapper: Many remnant native ecosystems in agricultural settings are wetlands, and there is no better way to determine (remotely) if a wetland is present at a specific site than this online version of the National Wetlands Inventory;
7) NRCS Web Soil Survey: The descriptions of soil series (the basic unit of soils mapping) indicate whether the soil is hydric (i.e., formed in a wetland), and under which class of native vegetation the soil formed under. While much more generalized than the applications above, this information is a useful adjunct, and sometimes the only option. Plus, the detailed information on soils, erosion hazards, and other features of agricultural landscapes makes *Web Soil Survey* valuable for many other aspects of organic production and certification, so learning how to use this application has multiple benefits; and
8) Global as Watch: This site offers real time imagery and information on deforestation. It is useful for areas in developing countries not covered by other tools, especially tropical forests.

Section D. Examples of Verification Scenarios provides 10 simulations of certification scenarios expected to come up in the context of native ecosystems, and organized into four broad contextual categories. Some scenarios are likely to be common, while others are expected to be less so, but all of them illustrate how different tools (including inspections and other site visits) may be combined for maximum effect. Use these scenarios as a guide to “real world” situations you may encounter.

Section E. Available Assistance When Site Visits are Needed describes several ways an operator or new applicant might seek technical assistance or guidance from third parties in order to meet the native ecosystems regulation.

Section F. Model Native Ecosystem Prior Land Use Declaration contains four key questions about native ecosystems we think should be included in certification applications to verify compliance, along with a discussion of the rationale for each. The declaration parallels the format of existing 3-year field histories routinely included in certification applications, and is intended for use by organic certifiers, either as a stand-alone form or (perhaps preferably) incorporated into existing PLU forms to minimize redundancy of administrative information.

Appendices. We have included several Appendices that describe the nuts and bolts of using each of the applications listed in Section C; most of these also link to short instructional YouTube ***videos*** illustrating the steps.

B. Native Ecosystems and Organic Farming

Protecting native ecosystems gives organic farmers selling under the National Organic Program (NOP) label many reasons to feel good. Doing so is good for people, good for the planet, and good for the farmers themselves. Growers see direct benefits when they use native ecosystems for production gains while conserving the integrity and function of the land for the future. Producers who are safeguarding native ecosystems by not converting them are also contributing to a broader well-being. Intact native ecosystems make farms and wider landscapes more resilient to impacts from environmental change, such as extreme weather events and the economic stresses that accompany them. With the enhanced ecological services they provide, growers can more easily recover and adapt their production systems to changing circumstances.

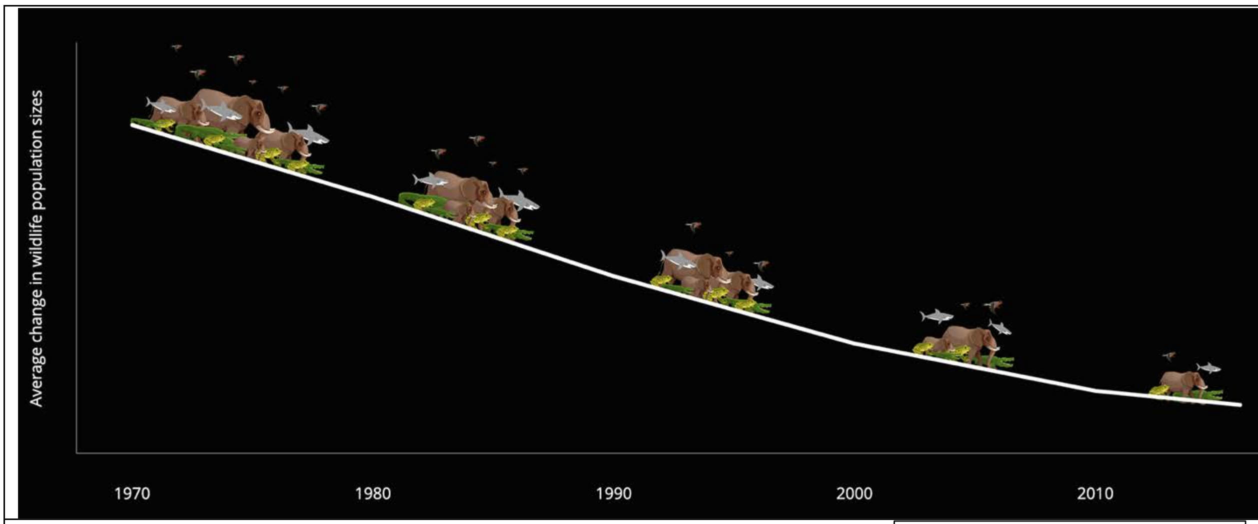
Good for People

People eat thousands of wild plant species, which are typically higher in micronutrients and vitamins[i] and are better adapted to local conditions than cultivated crops, yet about two-thirds of the world’s crop production centers around nine species (sugar cane, maize, rice, wheat, potatoes, soybeans, cassava, sugar beet and oil palm). Western medicine derives 40 percent of drugs from plants[ii], and more are yet to be discovered. By conserving the wild areas where these species reside, and taking care not to overexploit wild species, the world could expand its diet and medicine chest, which is especially important as climate change disrupts crop production. Indigenous people who rely on and care for these wild areas also benefit, and this will help protect their land rights from large and powerful NOP certified corporations who may otherwise threaten their existence by converting the native ecosystems.

Good for the Planet

Protecting native ecosystems stores carbon in woody plants, in the duff layer and in the soil. Native grassland and forest soils contain about 20 to 50 tons of organic carbon per acre in about the top three feet of soil.[iii] When land is converted from a natural ecosystem to cropland, 30 to 50 percent of soil carbon is lost to the atmosphere over a 50-year period. Conversion of forest causes larger losses of carbon from woody biomass, especially if the land is burned before being cropped—up to 75 percent of organic carbon is lost in 25 years when a tropical forest is cleared. [iv] Ribbons of habitat on or next to the farm can be significant. In one study, riparian areas and hedgerows with woody vegetation stored 18% of a farmscape's total carbon, despite occupying only 6% of the total area.[v]

By protecting native ecosystems, organic agriculture becomes part of the solution to the biodiversity crisis, and can help to slow down the mass extinction occurring worldwide as human activity, and especially agriculture, expand into the last remaining wild areas. Our ecosystems and native species are dwindling at an alarming rate. Climate change, insecticides, herbicides, invasive species and habitat destruction are causing Earth to lose critical species and functions. Insects, which are the basis of the food web are declining,[vi] and with them many other species who rely on this food resource. In the last 50 years, we've lost an enormous part of our wild animal populations in the world, and 3 billion birds (or about 30%) in North America.[vii] Landscapes that historically consisted of a mosaic of different native ecosystems are being fragmented into small, ecologically unsustainable 'islands' as a result of monocultures and other human-dominated, uniform land uses.



In the last 50 years, animal populations worldwide have declined 68%. This is based on the monitoring of about 21,000 populations of mammals, fish, birds, reptiles and amphibians, which include almost 4,400 species around the world. [viii]

Because of its huge footprint and unimpeded conversion of native ecosystems, conventional agriculture is now responsible for a majority of the biodiversity decline. Urbanization, mining, energy development, and shrinkage of water resources are not far behind. With demand for continued growth of organic production, more conventional farmland should be transitioned to organic, and many tools and resources are available to help farmers do that.

USDA Natural Resources Conservation Service (NRCS) has a program (CAP 138) to assist farmers with transitioning to organic production. Since organic agriculture only makes up about 1% of US farm acreage, according to USDA NASS 2016 report, that leaves 99% available to be transitioned from conventional agriculture instead of converting native ecosystems. Even in the states with the biggest percentages of organic acreage—Vermont with 11%, and California, Maine and New York each with about 4%—that still leaves tens of millions of acres of conventional land that can be transitioned.[ix]

Good for the Soil

Soil biodiversity underpins agriculture and native ecosystems alike. It is responsible for critical ecosystem services, including decomposition, nutrient retention and nutrient cycling. Plants roots constantly interact with soil microbiomes. Some soil biota confer disease-suppressive qualities and others offer less dependance on water and fertilizers. Conserving the genes of plants in wild areas will make it possible to reintroduce these connections and restore domesticated plants' ability to interact with beneficial soil microbes.[x]

Prairies once covered a million square miles of North America but now comprise less than one percent of their former range. Native ecosystems like these should be conserved as living libraries for future generations.

Massive root systems in prairies support a vast array of unique macro and micro soil biodiversity. The greater the diversity of species in a native ecosystem, the greater resilience and ecological services it embodies, and once destroyed, takes many decades, if not centuries to recreate.

Good for Pollination and Pest Control

Farms next to natural areas have a greater diversity of native bees and increased pollination services.[xi] Managed bees are healthier when they have a diverse food source provided by a native ecosystem as opposed to dining on mainly crop pollen and sugar water.

Organic farms sustain more bee, hoverfly and butterfly diversity than conventionally managed farms.[xii]

Pollinator diversity on the farm can be supported by nearby native ecosystems. Having that diversity helps to ensure crop pollination occurs, such as with the blueberries above, even as pollinator populations fluctuate.[xiii]

California oak woodlands host 110 bird species during the breeding season, and 35 percent of the state's mammals during some time of their lives. Besides providing acorns as a food source for these animals, oak trees host a myriad of moth and butterfly caterpillars that also serve as food. The flowering understory feeds pollinators and beneficial insects.

Natural enemies can be supported by habitat refuges that attract their alternate hosts, when crop pests aren't present. For example, beneficial insects and birds can consume the 150-500 caterpillar species supported by oak trees on the West and East Coast of the U. S., respectively, so having oak trees around a farm makes sure these natural enemies are present to curb pest outbreaks. [xiv,xv] When crops are within 500 meters of riparian areas and other natural vegetation, there are more parasitoid wasp species present.[xvi] Producers who learn about the native species and ecosystems of their region can be better informed about their on-farm biodiversity conservation efforts.

Songbirds like this Tree Swallow feed their nestlings insects every ten minutes for about two weeks, so while they may be eating pest insects on the farm, having another source of insect food in nearby native ecosystems means they have a better chance of raising a successful brood.

Barn Owls, which are in decline in much of the US, occupy nest boxes and provide rodent control services more often when located within a half mile of native ecosystems. A typical pair and their four offspring will consume 1,000 rodents during the nesting season.

Organic Integrity

Organic consumers care about protecting native ecosystems, as evidenced by the approximately one-thousand comments in support of the National Organic Standards Board's recommendation. Preserving native ecosystems builds on NOP's rules concerning biodiversity—its definitions make numerous references to the role of natural resources and biodiversity in organic production, as does the requirement to "maintain or improve the natural resources of the operation."[xvii] Additionally, the NOP encourages organic operations to manage native ecosystems in ways that provide benefits to their production lands, and to describe these activities in their organic system plans[xviii]. Continuous improvement in biological diversity above and below ground is what organic integrity is all about, and that begins with protecting native ecosystems.

C. Tools Used from a Desk

A variety of online tools are available to help determine the specific land cover and recent ecosystem history at any site in the world. Ranging from aerial and satellite imagery to advanced mapping applications, these tools have become freely and widely available alongside the widespread adoption of GIS (Geographic Information System) platforms by their host organizations (see Box 1 for the changing nature of web-based tools). In this section, we list several major categories of tools that can be used remotely to gain insight into the conditions and recent land cover history at a specific site, along with the leading websites within each category. With these tools, it is often possible to verify compliance (or not) with the native ecosystems rule without ever leaving one's desk – a development that might have seemed unimaginable only a decade ago.

a) **Aerial Photos.** These show land cover conditions at the time the photo was taken. For the U.S. and some U.S. territories, there are literally millions of digitally rendered aerial photos available online and free of charge for the period circa 1930-present. These aerial photos were and continue to be taken by Federal, state, and local agencies for a wide variety of purposes, including farm programs. In general, the resolution of aerial photos increases over time, but almost any aerial photo taken during this time frame – especially those taken specifically for agricultural and general land mapping purposes (as most are) - will depict the land cover of a particular field or site in sufficient detail to verify compliance with the NOP Native Ecosystems regulation. Aerial photographs have many other potential applications to organic production and certification, such as identifying problematic areas for drift, detecting persistent soil erosion and other natural resources management issues, and verifying compliance with the pasture rule, to name just three.

Aerial photos are available from many sources, such as local government websites, farm agencies (e.g., USDA Farm Service Agency) and several large collections maintained by state and Federal natural resources agencies. In many U.S. and Canadian states, provinces, and counties, aerial photos are taken periodically, sometimes as frequently as every 2-3 years, and for those localities with well-developed public geographic information systems (GIS), most of these photos are freely available for online viewing and printing at the corresponding government website. Some county GIS sites in the U.S. also maintain historical aerial photos dating back decades.

The most comprehensive archive of aerial photos and satellite images of the U.S. is found at *USGS-Earth Explorer*—https://earthexplorer.usgs.gov/. *USGS-Earth Explorer* contains historical-to-recent aerial photos for every location in the U.S., available free for download. The site hosts over a dozen different collections, but the National Agriculture Imagery Program (NAIP) administered by the Farm Service Agency (FSA) from 2002-present is expected to be the most commonly used collection of air photos for certification purposes. Additionally, the Single Frames collection contains historical air photos dating as far back as the 1930's, which can be extremely useful in situations where it is necessary to assess whether an ecosystem may have recovered from past disturbance. NAIP images are commonly used by FSA to create farm maps needed to administer various farm programs, and hard copies of the photos can usually be obtained from a local FSA office.
Natural Resources Canada (https://www.nrcan.gc.ca/maps-tools-publications/imagery/10782) offers a similar collection for that country*, while the National Institute of Statistics, Geography and Informatics* (INEGI) (http://en.www.inegi.org.mx/temas/imagenes/fotoaerea/areahistorica/default.html#Downloads) holds a much more limited archive for Mexico.

Google Earth Pro accesses aerial and satellite imagery, topography and other geographic data to provide high-resolution images. By adjusting its clock icon, recent and historical images can be seen for nearly any location around the world. This free application is available to download for use on computers and may be especially useful in countries otherwise lacking a systematized online imagery archive. https://google.com/earth/versions/#download-pro

b) **Satellite Imagery.** For the last quarter century or more, satellite images have been available for virtually anywhere in the world on a recurring basis. Resolution varies among imagery products and is usually less than that of most aerial photos, but is nevertheless an important tool for monitoring ecosystems and natural resources. Satellite images cover larger areas, which can make their resolution inferior to that of recent aerial photos, which typically cover much smaller areas; however, they are often the only imagery option for assessing land cover in developing countries where aerial photos are scarce and the ability to access them may be hampered by a lack of systematized archives. A caveat to this comparison is the constantly improving capabilities of satellite cameras: *Global Forest Watch's* "Planet" imagery, for example, offers high resolution to track the loss of tropical rain forests and the specific compliance of those who are enrolled in various ecolabel programs to reduce or prevent deforestation of primary rainforest by their activities (e.g., palm oil, tropical wood species, etc.) (https://www.globalforestwatch.org/).

Free, global satellite imagery is available from all three main North American imagery archives noted above (*USGS-Earth Explorer, Natural Resources Canada,* and *INEGI*), along with *Google Earth Pro*; these collections are the easiest to search and retrieve images for a specific site. Other sources include: *NASA* (https://search.earthdata.nasa.gov/search) and *Copernicus Open Access Hub* (https://scihub.copernicus.eu/); these generally require greater familiarity with the specific collection and search engine to use efficiently.

c) **Native Ecosystem Maps.** The *USGS Natural Terrestrial Ecosystems Viewer 2011* (also called GAP/Landfire, but hereafter referred to as *USGS Viewer*) is useful for assessing the presence or absence of native ecosystems at sites in all 50 states plus Puerto Rico. When a specific site is selected on the map, the viewer displays ecosystems from the International Vegetation Classification (IVC) and Terrestrial Ecological Systems Classification (TESC) in a "hybrid" hierarchy consisting of the top 6 levels of the IVC (class, subclass, formation, division, macrogroup, group), with the ecological systems of the TESC acting as the lowest level. The user has the option of obtaining ecosystem descriptions at any level of the hierarchy, but the three lowest levels (macrogroup, group, ecological systems) are the most descriptive at the site level and will therefore be the most useful to operators, certifiers, and inspectors. Of the three, ecological systems provide the most detail and are well suited to the scale of an individual field or farm, but the other two are also useful for obtaining more generalized ecosystem descriptions that can work fine for descriptive and verification purposes, as illustrated in some of the example verification scenarios. At any of these levels, the *USGS Viewer* provides a summary description of the ecosystem, but the TESC ecological systems descriptions typically include the most information about the dominant and characteristic species needed to define and monitor the ecosystem.

In addition to identifying vegetation down to the ecological system level, the *USGS Viewer* also distinguishes a variety of non-vegetated/non-native ecosystem categories, including cultivated cropland and other kinds of cultural vegetation and landscapes. The resolution of the viewer is 30m x 30m (1 pixel), which is sufficient to evaluate a specific field or site (see Box 3 for more on resolution). The viewer does have some limitations, however, which stem from the kinds of resolution issues and which are important for users to understand. The ecosystem maps were generated using hundreds of thousands of field observations and satellite imagery, along with other data layers (e.g., hydrology, topography, etc.) using an automated computer modeling process to interpret the spectral signatures of different kinds of ecosystems and cultural land covers (see Box 2 for different types of land cover). While quite accurate at distinguishing native ecosystems as a whole from cultural land covers, field verification of every land cover patch is impossible, so the *USGS Viewer* is not completely reliable for distinguishing specific ecological systems from similar or commonly adjacent ones (in our experience, it is more reliable at the Macrogroup and Group level). Also, it may not always distinguish between older, well-established native ecosystems vs. pioneer or early successional (often called 'ruderal') vegetation that may lack the dominant and characteristic species. Further, the *USGS Viewer* does not show "real time" land cover: The age of the database (10 years at the time of this writing) necessarily omits any subsequent land cover changes and ecosystem conversions that may have occurred in the interim. Still, it offers a reasonable method for making an initial determination, short of conducting a site visit. https://maps.usgs.gov/terrestrial-ecosystems-2011/ Additionally, since a national update of these maps is nearing completion in 2021, the newer version is anticipated to become available soon on the USGS Viewer.

Data Basin-Ecosystems of the Western Hemisphere, (hereafter referred to as *Data Basin*) is a similar interactive map application that relies on the same underlying ecosystems database and a similar automated map-making process as the *USGS Viewer*, but displays ecosystems only at the Macrogroup and Ecological Systems levels. It covers ecological systems in the U.S., Mexico, Central America, the Caribbean, portions of South America, and the temperate regions of southern Canada where most agriculture in that country is concentrated. It is especially useful for places outside the U.S., which are beyond the scope of the *USGS Viewer*. The nominal pixel resolution of the map is 270 x 270m, which is suitable for the ecosystem identification and verification activities described in this toolkit. In addition to ecological systems, this application has several other useful features, such as the ability to display IVC Macrogroups – larger, landscape-scale collections of broadly similar ecosystems – such as 'California Forest and Woodland' or "Midwestern Tall Grass Prairie", which in some instances may be simpler to interpret and use for verification purposes than the more numerous and detailed ecological systems. Another useful feature is called "potential ecological systems", which shows what would be expected at a site in the absence of disturbance, or, in the words of its creators, "the map depicts the location and extent of each [ecosystem] had there been no intensive human land uses in recent centuries".[3] In our experience, this feature helps cut through the clutter of many, tiny (often a single pixel or two) ecosystem remnants that typify historically disturbed and fragmented agricultural landscapes, and focuses on the dominant type(s) of ecosystems that were once present and may still be visually recognizable in small patches on site, and would thus be subject to this regulation. (https://databasin.org/maps/new#datasets=db6bef1fcd3a46c881ee8322aa14854f).

Three other static (non-interactive), downloadable maps may be useful in situations where a very general ecosystem classification at the biome level (e.g., 'tropical or subtropical shrubland') is needed. These will not be conclusive but rather supportive of other more specific information in the operator's application or certifier's verification efforts. These maps are: 1) the *2015 North America Land Cover* map, a joint project of Canada, the U.S., and Mexico, with land cover categories interpreted from satellite imagery at a 30m resolution, but presented on a much smaller scale map of North America: http://ssig.conabio.gob.mx/apollo/us/nalcms/; 2) the *National Land Cover Database* , a U.S. multi-agency effort, also with a 30m resolution, starting with periodic maps available beginning in 2001: https://www.mrlc.gov/national-land-cover-database-nlcd-2016; and 3) *Ecosystems of Mexico*, hosted by Biodiversidad Mexicana – National Commission for the Knowledge and Use of Biodiversity, with maps, descriptions, photographs and example sites of the 14 major ecosystem classes in the country: https://www.biodiversidad.gob.mx/ecosistemas/ecosismex.

d) **Vegetation Classifications.** *The International Vegetation Classification system (IVC)* and the *Terrestrial Ecological Systems Classification (TESC)* developed and maintained on ***NatureServe Explorer*** collectively make up the underlying names and summary descriptions of native ecosystems for both the *USGS Viewer* and *Data Basin*. The IVC embodies a hierarchy of ecosystem categories descending from global (Class) at the highest level to local (Alliance, Association) at the lowest; TESC ecological systems and their component associations correspond to these lowest and most detailed rungs of the IVC hierarchy, with each ecological system occurring at local scales in a specific geographic area (e.g., White Oak-Northern Red Oak-Shagbark Hickory Midwest Forest). Macrogroups, one of two categories featured in *Data Basin*, are about midway up the hierarchy and represent regional-scale groups of broadly similar ecosystems; they typically have more generalized names (e.g., Central Midwest Oak Forest, Woodland, & Savanna) that are more likely to be

[3] See https://databasin.org/datasets/db6bef1fcd3a46c881ee8322aa14854f/ for an explanation.

recognized by people with only a passing knowledge of plants. On the highest rungs are class and sub-class, global and continental groupings such as 'Forest and Woodland' and 'Grasslands', which are broadly similar to the concept of biomes and which more people have probably heard of. Illustrated examples of the classification systems appear in the appendices describing the use of *USGS Viewer*, *Data Basin* and *NatureServe Explorer*, as well as in several of the example verification scenarios.

If the *USGS Viewer* and *Data Basin* represent the "geography" of western ecosystems, then *NatureServe Explorer* could be thought of as the "encyclopedia" of those ecosystems and their constituent species. In addition to the U.S. and its territories, *NatureServe Explorer* also covers native ecosystems in Canada, Mexico and Central America, and is actively expanding to the rest of the Western Hemisphere. It also covers plant and animal species throughout the U.S. and its territories, Canada, and the Caribbean, both as individual entries in the database and by listing rare, threatened, endangered (RTE) and other notable species in every ecosystem description. This coverage provides valuable background to operators and certifiers with respect to RTE species and several other aspects of the NOP Natural Resources and Biodiversity Conservation standards and guidance. *NatureServe Explorer* can be queried by country, state, or province to produce a list and descriptions of native ecosystems present. *NatureServe Explorer* is not a map application, however, and cannot in and of itself determine the presence and identity of a native ecosystem at a particular site; it is ideally used together with the two native ecosystem map applications noted above to provide a comprehensive ecosystem description. https://explorer.natureserve.org/

Although much of our understanding of the distributions and relationships between ecosystems in the Americas has coalesced around the IVC, ecosystem classification is an evolving subject, and countries, agencies, and organizations outside of the Americas, as well as older publications within the Americas use somewhat different systems and names apart from the IVC. And, as the IVC hierarchy illustrates, even the term 'ecosystem' can have vastly different size connotations, depending on specific usage. For example, the Mexican government's official biodiversity website (https://www.biodiversidad.gob.mx/ecosistemas/ecosismex) describes 14 large-scale terrestrial and marine 'ecosystems' (e.g., cloud forests, temperate forests, scrubland, reefs, sea grass meadows, etc.) mentioned above that broadly correlate with the class or sub-class level of the IVC and the concept of 'biomes,' while acknowledging that each one is made up of numerous variations, or 'ecotypes' of more localized distribution. It is our opinion that, while the ecological systems of the TESC (or the correspondingly detailed groups, alliances, and associations of the IVC) are the ideal classification level for purposes of verification and monitoring for organic certification (and often necessary to identify the dominant and characteristic species at a site), broader concepts like what is used in Mexico or the IVC classes also have their place, because the 'ecosystems' they represent (grasslands, desert, forest, etc.) tend to be more readily understood and recognized among those without any particular ecological training or experience, such as many operators.

e) **Wetland Maps.** The *USFWS (U.S. Fish & Wildlife Service) Wetlands Mapper* is particularly valuable in situations where a wetland ecosystem may be present, because a significant number of remnant native ecosystems in agricultural regions are wetlands. *Wetlands Mapper* is based on the *National Wetlands Inventory (NWI)*[xix], which uses a more general classification of wetland ecosystems than either the IVC or TESC, but this application (https://www.fws.gov/wetlands/data/Mapper.html) is nevertheless the standard tool used to make a first cut on identifying whether a wetland is present on a given site. Resolution is equivalent to or better than the 1:24,000 USGS topographic maps on which the underlying *NWI* was first compiled.

An equivalent Canadian wetland map based on the ongoing Canadian Wetland Inventory is still a work in progress: https://www.arcgis.com/home/item.html?id=32127dc5d4e543a689848f25fc787621. Coverage currently extends to large parts of the agricultural regions of Quebec and Ontario, but is spotty elsewhere. More complete wetlands data may be found at the websites of some individual Canadian provinces. Nothing similar to the level of detail found in *Wetlands Mapper* exists for Mexico, though an interactive national map of *Potential Wetland Areas* is available at http://en.www.inegi.org.mx/temas/humedales/. More detailed wetland maps for a much smaller subset of the country are available via links at this same site.

f) **Soil Maps and Descriptions.** While the *Natural Resources Conservation Service (NRCS) Web Soil Survey* is primarily useful for soil maps, it has two features that can be helpful for identifying native ecosystems: 1) hydric soils, which indicate the existence (or past existence) of a wetland, and may be a useful adjunct to *Wetland Mapper*; and 2) listings of the typical native vegetation found on each soil series. While the latter is much more generalized than the vegetation classifications in either the IVC or *USFWS Wetland Mapper*, it nevertheless can give a good indication of the kind(s) of native ecosystem(s) typically found within the range of a given soil series. Also useful is that neither of these features is time dependent; i.e., they existed when the soil survey was made decades ago and still exist today. Hydric soils are identified in published county soil surveys, and online in the soil map application (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) and in the official soil series description (https://soilseries.sc.egov.usda.gov/osdname.aspx). Native vegetation classifications are found online in the official soil series description and in printed county soil surveys in some states.

A similar web-based soil survey does not exist at the same detailed scale for all of Canada and Mexico; instead, county- and regional-level soil surveys for selected Canadian agricultural regions are available here: http://sis.agr.gc.ca/cansis/publications/surveys/index.html and for Mexico, here: http://en.www.inegi.org.mx/temas/usosuelo/default.html#Downloads.

Box 1. The Changing Nature of Web-based Tools

The relative newness of most of the collections and tools listed here means that they are constantly undergoing refinement, updating, and, sometimes, major revisions that end up causing them to migrate onto completely different platforms than the ones described here. The descriptions and web addresses given below are current as of early 2021, but may change as applications evolve. If you find yourself suddenly unable to locate or access an application, we recommend typing its name or subject into a search engine, which will reveal the new web home of the application as well as viable alternatives.

Box 2. Land Cover vs. Land Use; and Cultural Landscapes

When we use the tools highlighted below to ascertain the presence and character of native ecosystems, we are basically describing *land cover*, so it is important to understand what that term means and how it differs from similar concepts, such as *land use*. *Land cover* refers to the physical, biological, or cultural attributes that currently occupy a piece of terrain (Fig. C1). The term is wide ranging, encompassing pristine native ecosystems, completely human-modified landscapes, and everything in between. It also includes oceans, lakes, and other kinds of open water environments. *Land cover* is not the same as *land use*, which – implicit in its name – describes different ways humans are using and modifying a landscape, e.g., urban, agriculture, etc. In contrast, *land cover* is a broader term encompassing not only the parts of the landscape that are significantly modified by humans, but also the universe of native ecosystems, some of which are only minimally modified by human activity. In this sense, land use is a subset of land cover. In this context, we also should mention another term that is commonly applied to human-modified landscapes and is used frequently in this toolkit: *cultural landscapes*.

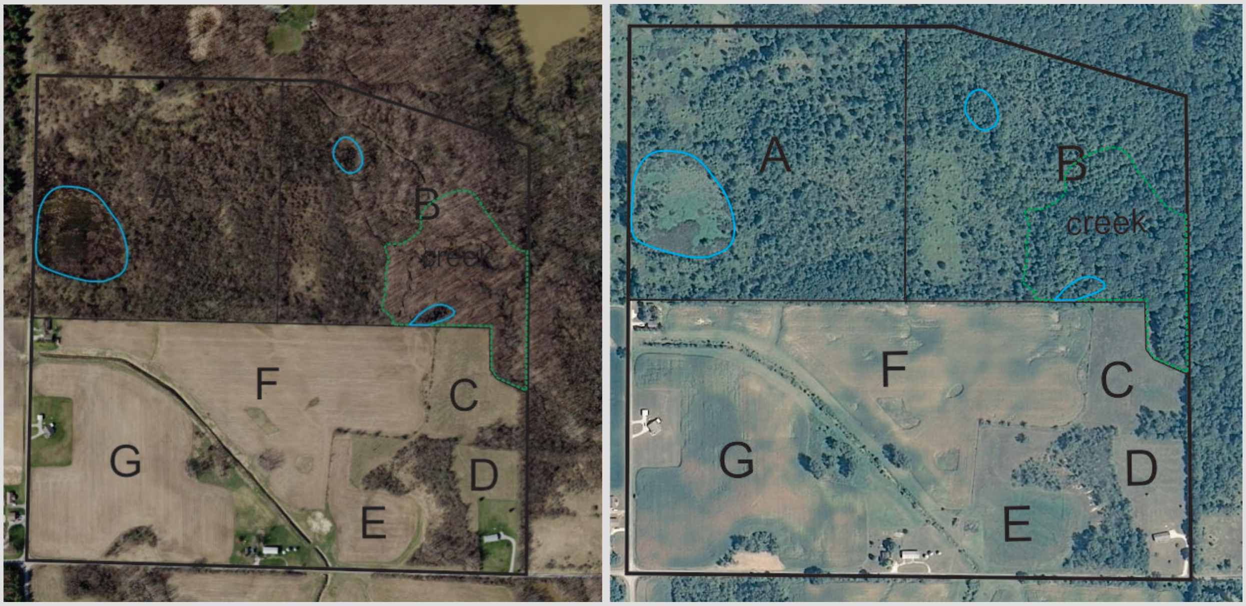


Figure C1. Seasonal Images of Land Cover. *Aerial photos taken on different dates for the site featured in Example D7. The images clearly have different spectral signatures, which partly reflects the time of year they were taken: the one on the left was taken in late winter and is characterized by reddish-brown tones, while the one on the right was taken in midsummer and is dominated by the blue part of the spectrum. The image on the left has somewhat better resolution (objects are sharper), which may reflect seasonal differences in sky conditions (less haze and humidity than the summer image) or some other cause. But land cover is readily identifiable on both, including a variety of native ecosystems and cultural landscapes. Source: USGS Earth Explorer*.

Box 3. Scale and Resolution

Most of the tools described in this section use maps and images to visualize and interpret land cover. Hence, it is important to understand scale and resolution, because they determine the inherent abilities and limitations of maps and images to represent objects and features on the Earth's surface. Scale and resolution both relate to the ability to discern specific objects or features from an image, but they refer to slightly different concepts. Scale refers to the physical size of an image (like a scale model) and is expressed as a ratio (e.g., 1:24,000) between units of length on the map or image and the corresponding units on the ground. For example, a scale of 1:24,000 means one inch on the map or image represents 24,000 inches (or 2,000 feet) on the ground (Fig. C2). Likewise, 1:250,000 means one inch on the map represents 250,000 inches (or almost 4 miles) on the ground.

Resolution, on the other hand, refers to the ability to resolve objects in an image, which is a function not only of scale, but also many other factors, such as how far above the ground a satellite orbits or a plane is flying when it takes an image, the quality of the camera used to take it, and how many dots per inch are used to scan, print, or project an image on a screen. In some of the applications described here, it also depends on the capabilities of the software or model used to interpret features, such as ecosystems, from tones and patterns on an image. The resolution of these map applications is typically expressed as the size of the land area (e.g., 30m x 30m) encompassed in one pixel of an image or map. A similar measure is dots per inch (dpi), which is used to describe the resolution of scans and prints of maps and images.

While it is correct to assume that higher resolution gives more detailed information about a site, it is incorrect to assume that higher resolution images are always necessary for assessing ecosystems and other kinds of land cover. In fact, lower resolution images are usually quite informative for this purpose. For example, some of the maps and images available from the tools presented in this toolkit have a single-pixel resolution of 30m x 30m. This is considered medium resolution, as seen in the maps and images from the *USGS Viewer* and *Wetland Mapper* further in this document.

High resolution imagery is able to distinguish small individual objects like cars or buildings in considerable detail, and is available for certain locations with *Google Earth Pro* and *Global Forest Watch*. Lower resolution is typical of older, historical air photos taken decades ago, which were shot with analog (film) cameras considered primitive by today's standards and sometimes under difficult atmospheric conditions (turbulence, haze, etc.), and later were scanned in order to add them to digital photo archives. Nevertheless, their resolution is typically good enough to easily distinguish parcels the size of small farm fields and the type of land cover on them.

In contrast, it can be problematic to identify the precise location of a small site such as a farm on extremely small-scale maps, such as the 1:1,000,000 Ecosystems Map of Baja California Sur shown in one of the verification scenarios later in this toolkit. Of necessity, map units on such small-scale maps are more generalized than those of large-scale maps, but they can still give a good indication of the type of ecosystem(s) present in the region around a site. In short, scale and resolution affect the quality of maps and images in myriad ways, so it is important for the user to be aware of potential pitfalls and choose the right map or imagery for the specific task at hand. To help depict this concept, local examples illustrating the roles of scale and resolution are sprinkled throughout the example verification scenarios in this toolkit.

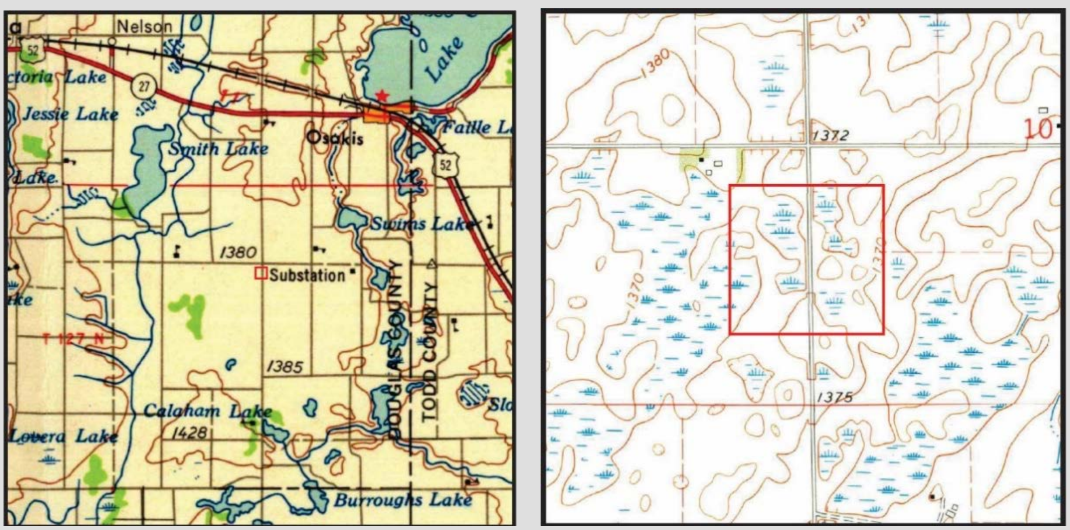


Figure C2. Scales of Maps. *The terms "large scale" and "small scale" are frequently misunderstood. The two maps in this figure are both centered on the grassland (outlined by red box) featured in Example D2. Both maps are shown at their actual, physical scales. Many people would incorrectly call the 1:250,000 scale map on the left "large scale" because it covers more land area per square inch (and overall, because the maps are the same physical size) than the 1:24,000 scale map on the right. In practice, the opposite is true: 1:24,000 is a larger scale than 1:250,000. The correct way to think about scale is fractions: 1/24,000 (0.00004 in decimals) is a larger number than 1/250,000 (0.000004). The larger the scale of a map or image, the larger individual objects will appear and the more detail the map or image will be able to show, as is apparent by comparing the two maps above. Source: USGS (1958), Topographic Map of the 1º x 2º St. Cloud, Minnesota Quadrangle, and USGS (1977), Topographic Map of the 7.5-minute Osakis, Minnesota Quadrangle.*

D. Examples of Application/Verification Scenarios[4]

Native Ecosystem *Has Not Been Present* in Previous Ten Years

1) *Earth Explorer* is used to obtain an aerial photo showing land in California was farmed for more than 10 years.

Level: Simple

Key Takeaways:
(i) historical aerial photos with an associated date (see Box 4) can be easily retrieved online, (ii) rows of cropland are readily distinguishable on aerial photos from scrub coastal forest and marsh ecosystems, but native grasslands may not be discernable from hay and pasture fields, and (iii) situations in which no native ecosystems are present are expected to be the most common kind of certification scenario, making compliance with the native ecosystem regulation in most cases a straightforward matter that can be easily done from a desk.
Operator Application Request:
A NOP-certified U.S. operator submits an application proposing to add a new field to the certified operation. The application indicates that no native ecosystem has been present for the past 10 years on the land proposed for certification and includes an undated aerial photo showing the field in question to be under cultivation at the time. The photo, which serves as the operator's farm map, also identifies native ecosystems elsewhere on and around the farm.

Certifier Actions:
The certifier can do one of two things to verify the application: 1) ask the applicant to provide documentation of the aerial photo date; or 2) use one of the tools to view a historic aerial image of the site, a process that usually takes less than two minutes with a good internet connection. The certifier chooses the second option and uses *Earth Explorer* to download a 10-year-old image from the National Agriculture Imagery Program (NAIP) Collection, and then adds the field boundaries and other features shown on the farm map (Figure 1-1).

[4] These examples are the product of Wild Farm Alliance's imagination. None of the specific incidents on the lands referred to in these examples are known to us to have been part of an actual organic application or certification. In some cases, these lands are in public ownership, in others private. They are only meant to be examples and do not imply anything else.

Figure 1-1. 10-year old NAIP Image (from *Earth Explorer*). *Outlines of black (current) and red (proposed) field boundaries, and designations of Scrub Coastal Forest (S) and Marsh (M) added for purposes of this example.*

Discussion:
The NAIP image on the left shows the field proposed for certification (outlined in red) was clearly cultivated at that time, and appears similar to the rest of the currently certified parts of the operation (outline added in black) and to the neighboring fields to the east. In the photo, cultivated areas are generally quite distinct from remnant native ecosystems, which consist mainly of scrub coastal forest (S) and marsh (M) in and adjacent to the large waterways on either side of the image. The original native ecosystem on the level uplands was mostly grassland, now almost entirely converted to agriculture; grasslands might be difficult to distinguish from hay and pasture on an aerial photo, but are readily differentiated from cropland by virtue of the regular geometric patterns of furrows or rows on the latter.

Conclusion:
The certifier confirms the application is correct that no native ecosystem has been present in the last ten years on the field proposed for certification.

Box 4. Identifying the Date of an Aerial Photo

When obtaining aerial photos to substantiate or verify ecosystem history for certification purposes, it is crucial that the date the photo was taken be documented. The form this takes depends on how old the photo is and the technology used to acquire it, as well as the method by which the photo is obtained.

Aerial photos taken by or on behalf of a government agency are typically catalogued according to the date the photo was taken along with other descriptors (e.g., agency, flight number, serial number, etc.). Where this information appears depends on the age of the photo and the criteria of the agency acquiring the photo. Many older single-frame photos have the date and serial number stamped in the corners of the photo itself; this is almost always true for older analogue photos taken using traditional film. When these photos are scanned, the date stamp becomes part of the digital image. This is illustrated by the historical aerial photo shown in Figure 1-2, which was taken in 1951.

Newer, digital photos, however, generally do not have a physical date stamp and are instead identified by a separate roster of data that includes the date taken along with other pieces of information that may include the resolution, altitude, originating agency, the collection the photo belongs to, serial number, detailed location coordinates, and many others. These **metadata** are available separately, usually as a text file that can be downloaded or viewed with the photo image itself. Photos taken for the FSA's NAIP are a good example: when acquired through *Earth Explorer*, the website gives the option of downloading a text file (Figure 1-3) containing the metadata for the selected photo.

Metadata may not be readily available as a separate file download if obtaining digital air photos from county GIS websites. However, the year the photo was taken (and sometimes the exact date) is listed on the layers menu of the GIS application. An easy way to document the photo date in these situations is to take a screenshot of the air photo within the GIS application, with the layers menu expanded and the box next to the photo date turned on (Figure 1-4).

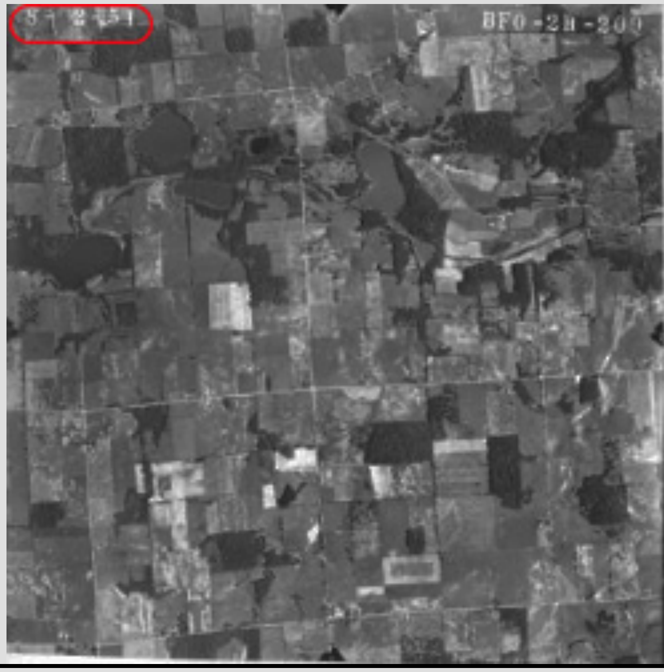


Figure 1-2. Photo with Date Stamp. *This photo was taken on traditional film, with the date stamp of 8-2-51 appearing in the red rectangle (added later).*

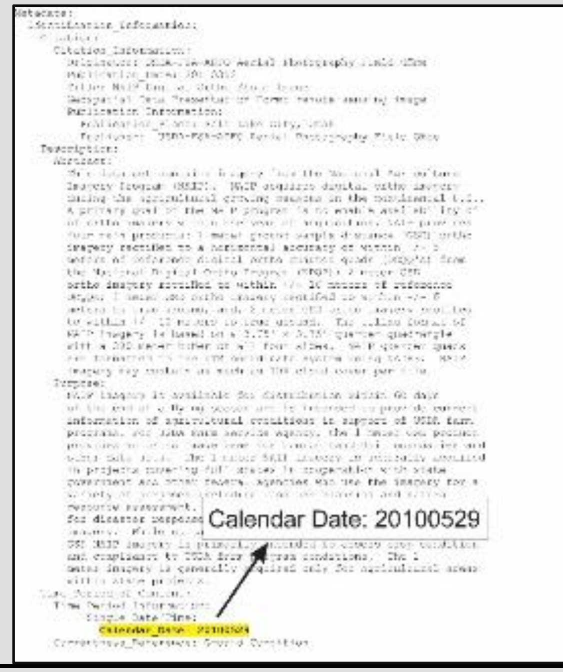


Figure 1-3. Information Included with Non-Date Stamped Photo. *The date of May 29, 2010 (highlighted above) appears on the first page of the metadata available for the 10-year-old aerial photo in the verification example above (Fig. 1-1).*

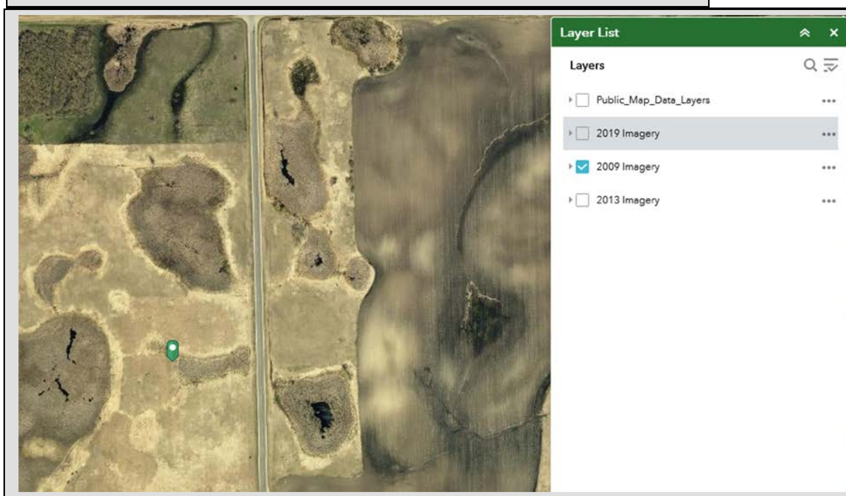


Figure 1-4. Photo with Date in Layers Menu. Screenshot from the Douglas Co., MN GIS dashboard of a 2009 aerial photo from the next verification example. The year the photo was taken is readily apparent by the selection of “2009 Imagery” in the Layers menu.

2) An onsite inspection of land that originally was a native prairie in Minnesota determines that it has not recovered from the effects of severe overgrazing and artificial drainage.

Level: Medium

Key Takeaways:
(i) Native prairies are hard to distinguish on aerial photos from cultural grasslands composed of non-native species; (ii) large areas of farmland, especially in the Midwest, are former wetlands made suitable for cultivation by artificial drainage; likewise, many remnant ecosystems in these agricultural regions are wetlands that proved too wet to farm even with drainage, as evidenced by the photographs in this example; (iii) artificial drainage can permanently alter the composition of ecosystems and lengthen the recovery period following disturbance to many decades; (iv) current and historical aerial photos are available from some county websites; and (v) clear ground-level photos of the vegetation at a site, or an affidavit from the operator or a third party may better substantiate 10-year land cover history than aerial photos, when grasslands are involved.

Operator Application Request:
An existing NOP-certified operator submits an application explaining that a new parcel proposed for certification historically used to be a prairie, but was artificially drained and severely overgrazed in decades past and is now vegetated by invasive domesticated forage grasses and farm weeds. A 10-year old aerial photo is submitted along with a current one (fig. 2-1), but it is impossible to distinguish between a native prairie and the invasive grasses and forbs using the photos alone.[5]

Figure 2-1. Aerial Photos Submitted with the Application. *Both represent relatively high resolution, full color digital imagery acquired during the non-growing season. The photo on the left is current (2019), with the new parcel outlined in red. The appearance of the parcel and its cultural grassland is nearly identical to nearby areas of native prairie (P). Other areas of interest include restored prairie (PR), several wetlands (W), and a large field of row crops (C), which is readily identifiable by the furrows. Note that the restored prairie was formerly cultivated and faint relic furrows are visible in some places. The photo on the right was taken 10 years prior and indicates no changes in land cover have occurred anywhere in the image area during the intervening years. Both of these images were obtained online from the Douglas County, MN Geographic Information System (GIS; https://dc-web-2.co.douglas.mn.us/InteractiveParcelViewerApp/).*

[5] The operator used a county website to obtain these photos. Many counties routinely update their aerial photo coverage and post it to their GIS websites. A random cruise of GIS websites of counties in several states turned up older aerial imagery, as well as the current iteration. These websites are easy to use and, when available, are likely to be a simpler method of obtaining aerial photos for both applicants and certifiers.

Certifier Actions:

The certifier dispatches a local inspector to visit the site. Before traveling there, the inspector takes a few minutes to look up a nearby intact prairie ecosystem at the Northern Tallgrass Prairie National Wildlife Refuge and finds a description using the *USGS Natural Terrestrial Ecosystems Viewer and NatureServe Explorer* (Figures 2-2, 2-3 and 2-4).

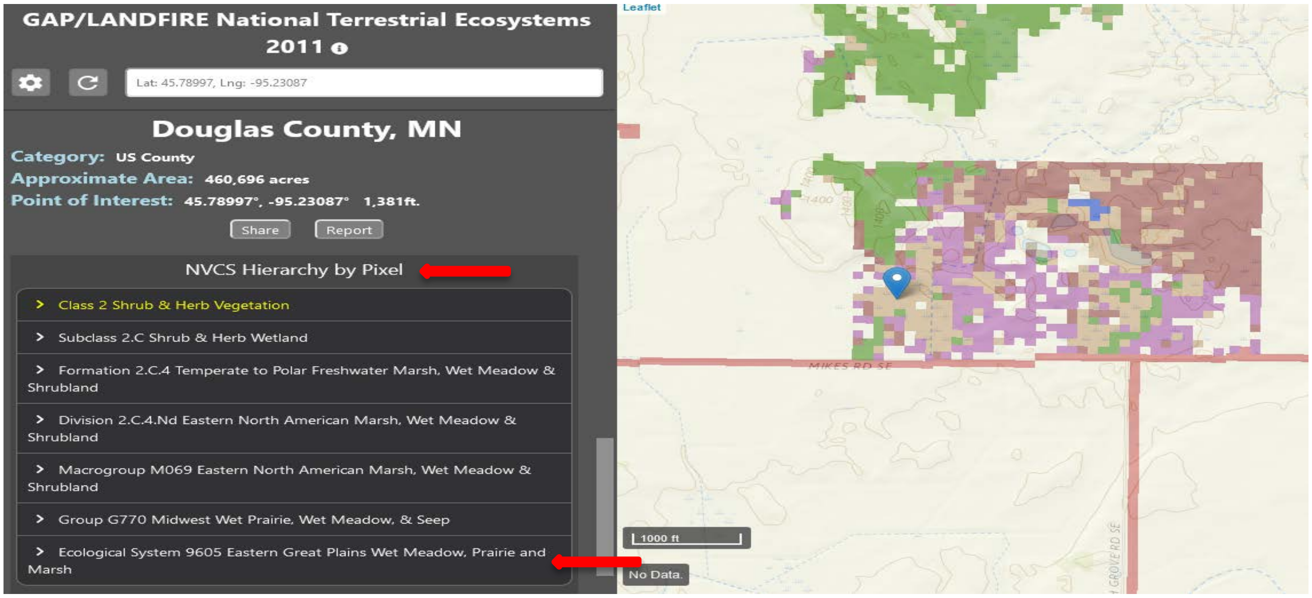
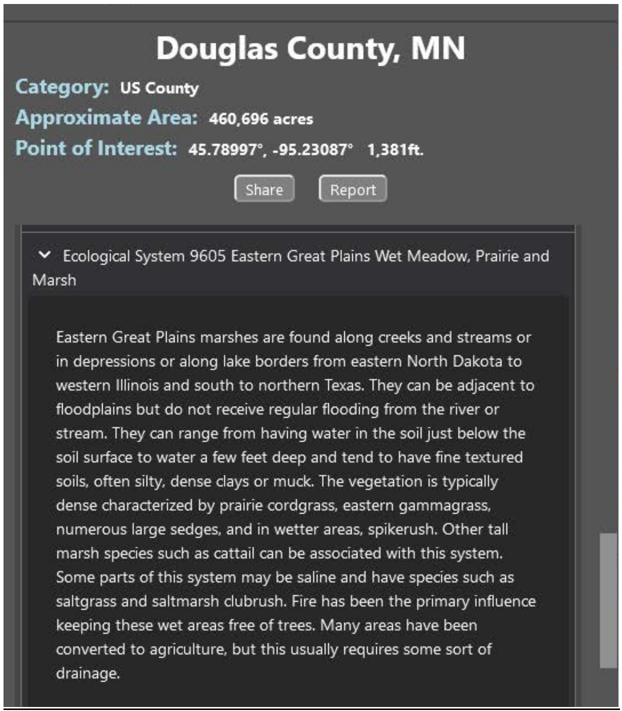


Figure 2-2. Map of Ecosystems in a Section of the Northern Tallgrass Prairie National Wildlife Refuge Close to the Site (from USGS Natural Terrestrial Ecosystems Viewer). *Placing the blue locator symbol on any of the different-colored polygons on the map identifies the name of the corresponding ecological system or cultural land cover and its full classification hierarchy in the "Hierarchy by Pixel" menu on the left (upper red arrow). Most of the polygons identify as various cultural land covers or places recovering from past conversion, but the tan polygon corresponds to an intact local prairie ecological system: Eastern Great Plains Wet Meadow, Prairie, and Marsh" (lower red arrow), Clicking on the "greater than" symbol to the left of the name opens a pop-up box with a summary description (Figure. 2-3).*



Douglas County, MN

Category: US County

Approximate Area: 460,696 acres

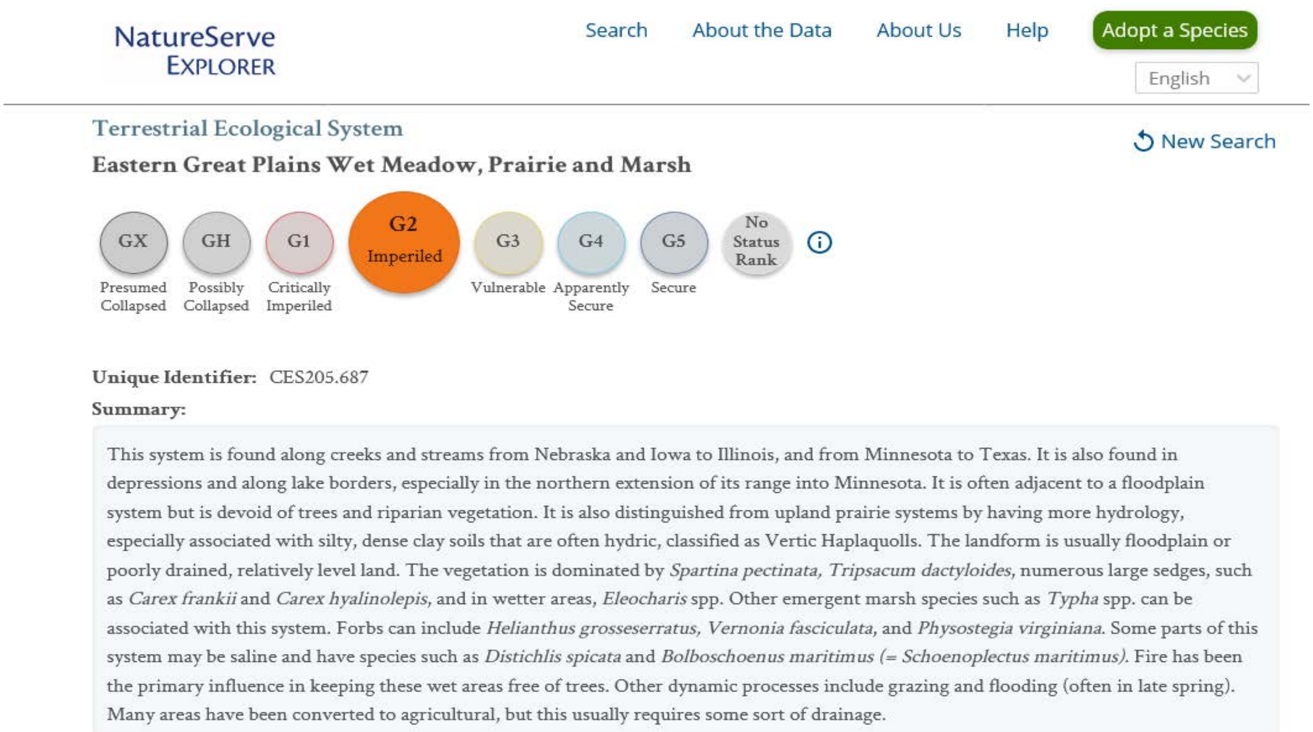
Point of Interest: 45.78997°, -95.23087° 1,381ft.

Share Report

Ecological System 9605 Eastern Great Plains Wet Meadow, Prairie and Marsh

Eastern Great Plains marshes are found along creeks and streams or in depressions or along lake borders from eastern North Dakota to western Illinois and south to northern Texas. They can be adjacent to floodplains but do not receive regular flooding from the river or stream. They can range from having water in the soil just below the soil surface to water a few feet deep and tend to have fine textured soils, often silty, dense clays or muck. The vegetation is typically dense characterized by prairie cordgrass, eastern gammagrass, numerous large sedges, and in wetter areas, spikerush. Other tall marsh species such as cattail can be associated with this system. Some parts of this system may be saline and have species such as saltgrass and saltmarsh clubrush. Fire has been the primary influence keeping these wet areas free of trees. Many areas have been converted to agriculture, but this usually requires some sort of drainage.

Figure 2-3. Comparing Two Descriptions of the Eastern Great Plains Wet Meadow-Prairie-Marsh Ecological System from the *USGS Terrestrial Ecosystems Viewer* (left) and *NatureServe Explorer* (below in Figure 2-4). *Both descriptions summarize the dominant species. The USGS Viewer gives common names (prairie cordgrass, eastern gammagrass, large sedges, spikerush), and NatureServe Explorer gives botanical names (below). Either description gives an inspector a good idea of what to look for on site. Another descriptive characteristic of potential relevance to this site is the last sentence in both descriptions: "Many areas have been converted to agriculture, but this usually requires some sort of drainage".*



NatureServe EXPLORER

Search About the Data About Us Help Adopt a Species

English

Terrestrial Ecological System

Eastern Great Plains Wet Meadow, Prairie and Marsh

New Search

Unique Identifier: CES205.687

Summary:

This system is found along creeks and streams from Nebraska and Iowa to Illinois, and from Minnesota to Texas. It is also found in depressions and along lake borders, especially in the northern extension of its range into Minnesota. It is often adjacent to a floodplain system but is devoid of trees and riparian vegetation. It is also distinguished from upland prairie systems by having more hydrology, especially associated with silty, dense clay soils that are often hydric, classified as Vertic Haplaquolls. The landform is usually floodplain or poorly drained, relatively level land. The vegetation is dominated by *Spartina pectinata, Tripsacum dactyloides*, numerous large sedges, such as *Carex frankii* and *Carex hyalinolepis*, and in wetter areas, *Eleocharis* spp. Other emergent marsh species such as *Typha* spp. can be associated with this system. Forbs can include *Helianthus grosseserratus, Vernonia fasciculata*, and *Physostegia virginiana*. Some parts of this system may be saline and have species such as *Distichlis spicata* and *Bolboschoenus maritimus (= Schoenoplectus maritimus)*. Fire has been the primary influence in keeping these wet areas free of trees. Other dynamic processes include grazing and flooding (often in late spring). Many areas have been converted to agricultural, but this usually requires some sort of drainage.

Figure 2-4. *NatureServe Explorer* Provides More Descriptive Detail. *This tool includes more information (than in USGS Viewer -Figure 2-3) about the distinctive characteristic species that may be easily recognized, such as Typha (cattails), Helianthus grosseratus (sawtooth sunflower),Vernonia (prairie ironweed), and Phytostegia (obedient plant). NatureServe Explorer also lists the ecosystem's "imperiled" ranking, which may have potential relevance to this site.*

Taking this description to the inspection, the inspector verifies that the native prairie has not recovered. Only a few of the initial invaders of this drained and formerly grazed site are characteristic prairie ecosystem species; the dominant species are largely missing, and domesticated forage grasses such as brome species and reed canary grass, along with other weedy upland species are prevalent, their persistence reflecting in part the effects of artificial drainage of a formerly wet site.

Discussion:
This scenario illustrates the difficulties of using aerial photos to distinguish native grasslands from cultural grasslands (e.g., hay, pasture, overgrown fields): it can be done, but requires a very high level of experience with aerial photo interpretation, and even experienced persons may be challenged. The land requested for certification in this example had previously only been grazed and never cropped, so no historical cropping patterns are present in aerial photos to help distinguish its history. Conclusive verification of the land cover ultimately required a site visit by a prepared inspector reasonably familiar with local ecosystems. A native ecosystem prior land-use affidavit, completed by the operator or a third party familiar with the site and stating that it has not contained a native prairie for the last ten years, provides another option to aerial photos in grassland situations. Finally, this site clearly illustrates the idea that many agricultural regions contain extensive areas of converted wetlands (as well as small remnant wetland ecosystems), which may take many decades to recover from the effects of artificial drainage once farming is abandoned. Drainage favors the proliferation of upland species where none were formerly present, and many of these are invasive, non-native farm weeds and forage grasses. In some cases, the long-term effects of agricultural drainage may represent the situation described in the native ecosystems rule, of land that has been "previously cultivated, cleared, drained or otherwise irrevocably altered".

Conclusion:
The land proposed for certification does not contain a native ecosystem and is eligible for certification contingent upon meeting other aspects of the NOP rule. In this and similar situations where aerial photos and other desktop methods are inconclusive, the operator could provide the certifier with current photographs of the vegetation on the parcel and a Native Ecosystem Prior Land-Use Declaration (the subject of section F of this toolkit) to support the absence of a native ecosystem for the past 10 years. The certifier can verify compliance with a visit.

Native Ecosystem Is Present and *Can Be Managed Organically*

3) A *county soil survey* is used by a new maple syrup applicant to identify a sugarbush ecosystem in Vermont and site-appropriate monitoring practices. The certifier uses other tools to verify it.

Level: Simple

Key Takeaways:
(i) Current and historical aerial photos are useful for understanding ecosystem composition, land use history, and for documenting change over time; (ii) many operators have no experience with modern, scientific ecosystem names and concepts, and are more likely to describe them in colloquial terms. The most important lesson is that the operator recognizes the presence of a native ecosystem (and some of its major plants), regardless of exactly how it is described; (iii) native ecosystems, and especially those in agricultural regions, are seldom 'pristine' or untouched. The key is that they are not irrevocably altered and retain their dominant and characteristic species; (iv) similarly, native ecosystems are not static or monolithic. They are dynamic and often diverse due to both human and natural processes, and may appear as a patchwork of differing age and composition, reflecting differences in relative abundance of dominant and characteristic species across the stand.

Operator Application Information:

A maple syrup producer is preparing a new certification application for 60 acres of mixed age sugarbush when he comes to the questions about native ecosystems. Parts of the tract are mature sugarbush that was never farmed or was preserved in wide hedgerows, but most is second growth that came up at various times over the last century on abandoned haymeadows, resulting in a mosaic of different age classes and compositions. The producer has watched the forest grow up and expand on this abandoned farmland for his entire life and has seen how the grasses, weeds, and blackberries along the retreating edges of the old haymeadows eventually get shaded out and replaced by plants of the sugarbush. This is to the benefit of the sugaring operation, as it is much easier to work in the more open, ferny vegetation of a mature sugarbush than in the brushier, younger parts of the stand. As a result, the management is mostly hands off, thinning only young sugar maples where they are excessively crowded while maintaining a closed canopy to continue shading out the brush in the less mature parts of the site.

The operator has no experience with ecosystem terminology and the kinds of mapping tools described in this toolkit, but he does know the names of the major trees and a few of the common understory plants in the area. One resource the producer is familiar with from being a farmer, however, is the county soil survey, so he pulls out his copy and looks at the soil map of the site. While reading the explanations of the soil series mapped at the site, he finds descriptions of the native forest under which the different soils formed: “Woodlots contain sugar maple, basswood, white ash, tulip poplar, and other hardwoods”, “Large areas are idle and support seedling birch and pine, bracken fern, and blueberries. Forests include sugar maple, eastern white pine, red pine, and white spruce”, and “In wooded areas common trees are eastern white pine, red maple, sugar maple, American beech, red oak, white oak, eastern hemlock, northern white-cedar, and eastern red cedar”. This makes sense to the producer because it mentions the main trees on the site: sugar maple, yellow birch, beech, and hemlock in the older parts of the stand, and sugar maple, ash, tulip poplar, white pine, and cedar in the younger parts.

There is no mention of specific ecosystems in the soil survey, however, so the operator ends up calling the ecosystem a “second growth sugarbush” on the application, and further describes the site as “old farmland with even older hedgerows”. The dominant species are listed as sugar maple, beech, hemlock, and white pine, with the others listed as characteristic species. In response to a question about how the sugarbush ecosystem is maintained, the operator checks: “monitoring of dominant and characteristic species,” “minimize disturbance of forest floor”, and “allow other native trees and shrubs to grow and naturally reestablish in the sugarbush.”

Is this description of the sugarbush ecosystem and its management sufficient and appropriate to the site? Can the certifier or inspector verify the information from a desk prior to the site visit?

Certifier Response:

Spoiler alert: The short answer is ‘yes’ to both questions. As emphasized in the NOP guidance and elsewhere in this toolkit, getting the exact name of an ecosystem correct is far less important than the fact that the producer recognizes one is present! This is no small feat in a society that has steadily been losing its connection to the land and, as a result, its biodiversity. Using terms like “sugarbush” to describe an ecosystem is perfectly acceptable, first because the local vernacular forms the context through which most producers recognize their local ecosystems, and second, because the operator in this example is able to recognize most or all of the major tree species that make up the dominant and characteristic species in this particular ecosystem. And the list of management practices, though short, suggests the operator understands the big picture and takes a holistic approach to the sugarbush.

While final verification ultimately awaits the results from the inspection visit, the certifier or inspector can take a couple of simple steps beforehand to assess whether the Organic System Plan (OSP) is generally on target and to guide the inspection visit. The first indication comes from a 10-year old aerial photo submitted with the application (Figure 3-1), which shows a substantial area of forest at the site, adjacent to three irregularly shaped fields.

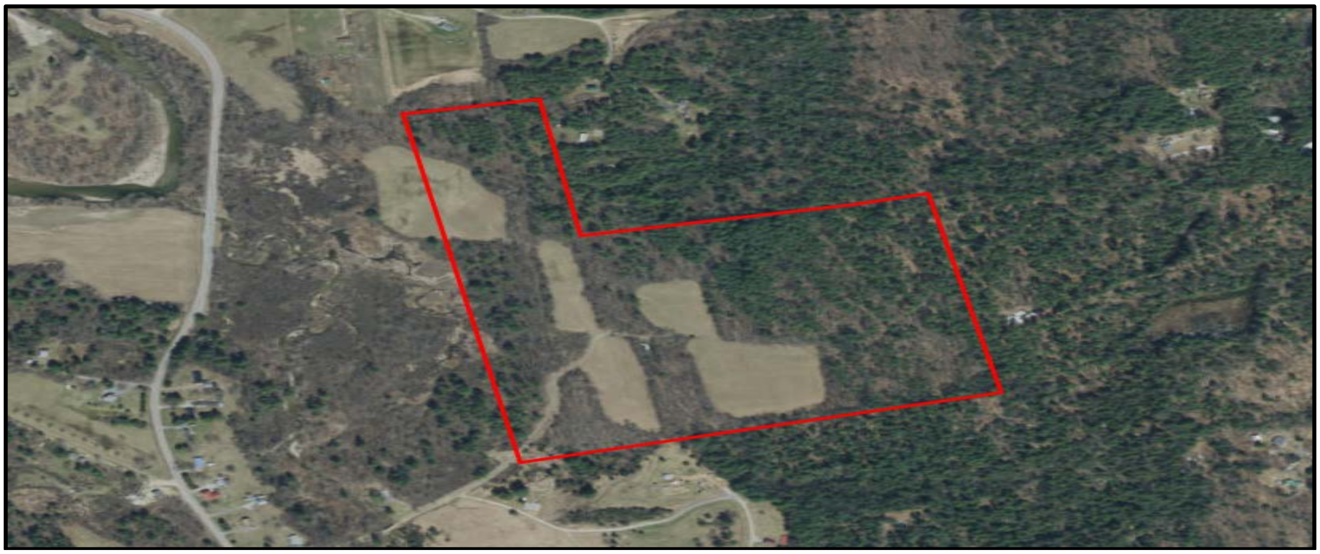


Figure 3-1. Ten-Year Old Aerial Photo Submitted with the Application. *The sugarbush site proposed for certification is outlined in red and appears to be noticeably well forested with a mix of hardwoods (brown tones) and coniferous trees (evergreen) in this non-growing season image. This is consistent with the mix of trees listed in the OSP. The three open fields visible here are also consistent with the site history mentioned in the OSP.*

Many historical aerial photos and more than a few modern ones are taken outside of the growing season, when the leaves of deciduous forests are down. Depending on the objectives and targets of the imaging program, this can have major advantages. In Figure 3-1, for example, it is easy to recognize various cultural features in the image, such as roads, farm fields, and buildings; natural features, such as terrain, water bodies, different soil types, and the proportion of evergreen species (mainly white pine and hemlock in this image) to deciduous species in a forest ecosystem are also easier to recognize. So are conservation issues that need to be addressed, such as gullies, sediment plumes entering water bodies, and other features associated with soil erosion. These sorts of features tend to be partly to entirely obscured by a leafy canopy.

Despite these advantages, it can also be informative to observe the same landscape using an air photo taken at the height of the growing season (Figure 3-2). This is particularly useful for determining whether a field is under cultivation, in hay or pasture, or has been entirely abandoned – and what kinds of agricultural practices are employed (tillage, for example) or the crops being grown. Likewise, for forest ecosystems, images taken during leaf season are ideal for assessing the structure and age of a forest: differences in tree height and crown size tend to be very obvious between nearby forests as well as within a given forest.

Figure 3-2. Aerial Photo Taken During the Growing Season. *The site is outlined in red. Differences in forest age are readily apparent and manifest as the size, or spread, of tree crowns, either individually or as patches of older and younger forest. Much of the southeast part of the site, for example, has a somewhat "blurry" appearance at this distance, which, when zoomed in, can be seen to be created by many small crowns; the forest in this area is noticeably shorter than the tall, much older forest immediately east of the site boundary. In contrast, the crowns of individual, large trees are readily distinguishable in other parts of the site, noticeably in the wide hedgerows between the fields, but also in small, irregular patches in the corners and other odd parts of the site that presumably were never cultivated or were abandoned much earlier. Though not directly related to ecosystems, another feature relevant to organic certification of this site is the appearance of the fields. They clearly are still in use: their extremely uniform appearance is not natural and indicates some type of agricultural management, such as mowing for hay. Zooming in reveals faint, alternating, linear soil tones parallel to the long field edges, which almost surely reflects some kind of recent cultivation or planting pattern that would otherwise be obscured by the more chaotic pattern of encroaching vegetation. The active use of the fields might raise some questions about potential drift risk and the need for buffers. This image happens to have come from the base map layer of USGS Terrestrial Ecosystems Viewer, but growing season images are readily obtainable from USGS Earth Explorer as well, simply by consulting the photo dates that appear in the search results for a site.*

Another step is a quick cruise through *USGS-Terrestrial Ecosystems Viewer* or *Data Basin-Ecosystems of the Western Hemisphere*, to see what kinds of ecosystems are mapped in the area, what their dominant and characteristic species are, and if the OSP is in reasonable agreement with them. As it turns out, it is (Figure 3-3). Two ecosystems cover most of the site, and have sugar maple, yellow birch, and beech as dominant species; they differ only in that one of them also has hemlock and occasionally white pine as dominant species. The other trees mentioned in the OSP are characteristic associates in one or both ecosystems.

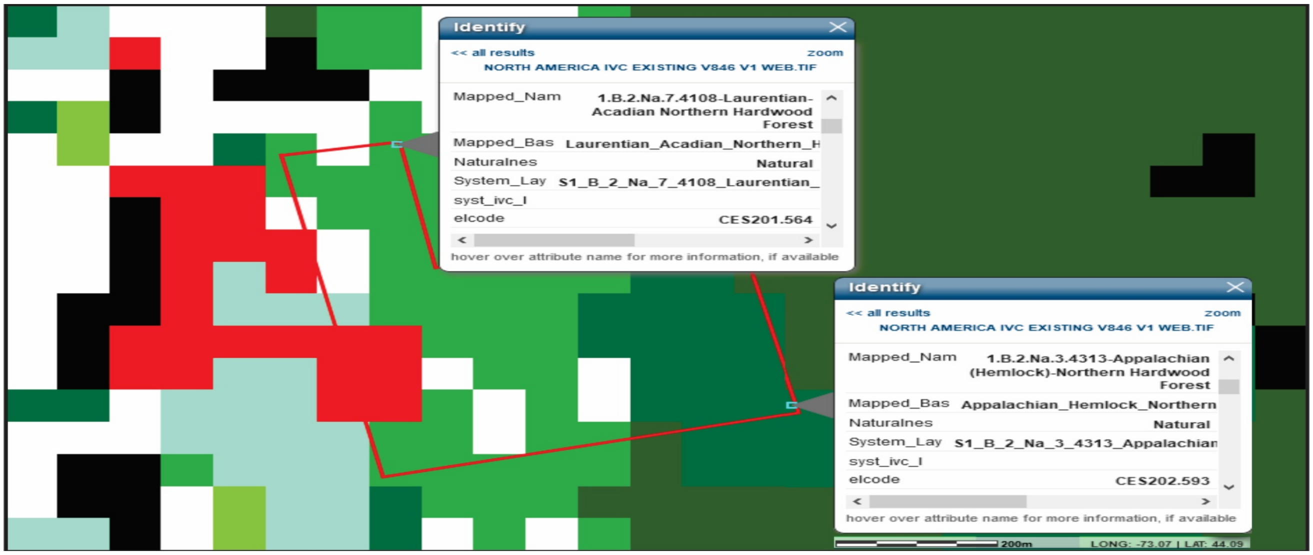


Figure 3-3. Map of Existing Ecological Systems from Data Basin. *Two ecological systems dominate the site: CES201.564, Laurentian-Acadian Northern Hardwood Forest (light green polygon) and CES202.593, Appalachian Hemlock-Northern Hardwood Forest (dark green polygon in the southeastern part of the site). The open fields visible in the images above (Figures 3-1 and 3-2) are indicated by the white pixels, which are identified as "General Agriculture", while the red and light blue pixels along the west side of the site are part of a large wetland complex, most of which lies off site. The mapped distributions of the two main ecological systems are broadly consistent with the pattern seen on the aerial photo in figure 3-1, which shows more coniferous trees in the eastern part of the site. The imperfect correspondence between the white "general agriculture" pixels and the actual shapes of the fields seen in the air photos is a good example of the limitations imposed by the resolution of the Data Basin mapping application: the analysis algorithm assigns pixel identity based on the predominant spectral signature within each pixel. And, since the pixel grid is oriented north-south-east-west, it may not perfectly capture land covers oriented in other directions, such as the northwest-oriented fields in this example.*

One other step that could be done is a search of *USGS Earth Explorer* for the oldest historical air photo available for the site, which can help confirm the history of field abandonment reported on the OSP. This search turns up a 1961 air photo on which the land cover at the site is readily discernable (Figure 3-4).

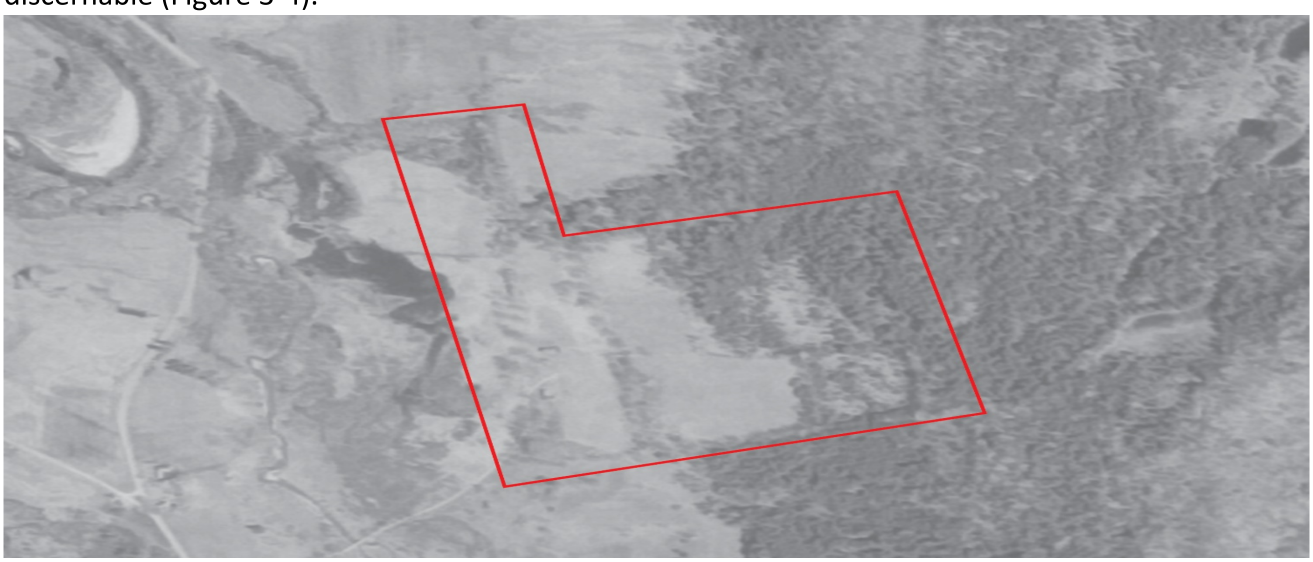


Figure 3-4. 1961 Aerial Photo Obtained from *Earth Explorer*. *By using landmarks such as roads and the large bend in the river (NW corner of the image), the site (red outline) is recognizable in this image from 60 years ago. Key observations are: 1) the three open fields had somewhat different dimensions and were generally larger than they are today (compare to Figure 3-2); 2) strips of mature trees between the fields do indeed resemble hedgerows; 3) another field, long abandoned by 1961 and filling in with trees, can be seen in the southeastern part of the site, the same area that now appears as younger forest in Figure 3-2. The area around this field is mature forest composed of older trees, possibly part*

of or descended from original hedgerows; and 4) other parts of the site that are forested today were a mix of young forest, parts of the (then larger) fields, and some enclaves of mature trees. Another more broadly applicable feature to notice is the aerial photo itself. Compared to the color digital imagery in Figures 3-1 and 3-2, the resolution of this black and white image is poor. The grainy and blurry appearance is likely a function of both the imaging process itself (done with a film camera) and the factors affecting the resolution during digital scanning of the image. Still, despite the obviously lower resolution, the site and its relevant features are readily discernable.

With this background in hand (all of which took less than 15 minutes to assemble), the inspector visits the site and confirms the description of the sugarbush in the OSP. The forest is generally healthy, with a mix of species, though the less mature sections still contain appreciable field weeds and forage grasses inherited from the abandoned fields. These light-demanding plants will be shaded out as the forest canopy enlarges and becomes more closed over time. Overall, there is good agreement between the OSP and conditions observed on the ground. As an aside, the inspector also confirms that the three remaining open fields on the site are managed by the operator for hay without any inputs. While the hay is not being requested for certification, its production poses no drift risk to the sugarbush.

The inspector does notice two items of concern, however. The first is a colony of Asian bush honeysuckle along the main lane leading into the site. This invasive shrub thrives in shady hardwood forests and can become so dense that it prevents forest regeneration by choking out tree seedlings. The inspector points this out to the applicant and suggests some resources to learn about managing it. The second is that some of the hemlocks are in serious decline and covered in tiny white fuzzy masses, the tell-tale sign of hemlock woolly adelgid, an imported pest that sucks sap from the needles of its host and has decimated hemlock stands throughout the eastern U.S. The operator is aware of this pest but does not know of any organic method of controlling it. The loss of hemlocks is allowing more light to reach the forest floor in places, which may change forest composition over time. This is noted in the inspection report.

<u>Discussion</u>:
This scenario illustrates three important ecological themes. First, uneven-age forest stands resulting from natural succession following abandoned farmland, logged areas, or other human disturbances over long time frames (100 years in this case) are common in agricultural landscapes. This results in patches of older, mature forest with most or all of the defining characteristics of a particular ecosystem, interspersed with patches of younger forest containing many, few, or none of these characteristics. The same “patchwork” pattern is also found in old native forest ecosystems, the result of natural dynamics such as wind, fire, drought, or simply the senescence of groves of very old trees reaching the end of their lifespan. Here, the presence of hemlock wooly adelgid – an imported pest beyond the control of the operator – is having a similar effect, and is duly noted in the inspection report.

Second, this “patchwork” condition illustrates two ideas expressed in the guidance: first, that native ecosystems are not necessarily pristine natural communities that have never experienced any human use or alteration, but they nevertheless are still ecosystems because they have not been irrevocably altered and are composed of the dominant and characteristic species; and second, that formerly converted land may recover the expected species given the right conditions or sufficient time. Recovery typically proceeds much more rapidly, and may skip much of the ‘ruderal’ or pioneer phase, when the formerly converted land is adjacent to well-established native ecosystems that act as a seed source for wind and animal dispersal. Wide, mature hedgerows composed of dominant and characteristic species, like the ones at this site, often act in this way.

Third, it is not necessary for an operator to be able to identify the specific name of an ecosystem in order to comply with the native ecosystem regulation. As long as the operator recognizes that a native ecosystem is present and can name even a few of the dominant and characteristic species (which are typically canopy trees in forests), then there is a basis for monitoring and conserving the ecosystem. “Second-growth sugarbush” is an apt and perfectly suitable name for the forest at this site.

Colloquial names and descriptions can be compared to established ecosystem descriptions to help understand if an OSP is in the right ballpark. Here, it is important to bear in mind that ecosystem maps like *Terrestrial Ecosystems Viewer* and *Data Basin* are not the final word: like all maps, they are interpretations and are subject to different kinds of errors that can affect their reliability from place to place. Nevertheless, they are the best options available short of a site visit to understand the ecosystems at a site. One particular shortcoming, for example, is their occasional inability to differentiate the ages of forest ecosystems and their fidelity to a specific ecological system. This poses a challenge for situations where one is trying to determine whether an ecosystem has “recovered expected species” or is still a ruderal ecosystem lacking those species. Such determinations can sometimes be fraught when based purely on ecosystem maps derived from remote imagery; for this example, aerial images helped.

This example shows how historical aerial photos can reveal details about site history that may not be evident from more recent photos or even on the ground. Their usefulness stems from their ability to depict retreating farm fields and the recovery of forest cover over time as an independent confirmation of the site history mentioned in the OSP. The usefulness of being able to see the landscape “as it was” is even more evident if the OSP had indicated no native ecosystem was present and the site was all “abandoned farmland.” The aerial photo tells a different story.

Finally, we would be remiss in not pointing out that the applications of aerial photos to organic production and certification go far beyond native ecosystems. They can suggest places that may be at risk of drift and may need buffers. They can be used to verify what crops are actually being grown and whether they are faithfully reported to the certifier (let’s face it, not all farm inspections occur at the optimal time). They are an excellent tool for detecting natural resource management issues, such as soil erosion and degradation of water quality by sediment running off fields. One of us met an organic farmer who identified under-performing areas in his fields quite precisely from tonal differences on air photos taken during the growing season, and used that information to further investigate and correct the cause. And many others.

<u>Conclusion</u>:
This sugarbush operation complies with the native ecosystem regulation. The operator avoids the overly manicured approach seen in some sugarbush operations, instead taking a minimalist approach to thinning and other kinds of stand management, allowing the ecosystem to take a natural course. Managing the encroaching Asian bush honeysuckle is a minor requirement, but one that is not onerous because the issue was caught early, when the population was still small.

4) ***USGS Natural Terrestrial Ecosystems Viewer*** **and** ***NatureServe Explorer*** **were used by a wild pecan operation in Missouri to identify the native ecosystem and a site-appropriate management strategy.**

Level: Simple

Key Takeaways:
(i) Operators with average internet skills can use this toolkit to determine whether a native ecosystem is present, its identity, and site-appropriate management strategies to conserve it; (ii) forest ecosystems are defined by the dominant tree species present on the land; (iii) it is sometimes easier to use levels of the hierarchy above "Ecological System" to identify the ecosystem, due to limitations of the mapping methodology; and (iv) the inspector can easily verify that all the dominant and characteristic species are conserved, both by visual observation and the operator's monitoring records.

Operator Application Request:
A wild pecan operation in the southeastern Great Plains applies for certification of land with native pecan trees, many of which are hundreds of years old. The operator has experience using the internet for marketing and other tasks, and when he gets to the part of the OSP questionnaire about native ecosystems, he downloads a copy of this toolkit, which is mentioned as a resource in the certifier's instructions. He already has a pretty good idea that the bottomland forest with the pecan trees is some kind of "ecosystem", but is unsure how to describe it. From the toolkit, he selects "USGS Terrestrial Ecosystems Viewer" and locates his site using latitude-longitude coordinates obtained from the GPS on his phone. Following the instructions in Appendix D of the toolkit, the operator places a pin on the map in the middle of the site, and selects the 'hierarchy by pixel' analysis from the menu. This action displays the hierarchy of ecosystems mapped at the site (Figure 4-1).

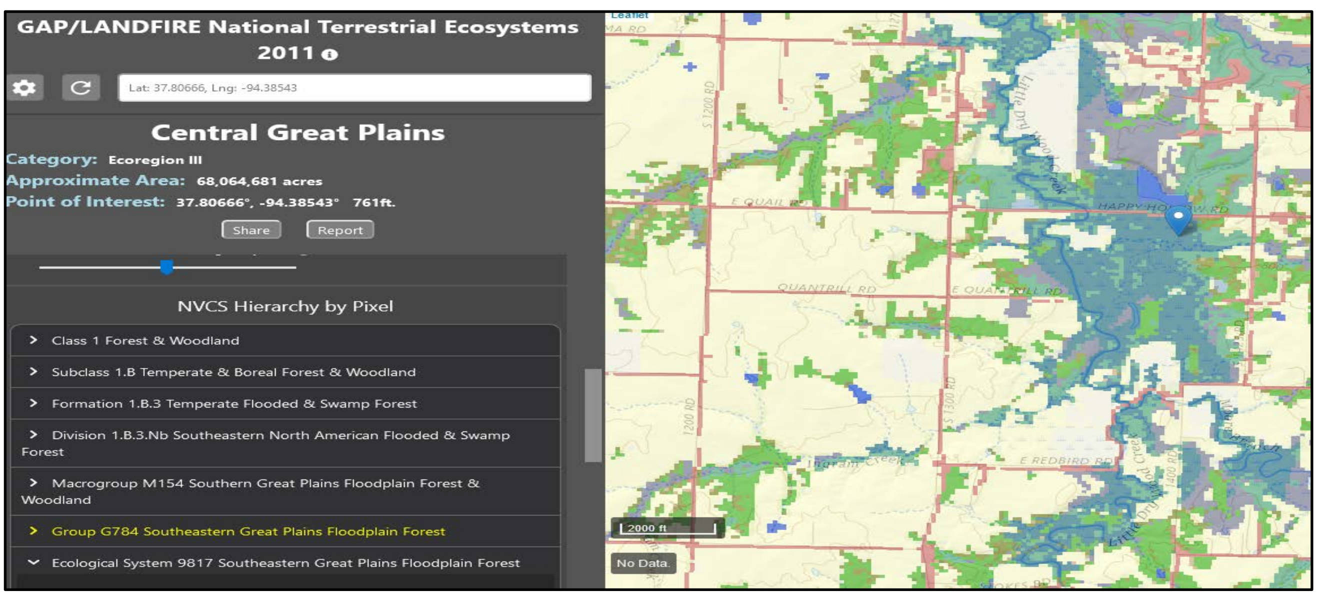


Figure 4-1. Site Map and Ecosystem Hierarchy from USGS Terrestrial Ecosystems Viewer 2011 (also called GAP/ LANDFIRE…). *On this image, the operator notices that the entire site appears in the same blue color, which suggests to him that there is only one type of ecosystem. Clicking the small tabs to the left of each name on the hierarchy opens up a corresponding summary.*

Following the toolkit instructions, the operator opens up a summary description of *Ecological System 9817 Southeastern Great Plains Floodplain Forest* (Figure 4-2). The operator is only vaguely aware of the concept of scientific species names, though he has seen the name "*Carya illinoinensis*" when reading extension publications about pecans. The rest are a mystery, so he types the familiar common names he knows for three other trees on the site ('sugarberry', 'box elder', 'sycamore') into a search engine, which gives the scientific names (*Celtis laevigata, Acer negundo, Platanus occidentalis*). With this translation, the operator finds that, while the term "floodplain forest" makes sense, the trees named in the ecological system description don't seem to match what he has observed on site; in fact, it doesn't even mention pecans. So he opens up the summary of the next level up on the hierarchy menu, *Group 784 Southeastern Great Plains Floodplain Forest* (Figure. 4-2). This description matches the site much better.

Ecological System 9817 Southeastern Great Plains Floodplain Forest

This system is found along rivers across the glaciated Midwest. It occurs from river's edge across the floodplain or to where it meets a wet meadow system. It can have a variety of soil types found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates and flooding that creates the mix of vegetation that includes Acer saccharinum, Populus deltoides, willows, especially Salix nigra in the wettest areas, and Fraxinus pennsylvanica, Ulmus americana, and Quercus macrocarpa in more well-drained areas. Within this system are oxbows that may support Nelumbo lutea and Typha latifolia. Understory species are mixed, but include shrubs, such as Cornus drummondii and Asimina triloba (in Kansas), sedges and grasses, which sometimes help form savanna vegetation. Flooding is the primary dynamic process, but drought, grazing, and fire have all had historical influence on this system. Federal reservoirs have had a serious and negative effect on this system, along with agriculture that has converted much of this system to drained agricultural land.

Group G784 Southeastern Great Plains Floodplain Forest

These floodplain and riparian forests and woodlands are found in the southern Great Plains of the U.S. (south-central and north-central Texas extending into Oklahoma). Characteristic species include those occurring at the southwestern extent of their range (*Acer negundo, Carya illinoinensis, Celtis laevigata var. laevigata, Cornus drummondii, Fraxinus pennsylvanica, Juglans nigra, Platanus occidentalis, Quercus macrocarpa, Quercus shumardii, Salix nigra, Sideroxylon lanuginosum, Taxodium distichum,* and *Ulmus americana)* and the southeastern extent of their range (*Celtis laevigata var. reticulata, Juglans major, Juglans microcarpa, Prosopis glandulosa,* and *Quercus fusiformis*).

Figure 4-2. Descriptions of Southeastern Great Plains Floodplain Forest Ecological System (left) and Group (right) from USGS Terrestrial Ecosystems Viewer. *The Ecological System description is a poor match for the site; none of the dominant tree species are mentioned. The Group description is a much better fit; the first three characteristic species mentioned are the ones most common at the site: box elder, pecan, and sugarberry.*

The grower is busy with other things, so he settles on *"Southeastern Great Plains Floodplain Forest"* as the name of the ecosystem in his OSP, and lists "pecan, sugarberry, box elder" as the dominant and characteristic species. For the question "briefly explain how you will monitor the site to ensure your production practices preserve the native ecosystem", he checks "photos" and "health of species being used in production", and adds "avoid shaking trees when wet or muddy to minimize ground disturbance". This completes the native ecosystems part of the OSP.

<u>Certifier Actions:</u>
The certifier finds the descriptions in the OSP logical and adequate and assigns the file for inspection. During the site visit, the inspector confirms that it is a native ecosystem with the dominant pecan, boxelder and sugarberry species. The operation uses a shaker, a mechanical device that clamps on to the pecan trees and shakes the ripe nuts loose. This requires motorized access, which the operator provides through a network of lanes, efficiently laid out to minimize compaction and disruption of the forest floor, which appears fairly healthy. The operator maintains clear harvest records and has taken several photos of scenes along and adjacent to lanes that he plans to repeat annually as a way of monitoring changes in the ecosystem. These will be submitted to the certifier as part of the annual update. This is an easy method of monitoring for the operator because it doesn't require a lot of time or detailed ecological knowledge. The inspector also notes that the operator generally maintains a light hand on the site, avoiding driving on it except in harvest season

and otherwise letting nature take its course. The inspector notes some patches of Japanese stiltgrass along one of the lanes, probably sprouted from seeds brought in by wheel traffic. This invasive annual grass can completely take over the understories of moist forests like this one, so she recommends that the operator make efforts to monitor and manage it and prevent it from spreading further into the site.

Discussion:
The operator in this example has what could probably be described as “average” computer and internet skills: he accesses NRCS and Extension materials online, including *Web Soil Survey*; keeps most production records on computer spreadsheets; and is part of a local collective of pecan growers that uses online marketing. Using online tools like *USGS Terrestrial Ecosystems Viewer* is no big deal, but what made it simple was that he had learned about “how-to” resources like this toolkit from his certifier.

This site still contains an intact floodplain forest ecosystem defined by its dominant trees: pecan, sugarberry, and box elder. As mentioned in the guidance and elsewhere in this toolkit, any ecosystem name, even a colloquial one, that accurately captures conditions on the ground is sufficient for purposes of the native ecosystem regulation. In this case, the better description in the vegetation classification hierarchy turned out to be at the Group level rather than the Ecological System. The operator knew enough of the dominant tree species to be able to recognize that while using *USGS Terrestrial Ecosystems Viewer*. The inspector could readily verify the information in the OSP by visual observation and the operator’s recordkeeping system. The idea of using annual photos taken at strategic places to monitor the ecosystem is sound and, in fact, is a strategy commonly employed by conservation organizations and land managers.

Invasive species that compromise ecosystem health pose an increasingly serious problem everywhere. The inspector is correct to note the Japanese stiltgrass at the site and explain the implications to the operator.

Conclusion:
From the standpoint of the native ecosystems rule, this site is eligible for certification with minimal conditions or recommendations, other than managing the stiltgrass.

5) *Data Basin-Ecosystems of the Western Hemisphere*, *NatureServe Explorer*, and other resources are used to evaluate an unconventional monitoring strategy proposed for a high-quality native prairie in Montana that will be grazed by certified cattle.

Level: Moderately complex

Key Takeaways:
i) The dominant and characteristic plant species are not the only way – or necessarily the best way – to monitor the impacts of grazing on the health of grassland ecosystems; ii) *NatureServe Explorer* contains up-to-date information for many prairie ecosystems explaining how different methods of grazing impact ecosystem integrity, both positively and negatively; iii) *NatureServe Explorer* contains information about the rare-threatened-endangered (RTE) and keystone species found in each ecological system, which can help to define better metrics for monitoring when those ecosystems

are used for organic production; iv) managed grazing is increasingly becoming a key tool of conservation organizations for maintaining and restoring temperate grasslands throughout the Great Plains.

Operator Application Information:
A northern Montana rancher submits an application to certify up to 750 head of cattle that will be rotationally grazed on about 5,000 acres of native prairie. The rancher is working with a conservation organization as part of a larger effort to help maintain and restore native grasslands in the region. A description of how the health of the prairie will be monitored names no plants. Instead, the application indicates several species of birds that will be the main focus of monitoring efforts: Chestnut-collared Longspur, Long-billed Curlew, Baird's Sparrow, Sprague's Pipit, and Thick-billed Longspur. It goes on to say that each bird species requires a somewhat different stand height and grass species composition, hence the relative abundances of these bird species will act as an indicator to judge the effectiveness of the rotational grazing schedule in maintaining a biologically diverse habitat.

Certifier Response:
Although experienced with native ecosystems, this is the first time the certifier has heard of a native ecosystem monitoring strategy that does not include plants, and is relatively unfamiliar with the significance of the bird species mentioned. Using the address on the application, the reviewer first looks up the site on Data Basin-Ecosystems of the Western Hemisphere and determines that most of it is classified as Northwestern Great Plains Mixedgrass Prairie (Figure 5-1), an ecosystem that is estimated to have lost up to 70% of its original range since European settlement (Figure 5-2).

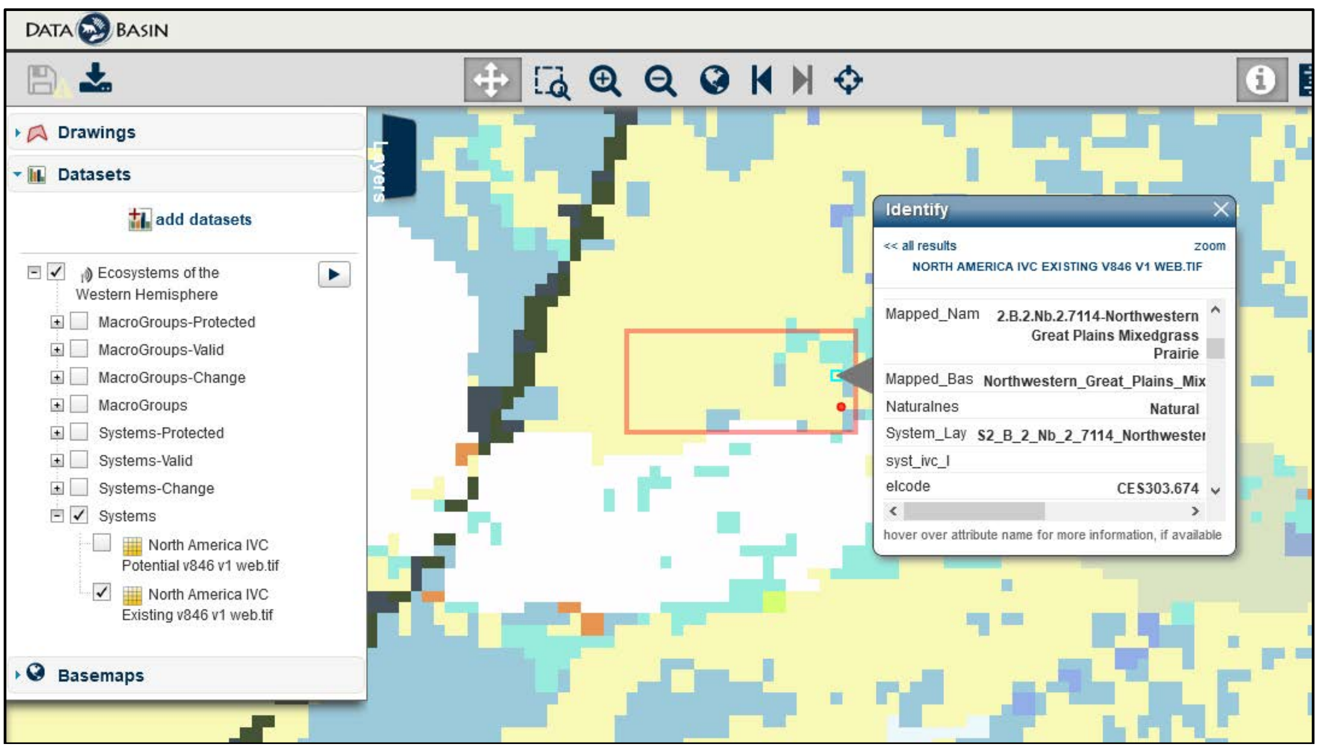


Figure 5-1. Map of Existing Ecological Systems from *Data Basin*. *The red dot is the address used to locate the site and the area proposed for grazing lies within the red rectangle. Most of the site lies within an extensive area of Northwestern Great Plains Mixedgrass Prairie represented by the light yellow color and identified in the pop-up box using the "Identify" tool. The unique ecological system ID # (CES303.674) is given on the lowest line visible in the box.*

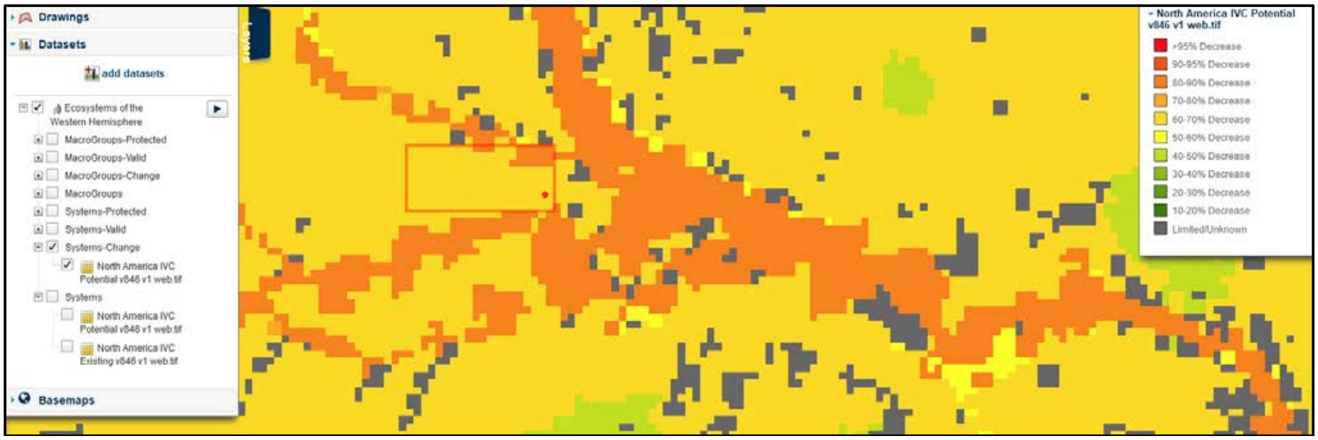
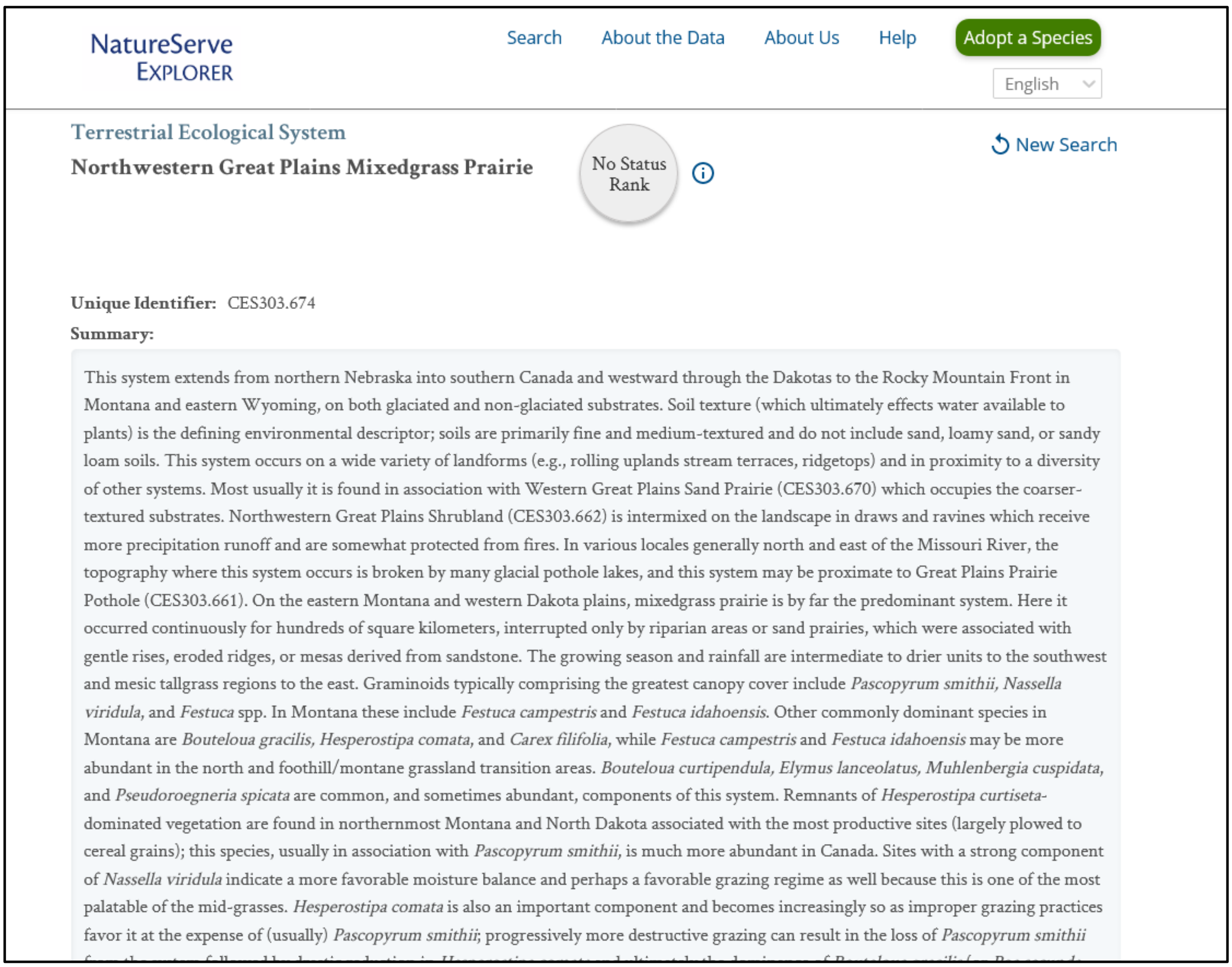


Figure 5-2. Map of Ecosystem Change from *Data Basin*. *The map indicates the estimated percentage of the total area of each ecosystem lost since European settlement, with warmer colors indicating greater ecosystem loss. The Northwestern Great Plains Mixedgrass Prairie ecosystem present at the site has lost an estimated 60-70% of its original range, mainly to cultivated crops and unmanaged grazing.*

Then, using the ecosystem name, the reviewer pulls up a description of this ecosystem from *NatureServe Explorer* (Figure 5-3), being mindful to cross check the unique ecosystem ID number, since there are several prairie ecosystems in the region with somewhat similar sounding names.



NatureServe Explorer

Search About the Data About Us Help Adopt a Species

English

Terrestrial Ecological System

Northwestern Great Plains Mixedgrass Prairie

No Status Rank

New Search

Unique Identifier: CES303.674

Summary:

This system extends from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front in Montana and eastern Wyoming, on both glaciated and non-glaciated substrates. Soil texture (which ultimately effects water available to plants) is the defining environmental descriptor; soils are primarily fine and medium-textured and do not include sand, loamy sand, or sandy loam soils. This system occurs on a wide variety of landforms (e.g., rolling uplands stream terraces, ridgetops) and in proximity to a diversity of other systems. Most usually it is found in association with Western Great Plains Sand Prairie (CES303.670) which occupies the coarser-textured substrates. Northwestern Great Plains Shrubland (CES303.662) is intermixed on the landscape in draws and ravines which receive more precipitation runoff and are somewhat protected from fires. In various locales generally north and east of the Missouri River, the topography where this system occurs is broken by many glacial pothole lakes, and this system may be proximate to Great Plains Prairie Pothole (CES303.661). On the eastern Montana and western Dakota plains, mixedgrass prairie is by far the predominant system. Here it occurred continuously for hundreds of square kilometers, interrupted only by riparian areas or sand prairies, which were associated with gentle rises, eroded ridges, or mesas derived from sandstone. The growing season and rainfall are intermediate to drier units to the southwest and mesic tallgrass regions to the east. Graminoids typically comprising the greatest canopy cover include *Pascopyrum smithii, Nassella viridula*, and *Festuca* spp. In Montana these include *Festuca campestris* and *Festuca idahoensis*. Other commonly dominant species in Montana are *Bouteloua gracilis, Hesperostipa comata*, and *Carex filifolia*, while *Festuca campestris* and *Festuca idahoensis* may be more abundant in the north and foothill/montane grassland transition areas. *Bouteloua curtipendula, Elymus lanceolatus, Muhlenbergia cuspidata*, and *Pseudoroegneria spicata* are common, and sometimes abundant, components of this system. Remnants of *Hesperostipa curtiseta*-dominated vegetation are found in northernmost Montana and North Dakota associated with the most productive sites (largely plowed to cereal grains); this species, usually in association with *Pascopyrum smithii*, is much more abundant in Canada. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the mid-grasses. *Hesperostipa comata* is also an important component and becomes increasingly so as improper grazing practices favor it at the expense of (usually) *Pascopyrum smithii*; progressively more destructive grazing can result in the loss of *Pascopyrum smithii*

Figure 5-3. Description of the Northwestern Great Plains Mixedgrass Prairie ecological system from *NatureServe Explorer*. *This appears to be a well-studied ecosystem and has a particularly robust and informative discussion, evidenced by the comprehensive summary at the beginning.*

Upon reviewing the ecosystem summary and the detailed descriptions of vegetation and environmental conditions that follow (not shown in figure 5-3), the reviewer realizes that this is a dynamic ecosystem containing potentially dozens of native grass species whose relative abundances commonly vary greatly from place to place and over time in response to subtle environmental gradients (e.g., moisture, soil type, etc.) and other dynamic processes such as drought, fire frequency, and grazing by prairie dogs and other wildlife. Her curiosity further piqued, the reviewer scrolls down to the section on ecosystem dynamics (Figure 5-4), which contains a helpful discussion of grazing by both native wildlife and domesticated livestock.

Dynamic Processes

Dynamics: Key Processes and Interactions:

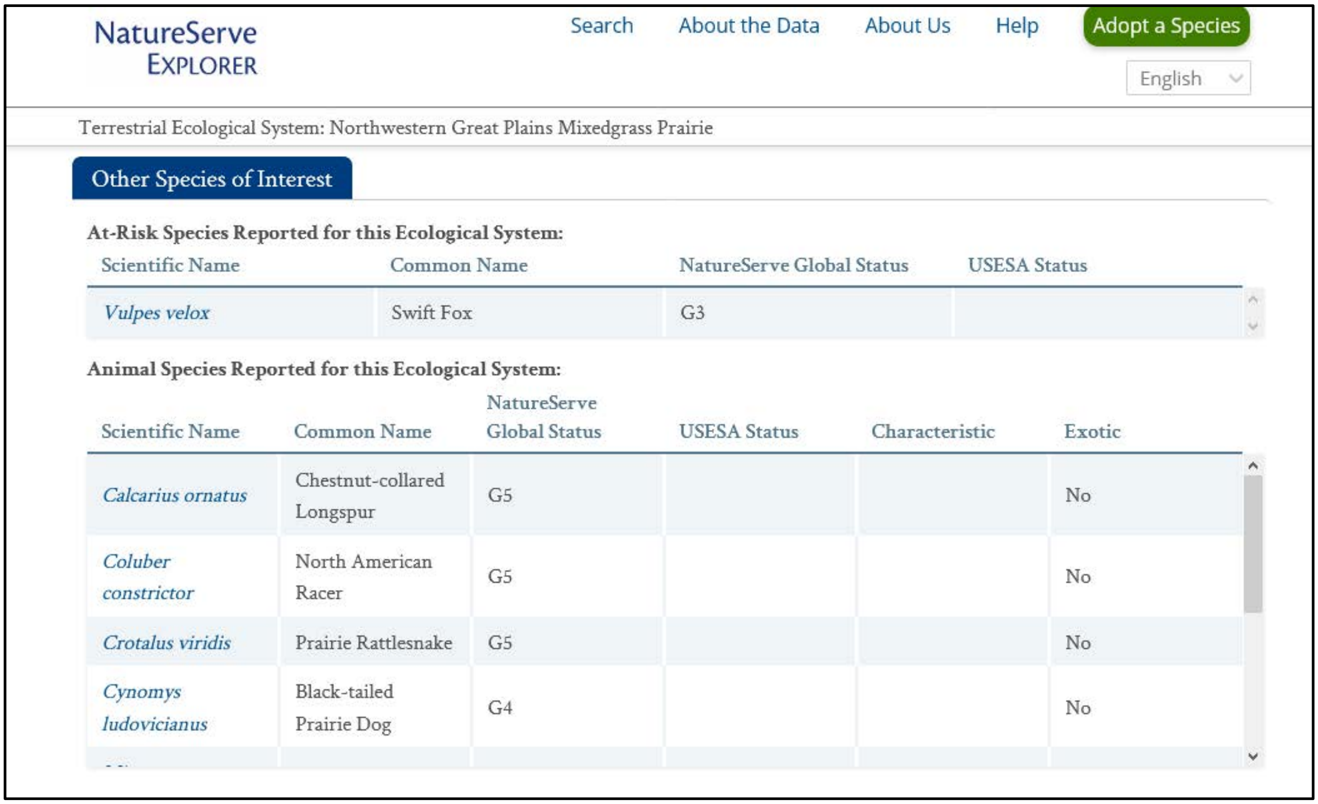
This grassland system evolved with fire, grazing, and drought, which constitute the primary dynamics affecting this system. The diversity in this mixedgrass system likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes (Collins and Barber 1985). Drought, rather than fire, is the primary driver maintaining the dry mixed grassland because it occurs more frequently than fire, inhibits expansion of woody shrubs and reduces the abundance of tallgrasses and mesophytic forbs, and prevents an accumulation of fuel that would maintain a frequent fire regime (Sala et al. 1996). Although variable in area, severe drought years in the Great Plains tend to occur in clusters periodically (1890s, 1930s, mid-1950s, late 1970s, late 1980s to early 1990s, and early 2000s) and have major ecological impacts.

Threats and Other Change Agents:

Historically, this system covered approximately 61.4 million ha (614,000 square km) in Nebraska, North and South Dakota, and Canada; now it covers approximately 29.9 million ha (299,000 square km) in this region, a 51% reduction in extent. Major threats to this system are loss through direct conversion to crop fields and heavily grazed pastures. Farmland development has fragmented the natural landscape and has eliminated the large-scale processes of fire and grazing by native ungulates and small mammals that were necessary to maintain this system. Lack of fire, grazing, or mowing result in a decrease in productivity as sites accumulate more litter. Lack of fire allows tree cover to increase rapidly, especially on lower, more mesic slopes and in the eastern, more mesic edges of the system's range. Encroachment by *Juniperus virginiana* as a result of fire suppression is problematic in some portions of the system's distribution (Rolfsmeier and Steinauer 2010). This system is well-adapted to moderate grazing over time or heavy grazing for short periods but when used as long-term pasture and with high stocking rates many of the dominant native grasses are reduced or eliminated (Branson and Weaver 1953). Heavy haying or grazing done for extended periods results in a selective reduction in more palatable mid- and tallgrass species. This results in a relative increase in short graminoids, such as *Bouteloua dactyloides, Bouteloua gracilis, Carex* spp., and

Figure 5-4. Selected sections from the ecosystem dynamics discussion in *NatureServe Explorer*. *This part of the ecosystem description contains key insights relevant to the grazing application, explaining how different methods and timing of grazing selectively alter the composition of the prairie by, for example, favoring certain grasses over others. The selection above contains some of the key passages.*

Several passages in this discussion jump out at the reviewer, notably "*This grassland system evolved with fire, grazing, and drought…*" and "*This system is well-adapted to moderate grazing over time or heavy grazing for short periods, but when used as long-term pasture and with high stocking rates many of the dominant native grasses are reduced or eliminated*". The reviewer also notes the list of "Other Species of Interest" further down in the ecosystem description (Figure 5-5), which includes Black-tailed Prairie Dog and Chestnut-collared Longspur, one of the birds targeted for monitoring in the application.



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English

Terrestrial Ecological System: Northwestern Great Plains Mixedgrass Prairie

Other Species of Interest

At-Risk Species Reported for this Ecological System:

Scientific Name	Common Name	NatureServe Global Status	USESA Status
Vulpes velox	Swift Fox	G3	

Animal Species Reported for this Ecological System:

Scientific Name	Common Name	NatureServe Global Status	USESA Status	Characteristic	Exotic
Calcarius ornatus	Chestnut-collared Longspur	G5			No
Coluber constrictor	North American Racer	G5			No
Crotalus viridis	Prairie Rattlesnake	G5			No
Cynomys ludovicianus	Black-tailed Prairie Dog	G4			No

Figure 5-5. The Other Species of Interest list in the ecosystem description (the lower part of the list is not visible). *A comparable list is available in every ecosystem description in NatureServe and is a great way to quickly identify any RTE or other key species known from the ecosystem. The scientific names contain links to the corresponding species descriptions in NatureServe Explorer. Clicking on the link in "Calcarius ornatus", for example, brings up the Longspur's species description (Figure 5-6).*

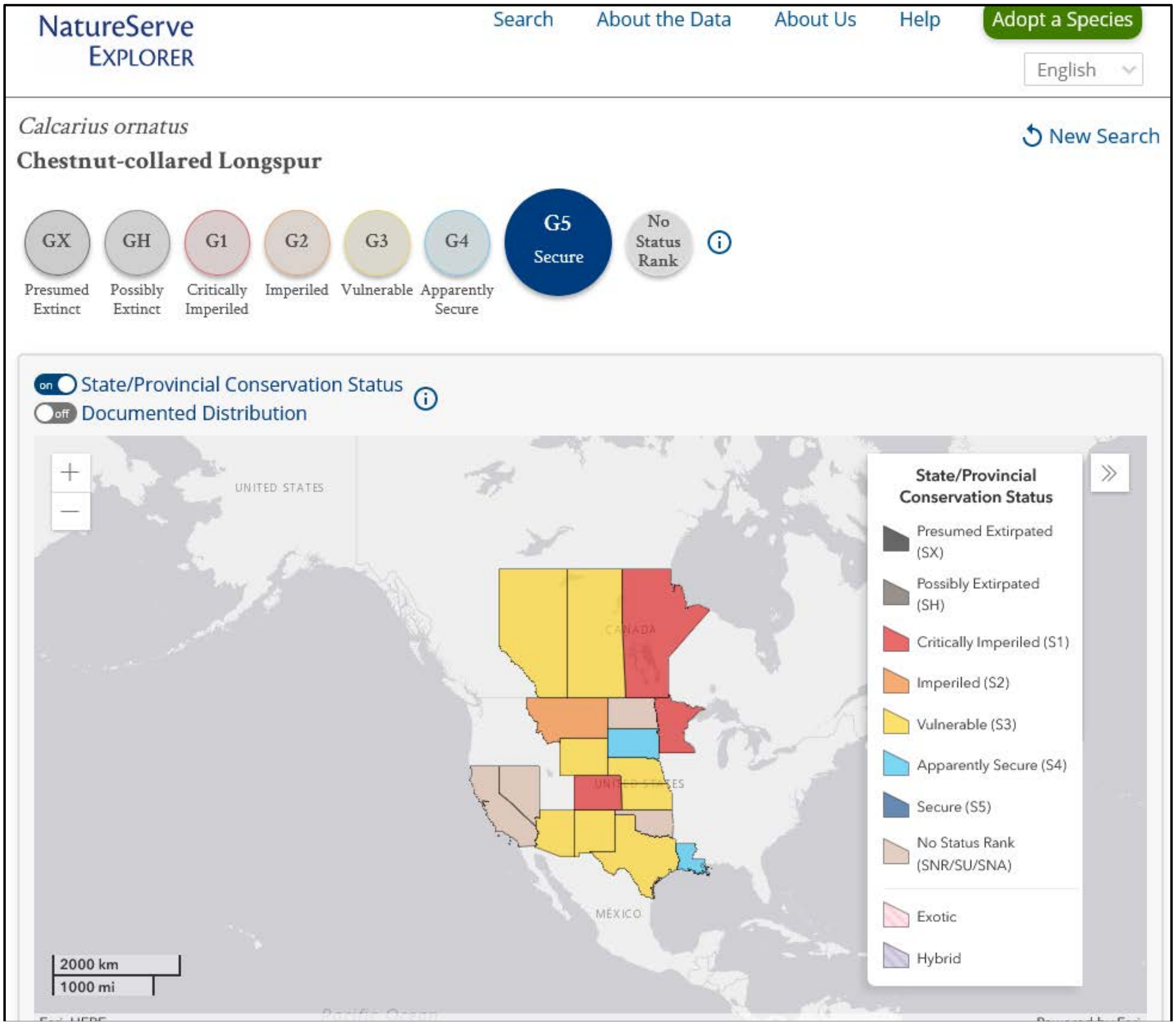

Figure 5-6. *NatureServe Explorer* species description for Chestnut-collared Longspur. *Each species description begins with a map like this one, indicating the range and state-by-state conservation status of the plant or animal. The circles above the map represent the ranking system for conservation status across the entire range of the species. The distinction between the "secure" overall conservation status of the Chestnut-collared Longspur and the much more varied and generally less secure state-by-state rankings illustrates a key point: loss of habitat due to conversion of ecosystems to agriculture and other uses has caused overall species populations to become increasingly fragmented into isolated sub-populations. This is the case for the Chestnut-collared Longspur in Montana, where the species is ranked as "imperiled" because of widespread conversion of its favored prairie habitat into cultivated crops and rangelands dominated by non-native grasses. Therefore, conservation practices that maintain and improve habitat in agricultural landscapes take on greater urgency for at-risk sub-populations. Explorer's species descriptions provide easy-to-read summaries of the habitat requirements and stewardship practices that benefit the species (Figure 5-7), with practical information that is readily transferable to the protection of native ecosystems on organic farms.*

Habitat

Habitat Type: Terrestrial

Terrestrial Habitats: Desert, Cropland/hedgerow, Grassland/herbaceous

Habitat Comments:

BREEDING: Uses level to rolling mixed-grass and shortgrass uplands, and, in drier habitats, moist lowlands (DuBois 1935, Fairfield 1968, Owens and Myers 1973, Stewart 1975, Wiens and Dyer 1975, Kantrud and Kologiski 1982). Prefers open prairie and avoids excessively shrubby areas (Arnold and Higgins 1986). However, scattered shrubs and other low elevated perches such as Canada thistle (CIRSIUM ARVENSE) often are used for singing (Harris 1944, Fairfield 1968, Creighton 1974). Areas with dense litter accumulations are avoided (Renken 1983, Berkey et al. 1993, Anstey et al. 1995).

In order of preference, uses native pastures, followed by other grazed grasslands and hayland (Fairfield 1968, Owens and Myres 1973, Maher 1974, Stewart 1975, Faanes 1983, Anstey et al. 1995, Davis and Duncan 1995). Preferred vegetation height is <20-30 centimeter (Fairfield 1968). Although usually avoided, cultivated fields, fallow fields, stubble, and dense, idle areas may support a small number if

Management Summary

Stewardship Overview:

Protect prairie areas from plowing and cultivation (Owens and Myres 1973, Stewart 1975).

Provide open, grazed native prairie (Owens and Myres 1973, Anstey et al. 1995, Davis and Duncan 1995). Longspurs prefer native pastures to all other habitat types and may tolerate a wider range of grazing intensities in native pastures than in other pastures (Owens and Myres 1973, Anstey et al. 1995, Davis and Duncan 1995).

Avoid managing for idle, dense vegetation, as densities decrease with increased mean vertical density, diversity, and litter depth (Renken 1983, Messmer 1990, Johnson and Igl 1995).

Burning may offer benefits, provided that vegetative regrowth is not too tall or dense (Maher 1973, Berkey et al. 1993).

In mixed-grass areas, mow to improve habitat by decreasing vegetation height and density (Owens and Myres 1973, Stewart 1975). Annual mowing was more beneficial than periodic mowing (once every 3 years) in northern mixed-grass prairie (Dale et al. 1997).

In mixed-grass prairie, graze at moderate to heavy intensity. Graze moister areas to increase diversity and patchiness and reduce tall, thick

Figure 5-7. Habitat and Management Sections of the Species Description in *NatureServe Explorer*. *These sections describe the prairie structure, specific native plants, and grazing practices that benefit the Chestnut-collared Longspur. The selections above contain some of the key passages.*

By quickly scanning the descriptions in *NatureServe Explorer* for the other bird species mentioned in the monitoring plan, the reviewer is able to confirm that all five species historically were found around bison and other native prairie grazers, with each species preferring different grass species and prairie structure, as would be found in a natural system with migratory grazers. Based on this brief cruise through *NatureServe Explorer*, the reviewer determines that the monitoring plan appears sound and the file is approved for inspection.

However, the reviewer, a birder herself, knows that it is often difficult to directly observe individual birds in a grassland (they tend to be well camouflaged), and that they must usually be identified by song, which requires a specialized skill set. Therefore, she asks the inspector to clarify who will be performing the monitoring, and their qualifications.
Once on site, the inspector learns that, while the rancher does have an interest in rangeland birds and is an amateur birder, the operation is part of a larger grass bank being established in the area by the partner conservation organization. That organization's biologist will be performing the bird monitoring at all of the local sites, and that information will be available at future inspections.

Second, while touring the site the inspector observes at least one Prairie Dog town. Aware that these creatures are sometimes disdained in the farming community, the inspector inquires about the rancher's attitude and plans. The rancher laughs and says they are harmless, and has no plans to alter his grazing area or take any other actions. Moreover, the biologist told him that grazing is usually beneficial to prairie dogs, at least as long as it is not too intensive, because it helps to maintain the lower-growing grasses that they prefer – a fact the inspector easily confirms in the species' description at *NatureServe Explorer*.

<u>Discussion</u>:
This scenario is loosely based on a real grazing operation and is illustrative of an increasingly common type of landscape-scale conservation arrangement between ranchers and organizations working to preserve and restore grassland ecosystems through grazing practices that mimic the ancient behaviors of the native grazers that were once an integral part of these ecosystems. Such initiatives have sprouted up and down the Great Plains, from the Canadian prairies south to the High Plains of Texas, and often feature groups of ranchers working collectively within high-value grassland ecosystems. Livestock products from these types of operations are typically marketed under various "grass fed" and similar labels, but organic certification is also becoming more common.

This new approach to grassland conservation is based on two realities: 1) cattle have long been a part of North American grassland landscapes and are likely to remain so for the foreseeable future. However, the unmanaged grazing that has characterized most of this history has largely been disastrous for grassland ecosystems and is proving increasingly unsustainable for the livestock industry as rangeland resources become severely degraded; 2) a growing body of empirical research is demonstrating that by carefully managing the size and grazing habits of cattle herds to more closely mimic the behaviors of bison and other native grazers, it is possible to preserve and restore native grasslands while improving the bottom line for ranchers. Much of this research is summarized in the NatureServe descriptions of grassland ecosystems, which provide not only the scientific context, but also incorporate recommended grazing practices specific to each ecosystem.

These same ecosystem descriptions also list some of the key birds and animals that help define an ecosystem, and summarize the roles of 'keystone' species like prairie dogs and bison, whose behaviors modify the ecosystem in ways beneficial to other species as well as themselves. The individual species descriptions available through *NatureServe Explorer* provide additional information summarizing the functional relationships of each species within the ecosystem and offer insights into monitoring targets and strategies, including unconventional approaches like the one described in this example, which uses characteristic bird species to define ecosystem health, rather than plants.

A major caveat to using wildlife as a monitoring tool, however, is that most animals, and especially birds, can be difficult to directly observe and count. This means their populations must be inferred from indirect and often ephemeral characters, such as vocalization, tracks, and other behaviors that may require a considerable level of expertise to identify and interpret. In short, it is much easier to monitor plants, which are stationary, readily observed, and for which numerous illustrated guides and keys are available for the lay person, than it is to monitor wildlife, which are typically transient and well concealed in their habitats. In this example, bird monitoring is being performed across multiple participating ranches by a biologist from the partner conservation organization, specifically to obtain data to better adjust the grazing program to the benefit of the grasslands. This type of

arrangement is still fairly novel, however, and qualified and experienced wildlife observers will typically not be freely available to the average ranch or farm. In such instances, falling back on monitoring the dominant and characteristic plant species remains the best choice.
Conclusion: The grazing operation at the center of this scenario is the quintessential example of good ecosystem stewardship, being characterized by innovation, empirical observation and continuous improvement. From the standpoint of the native ecosystems rule, it is certifiable as organic with no evident concerns.

Native Ecosystem *Recovered Expected Plant Species and Structure Following Past Disturbance*
***6) USGS Natural Terrestrial Ecosystems Viewer* and an onsite inspection help determine that a native forest ecosystem in New Hampshire has recovered.**

Level: Moderately simple

Key Takeaways:
(i) While effective at distinguishing natural vegetation from cultural landscapes, *USGS Natural Terrestrial Ecosystems Viewer* may not always reliably differentiate between well-established ecosystems containing the dominant and characteristic species vs. immature ruderal vegetation that lacks those species, (ii) ecosystem descriptions from adjacent (or nearby) tracts can help determine what ecosystem is actually present on the site; (iii) spontaneous natural processes typically cause disturbed land next to an intact ecosystem to recover more quickly than places lacking nearby intact natural ecosystems; (iv) selective logging or other uses that remove forest products without altering fundamental ecosystem processes are not the same as conversion of an ecosystem: the basic structure and composition remain unchanged.

Operator Application Request:
The operator submits an application with a hand drawn map (not shown) requesting certification of an acre of forest that will be converted into pasture in order to expand an existing pasture. The application states that the woodland was logged 50 years ago.

Certifier Actions:
The certifier finds the location of the parcel in the *USGS Natural Terrestrial Ecosystems Viewer* (Figure 6-1) and sees that the land itself is depicted as Ruderal Forest (meaning a chaotic mix of species that colonize disturbed land; another name is 'pioneer' forest), but knows from reading this toolkit that the viewer does not always reliably distinguish between older, well-established native ecosystems vs. pioneer or early successional vegetation that may lack the dominant and characteristic species and, therefore, is only a rough indicator of what may be found. On one side of the parcel is the existing pasture and the other is identified as Acadian Low-Elevation Spruce-Fir-Hardwood Forest (Figure 6-2).

The certifier assigns the file to an inspector, with instructions to verify the desk-derived ecosystem interpretation. The inspector finds that the Ruderal Forest description of the tract proposed for certification is incorrect. The Acadian Forest ecosystem's dominant red spruce and balsam fir and its characteristic black spruce, white cedar and yellow birch are present, some of them quite large and likely to be 100 or more years old. Small patches of early successional species such as paper birch, aspen and larch are scattered among the dominant and characteristic species. Further, the inspector finds no discernable difference between the tract proposed for certification and the adjacent tract the *USGS Terrestrial Ecosystems Viewer* identifies as Acadian Forest: both have the same forest structure, contain approximately the same numbers and age distributions of dominant, characteristic, and early successional species, and both show evidence of having been selectively timbered several decades ago.

Figure 6-1. Site Map and Ecosystem Hierarchy from USGS Terrestrial Ecosystems Viewer 2011 (also called GAP/ LANDFIRE…) *The pixel under the blue locator symbol, which is inside the parcel under review (red square), is identified using the "Hierarchy by Pixel" analysis as Ecological System 8504 Ruderal Forest (red arrow). The group of white pixels immediately to the left of the parcel represent the existing pasture. This tool gives an estimate of the kind of ecosystem and its age that may be found at a specific point; confirmation by onsite inspection is always desirable.*

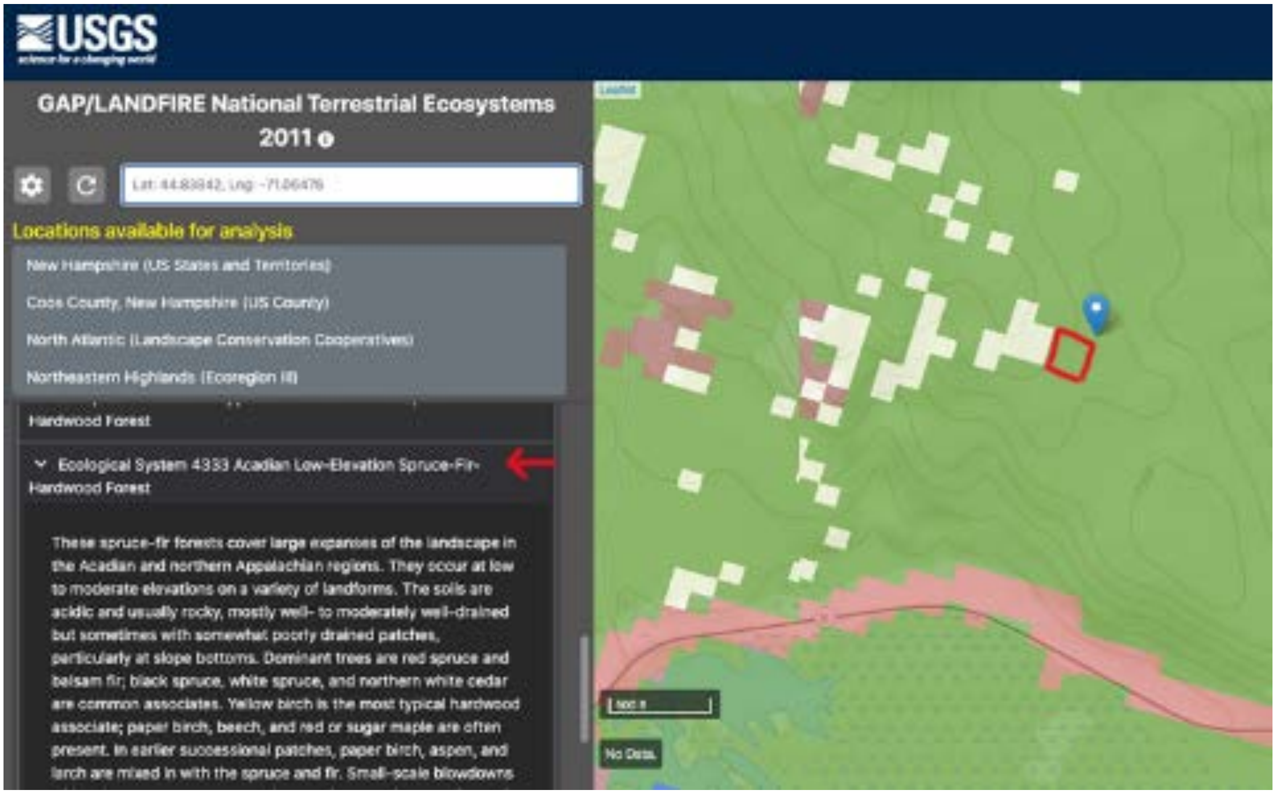

Figure 6-2. Ecosystem Hierarchy from USGS Terrestrial Ecosystems Viewer 2011 (also called GAP/ LANDFIRE…). *The blue locator symbol is now positioned on forest adjacent to the land under review (red square), which is described as Ecological System 4333 Acadian Low-Elevation Spruce-Fir-Hardwood Forest ecosystem red arrow).*

<u>Discussion:</u>
The dominant and characteristic species of the ecosystem are present in substantial numbers, including many mature specimens. The timber harvest that occurred 50 years ago was selective and left key ecosystem species intact; since the basic elements of the forest ecosystem have always been there, this event represents a disturbance of the ecosystem but not wholesale conversion to another use or land cover. The remaining dominant and characteristic species on the tract, along with adjacent forest of the same type provide an abundant source of seed and other plant material that has been dispersed with the help of wind, water, and animals; speeding the recovery of the native ecosystem from the logging disturbance.

This example also illustrates the caveat that, while they consistently do a good job differentiating native ecosystems as a whole from cultural land covers, the ecosystem mapping applications described in this toolkit are not always reliable at distinguishing well-established native ecosystems from ruderal forests and other immature, pioneer vegetation. However, they do give a good idea of the main ecosystems (and their dominant and characteristic species) that are typically present in the general area of a site, and this information can help inform “on-the-ground” observations during inspections and other kinds of site visits.

<u>Conclusion:</u>
The certifier informs the applicant that the parcel cannot be certified for 10 years following conversion of the native ecosystem.

7) *Earth Explorer, USFWS Wetland Mapper*, and *USGS Natural Terrestrial Ecosystems Viewer* are used to show that fields abandoned decades ago contain several kinds of native ecosystems in Indiana including ones that have recovered from past disturbance, others that have not, and one that appears to be little altered since European settlement.

<u>Level: Complex</u>

<u>Key Takeaways:</u>
(i) Discrepancies and unusual patterns can be detected by a sharp-eyed reviewer with minimal experience in aerial photo interpretation , (ii) the online tools described herein, used separately or together, can reveal potential conflicts with the native ecosystem rule and identify specific places requiring field verification by an inspector , and (iii) the ultimate resolution of complex situations may require field assessments by inspectors familiar with local native ecosystems.

<u>Operator Application Request</u>:
A new Midwest applicant for row crop certification submits a farm map on an undated aerial photo (Figure 7-1), showing several fields labeled A-G. The application indicates that none of the land proposed for certification contained a native ecosystem within the past 10 years.

Figure 7-1. Undated Farm Map/Aerial Photo Submitted with Application. *Fields C-G are clearly cultivated farmland, separated by or containing several hedgerows and naturalized areas. In contrast, fields A and B appear heavily vegetated throughout, though most of it looks young and scrubby, with the exception of the southeast quadrant of field B (green outline), which displays a somewhat different tone and texture, suggesting it is different from the rest. Standing water is visible in three other areas (blue outlines). This photo was taken in early spring before the trees leafed out.*

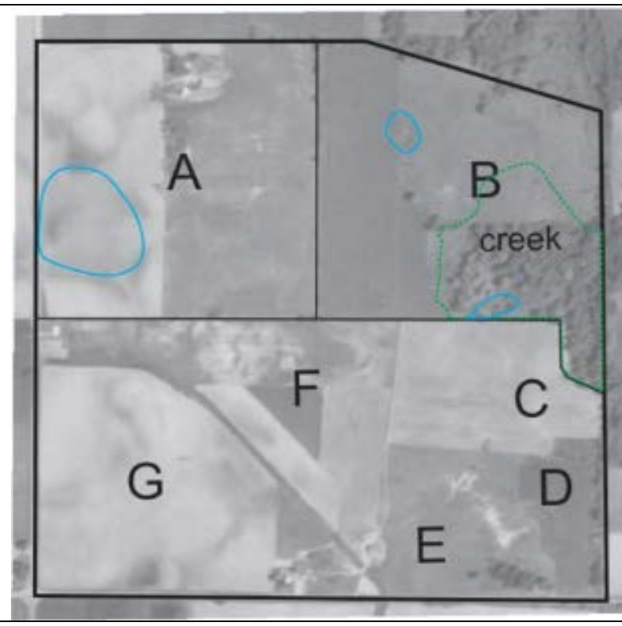

Figure 7-2. 1965 Aerial Photo of the Farm from *Earth Explorer's* Aerial Photo Single Frames Collection*. Field information from Figure 7-1 superposed for reference. Most of the land proposed for certification was cultivated in 1965, except for part of the forested area in the SE part of field B, which consists of mature forest with large trees. There is no evidence of standing water at any of the three areas where it is visible on the submitted farm map, though all three exhibit dark, mottled tones that differ from the appearance of adjacent soils and are suggestive of moist or wet conditions.*

The certification reviewer notices some features of potential concern in Figure 7-1. These include: three somewhat circular areas of standing water that may be depressional wetlands; and a forested area in the southeast part of field B with a distinctly different tone and texture from the rest. This area is centered on what is simply labeled on the farm map as a ‘creek’ with no further description provided.

The reviewer has at least a couple of choices. She can either ask the applicant to provide (or the inspector to obtain) more documentation of the land-use history and its current vegetation, or she can investigate further by using online tools and resources to better understand the landscape and interpret ecosystems and land use history, and perhaps better narrow down the locations that need field verification during the initial inspection. For purposes of this example, we’ll assume she chooses the latter option.

A good place to start is to view or download older historical aerial photos of the site from the Aerial Photo Single Frames collection in *USGS Earth Explorer*. A search of this collection turns up several sets of aerial photos taken between 1938 and 1979. The reviewer chooses one taken in 1965 (Figure 7-2), which has good resolution and shows the field boundaries clearly.

Another search, this time of the NAIP Collection in *USGS Earth Explorer*, identifies an aerial photo from 10 years ago (2010; Figure 7-3), in which fields A and B appear similar to today, having apparently been abandoned sometime since 1965. Fields C-G also are cultivated in the 2010 aerial photo, so no issues with native ecosystems appear to exist there.

Next, the reviewer decides to check the *USFWS Wetland Mapper* to see if the three circular wet areas appear in the *National Wetlands Inventory*. The results (Figure 7-4) identify all three areas as mapped wetlands. The two smaller areas are described as seasonally flooded forested-shrub wetlands, while the large wet area in the SW corner of field A is classified as a seasonally saturated emergent wetland dominated by herbaceous vegetation and being partially ditched or drained.

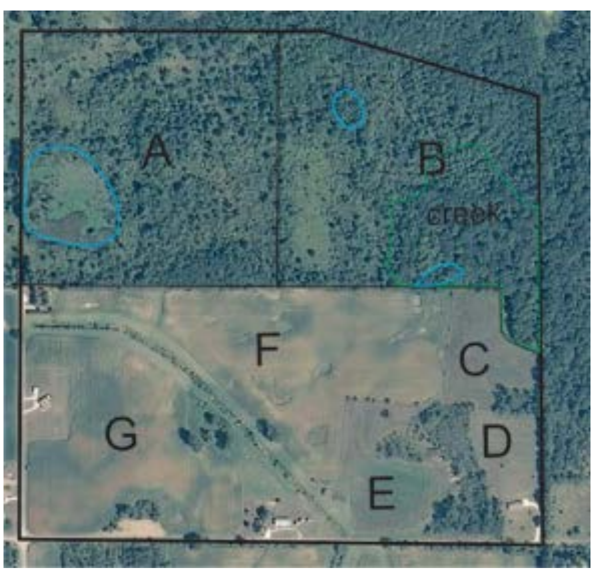

Figure 7-3. 2010 NAIP Aerial Photo of Farm (from USGS *Earth Explorer*). *Field information from Figure 7-1 superposed for reference. This photograph was*

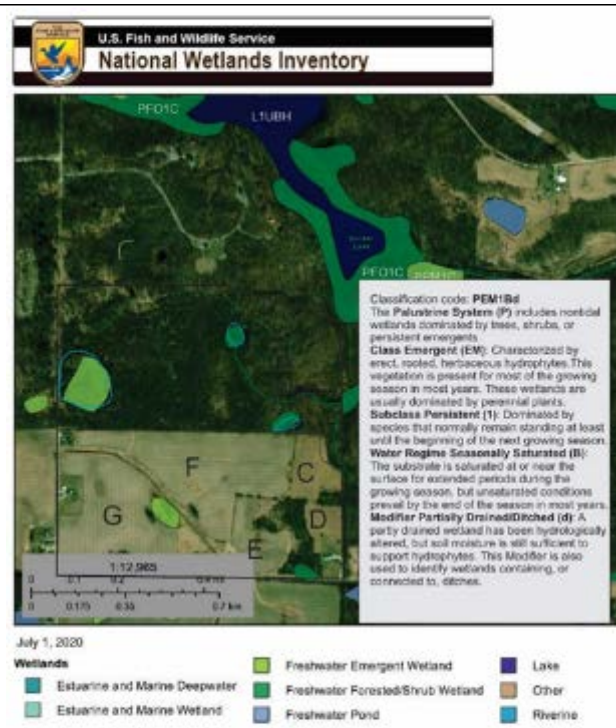

Figure 7-4. Wetlands Map of Farm (from USFWS Wetland Mapper). *Field information superposed from Figure 7-1. The three wet areas identified earlier (blue*

taken in June, at the height of the growing season. Significantly, standing water and potential wetland vegetation are visible in the southwest quadrant of field A; the other two potential wetlands are completely hidden beneath the forest canopy, making a determination of standing water impossible from this image.	*lines) coincide with mapped wetlands. An explanation of the wetland in the SW part of field A appears in the box as an example of the classification system.*

The last step is to determine the identities of these potential native ecosystems using the *USGS Natural Terrestrial Ecosystem Viewer* (Figure 7-5).

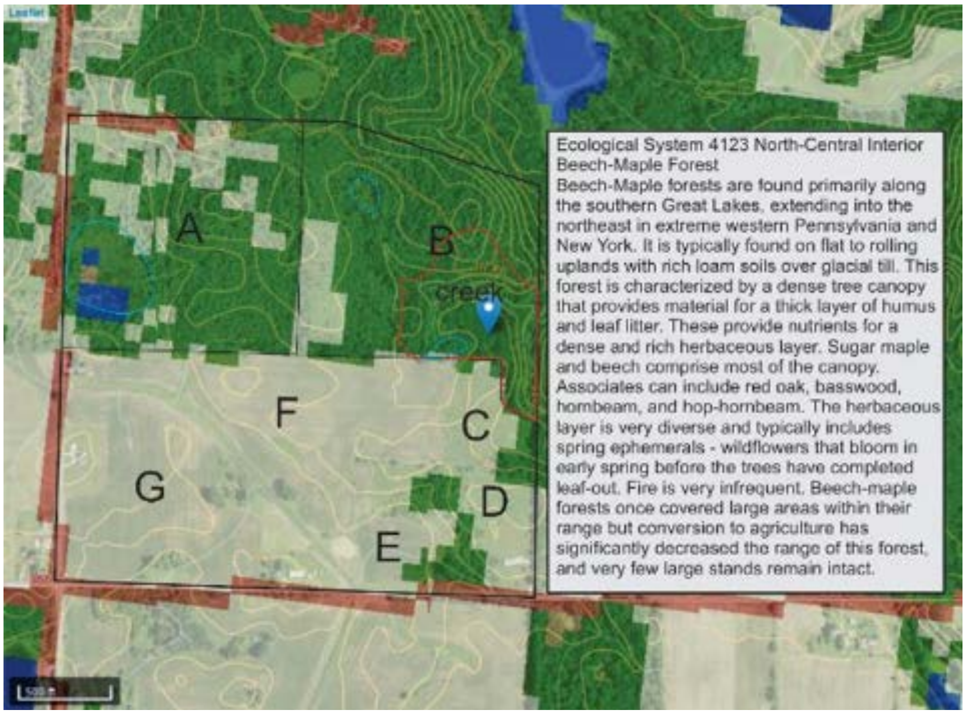

Figure 7-5. Ecosystem Map of Farm (from USGS Natural Terrestrial Ecosystems Viewer). *Field information superposed from Figure 7-1. The large wetland in the southwest of field A is identified as a mix of open water (blue polygons) and Ecological System 9222: Central Interior Shrub-Herbaceous Wetland (light brown polygon). Neither of the two wetlands in field B appear on this map; presumably they are too small to constitute separate polygons. The well forested area in the SE quadrant of field B (outlined in red) is identified as Ecological System 4123: North-Central Interior Beech-Maple Forest. An ecological description of this native ecosystem appears in the box and corresponds to the blue marker below the word 'creek'.*

<u>Conclusion:</u>

The results of this exercise raise questions about the accuracy of the application and suggest that native ecosystems are probably or potentially present in the places noted by the reviewer, and possibly elsewhere. Therefore, when setting up the initial inspection, the reviewer instructs the inspector to observe the vegetation in fields A and B, paying particular attention to the specific areas noted during the review, and to obtain photographs.

The inspection report is subsequently returned with photographs (Figures 7-6 to 7-9) and observations that largely confirm the reviewer's concerns. None of the three wetlands, or the beech-maple forest, can be certified for row crop production (though they could be for production practices that do not involve ecosystem conversion, such as wild crop harvest or maple syrup), since that would result in the conversion of good-quality native ecosystems. However, that still leaves most of fields A and B as viable candidates for row crop certification, since it can be seen from the photos that these areas contain only indistinct ruderal (pioneer) vegetation and not native ecosystems as defined under the rule.

Figure 7-6. Weedy Vegetation Photo Representative of Parts of Field A and Field B (at left). *Most of field A and the northwestern ~2/3 of field B are typical weedy old-field vegetation consisting of shrubs (both native and nonnative) and young pioneer trees; this area lacks the dominant and characteristic species and thus does not contain a native ecosystem.*

Figure 7-7. Native Forest Ecosystem Photos Taken in Field B. *The distinctive forested area in the southeast part of field B contains a mature beech-maple forest surrounding a pair of deep ravines (left photo), with the area north of the word 'creek' on the farm map being a younger version of the same (right photo). Both sites contain many of the dominant and characteristic species of this ecosystem, such as beech, sugar maple, northern red oak, basswood, spicebush, and a variety of flowering herbaceous species on the forest floor including ginseng, mayapple, and trillium.*

Figure 7-8. Wetland Photo Taken in Field A (at left). *The southwest corner of field A is a large area of open water and wetland that contains many of the dominant and characteristic species of a shrub-herbaceous wetland system, including cattails, bulrushes, dogwoods, buttonbush, and several others. The inspection report also notes an estimated water depth of 1-2 feet in parts of the wetland, an observation that suggests the wetland basin plays a key role in maintaining local hydrology.*

Figure 7-9. Swamp Forest Photo Taken in Field B (at left). *The inspection report indicates the two smaller wetlands in field B are both forested swamps and also contain appreciable water and the characteristic black ash and silver maple.*

<u>Native Ecosystem *Was Present and then Was Converted* in the Previous Ten Years</u>
8) *Google Earth Pro* and *Data Basin* are used to confirm observations made during a routine inspection that a scrubland ecosystem in Mexico was recently converted to cropland.

<u>Level</u>: Moderately complex

<u>Key Takeaways:</u>
(i) Field observations by an inspector with a basic working knowledge of local ecosystems suggest a native ecosystem was recently converted and lead to an investigation; (ii)) ecosystem maps and descriptions available for most of North and Central America can be used to identify the ecosystem present at a specific site and to obtain a description of the dominant and characteristic species – even after the ecosystem was converted; (iii) a time series of aerial or satellite images represents the gold standard for proving (or disproving) claims, concerns, and suspicions about the recent vegetative history at a site.

<u>Operator Application Request:</u>
A new applicant for certification of cultivated crops submits a hand-drawn site map of a 230-acre parcel in Baja California Sur and checks 'no' to the question about whether a native ecosystem has been present in the preceding 10 years. The application is assigned for inspection.

<u>Certifier Actions:</u>
During the initial inspection, a large amount of brush piled next to the crop land is observed, along with piles of ash and charred wood. The inspector, who hails from the Southwest and has some familiarity with the Sonoran Desert, recognizes some of the woody debris as mesquite, ocotillo, and at least two kinds of cactus – in other words, components of a mature desert scrubland ecosystem. In addition, parts of the tract appear to have never been farmed, while the beds in the currently cultivated part appear only recently established. Collectively, these observations are strongly suggestive of recent conversion of a native scrubland ecosystem.

Using her computer to access *Google Earth Pro*, the inspector obtains historical (2009) and current (2020) satellite imagery of the site (figs. 8-1 and 8-2). The imagery appears to confirm the inspector's suspicions, though the older image is more than 10 years old. The applicant's representative claims that all of the clearing took place 10 years ago and that the reason so much brush is still visible on site is the slow pace at which woody material decomposes in the desert. The inspector is skeptical.

Figure 8-1. 2009 Satellite Image from *Google Earth Pro*. *About 70% (the north half and southeast quadrant) of the 230-acre tract contains a relatively intact scrub ecosystem that looks similar to large areas of scrubland nearby (not shown in this photo). The land cover in the square area in the southwest part is less clear, but the geometric pattern is suggestive of cultural vegetation.*

Figure 8-2. 2020 Satellite Image from *Google Earth Pro*. *All but the northeastern tract has been converted to agricultural production.*

The inspector includes the *Google Earth Pro* images in her report, along with her field observations, which trigger an investigation on the part of the certifier. To deal with the 11-year gap between the two *Google Earth Pro* images, the certifier requests that the operator obtain a 10-year old photo (aerial or ground level) of the site or affidavits from at least one disinterested party to determine if what was seen by the inspector is being interpreted correctly.

Meanwhile, the certifier independently pursues information about local ecosystems. The first stop in this part of the investigation is the *National Institute of Statistics, Geography and Informatics* (INEGI) website ((http://en.www.inegi.org.mx/temas/usosuelo/#Map), where a 1:1,000,000 ecosystems map of Baja California Sur is obtained (Figure 8-3). Though published at a coarse scale, the map indicates the site lies within a large region known as *Matorral Sarco–Crasicaule de Neblina* (literally, *fog desert scrubland with thick, fleshy stems*, or *fog desert scrubland* for short). Among the prominent species of this ecosystem noted in the map explanation are the ones that the inspector recognized in the brush piles. The certifier also visits the official biodiversity website of the Mexican government, where the description of scrubland and map showing its range provide further confirmation of the findings so far.

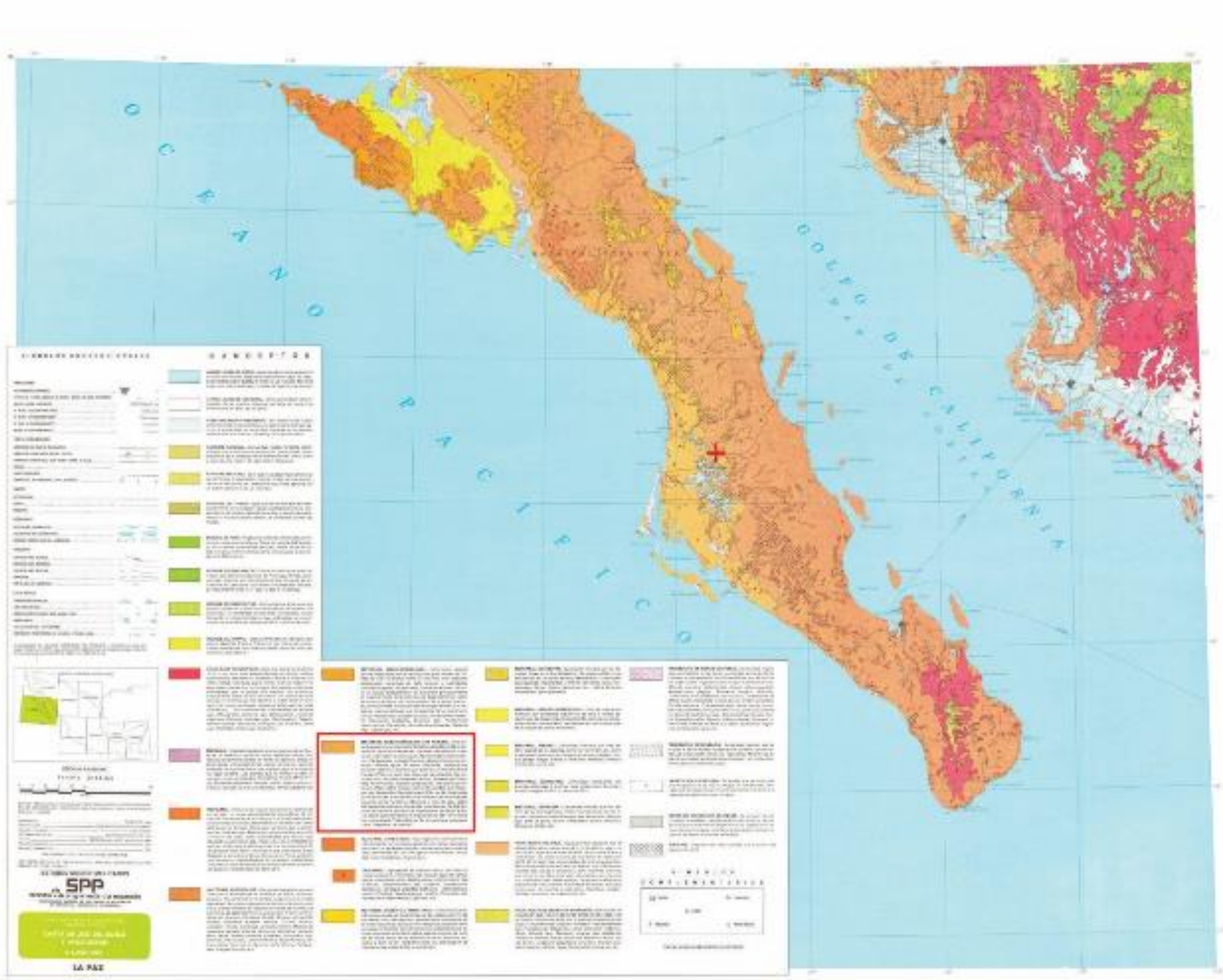

Figure 8-3. Ecosystem Map of Baja California Sur. *This map is part of the official map of Mexican vegetation, consisting of several charts available through* INEGI*. The site (red cross) lies on the east side of a large region of fog desert scrubland ecosystem (explanation outlined in red box) identified on the map by the light orange polygon that extends to the* Pacific Coast *of* Baja*.*

After further consulting this toolkit, the certifier also uses the 'potential ecosystems' feature of *Data Basin*, which utilizes a combination of existing and historical ecosystems range data, along with physiographic features, to look back in time (before human disturbance) and generate a 'potential ecosystems' map of the region around the site (Figure 8-4).

Entering the specific name of the ecosystem mapped at the site in the search engine at *Nature Serve Explorer* yields a comprehensive description from the *IVC* (Figure 8-5). This brief exercise further confirms the information unearthed thus far from the other sources. The description identifies the dominant and characteristic species of this ecosystem, including all of the shrubs and cacti the inspector observed in the brush piles. Thus, when viewed through the lens of all three descriptions, the investigation's findings strongly suggest that a mature native scrub ecosystem was recently converted at the site.

Finally, the certifier is able to obtain additional satellite images of the site (not pictured) from NASA for 2015-2019. The images clearly show that, other than the southwest quadrant, most of the ecosystem conversion took place in the 1-2 years immediately preceding the application for certification.

Figure 8-4. "Potential" Ecosystems Map of the Site (from *Data Basin*). *The ecosystem name and ID number (from the* IVC*) appear in the pop-up window when a corresponding polygon within the red circled site is clicked. The vast majority of the ecosystem present is the* Magdalena Barrancas Desert Scrub*, represented in the olive tone. A few other somewhat different ecosystems are represented by different colors. The resolution of this map is 30m.*

Figure 8-5. Description of Magdalena Barrancas Desert Scrub from the International Vegetation Classification (IVC).

Matorral Desértico de Magdalena Barrancas

Magdalena Barrancas Desert Scrub
No Status Rank
Terrestrial Ecological System: Matorral Desértico de Magdalena Barrancas
Unique Identifier:
CES302.739
Summary:
This southern Baja California desert scrub is found the northern part of the Magdalena region from the Pacific Ocean to the crest of the uplands that divide the peninsula. Climate is arid with mean annual precipitation less than 200 mm. Precipitation occurs mostly in the summer-early fall season (monsoon). It occurs in narrow valleys and rocky slopes below generally sparsely vegetated volcanic mesas. Soil is present and moisture is available locally in seeps from these mesas. Larger valleys or barrancas are typically drier and have more open vegetation than smaller ones. The lack of *Fouquieria columnaris, Pachycormus discolor*, and low frequency of *Agave* and *Yucca* species separate this vegetation from the Vizcaino region. Common species may include *Bursera fagaroides var. elongata, Fouquieria peninsularis, Jatropha cuneata, Pachycereus pringlei, Parkinsonia microphylla, Prosopis palmeri, Stenocereus thurberi, Opuntia cholla, Acacia brandegeana*, and *Ficus palmeri* and *Lysiloma candida* on rocky slopes.

The IVC makes up the underlying dataset for Data Basin. The IVC *description is obtained by entering the name or other ID of the ecosystem (obtained from the pop-up window shown in the previous figure) in the search engine at NatureServe Explorer. Plant species are given as scientific names, which, if necessary, can easily be translated to common names using any common search engine.*

Discussion:
Although concocted out of whole cloth, this scenario is an accurate portrayal of several 'real-world' certification experiences and illustrates several cornerstone principles highlighted in this toolkit. First, although inspectors need not be ecological experts, they should be reasonably knowledgeable about and able to recognize native ecosystems in the region(s) in which they inspect. While we hope that certifiers will require applicants to provide *a priori* documentation (via aerial photos, other imagery, or affidavits) demonstrating whether or not native ecosystems were converted in the ten years prior to certification, we recognize that this will not always be the case, and it will fall to inspectors to recognize problematic situations.

Second, inspectors should trust their instincts. They are trained observers, both of the farm environment and of human behavior, and when something seems 'out of place', it needs to be investigated further and reported to the certifier. Specifically, being vigilant for evidence of recent ecosystem conversion, whether the piles of brush, burn piles, and 'virgin' soil conditions in this example, or different kinds of evidence (e.g., recently filled or drained wetlands, stumps or slash, etc.) in other ecosystems, is the backbone of the native ecosystems rule and will help level the playing field for the large majority of organic operators who are treating their natural resources and native ecosystems with integrity.

Third, there are multiple ways to obtain both ecosystem information and aerial or satellite imagery for most places in the Americas, and that imagery is often the 'gold standard' when it comes to proving or disproving a claim or suspicion about native ecosystem conversion, whether the claim arises from an applicant, inspector, or certifier. In the present example, when a comparison is made between the 2009 and 2020 *Google Earth Pro* images, it immediately becomes clear that a scrubland ecosystem was removed from much of the subject property at some point during this 11-year period. Obtaining additional imagery from other sources taken at other times during this period proves that most of the site is not compliant with the native ecosystems rule.

Conclusion:
The certifier indicates that they can grant certification to the 60 acres in the SW part of the tract where the native ecosystem was converted more than ten years ago, but the rest will not be eligible for certification until 2029. The certifier never did receive the aerial or ground-level photo or affidavit(s) requested from the operator, who withdraws the application.

9) *Google Earth Pro, Data Basin,* and a subsequent onsite inspection are used to determine how much of the Coastal Live Oak Woodland ecosystem in California was removed in the last 10 years.

Level: Moderately complex

Key Takeaways:
(i) *Google Earth Pro's* clock-like icon in its top tool bar can be used to obtain historical imagery, and (ii) if a 10-year old *Google Earth Pro* aerial photo is available, an inspector can use it during the inspection to compare with what they see as they observe the land.

Operator Application Request:
In 2020, a winery in the central California Coast Range applies for certification and submits a hand-drawn site map (not shown) and checks ‘no’ to the question about whether a native ecosystem has been present in the preceding 10 years.

Certifier Actions:
Before assigning the application for inspection, the certifier decides to do a quick check using *Google Earth Pro* and its clock-like icon in the top tool bar that shows historical imagery. Aerial images from 2010 and 2018 are available (see Figures 9-1 and 9-2), but not from 2020. Nevertheless, by comparing the 2010 and 2018 images, the certifier sees that several sizable areas inside the property line appear to have been stripped of vegetation during this period, while in other areas the vegetation was cleared more than 10 years ago. Seen from the aerials, the vegetation that was removed was dominated by large, mature trees and appeared similar to oak woodlands, an important group of native ecosystems in the region.

Figure 9-1. 2010 Photo (from *Google Earth Pro*). *The site proposed for certification (black box) shows several sizable areas containing forest or woodland (outlined in red) that are missing in the next image.*

Figure 9-2. 2018 Photo (from *Google Earth Pro*). *This later image shows the loss of vegetation in the same areas outlined in red.*

To gain a better understanding of local ecosystems, the certifier uses the vegetation maps available at *Data Basin* to identify the specific native ecosystems present (or likely to have been present) at the site. This application has several features that can be useful in situations where the native ecosystems have been fragmented by disturbance. By comparing maps of existing ecosystems (Figure 9-3), ecosystem macrogroups (Figure 9-4), and potential ecosystems (Figure. 9-5), the certifier determines that most of the vegetation removed between 2010 and 2018 likely comprised one or more native oak woodland ecosystems and one coniferous (evergreen) woodland ecosystem. Further, the map called ‘ecosystem change’ (Figure 9-6) indicates that all of these ecosystems have experienced precipitous declines in range as they are converted to other uses.

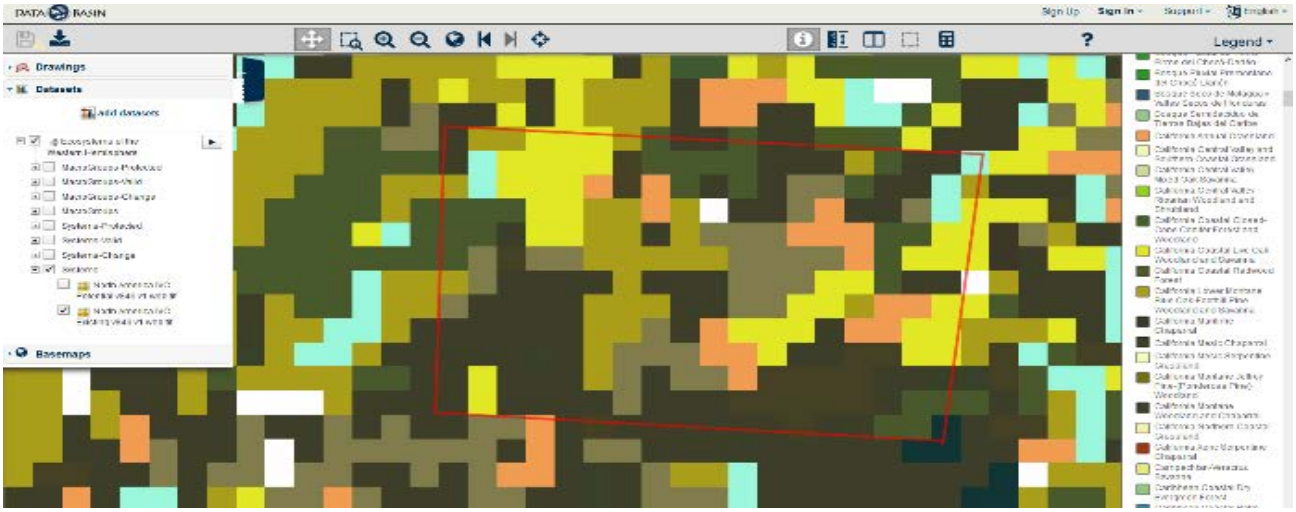

Figure 9-3. Map of Existing Ecosystems (from *Data Basin*). *The map of the site (outlined in red) contains a mosaic of 8 different ecosystems. Such a complex pattern can occur naturally in the geologically and ecologically diverse settings of the central* California Coast Ranges*, but it can also reflect historical ecosystem fragmentation from site disturbance, as has clearly occurred here in the recent past. Still, the complexity creates challenges for purposes of establishing which native ecosystems may have been removed and for narrowing down the possibilities for the inspector to assess. One clue comes from parts of the site (e.g., the NW corner) that still contain remnant forested ecosystems on the 2018 image. These areas coincide closely with the yellow, gold, and dark green polygons on the map, which are identified as three different kinds of California woodlands. Most of the other map units are grasslands which, as noted elsewhere, can be difficult to distinguish in imagery from agriculture- or disturbance-derived grasslands.*

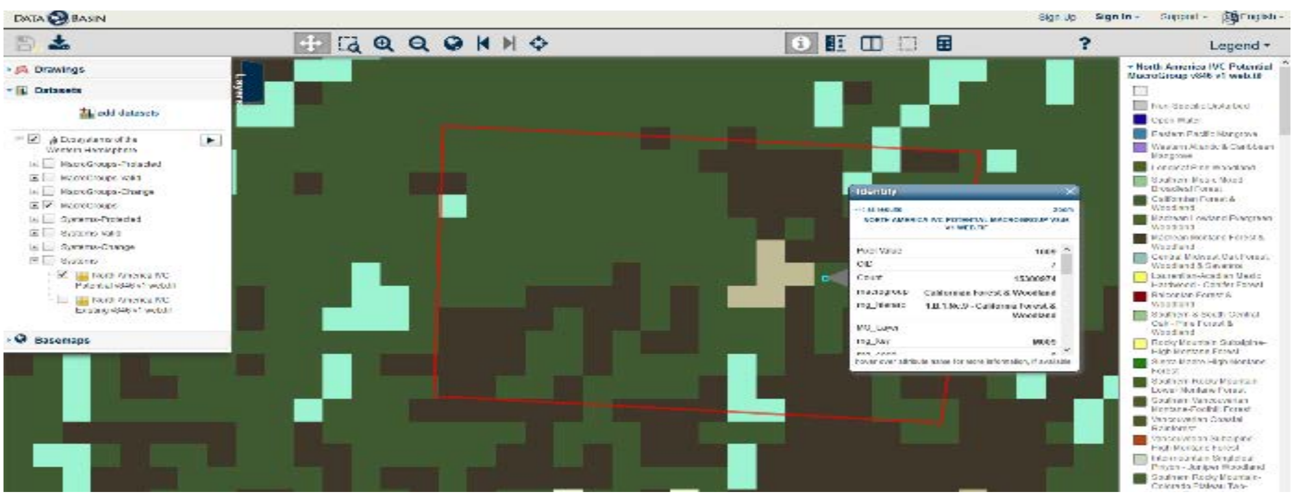

Figure 9-4. Map of Ecosystem Macrogroups (from *Data Basin*). *This tool presents a much less complicated picture: The majority of the site (outlined in red), and most of the areas where vegetation was recently removed, are shown as Californian Forest & Woodland (dark green polygons). Most of the rest is Californian Chaparral (black polygons).*

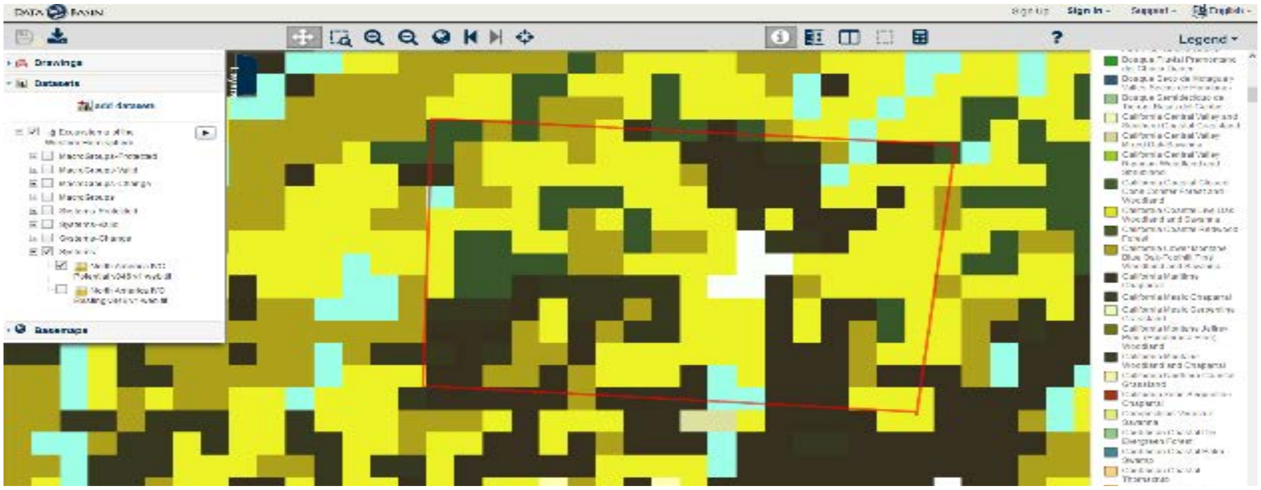

Figure 9-5. Map of Potential Ecosystems (from *Data Basin*). *This map is also easier to interpret, with most of the site (red outline) described as Coastal Live Oak Woodland and Savanna (yellow), along with smaller proportions of Blue Oak-Foothill Pine Woodland and Savanna (gold), Mixed Evergreen Woodland (green), and two different chaparral ecosystems (black and very dark green). As in Figure 9-4, most of the areas where vegetation was removed are woodland ecosystems.*

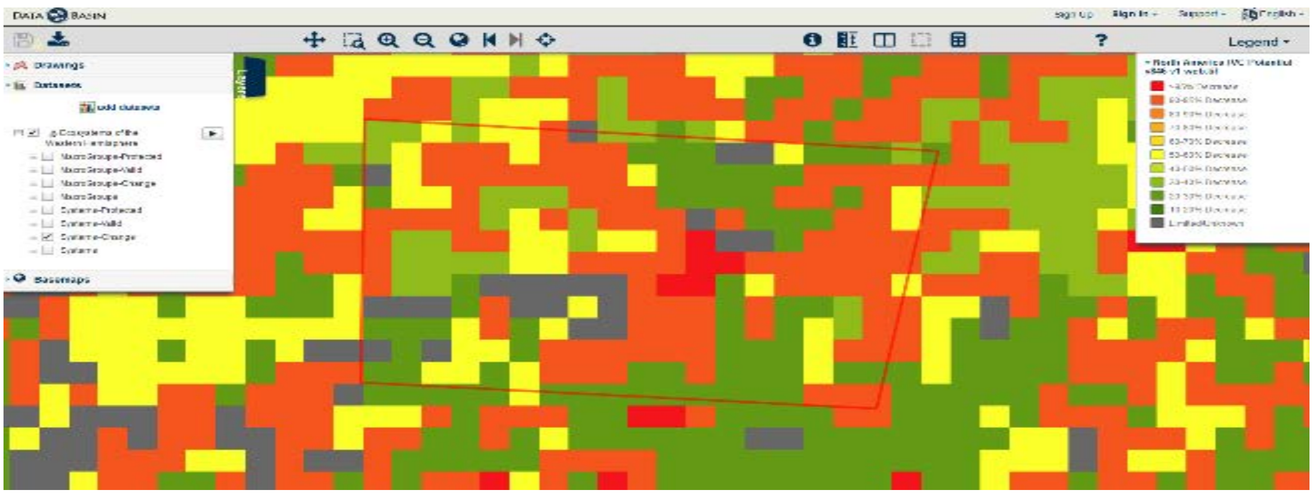

Figure 9-6. Map of Ecosystem Change (from *Data Basin*). *This map indicates the estimated loss of total area, or range, of an ecosystem since European settlement, with warmer colors indicating greater ecosystem loss. All of the ecosystems present at the site have experienced significant loss. However, the* Coastal Live Oak Woodland and Savanna *ecosystem has lost an estimated 90-95% of its original range, a staggering decline causing it to be listed as a critically imperiled ecosystem. According to the description of this ecosystem available in NatureServe Explorer, the dominant species is live oak, with characteristic species including blackberry, snowberry, poison oak, and several bunch grasses.*

The information gleaned from this brief exercise is added to the inspection file to assist with field verification. Since a current 2020 aerial photo is not available, the certifier includes both the 2018 and 2010 photos in the file for the inspector to take to the site, along with specific instructions to observe any field evidence that might confirm the aerial photo-derived interpretation of vegetation loss and to verify the ecosystem identification by observing other ecosystem remnants on parts of the site adjacent to where ecosystems were apparently removed.

Armed with this information, the inspector finds that current conditions closely match those on the 2018 aerial photo, indicating that no further habitat has been removed since then. He also observes several remnant oak woodlands that closely match the Coastal Live Oak Woodland ecosystem description provided by the certifier. These remnants occur in landscape positions similar (and adjacent) to those where vegetation was removed between 2010 and 2018, confirming the likely presence of a native oak woodland ecosystem in those areas identified on the aerials (figs. 9-1 and 9-2). Upon interviewing the manager, the inspector finds that the operation hired a site preparation company to develop the land in advance of the vineyard expansion, and that all of the parties involved appeared to be blissfully unaware that a native ecosystem was present in those areas.

Discussion:
This example illustrates several of the key tools that can be used by certifiers to quickly verify compliance with the native ecosystems rule and to establish specific areas and criteria for the inspector to assess during a site visit. In particular, it illustrates the power of two simple aerial photos, taken at different times leading up to the certification application, to identify major land use/land cover changes at a site that might otherwise go unnoticed.

Likewise, while the *USGS Terrestrial Ecosystems Viewer* and *Data Basin* are both efficient methods of estimating the native ecosystem(s) present or expected to be present at a site, *Data Basin* offers several mapping tools not available elsewhere that can both simplify the interpretation of a site and provide a retrospective look at native ecosystems by asking the question: based on the biogeographic location and physical characteristics of the landscape, what ecological communities were likely here before European settlement and attendant landscape disturbance? This ability is especially valuable in disturbed agricultural sites and landscapes where ecosystems are highly fragmented and maps of existing ecosystems may be inconclusive.

Conclusion:
The certifier grants certification to only those parts of the site outside of the areas bounded in red on the 2010 map (Figure 9-1). The operator is instructed to obtain additional years of aerial photos between 2010 -2018, so the specific year(s) of native ecosystem conversion within the red lines can be determined, and a 10-year timeframe can be established for when it will be eligible for certification.

Native Ecosystem *Was Present and then Was Converted* in the Previous Ten Years
10) A producer of palm oil in Indonesia submitted an application for NOP certification. *Global Forest Watch* is used to show that a native ecosystem was cleared about four years ago.

Level: Moderately complex

Key Takeaways:
(i) *Global Forest Watch's* dated maps and dated deforestation alerts can help determine when ecosystem conversion occurred, (ii) one map assists with identifying possible native ecosystems, and (iii) other maps show Indonesia's competing interests of oil palm production and its rich biodiversity heritage.

Operator Application Request:
In 2021, an oil palm operator submits an application for certification of a site in Indonesia. They fill out the prior land use form reporting that the land has been under cultivation for more than ten years, but they do not attach any supporting documentation.

Certifier Actions:
The certifier uses *Global Forest Watch's* "Emerging Hot Spots" map to determine that this site has had some recent forest clearing (Fig. 10-1). They also use the "Forest Landscape Integrity Index" to

learn where unfragmented forest landscapes and native ecosystems still exist (Fig. 10-2). The image taken sometime between 2016 and 2017 does not show forest clearing (Fig. 10-3), however by 2019 the Deforestation GLAD Alerts show forest clearing had begun (Fig. 10-4), and by 2020 and 2021 it was extensive at the site (Figs. 10-5 and 10-6). This country is known for both oil palm plantations (Fig. 10-7) and landscapes that possess great biological significance (Fig. 10-8). To learn more about dominant and characteristic plants in native ecosystems of the region, growers and inspectors can visit nearby protected areas (Fig. 10-9).

<u>Discussion</u>:
This example shows how several types of map layers can be used to determine that the site contained a forest until about four years before the application was submitted. It is likely that the forest was old growth, but some may have been second growth. Whether that second growth, if present, had recovered as a native ecosystem before being cleared is unknown. However, since the habitat has been cleared, it would be hard to prove that the site wasn't a native ecosystem, without an affidavit stating so.

<u>Conclusion:</u>
Since the operator has not submitted an affidavit stating what was present before the forest was cleared, the site will not be eligible for certification for another six years (10 years after conversion of the native ecosystem).

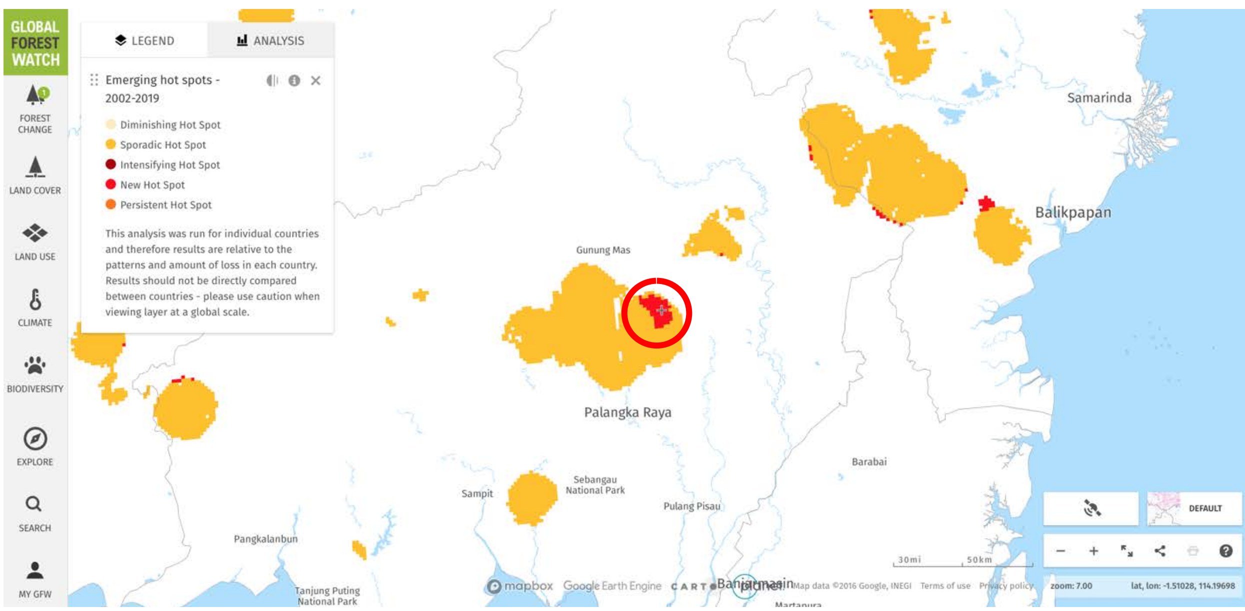

Figure 10-1. Emerging Hot Spots from Global Forest Watch. *The red-circled site on this map shows that part of the forest has recently been cleared.*

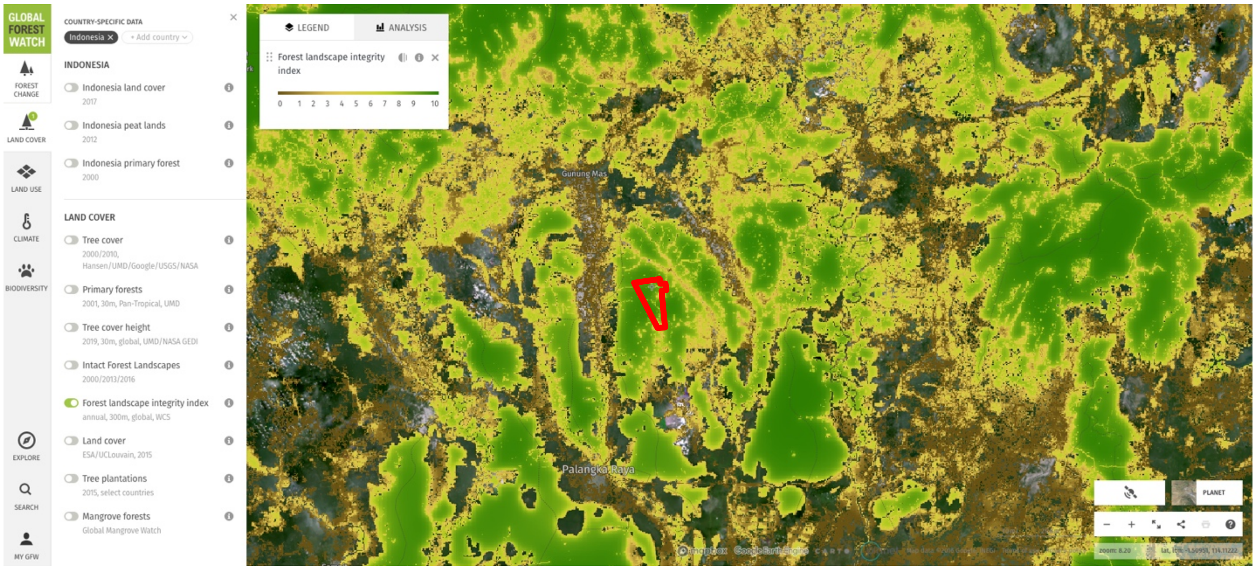

Figure 10-2. Forest Landscape Integrity Index from Global Forest Watch. *The deep green color in the site proposed for certification (red polygon) indicates that there hasn't been human impact, and therefore may have been a native ecosystem. The lite green color shows there has been some human impact.*

Figure 10-3. Image of Site Taken Between December 2016 and June 2017 on Global Forest Watch. *No forest clearing is seen at the proposed site for certification (red polygon) during these dates (red circle). While the uniformly green color above seems to indicate there has been no human impact, Fig. 10-1 in the same general area shows some, which could mean second growth forest. Several Indonesian National Parks contain second growth forests that have recovered enough to be native ecosystems and support a variety of species, including the rare Orangutan. Therefore, even if a second growth forest is present, it may contain a recovered native ecosystem.*

Figure 10-4. April 2019 Deforestation GLAD Alert from Global Forest Watch. *The pink areas within the red polygon of the site indicate deforestation is beginning to be reported. The date of the report (red circle) is at the left.*

Figure 10-5. December 2020 Image from Global Forest Watch. *Forest clearing at the site (red polygon) occurred during this month (red circle).*

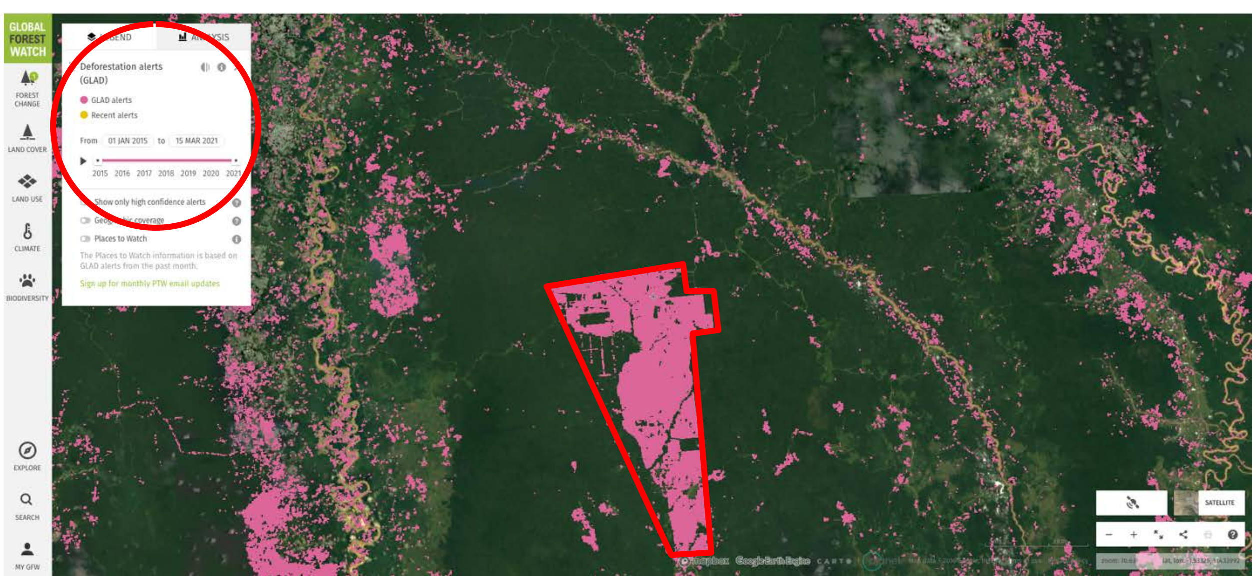

Figure 10-6. March 2021 Deforestation GLAD Alert from Global Forest Watch. *The pink areas within the red polygon indicate deforestation has recently increased significantly (date in red circle).*

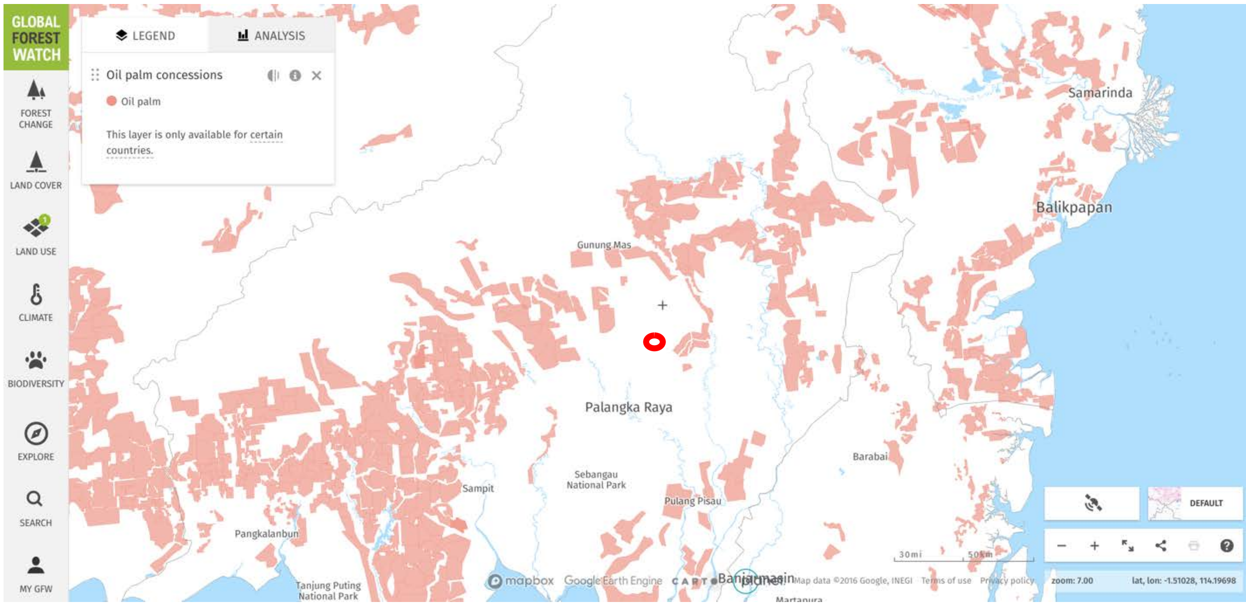

Fig 10-7. Oil Palm Concessions from Global Forest Watch. *Oil palm production is a big industry in Indonesia. It is a major contributor to this country having one of the highest deforestation rates in the world. The general area of the site proposed for certification is in the red circle.*

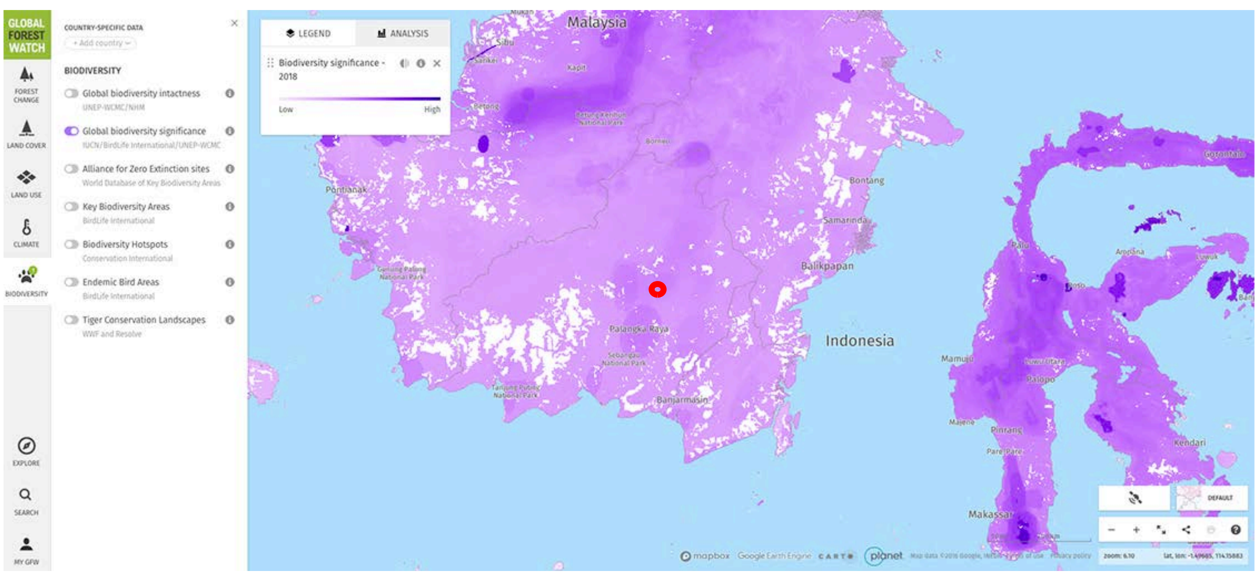

Fig 10-8. Global Biodiversity Significance from Global Forest Watch. *Indonesia is known for having a high diversity of plants and animals. It has 10% of the world's flowering plants (~ 25,000 flowering plants); about 12% of the world's mammals (515 species), 35 of whom are primates; about 16% of the world's reptiles (781 species), 17% of the world's birds (1,592 species) and 270 species of amphibians. This country is also one of the world's centers for agrobiodiversity – the birthplace of many plant cultivars and domesticated livestock.[6] The site proposed for certification lies within the red circle.*

[6] Convention on Biodiversity. Indonesia. https://www.cbd.int/countries/profile/?country=id

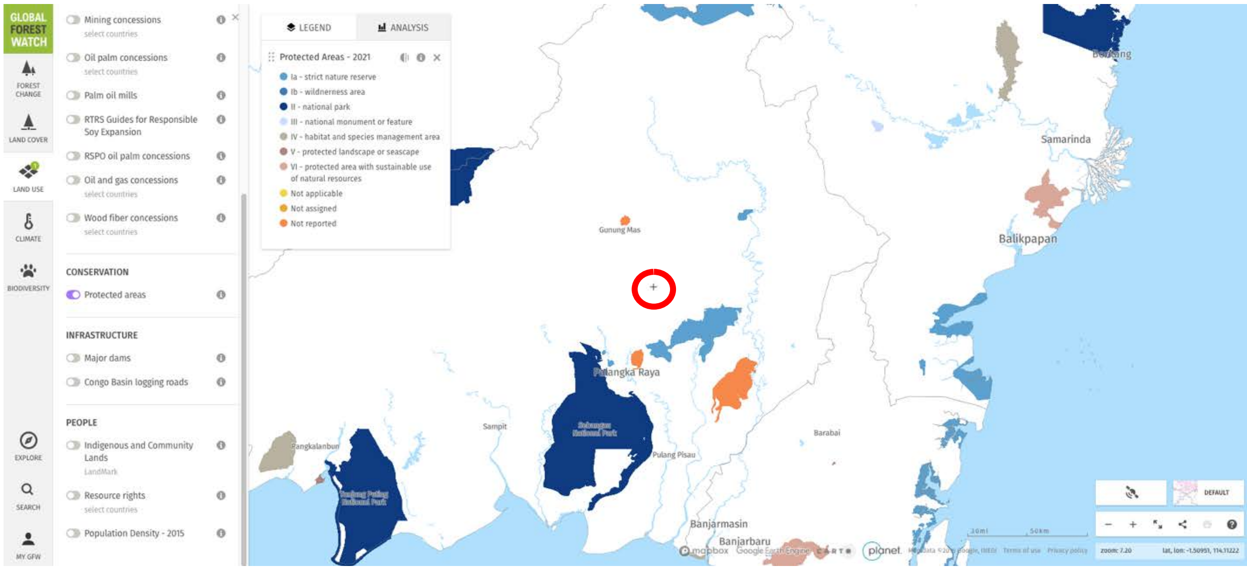

Figure 10-9. Protected Areas from Global Forest Watch. *These areas can be used as living libraries. Growers and inspectors can visit them to learn about the native ecosystems in the region, to compare with an ecosystem that may be present at the site (red circle).*

One negative aspect of both this and the previous example is that the native ecosystem rule did not prevent the conversion of imperiled native ecosystems for purposes of organic certification. This unfortunate result is expected to be somewhat common during the first few years after the rule is implemented, because some, perhaps many, operators and new applicants will be unfamiliar with the requirements. Therefore, it is incumbent on the entire organic community – certifiers, inspectors, the NOP, NGO's, and many others – to help publicize the rule, both within the U.S. and beyond. Harmonization of native ecosystem requirements among the many countries and certifiers who have such rules would likely go far to improve this result.

E. Available Assistance When Site Visits Are Needed

Many operators will not require assistance because they can easily prove no native ecosystem has been present for the previous 10 years. However, when tools used at a desk are not enough, or the operator does not use a computer, a variety of government agencies, non-governmental organizations and private individuals may be available to provide conservation assistance on site. Such assistance could take the form of helping the operator identify native ecosystems that may be present on the parcel proposed for certification, acting as a disinterested third party for purposes of completing a prior land-use form for native ecosystems (see Section F of this toolkit for an example), and supporting management practices for native ecosystems used for compatible kinds of organic production (e.g., maple products, wild harvest, etc.).

1. Natural Resources Conservation Service (NRCS). This federal agency is a logical point of contact for inquiries about this topic, as it is the principal agency that administers conservation programs geared to agriculture, and to organic agriculture in particular. Expertise and availability regarding native ecosystem identification may vary from office to office and region to region, and is most likely to be forthcoming when the operator or applicant already has a relationship with NRCS, such as by being enrolled in other conservation programs. **Technical Service Providers (TSPs)**[7] perform

[7] A list of TSPs, searchable by state and county, can be found here: https://techreg.sc.egov.usda.gov/CustLocateTSP.aspx

many conservation related tasks for NRCS clients, including site assessments, creating conservation plans, and more. Assuming the operator or applicant already has a relationship with NRCS or a TSP, such as by being enrolled in other conservation programs, then staff or a TSP may be able to fulfill an assistance role viz native ecosystems. And depending on the NRCS programs in which the operator/applicant is enrolled, their conservation plan may already contain an ecosystem inventory.

2. State Technical Assistance. Many states have **cooperative extension services** connected to their land-grant universities. The specific structure and available services vary by state, but they typically involve a combination of state and local staff who have local offices, some of which have a natural resources agent or educator.

Most U.S. states and Canadian provinces, as well as some localities elsewhere have **natural heritage programs** or their equivalents which employ **state biologists and ecologists** to survey and assess the region's ecological systems. In some states, natural heritage biologists may be available to perform assessments on private land, but usually this is a last resort because natural heritage programs tend to be underfunded and understaffed, and assistance to private landowners may not be part of the mission unless specified by legislation for certain kinds of lands or projects.

3. Soil and Water Conservation Districts (**SWCD).** SWCD, also called Resource Conservation Districts in some states, are organizations whose mission is to promote soil and water conservation, which often spills over to ecosystems. The capability to assist with identifying native ecosystems would likely vary by region and state, with the ability to provide ad hoc assistance probably being limited and most easily accomplished when a client is enrolled in other projects with their local SWCD.

4. Non-Government Organizations (NGOs). Numerous NGO's provide contract biologists (or may have their own on staff) to clients enrolled in their programs. Some examples include Ducks Unlimited, Pheasants Forever/Quail Forever, Xerces Society for Invertebrate Conservation, Point Blue Conservation Science, American Bird Conservancy, National Wild Turkey Federation, Bird Conservancy of the Rockies, Izaak Walton League, and Trout Unlimited. Operators and applicants who belong to or otherwise have a relationship with such an organization may be able to draw on their expertise.

5. Contract Biologists and Ecologists. These experts are knowledgeable about local ecosystems and are available in every state in the U.S. and beyond. This should be viewed as a last resort, however, as these services impose a cost on the operator, which may be substantial. Last, other operators, neighbors, and farmer organizations, while perhaps lacking a professional level of expertise, are all potential sources of (probably informal) local and regional ecosystem knowledge.

F. Example of Prior Land Use Form for Certification Agency Use

The form on the following page includes the key questions for verifying compliance with the NOP native ecosystems rule. The form can be included as an addendum to certifiers' Organic System Plans, or integrated into an existing prior land-use declaration. In most cases, the latter option makes sense to avoid duplication of a considerable amount of administrative information. However, the first question may be more appropriate (or may already be covered) in the primary Natural Resources Biodiversity Conservation (NRBC) section of the application/OSP.

Native Ecosystems Prior Land Use Declaration

Operation Name:________________________ Certificate Number (if adding new land):___________

Date:_________________________________

Parcel Identification and Location

Field or Parcel Name or Number:_______________ Acreage:______________

Other Legal Description (Assessor's Parcel Number, Township-Range-Section, Lat.-Long., other coordinates):
____

_______________________________ parcel near the intersection of these roads

Street Address:______________________________ City:_____________ County:_____________
State/Province:_________________ Country:________

Native Ecosystem Description

1. What native ecosystems are present on the land intended for organic certification? What are the dominant and characteristic species? Please identify the location(s) and type(s) of native ecosystems on your farm map.

2. If no native ecosystems are currently present, has the parcel proposed for certification had a native ecosystem on it within the past 10 years? Y/N

If you answer 'yes', indicate the date that ecosystem was converted to another land use: ________________

If you answer 'no', indicate how the parcel has been used for the past ten years (e.g., row crops, pasture/hay, idle, etc.):
____

3. Please submit the following: 1) a current photograph of the vegetation on the parcel; and 2) a 10-year old aerial photograph that clearly shows the type of land use on the parcel at the time the photo was taken.

4. Do you intend to use a native ecosystem for organic production? Y/N

If yes, indicate the type of production: Grazing mushrooms maple syrup wild harvest other_______

If not covered elsewhere in this application (e.g., a separate maple syrup or wild harvest questionnaire), briefly explain how you will monitor the site to ensure your production practices preserve the native ecosystem:

( ) photos ( ) counts of dominant and characteristic native species ( ) invasive species counts

( ) health of species being used in production ( ) observe birds and wildlife ( )
other____

If you are uncertain about the answer to any of these questions or you have not managed the parcel for the entire 10 years, you may have a knowledgeable observer (prior owner/manager, neighbor, extension or NRCS agent, etc.): 1) complete and sign this portion of the PLU form; or 2) complete and sign a separate affidavit indicating either that a) no native ecosystem has been present for 10 years, b) a native ecosystem was present within the last 10 years, and the date of conversion (if known), or c) a native ecosystem is currently present.

I have direct knowledge of the ecosystems and activities taking place at the parcel named above during the time period (check one): ☐ (MM/DD/YY) through (MM/DD/YY) OR ☐ (MM/DD/YYYY) through the present, because (check one):

☐ I owned the parcel and controlled activities taking place there during the time period above

☐ I managed the parcel and controlled activities taking place there during the time period above

☐ Other (describe): ____

Name:____ Title: ________________________________

Company or Agency: ____

Email: ____ Phone: ______________________________

Signature: _____________________________________ Date: ________________________________

Native Ecosystems Prior Land Use (NEPLU) Declaration: Discussion

General Observations:
This NEPLU was created as an example for certifiers to use or adapt as they see fit.

Unless this NEPLU is piggybacked onto certifiers' current PLUs, there would be much overlap in the information required to verify 3-year Prior Land Use (PLU)/field history and what is needed to verify the presence/absence of native ecosystems within the last 10 years. For example, both parcel applications would need to include: operator name, parcel name/location/ID/buffers, who controlled the land in prior years, and other related info in the PLU.

Therefore, to avoid duplication and minimize paperwork, in most cases it makes sense to piggyback these, or similar, Native Ecosystem Prior Land Use Declaration questions on existing PLU forms as much as possible. As noted below, however, the first question might best be included in the main body of the certification application with other Natural Resources and Biodiversity Conservation (NRBC) information.

We note a potential problem viz native ecosystems in some existing PLU declarations (for 3-year field history), which contain answers like: "This land was woods, meadow, fallow … and no seeds or inputs were used from xx/xx/xx to yy/yy/yy". This and similar statements imply that it is OK to convert a native ecosystem (e.g., woods, meadow) to immediate organic production in lieu of a 3-year transition. Answering such a statement in the affirmative takes on a new meaning in light of the new native ecosystems regulation.

Potential Questions and Changes to Instructions to Incorporate NEPLU Verification:
Question 1:

> *1. What native ecosystems are present on the land intended for organic certification? What are the dominant and characteristic species? Please indicate the location(s) and type(s) of native ecosystems on your farm map.*

Comments: This question (or one like it) should appear in the main body of the certification application, whether the applicant is new or renewing. It could logically be added to the section covering NRBC management. The question is worded in a way that assumes one or more native ecosystems are present. This forces operators and certifiers to think about the what, where, and why of the answer, rather than giving them an easy out, e.g., a yes/no question: "Are any native ecosystems present on…". Requiring ecosystems to be shown on a farm map follows the same logic as showing other kinds of NRBC features and practices.
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Question 2-4 below would logically be part of the general PLU declaration/affidavit, or they could comprise a separate NEPLU declaration, as on the preceding page (which also includes question 1, for now):

> 2. If no native ecosystems are currently present, has the parcel proposed for certification had a native ecosystem on it within the past 10 years? Y/N
> If you answer 'yes', indicate the date that ecosystem was converted to another land use:
> If you answer 'no', indicate how the parcel has been used for the past ten years (e.g., row crops, pasture/hay, idle, etc.)
> 3. Please submit the following: 1) a current photograph of the vegetation on the parcel; and 2) a 10-year old aerial photograph that clearly shows the type of land use on the parcel at the time the photo was taken.

Comment: the idea here is to: a) provide a visual of the potential ecosystem, and b) make it easy for the certifier to verify any 10-years-ago claims concerning ecosystems and land cover. If this is not possible (e.g., the operator does not use or lacks access to the internet), options include obtaining hard copies of NAIP photos from FSA, or having the certifier obtain them as part of the application review.

Question 4:

4. Do you intend to use a native ecosystem for organic production? Y/N
If yes, indicate the type of production: Grazing   mushrooms   maple syrup   wild harvest other_______
If not covered elsewhere in this application (e.g., a separate maple syrup or wild harvest questionnaire), briefly explain how you will monitor the dominant and characteristic species to ensure your production practices preserve the native ecosystem.

Comment: If not already included, certifiers may want to add questions to maple syrup, wild harvest, and grazing sections of their OSPs about whether native ecosystems are being used, and if so, ask how they are monitoring the dominant and characteristic species. In most cases, the dominant and characteristic species will be plants, but in some cases, they may also be animals (birds, mammals, fish, insects, etc.), especially rare-threatened-endangered-priority animal species, that are protected in their own right and whose populations often acts like a proxy for the health of the whole ecosystem.

Question 4 Continued:

If you are uncertain about the answer to any of these questions or you have not managed the parcel for the entire 10 years, you may have a knowledgeable observer (prior owner/manager, neighbor, extension or NRCS agent, etc.) a) complete and sign this portion of the PLU form; or b) complete and sign a separate affidavit indicating either that a) no native ecosystem has been present for 10 years, b) a native ecosystem was present within the last 10 years, and the date of conversion, or c) a native ecosystem is currently present.

Comment: There are many ways to word and format this section, as seen from the existing PLU affidavits from different certifiers. Here, I simply appropriated the language of one certifier's PLU declaration. However, it is constructed, the key outcome is that the relationship and history of the individual signing the affidavit to the land in question be clearly established.

Appendix: Instructions for Using Desk Tools

Instructional videos that describe how to use all of the following tools (except the *NRCS Web Soil Survey*) can be found on Wild Farm Alliance's YouTube Channel. Written explanations of all the tools will be included in the final toolkit.

a) USGS Earth Explorer
b) Google Earth Pro
c) NatureServe Explorer
d) USGS Terrestrial Ecosystem Viewer
e) Data Basin-Ecosystems of the Western Hemisphere
f) Wetland Mapper
g) NRCS Web Soil Survey
h) Global Forest Watch

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