

Effects of Implementation of the Farm Bill's Title II Conservation
Programs as Administered by NRCS on the Monarch Butterfly
(*Danaus plexippus*)



Prepared Jointly by:

U.S. Fish and Wildlife Service & the Natural Resources Conservation Service

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1 INTRODUCTION

This document has been jointly prepared by the United States (U.S.) Fish and Wildlife Service (Service) and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) to identify and to address the effects (benign, beneficial, and adverse) of NRCS actions on the monarch butterfly (*Danaus plexippus*) as a result of working with eligible agricultural producers and entities¹ under the Conservation Title (Title II) of the Farm Bill².

This document complies with Section 7 of the Endangered Species Act (ESA) and 50 CFR §402 of the Service's interagency regulations governing Section 7 of the ESA, as amended. This document is intended also to advance the purposes and intent of an Optional Collaborative Process – a term used in 50 CFR §402.14(h)(4) [referring to collaboration for developing and adopting action agency documents in consultation.] The monarch is a candidate for listing as threatened or endangered. There are no requirements under Section 7(a)(2) or 7(a)(4) of the ESA to consult or confer, respectively on actions due to their effects on candidate species. This is a voluntary conference taken as a precaution to help ensure compliance of the Proposed Action with Section 7 of the ESA in the event the Service, at some point in the future, were to propose listing of the species and ultimately list the species under its authorities of the ESA.

Pursuant to the *Partnership Agreement Between the U.S. Department of Agriculture Natural Resources Conservation Service and the U.S. Department of the Interior Fish and Wildlife Service* (Appendix 10.11), if the monarch is listed as threatened or endangered, the Service commits to converting the findings and analyses in this Conference Opinion (CO) to a Biological Opinion covering implementation of the Proposed Action and providing participating agricultural producers and entities with incidental take coverage for a minimum of 30 years from the date that this document is signed.

1.1 AUTHORITIES

This document is consistent with, and satisfied the requirements of the:

- informational requirements for NRCS to request programmatic formal and informal consultation from the Service as outlined in Parts 50 CFR §402.13 and 50 CFR §402.14, respectively;

¹ Throughout this document the terms client, cooperator, customer and agricultural producer are used interchangeably.

² The Farm Bill is comprehensive legislation that incorporates the primary agricultural policy for the Federal government. A new farm bill is typically enacted every five to seven years. The conservation provisions are normally set forth in Title II of the Farm Bill, though such provisions were in Title XII of the 1985 Farm Bill, Title XIV of the 1990 Farm Bill, and Title III of the 1996 Farm Bill. The current Farm Bill is the Agriculture Improvement Act of 2018, Public Law Number 115-334 (12/20/2018), as amended.

- requirements (content and sufficiency) of a programmatic Biological Assessment (CFR§ 402.12); and
- completion of a sufficient and compliant CO, as prepared under §7(b)(4) of the ESA.

This document uses the best available biological and commercial data to describe, analyze, and evaluate the following:

- **Part 2** and supporting Appendices describes the Proposed Action, as well as the Action Area, the area that could be affected by the Proposed Action.
- **Part 3** is a review of the status of the monarch throughout its current range within the Action Area.
- **Part 4** describes the environmental baseline, the current condition of the monarch in the Action Area.
- **Part 5** describes the effects the Proposed Action is expected to have on the monarch.
- **Part 6** describes cumulative effects of activities caused that are reasonably certain to occur in the Action Area.
- **Part 7** is the Service's synthesis of the information supporting its CO and the conclusion as to whether the Proposed Action is likely to jeopardize the continued existence of the monarch.
- **Part 8** describes conservation recommendations.
- **Part 9** describes how the Service's CO may be adopted as a biological opinion if the monarch is listed as endangered or threatened.
- **Part 10** includes all supporting appendices – which includes more details of the attributed of the Proposed Action and which provides the information sources cited for this document.

1.2 ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

1.2.1 Jeopardy Determination

In accordance with the Service's regulations (see 50 CFR §402.02, §402.14(g)), the jeopardy determination in this CO relies on the following four components:

1. The *Status of the Species* evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population retains sufficient abundance, distribution, and diversity to persist and retains the potential for recovery (see Endangered Species Consultation Handbook, March 1998).
2. The *Environmental Baseline* section evaluates the past and current condition of the species in the Action Area relative to its reproduction, numbers, and distribution absent the effects of the Proposed Action; including the anticipated condition of the species

contemporaneous to the term of the Proposed Action; the factors responsible for that condition; and the relationship of the Action Area to the survival and recovery of the species.

3. The *Effects of the Action* section evaluates all consequences to the species that are reasonably certain to be caused by the Proposed Action (i.e., the consequences would not occur but for the Proposed Action and are reasonably certain to occur) and how those consequences are likely to influence the survival and recovery of the species.
4. The *Cumulative Effects* section evaluates the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Proposed Action subject to conference, on the species and its habitat, and how those effects are likely to influence the survival and recovery of the species.

In accordance with policy and regulation, the jeopardy determination is made by formulating the Service's opinion as to whether the Proposed Action, including its consequences, taken together with the status of the species, environmental baseline, and cumulative effects, reasonably would be expected to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution of that species.

Note, at this stage the Service has not proposed nor designated critical habitat. If and when the Service proposes critical habitat, the analysis of, and elements pertaining to describing how the Proposed Action will/will not adversely affect will be determined at that time.

1.3 DURATION

The duration of the document is 30-years, effective upon the last date of the signature on the document's title page.

1.4 CONFERENCE HISTORY

Leadership of the USDA, NRCS, the U.S. Department of Interior, and the Service began conversations meeting in early summer of 2024 to discuss additional landscape level conservation and collaborative actions to support monarchs. Further, the agencies determined that this document and the supporting Partnership Agreement (Appendix 10.11) would formulate the most prudent near-term administrative strategy. A NRCS-Service technical team was convened in late July 2024 to develop this document and met weekly. A final combined document was reviewed by a multi-disciplinary group from both agencies between November 7 and November 22, 2024.

1.5 RELATED COORDINATION

NRCS has a long-established partnership with the Service and other cooperating entities to specifically promote monarch butterfly conservation and its resource needs on non-federal lands associated with its Title II Farm Bill authorities. As analyzed herein, the operational

aspects of NRCS' Title II programs also have some direct benefits to the monarch's conservation needs and indirectly, by addressing other societal priorities. Examples are highlighted below - with more information available in a summary report from NRCS (USDA-NRCS 2020).

"In 2019 NRCS, Service, and other partners established the New England Pollinator Partnership (NEPP). The NEPP provides financial and technical assistance to agricultural producers in the states of Connecticut (CT), Massachusetts (MA), Rhode Island (RI), New Hampshire (NH), Vermont (VT), and Maine (ME) to implement conservation practices to address the decline in pollinators, including the monarch. For example, conservation practices may include establishing wildflower gardens or flowering hedgerows adjacent to pollinator-dependent crops as well as managing natural habitats. Beginning in fiscal year (FY) 2020, NRCS has been pursuing an objective of enrolling 1,182 agricultural producers to promote pollinator conservation on 7,680 acres (~3,111 hectares) over the 25-year term of the NEPP."

"In FY 2017, NRCS and the Service facilitated the creation of the Working Lands for Wildlife (WLFW) Monarch Butterfly landscape conservation initiative. The geographic focus for this WLFW includes the states of Illinois (IL), Indiana (IN), Iowa (IA), Kansas (KS), Minnesota (MN), Missouri (MO), Ohio (OH), Oklahoma (OK), Texas (TX), and Wisconsin (WI) - the primary eastern monarch migration corridor in a 10-state area of the central U.S. This effort targets strategic conservation actions in two sub-regions (a Midwest Strategy and a Southern Great Plains Strategy (Service 2016). In general, the Midwest Strategy is focused on the planting of milkweed and nectar-rich plants to support breeding. In the Southern Great Plains strategy, the effort is focused on improving monarch habitat on existing grasslands to support migration. Since 2016, NRCS has successfully implemented actions on 529,239 acres (~214,175 hectares) (USDA NRCS 2024)."

"Through the Conservation Stewardship Program ((CSP) - (see Part 2.7)), NRCS offers additional opportunities for agricultural producers to enhance wildlife habitat by building on existing conservation efforts while strengthening agricultural operations. In FY 2016, NRCS developed four CSP Enhancements (Conservation cover for pollinators and beneficial insects; Establish monarch butterfly habitat; Improved crop rotation to provide benefits to pollinators; and Enhanced field borders to increase food for pollinators along the edge(s) of a field) focused on establishing habitat for monarchs and other pollinators. Through these CSP Enhancements, over 325,000 acres (~131,522 hectares) have been managed to date to improve outcomes for pollinator habitats."

"In FY 2014, NRCS launched a targeted effort to accelerate conservation activities where more than two-thirds of the managed honeybee population spends the summer months pollinating crops and building strength to survive winter. Assistance under this effort is available for agricultural producers in the states of Michigan (MI), MN, Montana (MT), North Dakota (ND), South Dakota (SD), and WI. Since FY 2014, the effort has enhanced

over 161,000 acres (~65,154 hectares) for honeybees. These actions increase foraging resources for the monarch.”

Beyond individual (landowner specific) actions and supporting the aforementioned landscape scale efforts, NRCS is incorporating pollinator conservation actions to support private landowners’ implementation and adoption of climate-smart agriculture and forestry mitigation activities³ (see USDA 2023). When applied appropriately, these activities are expected to reduce greenhouse gas emissions or increase carbon sequestration. Specific Conservation Practice Standards and Enhancements (CPS/E(s)) have been designated by NRCS as offering additional benefits that help operations build climate change resilience while addressing other natural resource concerns such as soil health, water quality, pollinator and wildlife habitat and air quality. The following are a sub-set of those CPS/Es from the larger list specifically relevant to benefiting monarch habitat and its conservation needs:

- Brush Management (314) and related Enhancements
- Herbaceous Weed Treatment (315) and related Enhancements
- Conservation Cover (327) and related Enhancements
- Prescribed Burning (338) and related Enhancements
- Forest Farming (379) and related Enhancements
- Field Border (386) and related Enhancements
- Riparian Forest Buffer (386) and related Enhancements
- Riparian Herbaceous Cover (390) and related Enhancements
- Wildlife Habitat Planting (420) and related Enhancements
- Hedgerow Planting (422) and related Enhancements
- Pasture and Hayland Planting (512) and related Enhancements
- Prescribed Grazing (528) and related Enhancements
- Range Planting (550) and related Enhancements
- Saturated Buffer (604) and related Enhancements
- Tree-Shrub Establishment (612) and related Enhancements
- Restoration of Rare or Declining Natural Communities (643) and related Enhancements
- Wetland Restoration (657) and related Enhancements
- Forest Stand Improvement (666) and related Enhancements

Additional financial incentives available to implement these climate-smart practices under NRCS’ authorities through the Inflation Reduction Act of 2022 (Statute at Large 136 Stat. 1818 - Public Law No. 117-169) should further amplify and accelerate reducing greenhouse gas emissions or increase carbon sequestration efforts on private working lands while also supporting the monarch’s resource needs (USDA 2024).

³ The most current list of selected CPS/E can be found here: <https://www.nrcs.usda.gov/sites/default/files/2023-10/NRCS-CSAF-Mitigation-Activities-List.pdf>

2 DESCRIPTION OF THE PROPOSED ACTION

The scope of this document encompasses the effects of NRCS' federal actions that "may affect" the monarch, where those actions are conducted in accordance with NRCS mission, policies, and procedures, and when Conservation Plans are developed with eligible agricultural producers and entities which implement NRCS Conservation Practice Standards and Enhancements (CPS/E) – see Parts 2.6 and 2.7 - through programs authorized by Congress within Title II (the Conservation Title) of the Farm Bill. By way of example, below are four of the most commonly utilized programs:

Conservation Stewardship Program (CSP)— CSP provides financial and technical assistance to producers to maintain and improve existing conservation systems and to adopt additional conservation activities in a comprehensive manner on a producer's entire operation. CSP contracts must meet or exceed a stewardship threshold for at least two priority resource concerns at the time of application and meet or exceed at least one additional priority resource concern by the end of the contract.

Environmental Quality Incentives Program (EQIP)— The program provides financial and technical assistance to producers and private landowners to plan and install structural, vegetative, and (land) management practices on eligible lands to alleviate natural resource problems. Eligible producers enter into contracts with USDA to receive payment for implementing conservation practices. Approved activities are carried out according to an EQIP plan, approved by USDA and developed with the producer, that identifies the appropriate conservation practice(s) to address identified resource concerns on the eligible lands. As a subprogram of EQIP, the Conservation Innovation Grants (CIG) supports the development, demonstration, and transfer of innovative conservation approaches and technologies to address natural resource concerns on private agricultural lands through competitive grants to eligible clients.

Agricultural Conservation Easement Program (ACEP)—Under the Wetland Reserve Easement (ACEP-WRE) component, provides financial and technical assistance to private and tribal landowners to protect, restore and enhance wetlands which have been previously degraded due to agricultural uses through the purchase of long-term easements held by NRCS. Under the Agricultural Land Easement (ACEP-ALE) component provides financial assistance to eligible entities for the purchase of long-term easements that protect agricultural land from conversion to nonagricultural uses or protect grazing uses and grasslands from conversion to non-grassland uses.

Regional Conservation Partnership Program (RCP)—Provides assistance to partners to address natural resource concerns on a regional or watershed scale.

2.1 NRCS MISSION

The NRCS is an agency of the USDA with the following mission statement: “We deliver conservation solutions so agricultural producers can protect natural resources and feed a growing world”. NRCS’ vision is “A world of clean and abundant water, healthy soils, resilient landscapes, and thriving agricultural communities through voluntary conservation.” Productive use of privately owned cropland, rangeland, pastureland, and forestland is essential to the Nation’s security and the health and well-being of its citizens. Those lands form the foundation of a substantial and vibrant agricultural economy that provides food, fiber, forest products, and energy for the Nation. Those lands also produce environmental benefits that people need: clean and abundant water, clean air, and healthy ecosystems. The NRCS recognizes this is its mission to develop and deliver high quality products and services that enable people to be good stewards of the Nation’s soil, water, and related natural resources occurring primarily on private, non-Federal, and Tribal lands.

The NRCS is neither a regulatory nor a public land management agency, and its role in conservation is largely advisory at the invitation of their clients and its programs are completely voluntary.

2.2 SCOPE, DURATION, AND EXTENT OF THE PROPOSED ACTION

The analysis and conclusions in accordance with Part 1 above envelops the following:

1. Continued implementation and maintenance of existing Financial Assistance (FA) conservation plans produced by NRCS consistent with the requirements outlined herein, including additional actions designed to maintain or improve the condition of the identified resource concern after the expiration of the FA contract;
2. Implementing and maintaining future FA Conservation Plans designed by NRCS consistent with the requirements outlined herein;
3. Implementation of FA Conservation Plans with active NRCS contracts;
4. Implementation of all FA Conservation Plans associated with other interagency efforts explicitly designed to improve habitat for the monarch, consistent with NRCS policy and the requirements outlined herein;
5. Provisions for any future conversion of habitat created. [USFWS recognizes that future conversions covered as part of the Proposed Action may or may not involve the removal of milkweed and other monarch resource needs.]
6. It is anticipated that the Farm Bill will continue to be reviewed, revised, and reauthorized by Congress approximately every five to seven years. During each reauthorization cycle, additional conservation programs may be developed to fund conservation activities within an agricultural context. Thus, the analyses and findings contained in this CO (and the future Biological Opinion if the monarch butterfly is listed) are designed to cover and anticipate how the CPS/E(s) will be applied within all future eligible land units, include all programs involving planning and implementation of

conservation practices, enhancements, resources concerns, and/or any new or revised CPS/E(s) developed to support NRCS program authorities outlined in this CO.

7. NRCS has limited influence in cropland land uses within the Action Area. While croplands provide limited support to the monarch's life history and resource needs, there are places within these landscapes where NRCS can incentivize the creation or maintenance of monarch habitat (e.g., Field Borders, Grassed Waterways, Strip Cropping, and Hedgerow Plantings). Where overlap between monarch habitat and active cropland exists, NRCS will continue to provide species-specific voluntary considerations during the conservation planning process.
8. Although the Service is providing a thirty-year period of predictability as a component of this CO, new conservation recommendations may be collaboratively developed with each new Service review during the listing process for the monarch and incorporated into Table 8-1 for consideration during the planning process. NRCS commits to maintained monarch specific coordination and possible funding opportunities as new science and information becomes available.

2.3 COORDINATION ON OTHER SPECIES

The findings and analyses included in this interagency document, as well as the Service's regulatory conclusions in Part 7 are limited to monarch butterfly.

2.4 NRCS PLANNING PROCEDURES

NRCS's conservation planning technical assistance actions alone do not constitute a federal action, as the NRCS has no control or discretion over the client's decision to implement the planned actions (the client is the decision maker). The technical assistance provided to NRCS clients is embodied in a Conservation Plan (Plan), based on the client's decisions. The Plan documents the client's decisions regarding the treatment of a unit of land meeting planning criteria for one or more identified natural resource concerns as a result of the planning process. The Plan describes the schedule of implementation for selected CPS/E(s) and associated activities needed to address or improve identified natural resource concerns. A plan may include components such as comprehensive nutrient management plan, grazing plan, integrated pest management plan, etc.

However, when the NRCS provides financial assistance to support implementation of a Plan, this constitutes a federal action for the agency. The NRCS action is defined under NRCS policy as "all activities in which NRCS exercises (or fails to exercise) control, responsibility, or jurisdictional authority". The NRCS action most commonly occurs in the form of federal financial assistance but includes other instances where NRCS control or responsibility is exercised (such as authorizing compatible uses on U.S.-held easements or approving easement administration actions) (NRCS, GM-190-410.22 (D)). Most NRCS CPS/Es are implemented under a term-duration contract between the program participant and NRCS where the client agrees to

implement and maintain the affected CPS/Es to address or improve the identified natural resource concerns. Through the contract, the client receives financial assistance for implementation of each CPS/E(s) to NRCS standards and specifications. When the term of the contract expires, the federal nexus for NRCS also expires, except on U.S.-held easements.

NRCS is customer focused and develops and delivers products and services that meet customer/client needs, are technically sound, and provide solutions to identified natural resource concerns.

NRCS' policies and procedures provide an important framework on how NRCS will implement the Proposed Action at the individual producer level and provides details of its technical implementation. As part of the scope of the consultation, Appendix 10.1 provides an overview of NRCS' existing Conservation Planning processes and component elements that will be used to implement the Proposed Action.

2.5 NATURAL RESOURCE CONCERNS

Within the NRCS Planning Process a natural resource concern is defined as a resource condition that does not meet minimum acceptable condition levels as established by resource planning criteria shown in the Field Office Technical Guide (FOTG), Section 3. This implies that the NRCS planning process begins when the condition of a natural resource - soil, water, air, plant, animal, or energy - is degraded to the extent that its sustainability or intended use is impaired. Planning criteria are quantitative or qualitative statements of the minimum level of treatment required to address a given natural resource concern. National Planning criteria are established for all NRCS resource concerns and may be assessed using specific tools or through client input and planner observation. Nationally supported tools that automate and streamline the resource concern assessment process (e.g., Conservation Assessment Ranking Tool or Conservation Desktop) are used to document meeting FOTG planning criteria for conservation program planning purposes.

Below is the FY2024 NRCS national list of Natural Resource Concerns⁴. Further, specific details of how each of the selected CPS/E(s) address these resource concerns is provided in Appendix 10.2.

Soil Resource Concerns	Water Resource Concerns
Sheet and rill erosion	Ponding and flooding
Wind erosion	Seasonal high-water table
Ephemeral gully erosion	Seeps

⁴ <https://www.nrcs.usda.gov/sites/default/files/2024-04/National%20Resource%20Concern%20List%20and%20Planning%20Criteria.pdf>

December 2024

Classic gully erosion Bank erosion from streams, shorelines, or water conveyance channels Subsidence Compaction Organic matter depletion Concentration of salts or other chemicals Soil organism habitat loss or degradation Aggregate instability	Drifted snow Surface water depletion Groundwater depletion Naturally available moisture use Inefficient Irrigation water use Nutrients transported to surface water Nutrients transported to groundwater Pesticides transported to surface water Pesticides transported to groundwater Pathogens and chemicals from manure, bio-solids, or compost applications transported to surface water Pathogens and chemicals from manure, bio-solids, or compost applications transported to groundwater Salts transported to surface water Salts transported to groundwater Petroleum, heavy metals, and other pollutants transported to surface water Petroleum, heavy metals, and other pollutants transported to groundwater Sediment transported to surface water Elevated water temperature
Air Resource Concerns Emissions of particulate matter (PM) and PM precursors Emissions of greenhouse gases (GHGs) Emissions of ozone precursors Objectionable odors Emissions of airborne reactive nitrogen	Animal Resource Concerns Terrestrial habitat for wildlife and invertebrates Aquatic habitat for fish and other organisms Feed and forage imbalance Inadequate livestock shelter Inadequate livestock water quantity, quality, and distribution

Plant Resource Concerns Plant productivity and health Plant structure and composition Plant pest pressure Wildfire hazard from biomass accumulation	Energy Resource Concerns Energy efficiency of equipment and facilities Energy efficiency of field operations
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2.6 CONSERVATION PRACTICE STANDARDS

An NRCS conservation practice standard (CPS) is a structural or vegetative measure, or management activity used to protect or reduce the degradation of one or more of the resource concerns (e.g., of soil, water, air, plant, animal, or energy resources) listed in the Table above. The [National Planning Procedures Handbook \(NPPH\)](#) establishes NRCS national standards for each developed Conservation Practice Standard and Enhancement (2.6 and 2.7) that might be applied to address the identified resource concern (2.5). This includes interim practice standards which are included and analyzed as part of the Proposed Action. The selection of CPS/E(s) is in part dependent upon the land use and associated assessment tools and planning criteria. A CPS defines the practice and establishes criteria that must be followed in order to use the practice for its intended purpose.

Appendices 10.3 and 10.4 provide details of the elements and components of each CPS/E(s). Further, Appendix 10.5 provides the current hyperlinks for each CPS with a short description of their intended purpose(s) and common associated practices. Appendix 10.6 identifies the land uses wherein each CPS is applied/installed. By extension, the similar actions explained in Part 2.7 below are also considered as part of the scope of the action.

Appendix 10.2 presents each resource concern, provides a list of the typical causes that create a resource concern, the conservation actions that NRCS may take to address the resource concern, and a list of CPS/E(s) that accomplish the conservation action and are believed (based upon NRCS's [Conservation Practice Physical Effects matrix](#) (CPPE) to result in moderate to substantial improvement of that resource concern once implemented.

Each state's NRCS office adopts and may adjust those practices that are applicable in that state⁵.

⁵ All state-specific conservation practice standards are available in the Electronic Field Office Technical Guide (eFOTG, available at <http://www.nrcs.usda.gov/technical/efotg/>). To find a specific standard, use the interactive maps on eFOTG to select the appropriate state and county. Then select Section IV from the menu at the left side of the screen for a list of practice standards available in that state.

Appendix 10.9 presents the last 3 years of available data on the frequency of use and unit of measure across the Action Area.

2.7 CONSERVATION STEWARDSHIP PROGRAM ENHANCEMENTS

In addition to conservation practice standards, the NRCS utilizes enhancement activities (Enhancements (E)) through the Conservation Stewardship Program (CSP). Enhancements are similar to conservation practices in that they are used to improve natural resources (e.g., address resource concerns), except they are applied in a manner that exceeds the minimum treatment requirement in the conservation practice standards. Essentially, they increase the management intensity level of their corresponding practice in order to achieve results that meet or exceed the sustainable level for the resource concerns (i.e., higher level of beneficial outcome).

Most CSP applicants have already applied conservation practices to their land. Through CSP, producers can further improve their conservation efforts with conservation activities called “enhancements.”

Enhancements allow a producer to address additional levels of conservation beyond what the minimum conservation practice standard requires. CSP applicants work one-on-one with their NRCS conservation planner to select enhancements that best fit their management goals and will address resource concerns on the enrolled land.

Because enhancements are tied directly to a USDA Farm Bill program (unlike conservation practices) they tend to evolve and change with each fiscal year. However, their effects can be evaluated in this CO because regardless of the changes made, each enhancement must correlate and adhere to a conservation practice standard. This correlation is made at the national level to maintain consistency in application across the nation. The below Table 1 illustrates this concept:

Table 1: Crosswalk of Conservation Practices and Enhancements

CPS Code ⁶	CPS Name	CSP ⁷ Enhancement Code(s)	CPS/E ⁸ Name
Seasonal Water Development and Management	646	E646A	Close structures to capture and retain rainfall for waterfowl and wading bird winter habitat.

⁶ CPS = Conservation Practice Standard

⁷CPS/E = Conservation Practice Standard and Enhancements, CSP = Conservation Stewardship Program

⁸ CPS = Conservation Practice Standard, CPS/E = Conservation Practice Standard and Enhancements, CSP = Conservation Stewardship Program

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		E646B	Extend retention of captured rainfall for migratory waterfowl and wading bird late winter habitat.
		E646C	Manipulate vegetation and maintain closed structures for shorebirds mid-summer habitat.
		E646D	Manipulate vegetation and maintain closed structures for shorebird late summer habitat.

Additional information the elements and structure of Enhancements is found in Appendix 10.7.

Further, Appendix 10.9 presents the last 3 years of available data on the frequency of use and unit of measure of the Enhancements across the Action Area.

2.8 CATEGORIES OF ACTIONS AND ACTIVITIES

2.8.1 Activities not part of the Proposed Action

It is also important to identify that NRCS policies and procedures do not result in the following consequences of the Proposed Action:

- Conversion of natural land uses to monoculture pastureland, commercial forestry, or cropland.
- Conversion to residential, industrial, or commercial development.
- Conversion of native rangelands to monoculture hay or pastureland.
- Siting, construction or the conversion of natural lands uses to commercial mining operations, renewable energy, or those related to fossil fuel extraction and processing, nor their supporting industries.
- Public infrastructure (e.g., roads, bridges, transmission lines).

2.8.2 Activities part of the Proposed Action

All activities included in the Proposed Action involve the implementation of CPS/E(s) to improve the condition of natural resources (such that planning criteria is met or improved for the identified resource concern) within the context of ongoing agricultural operations. The ongoing agricultural activities are not part of the Proposed Action but provide the baseline against which the natural resource conservation benefit of the Proposed Action can be measured.

Although some short-term and temporary adverse effects to monarchs and monarch habitat (e.g. temporary soil disturbance and loss of supportive vegetation) may be expected from the

implementation of CPS/E(s), all NRCS conservation actions have the express purpose of improving the condition of natural resources on agricultural lands to produce long-term benefits within the landscape. The improvement of natural resource conditions through the continued implementation of NRCS CPS/E(s) will provide direct and indirect benefits to monarchs and monarch habitat that far exceeds any temporary adverse effects.

Eligible agricultural land uses on which conservation practices are implemented to address natural resource concerns are described briefly below. Additional information can be found in the NPPH. Additionally, Appendix 10.2 provides, for each resource concern, causes creating the resource concern, conservation actions that can be taken to address the resource concern and a list of practices that, when implemented as part of the conservation action, most effectively address the resource concern such that planning criteria is met. (Planning criteria and method for assessing planning criteria for each resource concern can be found at [Natural Resources Conservation Service \(NRCS\) Resource Concern List and Planning Criteria](#)).

2.8.2.1 Land Use Definition⁹ – Crop

Land used primarily for the production and harvest of annual or perennial field, forage, food, fiber, horticultural, orchard, vineyard, or energy crops.

2.8.2.2 Land Use Definition - Forest

Land on which the historic and/or introduced vegetation is predominantly tree cover managed for the production of wood products or non-timber forest products.

2.8.2.3 Land Use Definition – Range

Land on which the historic and/or introduced vegetation is predominantly grasses, grass-like plants, forbs or shrubs managed as natural ecosystem. Range land may include natural grasslands, savannas, shrublands, tundra, alpine communities, marshes and meadows.

2.8.2.4 Land Use Definition – Pasture

Land composed of introduced or domesticated native forage species that is used primarily for the production of livestock. Pastures receive periodic renovation and cultural treatments, such as tillage, fertilization, mowing, weed control, and may be irrigated. Pastures are not in rotation with crops.

2.8.2.5 Land Use Definition – Designated Protected Areas

Land or water used for the preservation, protection, and observation of the existing resources, archaeological or historical interpretation, resource interpretation, or for aesthetic value. These areas are officially designated by legislation or other authorities. Examples: legislated natural or scenic areas and rural burial plots.

⁹ See glossary for descriptions of the land uses characterized in this Part.

2.8.2.6 Land Use Definition – Farmstead

Land used for facilities and supporting infrastructure where farming, forestry, animal husbandry, and ranching activities are often initiated. This may include dwellings, equipment storage, plus farm input and output storage and handling facilities. Also includes land dedicated to the facilitation and production of high-intensity animal agriculture in a containment facility where daily nutritional requirements are obtained from other lands or feed sources.

2.8.2.7 Land Use Definition – Developed Land

Land occupied by buildings and related facilities used for residences, commercial sites, public highways, airports, and open space associated with towns and cities.

2.8.2.8 Land Use Definition – Water

Geographic area whose dominant characteristic is open water or permanent ice or snow. May include intermingled land, including tidal-influenced coastal marsh lands.

2.8.2.9 Land Use Definition – Other

Land that is barren, sandy, rocky, or that is impacted by the extraction of natural resources, such as minerals, gravel or sand, coal, shale, rock, oil, or natural gas.

2.8.2.10 Land Use Definition – Associated Agricultural Land

Land associated with farms and ranches that are not purposefully managed for food, forage, or fiber and are typically associated with nearby production or conservation lands. This could include incidental areas, such as idle center pivot corners, odd areas, ditches and watercourses, riparian areas, field edges, seasonal and permanent wetlands, and other similar areas.

2.9 ACTION AREA

The “Action Area” is defined as “all areas to be affected directly or indirectly by the Proposed Action and not merely the immediate area involved in the action.” (50CFR §402.02) The geographic scope of the Proposed Action is all eligible land units in all U.S. states and territories (represented in Figure 2-1 below). For a land unit to be eligible, it must be associated with an agricultural producer or legal entity who has successfully completed all of the USDA’s formal application processes and meets all the criteria established for participation in and receipt of funds through NRCS conservation programs authorized under the Farm Bill.



Figure 2- 1. Action Area

3 STATUS OF MONARCH BUTTERFLY

This Part summarizes best available data about the biology and condition of the monarch butterfly that are relevant to the Service's conference opinion about the effects of the Proposed Action. The Service published its decision that the listing of the monarch butterfly was warranted but precluded by higher priority listing actions on December 15, 2020 (85 Federal Register 818813). The Service recently completed a Species Status Assessment (SSA) for the monarch as part of its evaluation (Service 2020). Status information presented here is taken from the SSA and additional sources.

3.1 SPECIES DESCRIPTION

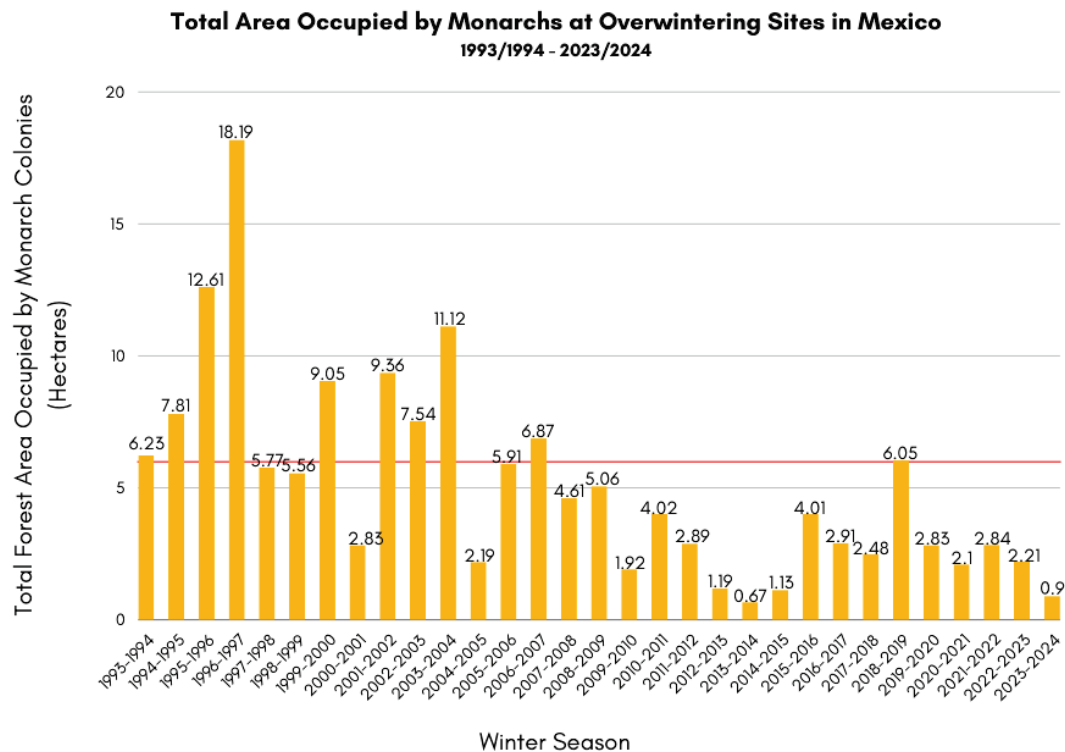
The monarch is a species of butterfly in the order Lepidoptera (family Nymphalidae) with many subspecies that occur throughout North, Central, and South America; Australia; New Zealand; islands of the Pacific and Caribbean; and elsewhere (Malcolm and Zalucki 1993). Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border

and covered with black veins. The black border has a double row of white spots, present on the upper side and lower side of forewings and hindwings (Bouseman and Sternburg 2001, p. 222). Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches (Secretariat of the Commission for Environmental Cooperation (CEC) 2008, p. 11). The bright coloring of a monarch serves as a warning to predators that they can be toxic. *Plexippus plexippus* is the subspecies occurring within the U.S.

3.2 STATUS OF MONARCHS IN EASTERN NORTH AMERICA

Annual winter population estimates of the Eastern North American (ENA) monarch population have been conducted in Mexico since the winter of 1993-1994 (Vidal and Rendón-Salinas 2014, p. 167-168). These estimates are determined by identifying and measuring the area occupied by overwintering colonies of monarchs in and near the Monarch Butterfly Biosphere Reserve in Mexico and assuming a density of 21.1 million monarch per hectare (ha) (Vidal and Rendón-Salinas 2014, Thogmartin *et al.*, 2017a).

Although varying year-to-year, estimates consistently numbered in the hundreds of millions throughout the 1990s and early 2000s and survey data suggest that monarch numbers were as high or higher in the two decades before standardized monitoring began at the Mexican overwintering sites (Calvert and Brower 1986, p. 167-169, Vidal and Rendón-Salinas 2014, p. 172). The latest survey in 2023-2024 the monarchs occupied less than 1 hectare in the reserve (Fig. 3-1). If each hectare is approximately 2.47 acres, with the number of monarchs per hectare variable, but likely between 20-30 million monarchs per hectare (median 21.1, according to Thogmartin *et al.*, 2017), thus the estimated current monarch population is less than 20 million individuals.



Scientists estimate that a minimum of 6 hectares of overwintering monarchs is needed to sustain the eastern populations (Semmens et al., 2016)

Data from 1994-2003 were collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Protected Natural Areas (CONANP) in Mexico. Data from 2004-2024 were collected by the WWF-Telcel Alliance, in coordination with the Directorate of the MBBR. 2000-2001 number as reported by Garcia-Serrano et al. in 2004

Figure 3-1. Total Area occupied by monarch colonies at overwintering sites in Mexico. Source: Monarch Joint Venture – February 2024.

About half of the monarchs that overwinter in Mexico come from the U.S. Midwest and there are multiple hypotheses regarding the primary factors driving the 1990s-present decline (Pleasants and Oberhauser 2013). The milkweed limitation hypothesis contends that the loss of milkweed from croplands in the U.S. Midwest, resulting from the increased and widespread use of herbicide resulted in lower recruitment during spring and summer that led to the declines beginning in about 1993 (Pleasants *et al.* 2023, Shirey and Ries 2023). Glyphosate uses and associated milkweed loss were suggested to be significant predictors of monarch declines beginning in about 1993 or 1994 and up until the mid-2000s (Saunders *et al.* 2018; Shirey and Ries 2023).

In addition to milkweed availability in the U.S. Midwest, authors have pointed to other factors that may be limiting monarch numbers in eastern North America, including mortality during migration (Agrawal and Inamine 2018), and climate change (Zylstra *et al.* 2021; Shirey and Ries 2023) – with the latter two obviously related. Thogmartin (2024) contends that extinction risk of the ENA migratory population depends on its abundance and unpredictable variations in weather that drive annual variations in abundance. He points out that our “current

management tools” likely preclude us from reducing the effects of adverse weather conditions on monarch numbers and that increasing population size through restoration of milkweed is “the most promising means of mitigating” extinction risk.

Shirey and Ries (2023) contend that “the best evidence” supports climate change as the primary driver of the declines since the effects of herbicide use may have plateaued in the mid-2000s. Crossley *et al.* (2022) contend that monarchs in ENA currently “have some ability to recover” from declines observed on the wintering grounds by using available milkweed to fuel “high population growth” during summer. They caution, however, that this may not hold considering increasing threats from climate change (e.g., see Zylstra *et al.* 2022).

Factors that drive numbers of overwintering monarchs wintering in Mexico are likely to continue to vary in space and time and appear to be increasingly unpredictable (Saunders *et al.* 2018, Thogmartin 2024). In addition to milkweed availability, weather, and climate change, factors may include nectar availability in “southern U.S. floral corridors” and amount of dense cover at the overwintering area in Mexico (Saunders *et al.* 2019; Thogmartin 2024).

3.3 STATUS OF MONARCHS IN WESTERN NORTH AMERICA

Since the onset of annual monitoring, numbers of wintering monarch in western North America declined from about 1.2 million to 233,394 in 2023. Data prior to standardized monitoring suggest that the western population numbered at least four million monarchs in the 1980s (Schultz *et al.* 2017, p. 3). After 1997, numbers have never climbed back above one million and have remained in the hundreds of thousands or below (Fig. 3-2). After a precipitous decline that began in 2018 and lasted for two more years, monarch numbers climbed back to approximate pre-2018 levels in 2021 (Fig. 3-2). A decline in overwinter survival may be a primary factor in the decline of monarchs at overwintering sites, but other factors are likely also contributing (Edwards *et al.* 2023). James (2024), for example, contends that record-high temperatures in California (CA) during the fall of 2020 caused migratory monarchs to stop short of the wintering areas to reproduce.

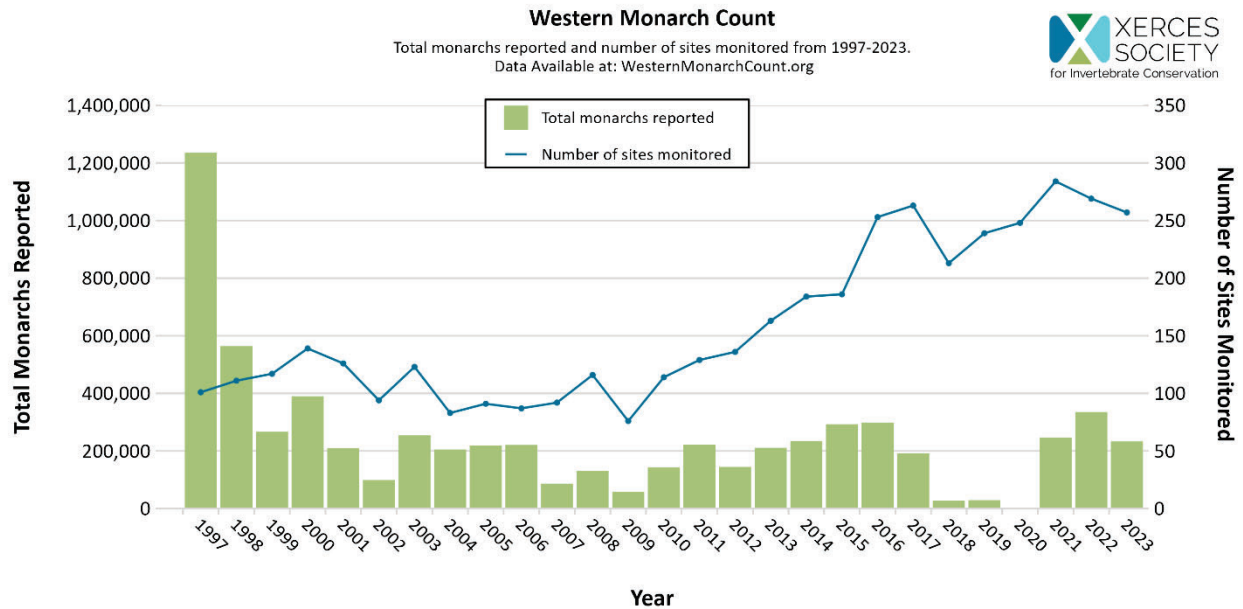


Figure 3-2. Western monarch Thanksgiving count results, 1998 through 2023.: Source Xerces Society website.

In addition to the decline in numbers of monarchs in the West, the summer range of monarchs has also contracted (Crone and Schultz 2021, Edwards *et al.* 2023). Before 2018, the maximum migration distance of monarchs in the West had declined somewhat from the distance first estimated in 1975. After 2018, however, it reduced drastically to about 600 km – about 43% shorter than in 1975 (Edwards *et al.* 2023).

In addition to a contraction in the summer range, resident populations have become established in CA. These populations may be able to persist, but are unlikely to have the reproductive capacity to expand inland from the resident areas (Crone and Schultz 2021). Others posit that this shift indicates a sustained change in overwintering strategy by western monarchs due to rising temperatures (James 2024).

3.4 HAWAII POPULATION

There is little data available on the population of monarch butterflies that exist in Hawaii. The Service's 2020 SSA noted that the monarch is extant in Hawaii, but there are no known trends in population, milkweed or nectar resources, impacts from insecticides or predators/parasites and overall condition (Service 2020).

3.5 LIFE HISTORY AND RESOURCE NEEDS

This Part provides a summary of the monarch's resource needs. Resource needs are features that may be essential for the monarch to fulfill its life cycle.

In addition to describing resource needs, information on recent trends in monarch resource availability, factors that may be driving those trends, and how the changes in monarch

resources may affect the species are described. Emphasis is information that may be especially relevant to the interplay between applications of the CPS/E(s) and monarch habitat. Some mention on vectors in which herbicides could affect the way that monarch interacts with its resources is noted, but the effects of herbicides to the monarch is not a primary focus of this Part. Potential effects of pesticides – from non-federal actions - to the monarch in the Action Area are addressed primarily under Cumulative Effects.

3.5.1 Milkweed

Monarchs lay eggs on plants in the milkweed family (Asclepiadaceae), primarily those in the genus *Asclepias*. Monarchs regularly use more than 30 species of milkweed in the wild (de Roode 2015). The amount of milkweed habitat available to the monarch is the ultimate factor influencing its numbers during summer. Milkweed habitat “sets a ceiling for the size of the summer population but temperature and precipitation, and other factors, determine whether that ceiling can be reached” (Pleasants *et al.* 2023).

3.5.1.1 Eggs and Larvae

After hatching two to five days after eggs are laid, monarch larvae begin feeding on milkweed (Zalucki 1982, p. 242, Zalucki and Brower 1992, p. 81, Secretariat of the Commission for Environmental Cooperation (CEC) 2008, p. 12). Larvae develop through five larval instars (intervals between molts) over 9 to 18 days, growing from about 2-45 mm in length before pupating. The larva then pupate into chrysalis before eclosing 6 to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; in migratory populations the overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months (Cockrell *et al.* 1993; Herman and Tatar 2001) (Figure 3-3). The number of generations of monarchs produced in a given year can vary between three and five and is dependent upon environmental conditions (Brower 1996). Monarchs cannot develop in temperatures lower than 12°C (53°F) or higher than 33°C (91°F) (Zalucki 1982).

Larvae sequester toxic cardenolides from the milkweed that can serve as a defense against some predators (Parsons 1965, p. 299). The types and levels of cardenolides vary among milkweed species and may mediate effects of parasites and parasitoids and even affect flight abilities of adults (see, Milkweed Species Richness, below). The cardenolides defense mechanism is often overstated, as predation (primarily by invertebrate predators) on eggs and larvae can be high, with estimated survival through the second instar of about 2% in one study (de Roode 2015) and 13-19% in another study (Scott *et al.* 2022).

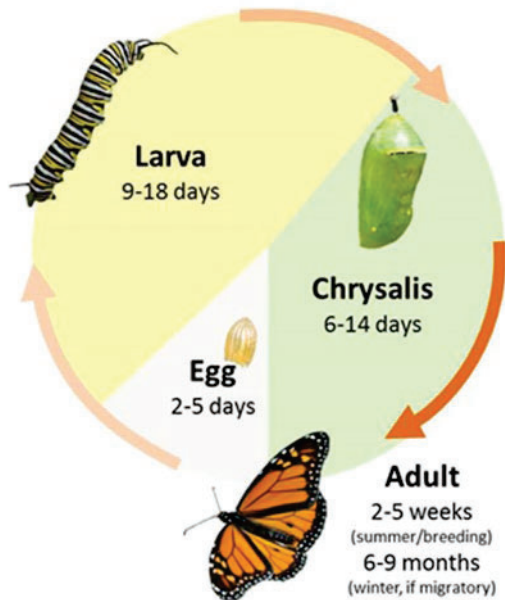


Figure 3-3. Monarch life cycle.

In a few parts of North America and in most areas outside North America, monarchs breed year-round, repeatedly following the above-referenced life cycle throughout the year. However, monarchs in temperate climates such as in eastern and western North America undergo long-distance migration, where the migratory generation of adults enters reproductive diapause and lives for an extended period of time (Herman and Tatar 2001). In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km (Urquhart and Urquhart 1978) and last for over two months (Brower 1996).

3.5.1.2 Milkweed Abundance and Monarch Productivity

Monarch productivity generally increases with milkweed abundance until other factors take effect. In the range of common milkweed (*A. syriaca*, Fig. 3-4), egg and larval density may increase with milkweed density up to about 6,000 milkweed stems per ha ($\approx 2,428$ stems per acre) and high milkweed abundance may also lead to higher survival rates of both eggs and larvae (Nail *et al.* 2015b, Kasten *et al.* 2016).

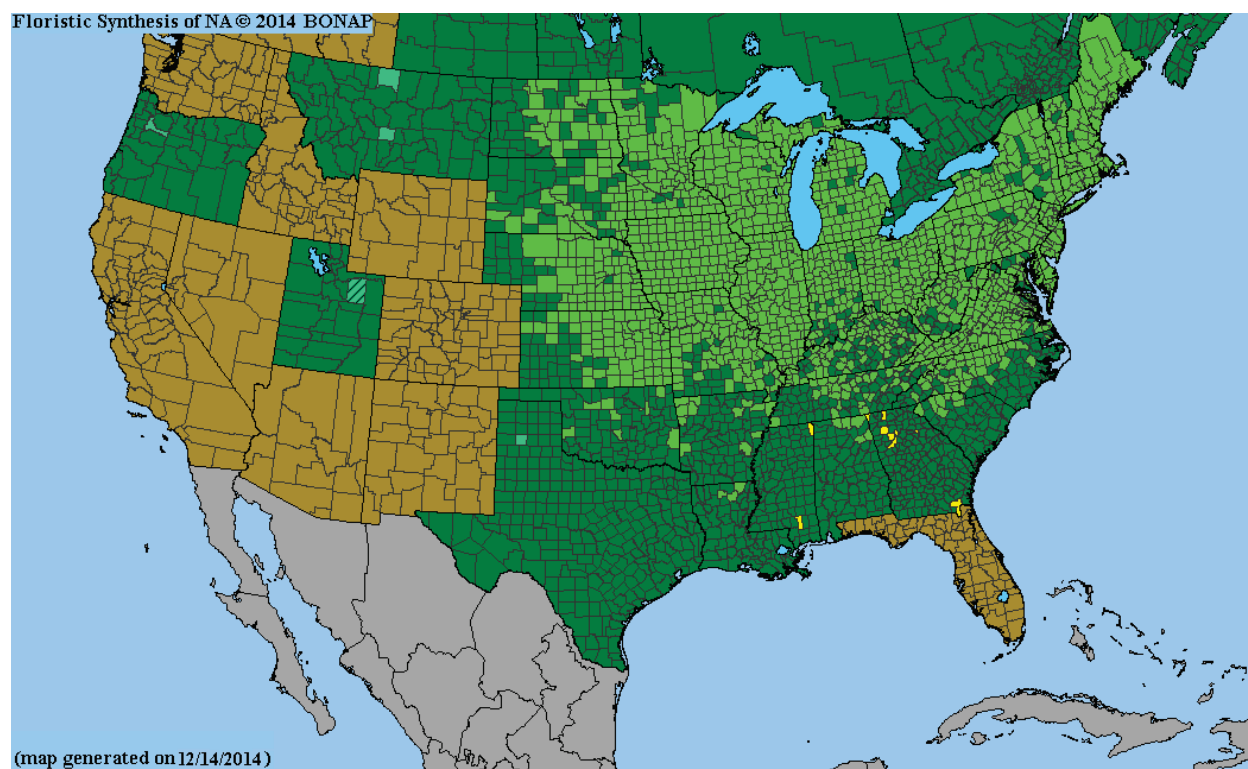


Figure 3-4. County distribution of common milkweed (*Asclepias syriaca*). Light green counties and dark green states contain records for the species. Its presence is “Questionable” in cross-hatched counties; “present and rare” in yellow counties; and “adventive” in teal counties. Source: The Biota of North America Program, North American Vascular Flora, <http://www.bonap.org/>.

High milkweed stem densities may boost productivity by reducing starvation of larvae, which typically require multiple stems during development. Monarch larvae feed and grow the fastest on young milkweed plants, especially early in development, and can consume entire plants (Yang and Censer 2020). Single larvae typically leave the stem on which they hatched after 6-7 days without consuming all available leaf tissue and search randomly for other milkweed stems (Fisher 2021). Isolated milkweed stems are unlikely to support larvae to pupation and large patches of milkweed and high stem densities could reduce the number of larvae that die by starvation (Yang and Censer 2020).

Density and diversity of milkweed may be higher in remnant natural habitats, but common milkweed readily colonizes habitat restoration sites. In Iowa (IA), milkweed densities were highest in remnant (never plowed) prairie preserves (8,705 stems/ha), intermediate in roadside plantings (1,274 stems/ha), and lowest in non-linear “conservation” plantings (212 stems/ha) (Kaul and Wilsey 2019). Milkweed was included in the seed mix at only three of the 93 planting sites. Remnant prairies also contained the diversity highest of milkweed species. Lukens *et al.* (2020) studied 61 sites in IA, Minnesota (MN) and Wisconsin (WI) about six years after seeding, with common milkweed present at 96-100% of sites - whether it was included in the seed mixes or not - and present at high densities (1,218 – 1,526 stems per ha).

Inclusion of milkweed species unlikely to colonize naturally in seed mixes is likely to increase milkweed abundance and diversity, at least in the Upper Midwest. At the 61 restoration sites studied by Lukens *et al.* (2020), swamp milkweed (*A. incarnata*) and butterfly milkweed (*A. tuberosa*) colonized some sites where they were not included in seed mixes. Mean densities of the species, however, were higher where they were seeded – (1-2 plants per ha versus 367 and 132 plants per ha), for swamp milkweed and butterfly milkweed, respectively.

Monarch breeding during the fall can be an important contributor to overwintering numbers in years when milkweed availability is high in the southern U.S. (Scott *et al.* 2022). During what may typically be regarded as the fall migration period, monarchs breed in some years from September through November on native milkweeds in west Texas (TX) (Brym *et al.* 2018; 2020; Tracey *et al.* 2022). In 2018, for example, a high quantity and quality of milkweed stems after high precipitation led to a local peak abundance of eggs and larvae on milkweed that preceded the peak migration through the study area by about 26 and 16 days, respectively (Brym *et al.* 2018; 2020). Flockhart *et al.* (2017) estimated that fall breeding monarchs may contribute from 11 to (upwards of) 30 percent of the total butterflies which winter in Mexico.

3.5.1.3 Effects of Milkweed Species and Diversity on Monarch Egg-Laying and Larval Growth

3.5.1.3.1 Egg-Laying Preferences

Increased milkweed diversity and inclusion of certain milkweed species in midwestern restoration plantings could ensure monarchs' preferred species for egg laying are available and could increase numbers of eggs laid. Among the nine milkweed species that occur in IA, females appear to prefer swamp milkweed for egg laying and they laid more eggs when able to choose among four milkweed species than when only one species was available (Pocius *et al.* 2018a; b).

A preference for swamp milkweed for egg laying has also been demonstrated in direct tests against both common milkweed and butterfly weed (Ladner and Altizer 2005, Potter *et al.* 2020). Monarchs also laid high numbers of eggs on common milkweed, but a layer of trichomes (hair-like appendages, Levin 1973) on butterfly milkweed leaves that “may inhibit oviposition or decrease a female's ability to sense leaf chemicals” (Pocius *et al.* 2018a; b)

Egg-laying preferences between milkweed species have also been noted in the Southwest. In a comparison of two southwestern U.S. milkweed species that are commonly available for planting, monarchs were more likely to lay eggs on Arizona (AZ) milkweed (*A. angustifolia*) than on pineneedle milkweed (*A. linaria*) (Pegram and Melkonoff 2020).

Egg-laying preferences between milkweed taxa in some situations may contrast with differences in larval growth rates and adult cardenolide levels. When laying eggs, monarchs preferred the subspecies *A. incarnata pulchra* in some circumstances despite slower larval growth rates and lower adult concentrations of cardenolides than in the group that fed on *A.*

incarnata incarnata (Jones and Agrawal 2019). The authors speculated that this preference could be related to the higher predator defenses afforded by the denser trichomes on *A. i. pulchra*. Trichomes on *A. i. pulchra* are dense, as in butterfly milkweed, and it exudes high amounts of latex, a plant defense against herbivory (Jones and Agrawal 2019).

3.5.1.3.2 Larval Growth Rates and Predator Defense Across Milkweed Species

Larval growth rates can vary substantially across milkweed species. In a study of 53 milkweed species, growth of early-stage monarch larvae was almost five times faster on the five “best” host plants than on the five “worst” (Agrawal *et al.* 2015). In AZ, monarch larvae were more likely to be found on AZ milkweed in the field and larval survival and growth and adult size were higher among monarchs reared on AZ milkweed (Pegram and Melkonoff 2020).

In a comparison between two other western species, larvae that fed on narrow-leaved milkweed (*A. fascicularis*) grew faster, had higher survivorship, and were larger than larvae that fed on showy milkweed (*A. speciosa*) (Yang *et al.* 2020). Larvae generally grew faster when they fed on young plants of both species (see *Seasonal Changes*, below). The differences in larval performance between the two milkweed species was more pronounced on older plants. As both species senesced, the relative value to larvae of narrow-leaved milkweed increased, possibly due to an increase in traits useful for defending against herbivory in showy milkweed (Yang and Censer 2020).

3.5.1.4 Milkweed Host Plant Suitability – Seasonal Changes

The suitability of milkweeds for monarchs declines as plants age (Zalucki and Kitching 1982). Monarchs prefer young plants over mature plants for egg laying until they have already laid many eggs and become less “choosy”, and larvae grow faster on young plants (Zalucki and Kitching 1982, Urquhart 1987, p. 89, Bergstrom *et al.* 1994, p. 150-151, Yang *et al.* 2020). The faster growth of larvae that fed on young versus old plants of narrow-leaved milkweed and showy milkweed – two western milkweed species – was due mostly to large differences during the first 24 hours of development when larvae are especially small (Yang *et al.* 2020).

As summer progresses monarchs may be “left with increasingly poor options” for egg laying, but still lay eggs on young leaves around the flower heads or on a cluster of buds on fully grown milkweed plants (Bergstrom *et al.* 1994, p. 151, Haan and Landis 2019, p. 2). Egg-laying also declines after insect damage on at least some clonal milkweed species [e.g., common milkweed and whorled milkweed (*A. verticillata*), He and Agrawal 2020]. Avoidance of insect-damaged plants may be an adaptation to select plants that maximize larval fitness. Larvae that fed on insect-damaged common milkweed, for example, were 20% smaller than those that fed on undamaged plants (Zandt and Agrawal 2004).

3.5.1.5 Effects of Mowing and Fire on Milkweed Resources

Monarchs may increase egg-laying in milkweed patches after they are mowed or burned, but timing of such disturbances would have to be right to ensure a net benefit to monarch productivity. Egg-laying on regenerating stems of butterfly milkweed and swamp milkweed – two non-clonal species – increased after mowing. In green milkweed (*A. viridis*), an important non-clonal monarch host plant in the south-central U.S., Dee and Baum (2019) found that “Limiting mowing during the early summer flowering season could support efforts to maximize host plant and nectar availability for monarchs.” In Oklahoma, mid-summer fires prolonged the availability of milkweed resources for monarchs and increased the number of eggs laid compared to unburned milkweed (Baum and Sharber 2012).

Effects of mowing common milkweed have been mixed. He and Agrawal (2020) reported no differences in egg-laying in mowed versus unmowed common milkweed. Fischer *et al.* (2015) and Knight *et al.* (2019), however, both found significantly more eggs in mowed than in unmowed plots. Monarchs preferred to lay eggs on common milkweed plants 1-3 weeks after they were mowed (Knight *et al.* 2019). Mowing conducted too late in the growing season would produce optimal leaf tissue conditions for larvae after the local peak of egg-laying and could cause high mortality of developing larvae.

Recent work has also focused on whether monarchs have a preference for laying eggs on plants that are regenerating after being cut or burned and whether that behavior translates into higher survival and fitness of eggs and larvae i.e. ‘preference-performance’ relationship (Alcock *et al.* 2016, He and Agrawal 2020). At least one study, conducted in Michigan (MI) addressed this question. In that study, Haan and Landis (2020) found higher survival of 2nd instar larvae on regenerating stems than on uncut controls of common milkweed.

Gravid female monarchs prefer young (more nutritious) plants for egg laying to assure high quality diets for the larva (Baum and Sharber 2012, Fischer *et al.* 2015, and Alcock *et al.* 2016). The availability of young milkweed plants can be limited from mid-summer to fall because the phenology of the most milkweed species is partial or full summer senescence after seed production; thereby, reducing (without disturbance) availability or suitability of milkweeds for monarch reproduction after flowering. Thus, areas may have adequate milkweed resources early in the growing season, but a dearth of milkweed resources later in the growing season. Mowing, burning, or physical removal of top growth prior to seed production resets the plant’s regenerative phenology (with adequate soil moisture). With a strategic top-growth removal strategy (timing, replication, and scale), the land manager can create an un-even age milkweed population (Dee and Baum 2019, Baum and Sharber 2012, Fisher *et al.* 2015, Knight *et al.* 2019, Haan and Landis (2020); Scott *et al.* 2022,) which better mimic the pre-European settlement conditions, where summer disturbances from bison (hoof action), indigenous peoples, and summer burns were common occurrences.

3.5.1.6 Importance of Milkweed Geographic Location in the West

For the population of monarchs that overwinter in CA coastal areas and then migrate inland to breed, availability of milkweed may be especially important in areas where the first generation of monarchs are produced each spring. Pelton *et al.* (2019) suggest increasing the availability of three early emerging native milkweed species to support monarch reproduction in these areas and a few later emerging species that could also be beneficial.

3.5.1.7 Milkweed Species and Parasite Defense

The milkweed species that larvae consume could affect their longevity when infected by parasites or parasitoids. Monarchs infected by the protozoan parasite, *Ophryocystis elektroscirrha* (OE) lived longer when reared on milkweeds with an “intermediate concentration, diversity, and polarity of cardenolides” (Sternberg *et al.* 2012). Infected monarchs that fed on common milkweed lived longer than those that fed on swamp milkweed despite apparent preferences for egg-laying on the latter (see above). (Sternberg *et al.* 2012).

Conversely, after exposure to the parasitoid tachinid fly, *Lespesia archippivora*, monarch larvae that fed on common milkweed were more frequently parasitized and marginally more likely to die than those fed on swamp milkweed (Oberhauser *et al.* 2007, 2015). Estimated incidence of parasitism by tachinid flies on monarch larvae can be high – for example, 90% in some milkweed stands, 30% at conservation sites in Nebraska (NE), and 13% among sites in WI, MI, and North Carolina (NC) – and “the vast majority of monarchs infected by tachinids die” (Oberhauser *et al.* 2007, de Roode 2015, Geest *et al.* 2019).

3.5.1.1 Regional Variation in Effects of Milkweed on the Eastern Monarch Population

The effects of increasing the amounts of milkweed available to monarchs on the viability of the ENA population may depend on the region in which the milkweed is added. Increases in milkweed in the “central region”, for example, may have a greater impact on the size of the overwintering population than similar increases in the south (Fig. 3-5, Solis-Sosa *et al.* 2021). Increasing milkweed in the south, however may play “a paramount role in keeping the population above a critically small size” . Solis-Sosa *et al.* (2021) estimated an optimal allocation of efforts to increase milkweed of 7.35, 92, and 0.15% to the south, central, and northern regions, respectively (Fig. 3-5).

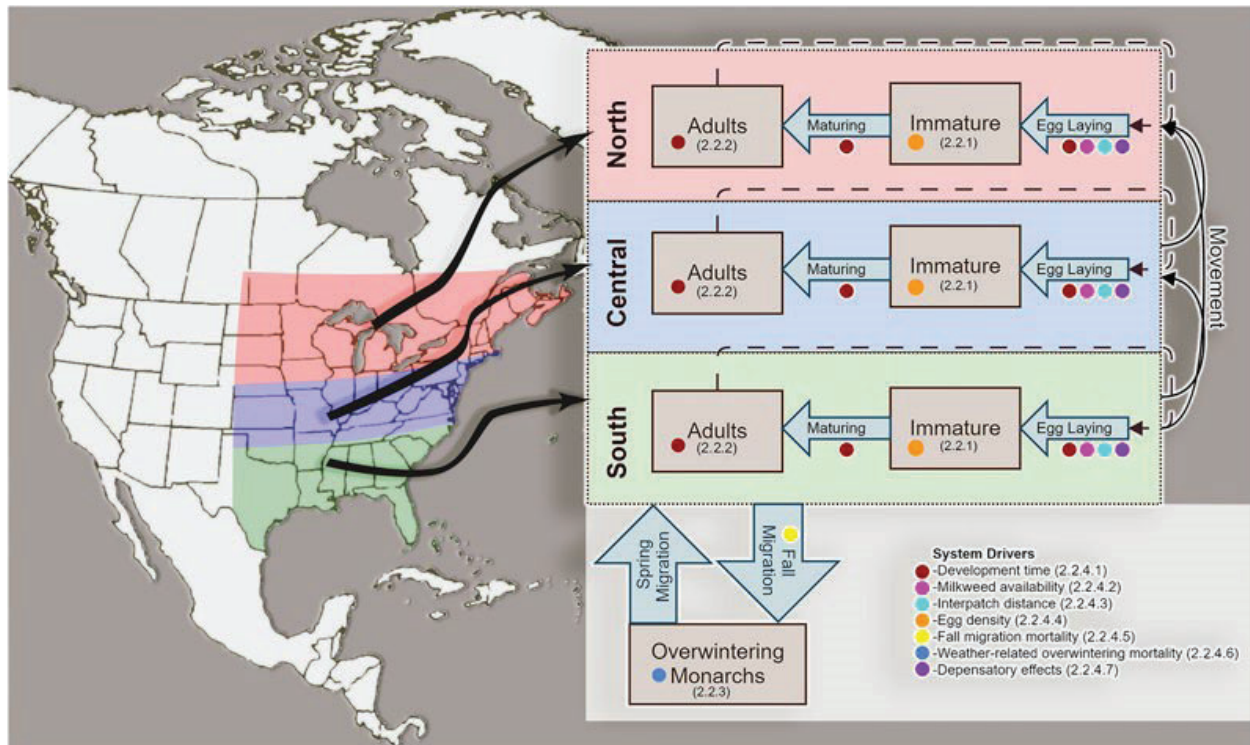


Figure 3-5. Adapted from Solis-Sosa et al. 2021.

3.5.1.2 Effects of Tropical Milkweed on Parasite Prevalence and Migration

The parasite, *Ophryocystis elektroscirrha* (OE), kills and deforms monarchs, but migration decreases its incidence in populations. OE symptoms include death of larvae and wing deformities in adults (Bartel et al. 2011, Satterfield et al. 2016). Migratory monarchs leave breeding areas where OE prevalence is typically high, and migration culls infected individuals (Satterfield et al. 2015, 2016). In year-round resident populations of the monarch, however, high larval densities exacerbate the spread of OE (Lindsey et al. 2009, Satterfield et al. 2015). In the state of CA, for example, OE infection rates were nine times higher in non-migratory monarchs than in migratory monarchs (Satterfield et al. 2016). Migratory monarchs can suffer from increased infection rates when they interact with resident populations. In TX, migrants at sites with resident monarchs were 13 times more likely to be infected by OE (Satterfield et al. 2018).

Establishment of the non-native tropical milkweed (*A. curassavica*) in the U.S. where it is not killed by winter freezes has increased the prevalence of parasitic infections and has facilitated the establishment of new resident monarch populations (Altizer et al. 2000; Satterfield et al. 2016; Crone and Schultz 2021). In areas that do not experience winter freezing, tropical milkweed does not deteriorate in the winter when native milkweed does and becomes a supplemental year-round foliage source for breeding and oviposition when monarchs would otherwise be at overwintering sites in a state of reproductive diapause (Ducat 2020).

Use of tropical milkweed by larvae that later attempt to migrate as adults could also interfere with the type of flight typically used during migration. Monarchs that feed as larvae on tropical milkweed have shorter, wider, and thinner forewings than those that feed on swamp milkweed and common milkweed (Decker *et al.* 2019; Soule *et al.* 2020). Shorter and wider forewings are poorer for the gliding flight used by monarchs during migration.

3.5.1.3 Milkweed Decline in Cropland and Effects of Expanded Corn and Soybean Production in the Midwest

The decline of milkweed in cropland likely had a disproportionate effect on monarch reproduction in the ENA population (Pitman 2017, p. 16; Myers 2019, p. 46). Egg densities per milkweed stem in agricultural fields can be four times greater than in other habitat types (Pleasants and Oberhauser 2013). In addition, predation rates on eggs are typically low in agricultural fields compared to perennial grasslands (Haan and Landis 2019, p. 3; Myers 2019, p. 46; Myers *et al.* 2019).

Milkweed stems in the Midwest declined by 40%-70% between the late 1990s and 2014-2016, with most of the decline occurring from within agricultural fields (Pleasants 2017, p. 7; Zaya *et al.* 2017; Stenoien *et al.* 2018). Decreased milkweed in agricultural fields has been exacerbated by additional losses caused by conversion of natural and semi-natural grasslands for corn and soybean production in the Midwest (see *Habitat Decline – Expanded Corn and Soybean Production in the Midwest*, below).

Conversion of grasslands for corn and soybean production has further compounded effects of herbicide use on the ability of monarchs to locate milkweed on the landscape (Zalucki *et al.* 2016). Between 2008 and 2016, up to about 220 million milkweed stems may have been lost to habitat conversion in the Midwest (Lark *et al.* 2020, p. 4-5). The largest impacts were in the North and South Dakota (ND and SD), IA, and Missouri (MO) due in part to “high proportions of conversion from lands enrolled in the Conservation Reserve Program” (Lark *et al.* 2020, p. 4). On average, cropland expansion in the Midwest may be causing a loss of up to 27.5 million milkweed stems each year (Lark *et al.* 2020, Suppl. Note 1).

3.5.1.4 Climate Change and Milkweed

Changes in the distribution of milkweed species caused by climate change could shift the nature and distribution of monarch breeding habitat. Under the climate change scenarios assessed by Svancara *et al.* (2019), for example, suitable habitat for showy milkweed – a Great Plains and western milkweed species – may decrease slightly whereas it may increase for swamp milkweed – a largely eastern and midwestern species. Shifts in distribution of milkweed could have significant implications for monarch conservation depending on the species-specific effects and changes in the overlap of milkweed with areas where milkweed and monarch conservation is prioritized.

The effects of climate change may further exacerbate effects of tropical milkweed on adult survival. At elevated temperatures designed to reflect future conditions caused by climate change, cardenolide levels increased in tropical milkweed (Faldyn *et al.* 2018). In addition to shorter forewings, monarchs that fed on the tropical milkweed grown under simulated warming scenarios have lower adult survival and mass (Faldyn *et al.* 2018).

3.5.1.5 Other Theories on Milkweed/Monarch Declines

Other explanations offered by Boyle *et al.* (2022) suggests that current downward rangewide trends in monarch and milkweed abundance are a return to historically sustainable population sizes. [Specifically, the expansion of milkweed during the large-scale clearing of eastern forests in the 18th and 19th centuries resulted in a range expansion that is now reversing due to regrowth of these forests].

3.5.2 Nectar Resources

3.5.2.1 Adults – Spring Migration and Spring-Fall Breeding

After breaking diapause and mating at overwintering sites, monarchs in migratory populations require sources of nectar to fuel flight and reproduction as they disperse to spring- and summer-breeding areas (Leong *et al.* 1995, p. 46; Hook 1996, p. 16-17). The same butterflies that undertook the autumn migration lay eggs as they encounter milkweed to restart the cycle of generational migration (Malcolm *et al.* 1993, p. 262). Monarchs in the eastern migratory population move as far north as Canada over two to three successive generations and require nectar resources throughout their breeding range (Fig. 3-6; Flockhart *et al.* 2013, p. 4-5).



Figure 3-6. There are three monarch butterfly populations in North America. Two of these populations migrate - eastern (east of the Rocky Mountains) and western (west of the Rocky Mountains). The eastern population overwinters in central Mexico and breeds throughout the U.S. and southern Canada. The western population overwinters along the California coast and breeds across the western states and southern Canada. A non-migratory population of monarch butterflies live in Florida year-round.

In western North America, monarchs move north and east over multiple generations from coastal CA toward the Rockies and to the Pacific Northwest (Urquhart and Urquhart 1977, p. 1585; Nagano *et al.* 1993, p. 157). In the West, nectar and milkweed are often associated with riparian corridors and milkweed may function as a principal nectar source (Dingle *et al.* 2005, p. 494; Dilts *et al.* 2018, p. 8; The Xerces Society 2018, p. 18; Waterbury and Potter 2018, p. 38).

Some plant species stand out as important nectar sources. In ND, for example, milkweeds, native thistles (*Cirsium* spp.) and blazing stars (*Liatis* spp.) are “particularly important” nectar sources (Antonsen *et al.* 2021). The importance of species in these groups was consistent throughout the state and across the three years of the study. Monarch abundance at a site was also consistently and positively related to the availability of flowering milkweed (Antonsen *et al.* 2021). At least nine species in the aster family are especially important as sources of nectar for migrating monarchs in TX, especially frostweed (*Verbesina virginica*) (Brower *et al.* 2015).

Abundant floral resources can typify habitats that are important for reproduction. At sites managed for to promote young forests or young shrublands within a deciduous forest-dominated landscape in Minnesota (MN) and WI, for example, the presence of immature monarchs was positively associated with floral abundance (Keele *et al.* 2023).

3.5.2.1.1 Eastern North America

Nectar availability for fall migrating monarchs in the ENA population can affect the size of the wintering population in Mexico (Inamine *et al.* 2016; Saunders *et al.* 2019). Monarchs in the ENA population store fat to increase the odds of surviving winter by nectaring extensively during migration. They store more fat when migrating than during breeding and low nectar availability due to drought or other factors could result in fewer monarchs on the wintering grounds (Saunders *et al.* 2019).

Nectar resources for migrating monarchs may be important throughout the Great Plains but may be especially critical in the “Central Funnel” in Oklahoma (OK), TX, and into Mexico (Tracy *et al.* 2019). Monarchs begin to store fat early in migration but may undergo a behavioral shift and increase time nectaring when they reach TX (Brower *et al.* 2006, p. 1135-1137; Tracy 2018, p. 85). Broad distribution of nectar resources throughout the Central Funnel may be critical because migratory routes shift up to 200 km east to west (Tracy *et al.* 2019).

Multiple factors, including the reduction in extent of natural areas and effects of widespread herbicide use, have reduced nectar resources for migrating monarchs (Brower *et al.* 2006; Tracy *et al.* 2019). In some areas disruption of natural processes, especially fire, has also played a role. Fire suppression in the forested portions of the Ouachita Mountains Physiographic Region in northern Arkansas (AR), for example, appears to have restricted nectar resources during fall migration to disturbed areas like road and utility rights-of-way (Rudolph *et al.* 2006, p. 168).

3.5.2.1.2 Western North America

Nectaring resources in migratory corridors in the western U.S. may be especially important for monarchs in the Western North America migrating population. Data from monarchs tagged in the southwestern states in the fall suggest that those in Nevada migrate to CA, those in New Mexico (NM), migrate to Mexico, and those in AZ migrate to either Mexico or CA (Morris *et al.* 2015). In the Southwest, migrating monarchs tend to occur more frequently near water sources such as rivers, creeks, roadside ditches, and irrigated gardens (Morris *et al.* 2015, p. 100).

3.5.2.2 Floral Abundance, Establishment, and Enhancement

In addition to its value during migration, abundant and diverse floral resources may also be indicative of habitats important for monarch reproduction. In a deciduous forest-dominated landscape in MN and WI at sites managed to promote young forests or young shrublands for golden-winged warblers (*Vermivora chrysoptera*), for example, the presence of immature monarchs was positively associated with floral abundance (Keele *et al.* 2023).

Efforts to establish highly diverse and abundant nectar resources could increase the value of conservation sites for monarchs. At conservation grasslands in MN, WI, and IA, Lukens *et al.* (2020b) found increased nectar plant establishment at larger sites planted in the fall, but early season nectar sources were infrequent at both newly planted and existing conservation sites. To remedy this, the authors suggested managers consider seeding more early blooming species to provide nectar when monarchs first return in the spring (Lukens *et al.* 2020b). A meta-analysis of studies assembled by Kral-O'Brien *et al.* (2020) found most groups of insect pollinators, including bees, butterflies, flies, moths, and wasps, responded positively to increasing plant species richness, irrespective of location or land use, suggesting the capacity to increase pollinator richness through management strategies that increase plant species richness. However, they also found pollinators in manipulated studies did not consistently respond to increasing plant species richness despite the overall positive relationships in observational and experimental studies, highlighting the importance of plant selection when making management decisions aiming to improve pollinator richness (Kral-O'Brien *et al.* 2020).

Post-planting management can also affect nectar availability for monarchs. In the Upper Midwest, mowing during the growing season can reduce floral abundance and nectaring resources for monarchs for 3-5 weeks (Haan and Landis 2020). However, mowing at 8-12 inches after planting is often needed to control weeds to release the planted flowering species. Some species respond to mowing by blooming later than normal.

3.5.3 Effects of Predation

A diverse suite of arthropod predators prey on monarchs. Hermann *et al.* (2019) reported 36 previously unreported monarch predators, “including representatives from four new orders and ten families.” Even some presumed herbivores readily consumed immature monarchs, “both in a targeted fashion or incidentally as a result of herbivory.”

Predation of eggs and early instar larvae is typically high in grassland but may be low where monarchs can still find milkweed in agricultural fields (Haan and Landis 2019, p. 3; Myers 2019, p. 46). In prairie less than 20% of eggs and first instar larvae survived a 72-hour period compared to greater than 70% survival in corn (Myers *et al.* 2019). Differences during the two other periods studied resulted in only insignificant differences between the two treatments (Myers *et al.* 2019, p. 680).

Disturbance (e.g., mowing) may reduce predation pressure indirectly by removing aphid-infested stems that attract predators and by resetting milkweed phenology (Haan and Landis 2019, p. 3). Regenerating milkweed stems host lower predator densities (Haan and Landis 2020).

3.5.4 Cover and Roosting Habitat

3.5.4.1 Cover for Pupae

When ready to pupate, monarch larvae leave the milkweed plant on which it has been feeding to find a site on which to pupate safely and emerge without wing distortion (Urquhart 1987). Monarch larvae attach to a variety of features that provide shelter from sun and rain. This includes undersides of leaves, suspended logs, and tree limbs (Urquhart 1987). Exposure to sun and rain can cause pupae to overheat and to become detached from their support, respectively (Urquhart 1987). If the silk connection between the chrysalis and its supporting features fails due to saturation, the pupa can fall to the ground where it may be at increased risk of predation and of developing distorted wings when emerging (Urquhart 1987).

3.5.4.2 Fall Roosting Habitat for Migrating Monarchs

Two North American populations, the migratory populations located east and west of the Rocky Mountains, have been monitored at their respective overwintering sites in Mexico and CA since the mid-1990s. While these populations fluctuate year-to-year with environmental conditions, the census data indicate long-term declines in the population abundance at the overwintering sites in both populations.

3.5.5 Synthesis of Resource Needs

The below table summarizes the requisites for monarch survival and reproduction:

Life Stage	Requirements	Description
Eggs, Larvae, and Adults – breeding	Milkweed resources	Healthy and abundant milkweed is needed for oviposition and larval consumption.
Adult – breeding and migration	Nectar resources	Sufficient quality and quantity of nectar from flowers is needed for adult feeding throughout the breeding and migration seasons.
Adult – overwintering	Suitable habitat for overwintering	Habitat that provides a specific roosting microclimate for overwintering: protection from the elements (e.g., rain, wind, hail, excessive radiation) and moderate temperatures that are warm enough to prevent freezing yet cool enough to prevent lipid depletion. Nectar and clean water sources located near roosting sites.

Adult – migration	Connectivity & phenology	Nectar and milkweed resources along the migration route when butterflies are present; the size and spatial arrangement of habitat patches are generally thought to be important aspects but are not fully understood. Roosting sites may also be important for monarchs along their fall migration route.
All	Suitable climatic conditions	Temperatures, precipitation levels, and other climatic conditions supportive of life processes (e.g., breeding, migrating, and overwintering).

4 ENVIRONMENTAL BASELINE FOR MONARCH BUTTERFLY

This Part describes the best available data about the condition of the monarch butterfly in the Action Area without the consequences caused by the Proposed Action. Per Section 7 of the ESA, the environmental baseline:

“refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Proposed Action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline.”

4.1 ACTION AREA NUMBERS, REPRODUCTION, AND DISTRIBUTION

As stated in Part 3.0, Status of Monarch Butterfly, population numbers for eastern and western monarchs are derived from annual census data taken from the overwintering grounds in Mexico and CA. The SSA noted that little is known about the Hawaiian population of monarchs (Service 2020).

Debate and investigations in the trend, distribution, and rate of change of the monarch butterfly population continues.

Crossley *et al.* (2022) concluded that monarch populations across the U.S may have actually been increasing about 1.3% each year since the mid 1990's. Meehan and Crossley (2023) evaluated wider abundance data rangewide (period between 1993 and 2020) and suggested that the most likely change in abundance over the past ten years was +5.23% and that value was not statistically distinguishable from 0%, suggesting no systematic change in abundance over the past ten years.

Davis *et al.* (2024) suggest the significant decline in the density of roosting monarchs observed during the fall migratory season (Eastern Population) – ostensibly due to increasing migratory mortality rates - explains the apparent drop in monarch numbers from summer breeding to overwintering populations.

Shirey & Ries (2023) synthesized 23 studies that assessed trends and drivers of ENA monarch numbers. They found that drivers of monarch numbers are shifting over time, but that there is consistency in the conclusion that this population is declining. Shirey and Ries, and several of the studies they synthesized, note the importance of both climate and habitat availability as drivers of monarch numbers. They suggest that: 1) pre 1990s declines were likely driven by forest loss in the Mexican overwintering grounds; 2) declines from the mid-1990s to mid-2000s were likely driven by glyphosate use and resultant loss of milkweed in agricultural habitat; 3) post 2005, climate is the primary driver of monarch decline; and 4) there is little evidence supporting increased migratory mortality as a driver in monarch decline.

Through genomic inference and a Bayesian random machine learning method, Boyle *et al.* (2023) found that *Asclepias syriaca* and monarch butterflies have a paired demographic history: their populations increased during glacial recession 10,000-20,000 years ago and increased again ~200 years ago during the conversion of forest and prairie to agriculture. The results showed no effective population reduction for either species over the past 75 years. The authors attributed that this conclusion to either the absence of such a decline, an undetectably small decline in their dataset, or a decline too recent to detect. The study included a novel chromosome-level annotation for *A. syriaca* based on wide scale sampling, from which the researchers deduced that North American milkweed forms a panmictic¹⁰ population; genetic variation is uniform across the population despite its broad range.

Significant scientific debate on interpretations of available data and modelling approaches are continuing. At this time, there are no estimates for numbers within the Action Area and they would vary seasonally as the monarch migrates from overwintering grounds North to southern Canada and from the interior west to overwintering sites in CA and AZ. The Service believes that the trend data is negative for the monarch (Service 2020).

¹⁰ A species exhibiting this trait means random mating within a breeding population

Climate change could cause monarchs to be more abundant in some parts of the U.S. and less abundant in others due to regional variations in temperature and precipitation changes (Zylstra *et al.* 2022).

4.2 ACTION AREA THREATS AND CONSERVATION NEEDS

The recent SSA (Service 2020) listed 11 major influences that affect monarch populations. Of these 11 factors, six potentially occur within the Action Area. These are:

- Availability, spatial distribution, and quality of milkweed
- Availability, quality, and spatial distribution of migration resources
- Disease and natural enemies
- Insecticides
- Availability, spatial distribution, and quality of nectar resources
- Biogeographical scrambling of milkweed spp. (including introduction of non-native species)

These individual influences are described in more detail as laid out in the SSA below.

4.2.1 Availability, Spatial Distribution, and Quality of Milkweed

In total, there are 73 species of native milkweeds in the U.S. (Monarchwatch.org 2024). Some milkweed occur throughout the Action Area but some species are only found in western states. For example, there are approximately 44 species of milkweed (*Asclepias* spp.; family Asclepiadaceae), excluding subspecies, native to western North America of which 20 have been documented as larval hosts for the monarch (The Xerces Society 2018). Milkweeds occur in every Western state but richness and distribution vary widely.

Milkweeds grow in a variety of habitat types from barren desert slopes to wet meadows in both disturbed and undisturbed areas. Some milkweed species are adapted to natural disturbances, and are commonly found on roadsides, along irrigation ditches or canals, in or adjacent to irrigated agricultural fields, in burned areas, or along stream or river banks (e.g., *A. speciosa* and *A. fascicularis*), while others may be more sensitive to disturbance and have more specific habitat associations (e.g., *A. cryptoceraus*) (The Xerces Society 2018).

The availability of milkweed is essential to monarch reproduction and survival. Reduction in milkweed is often cited as a key driver in monarch declines (Brower *et al.* 2012, p. 97; Pleasants and Oberhauser 2013; Inamine *et al.* 2016, p. 1081; Thogmartin *et al.* 2017b, p. 12; Waterbury and Potter 2018, p. 42-44; Saunders *et al.* 2019, p. 8612).

Much of the milkweed loss has occurred in agricultural lands, where intensive herbicide usage for weed control has resulted in widespread milkweed eradication. Pleasants (Pleasants 2017, p. 7), for example, estimated that over 860 million milkweed stems were lost in the Midwest between 1999 and 2014, a decline of almost 40%. Currently, approximately 89% and 94% of

corn and soybean crop acreage, respectively, are planted as glyphosate (herbicide)-tolerant crops (USDA ERS - Recent Trends in GE Adoption 2023). Glyphosate use in western agricultural lands has also increased dramatically since the 1990s, especially within the Central Valley of CA, Snake River Plain of ID, and the Columbia River Basin, which spans the border between WA and OR (USGS NAWQA: The Pesticide National Synthesis Project 2017; Waterbury and Potter 2018, p. 42). As weed species develop increasing resistance to glyphosate, other herbicide (e.g., dicamba) tolerant crops are developed, which can lead to a corresponding increase in herbicide use. Accordingly, herbicide impacts to milkweed and nectar plants will continue to impact monarch resources. However, some authors (Boyle *et al.* 2019) have concluded that monarch and milkweed declines began around 1950 (before the widespread use of genetically modified crops) and continue until the present day.

While milkweeds within cropland systems appear declining, milkweed abundance and distribution on non-federal rangelands appear robust. Spaeth *et al.* (2022) accessed the NRCS' National Resource Inventory (NRI)¹¹ rangeland data set (~23,400 on-site samples; 2,032 sites with milkweed presence) to evaluate milkweed species densities, geolocations, and environmental gradients. Results indicated that twenty-two milkweed species were identified on non-federally owned rangelands across 17 sampled U.S. western states, with seven species comprising 65.5% of milkweed frequency of occurrence. Using the described methods (Spaeth *et al.* 2022 – Table 3) the calculated total milkweed density estimates based on low, midpoint, and high estimates within the study area were 1.3, 4.1, and 6.9 billion plants respectively on 13.2 million ha (32.6 million ac). This is significantly more than other estimates estimated nationally (Thogmartin *et al.* 2017c; Flockhart *et al.* 2015) and across all land uses.

Further, Spaeth *et al.* (2022) found:

- Abundance was heavily concentrated in seven (7) U.S. states (Kansas (KS), TX, SD, ND, OK, and Montana (MT)) which contained 88.8% of the total estimated (e.g., land with milkweed presence).
- In the Central Great Plains – the Northwestern Great Plains, Nebraska Sand Hills, and Flint Hills, Southwestern Tablelands, High Plains, Northwestern Glaciated Plains, and Cross Timbers, Omernik level III ecoregions contained 76.7% of the estimated milkweed plants.

Although similar modelled outcomes are not available to establish an absolute trend and abundance of milkweed (as no NRI data exists that explicitly collected to discern milkweed presence from 1982 to 2004), Spaeth *et al.* (2022) reviewed plant community composition (based upon similarity index) and surmised that rangeland plant community composition on

¹¹ The NRI rangeland on-site study is scientifically based, using a randomized statistical methodology where each NRI sample point has a calculated weighting factor, which represents the number of hectares the sample point represents on the landscape (Nusser and Goebel 1997, Nusser *et al.* 1998, Breidt and Fuller 1999, Yu *et al.* 2017). Detailed explanations of NRI sampling protocols are provided in the USDA-NRCS NRI handbook (USDA-NRCS 2018b).

U.S. non-federal rangeland has been somewhat consistent within expected annual temporal environmental fluctuations, and as a result, it is likely milkweed populations have remained functionally static.

Diffendorfer *et al.* (2024) investigated spring and fall trends in land use and land cover – milkweed and nectar resources – over a 20-year period and ~30 years of climate variables in Mexico and TX. Using described methods and assumptions therein, they estimated a 2.9% decline in milkweed in TX, but little to no change in Mexico; with fall and spring nectar resources declining < 1% in both study extents (Diffendorfer *et al.* 2024).

To the advantage of the monarch, milkweed resources can occur in disturbed and intensively managed land uses – including extremely arid environments (McCoshum and Agrawal 2021) and urban areas (Johnston *et al.* 2019). Further, milkweed resources can be developed and sustained incidentally to water infrastructure and in arid climates can be very important to the species. Waterbury *et al.* (2019) conducted some state wide surveys (states of WA and ID) and reported that indirect watering areas (patches of milkweed receiving supplemental watering from agricultural runoff, sprinkler systems, irrigation canals, roadside ditches, agricultural ponds and at the edges of irrigated fields) were a significant component of the species' state-wide distribution (13% of ID milkweed occurrences (n = 34) and 49% of WA occurrences (n = 183). Such areas are frequently disturbed and not intentionally managed for the monarch but may be nevertheless important to ensuring successful reproduction and migration of the species.

Milkweed may be lost on the landscape through development and conversion of grasslands (Lark *et al.* 2015, p. 3-4). Between 2008 and 2012, a total of 5.7 million acres of grassland were converted to new cropland, including up to 3 million acres of Conservation Reserve Program (CRP) land (Lark *et al.* 2015, p. 5). Pleasants and Oberhauser (2013) estimate that the loss of agricultural milkweeds in the Midwest has resulted in an 81% decline in monarch production, in part because monarch egg densities were higher on milkweed in agricultural fields (3.89 times more eggs than on non-agricultural milkweed). This particularly impacts the ENA monarch population because more Mexico overwintering monarchs originate from the Midwest crop belt region than any other region with estimates ranging from 38% to over 85% of all overwintering monarchs originating from the Midwest (Wassenaar and Hobson 1998 p. 15438-15439; Flockhart *et al.* 2017, p. 4).

Another body of scientific inquiry has led others (Inamine *et al.* 2016; Davis and Dyer 2015) to conclude that milkweed is not a limiting factor; rather, that the elements of the fall migration affecting survival rates (such as nectar sources, habitat fragmentation, the integrity of the overwintering site, etc.) are the keys to the monarch's population dynamics. These authors evaluated the status of monarch butterflies using multiple datasets covering 22 years of monarch monitoring programs across North America to retrospectively investigate associations between population dynamics in different regions, and to identify stages contributing to the recent population decline. Using count data reported to the North American Butterfly

Association (NABA) and other citizen scientist data, the authors analyzed the relationships between butterfly population indices at successive stages of the annual migratory cycle to assess demographic connections and to address the roles of migrant population size versus temporal trends that reflect changes in habitat or resource quality.

Inamine *et al.* (2016) found a sharp annual population decline in the first breeding generation in the southern U.S., driven by the progressively smaller numbers of spring migrants from the overwintering grounds in Mexico, with monarch populations building regionally during the summer generations. Contrary to the work cited above implicating milkweed loss, Inamine *et al.* (2016) did not find statistically significant temporal trends in stage-to-stage population relationships in the mid-western or northeastern USA. In contrast, there are statistically significant negative temporal trends at the overwintering grounds in Mexico; Inamine *et al.* (2016) concluding that monarch success during the fall migration and re-establishment strongly contributes to the butterfly decline.

Davis and Dyer (2015) also conducted a meta-analysis of some of the population status literature and concluded that there had been no decline over the past two decades in summer breeding numbers for the ENA population. Recent work by Pleasants *et al.* (2023), suggest that data evaluated during the pre-(milkweed) eradication period (prior to 2006) resulted in these summer counts not accurately measuring summer population size and therefore the priority conservation action should be to increase milkweed on the landscape.

As the reasons for monarch rangewide changes and declines are continuing to be assessed and investigated, it is clear that *Asclepias* distributions are an important predictor of current monarch distributions in both the ENA population (Lemonie 2015) and Western population (Dilts *et al.* 2019).

4.2.2 Availability, Quality, and Spatial Distribution of Migration Resources

The monarch migration can be characterized by alternating bouts of flying and stopping as the butterflies rest or access nectar resources. At some stopover sites, monarchs form nocturnal roosts in shrubs and trees, with such roosts sometimes including thousands of individuals (Urquhart and Urquhart 1979; Howard and Davis 2009). Monarch' selection strategies for these areas are unknown and cannot generally be predicted. However, Boxler *et al.* (2024) concluded that monarchs predominately roost near fresh water, and in areas where natural vegetation provides nectaring opportunities. Further, that warm, windy areas with low solar radiation were also heavily used, as were south facing slopes and areas with human disturbance.

Some migratory stopover sites are well-known. For example, McCord and Davis (2010) presented information on a 13-year study at one site in coastal South Carolina. The site was characterized as a coastal barrier island with a variety of habitats ranged from maritime forest, maritime shrub and grasslands interspersed with low-intensity residential and commercial

development. The study did not elucidate or draw conclusions on how these features influenced its importance as stopover habitat but focused on monarch capture and tagging.

Davis *et al.* (2022) attempted to characterize the habitats of migratory roost sites (of the ENA population), evaluating 217 roost reports from citizen science observers between 2005 and 2008. In summary (Davis *et al.* 2022) reported that:

- 97.7% of the roosts were reported on 38 species of trees with the most frequently reported¹² species as:
 - pines or other conifers (21.8%)
 - maple species (20.7%)
 - oaks (15.6%)
 - pecans (14.5%)
 - willows (7.8%)
- the remaining occurrences were characterized as herbaceous vegetation, including two observations of monarchs roosting on seaside goldenrod (*Solidago sempervirens*), and one each of common groundsel (*Senecio vulgaris*), beach grass (*Ammophila* sp.), and golden crownbeard (*Verbesina encelioides*).
- At the landscape scale, the authors concluded there was no one land cover type which best predicted the location of monarch roosts throughout the flyway.

Davis *et al.* (2022) concluded that the data and analysis gathered in this effort did not point to a select few landscape features or roost tree types, but instead indicates that monarchs are capable of using a wide variety of habitats for roosting.

Fyson *et al.* (2023), in a related assessment for variables influencing roost site selection in Ontario Canada, suggested that closer distance to the Great Lakes, increased goldenrod *Solidago* spp. cover, moderate forest cover, rural road cover, and urban land cover are all important to roosting site selection.

Most daytime roosting by summer monarchs in eastern WA and ID in response to high temperatures occurs in Russian Olive (*Elaeagnus augustifolia* L.) trees (James 2016; Waterbury 2019). This is likely due to the predominance of this invasive species in the riparian habitats occupied by monarchs; native trees and bushes are used if present (James 2016).

Boxler *et al.* (2024) developed species distribution models of the landscape context of Atlantic flyway roost sites via citizen scientist observations and environmental variables that affect monarchs in the adult stage prior to migration. Their model results predicted that habitat suitable for monarch roosts likely occurred on 2.6 million ha (2.9% of the study area) and fell

¹² For tree selection, no statistically-derived preferences could be extracted from the data.

within two primary areas, one that encompasses the Atlantic Coastal Plain and the other along the ridges of the Appalachian Mountains.

For the Western population, Fisher *et al.* (2024) constructed a species-distribution model for predictive migratory and overwintering habitat selections for monarch and found that the top range-wide predictor was the minimum temperature in December, contributing 83.7% to the model, and was positively associated with presence. At the local scale, the strongest predictors of presence were the range-wide output and percent coverage of low and medium levels of development, contributing > 95%, with 61–63% from the range-wide output, with local-scale suitability coinciding with the CA coastal zones.

The Service believes that the species has a wide tolerance and is adaptable to virtually any lands during migration. The monarch's site occupancy and abundance during migration or roosting on a particular day or location will be dependent on a host of environmental factors operating at different spatial and temporal scales and site-scale selections are ephemeral and unpredictable based upon the current level of scientific understanding. However, availability and suitability of proximate nectar resources or lack thereof in/near roost sites are due to same stressors identified above for milkweed resources. Additionally, with a warming climate, drought impacts may become more important, especially in the western population and in the migratory bottleneck for the ENA population.

4.2.3 Disease and Natural Enemies

Monarchs face pressure from a diverse suite of arthropod predators and predation pressure can be high. Hermann *et al.* (2019) reported 36 previously unreported monarch predators, "including representatives from four new orders and ten families." They found species presumed to be herbivores that readily consumed immature monarchs, "both in a targeted fashion or incidentally as a result of herbivory."

Predation rates on eggs are low in agricultural fields compared to grasslands (Haan and Landis 2019, p. 3; Myers *et al.* 2019, p. 46). In prairie, less than 20% of eggs and first instars survived a 72-hour period in one experimental period compared to greater than 70% survival in corn (Myers *et al.* 2019). Differences in survival in the two other periods studied resulted in only insignificant differences between the two treatments (Myers *et al.* 2019, p. 680). Multiple studies (cited in Haan and Landis 2019, p. 3) documented survival of 2% or less for eggs and early instars. Disturbance (e.g., mowing) may reduce predation pressure indirectly by removing aphid-infested stems that attract predators and by resetting milkweed phenology – vegetative milkweed stems host lower predator densities (Haan and Landis 2019, p. 3).

Parasitism by, *Ophryocystis elektroscirrha* (OE) causes include wing deformities and death of larvae (Bartel *et al.* 2011; Satterfield *et al.* 2016). The incidence of infection is linked to non-native milkweed availability and migration (see Part 4.2.6 for more discussion).

4.2.4 Insecticides

Insecticides are pesticides with chemical properties that are designed to kill insects, and most are non-specific and broad-spectrum in nature. That is, insects exposed to these insecticides are susceptible to mortality and/or sublethal effects. Furthermore, the larvae of many Lepidopterans are considered major pest species and insecticides are tested specifically on this taxon to ensure that they will effectively kill individuals at labeled application rates. Monarchs may also be exposed to insecticides in areas beyond the insecticide application points due to drift (Olaya-Arenas and Kaplan 2019, p. 1; Halsch *et al.* 2020, p. 3).

The monarch is widely distributed across the U.S., occurring in a variety of urban and rural habitat types that include milkweed plants and other flowering forbs. Insecticide impacts to monarchs are primarily influenced by the extent to which monarchs are exposed to insecticides throughout their range. Although insecticide use is most often associated with agricultural production (for example, between 2005 and 2012, 60% of insecticide applied occurred on agricultural lands (U.S. Environmental Protection Agency (USEPA) 2017, p. 11)), any habitat where monarchs are found may be subject to insecticide use. Insecticides can be used for insect pest control anywhere there is a pest outbreak or for general pest prevention. Homeowners may treat yards and gardens to protect plants from pests or purchase plants from nurseries that sell neonicotinoid-treated plants as ornamentals. Natural areas, such as forests and parks, may be treated to control for insects that defoliate, bore into wood, or otherwise damage trees. Outbreaks of pests such as gypsy moths, Mormon crickets, or grasshoppers may trigger insecticide treatments over larger areas to control populations. Use of insecticides in vector control, especially pyrethroids and organophosphates, may be significant in areas of the country where mosquitoes pose a public health threat or reach nuisance levels. The use of insecticides in the U.S. is ubiquitous; in 2012 for example, expenditures on insecticides topped \$5 billion in the U.S., with 64 million pounds used for agriculture, home and garden, and other purposes (USEPA 2017 - Tables 2.2 & 3.1).

The most widely used classes of insecticide include organophosphates, pyrethroids, and neonicotinoids. Neonicotinoids entered the market in the mid- to late-1990s, and because of their high insecticidal activity at low application rates, they are now the most used class of insecticides in the world (Braak *et al.* 2018, p. 507). By 2008, for example, neonicotinoid insecticides accounted for 80% of global seed treatment sales (Jeschke *et al.* 2011, p. 2898), and by 2011, >79% of the corn hectares and 34% to 44% of soybean acreage in the U.S. were planted with neonicotinoid-treated seeds (Douglas and Tooker 2015, p. 5092). Neonicotinoid insecticides are absorbed into plants and distributed throughout their tissues to their stems, leaves, roots, fruits, and flowers. They kill and injure insects by attacking their central nervous system.

Studies looking specifically at dose-response of monarchs to neonicotinoids, organophosphates and pyrethroids have demonstrated monarch toxicity (Krischik *et al.* 2015; James 2019; Bargar *et al.* 2020; Krishnan *et al.* 2020). Moreover, the magnitude of risk posed by insecticides may be

underestimated, as research usually examines the effects of the active ingredient alone, while many of the formulated products contain more than one active insecticide (Krishnan *et al.* 2020, p. 17) – e.g., Swagger contains bifenthrin and imidacloprid (Krishnan *et al.* 2020, p. 17), but see Oberhauser *et al.* (2009, entire). The additional risk posed from compounds added to improve the kill rate (referred to as synergists) are often not assessed. The use of synergists is not uncommon. Olaya-Arenas *et al.* (2019, p. 13), for example, reported that fungicides (often used as a synergist) were most commonly detected on milkweed samples (e.g., 98% of the milkweed sample in one year contained the fungicide, Propiconazole) and, in many of these cases, co-occurred with insecticides like deltamethrin and thiamethoxam.

Van Deynze *et al.* (2024), in a modelling exercise, found the use of insecticides was the best explanatory variable for both loss of butterfly species richness and monarch abundance in the U.S. corn belt (states of MN, WI, IA, Illinois (IL), Indiana (IN), and Ohio (OH)). The authors state that neonicotinoid insecticides (specifically their use as seed coatings for corn and soy beans) appeared to have the greatest impact, but their inference is circumstantial.

4.2.5 Availability, Spatial Distribution, and Quality of Nectar Resources

Reductions in nectar resources are also cited as a potential key driver in monarch declines (Thogmartin *et al.* 2017b, p. 12). Losses of nectar resources are due to the same stressors identified above for milkweed resources. Estimates on nectar resources throughout the Action Area are generally unavailable. Monarchs obtain nectar where available and from a wide-variety of native and non-native forbs and other flowering plants. Plants with the most observations of monarch usage include blazing stars (*Liatris* spp.), beggarticks (*Bidens* spp.), thistles (*Cirsium* spp.), crownbeards or wingstems (*Verbesina* spp.), goldenrods (*Solidago* and *Oligoneuron* spp.), and asters (*Symphyotrichum* spp.); however over 358 native species have been recorded as nectar sources for monarchs (The Xerces Society, n.d.). Further, several large datasets of rangeland and pastureland conditions may provide two rangewide insights into the influence of distribution and trends of monarch nectar resources – at least on those land uses where assessed. While not a complete picture of these resources throughout the Action Area, they provide insight in (1) baseline conditions on forbs and (2) the increasing influence of noxious, invasive, and/or aggressive plant species affecting the ecological health of grasslands

As previously introduced in Part 4.2.1, the NRI¹³ data present rangeland and pastureland conditions nationally. The most recent NRI Pastureland Resource Assessment was completed in 2018 (USDA-NRCS 2018). NRI data have been collected on nearly sixteen hundred non-Federal pastureland sites during 2013-2016 but trend analysis was not discernable from accessed information. Data from the four years were aggregated by six regions. The data collected does not specifically highlight the presence of monarch nectar plants, but it does offer estimates of coverage in five plant species functional groups (leguminous forbs, non-leguminous forbs, cool

¹³ <https://www.cssm.iastate.edu/nri>

season (C3) grasses, warm season (C4¹⁴) grasses, and woody species). Many of the plant species assessed in the first 2 categories (e.g., *Trifolium* spp., *Medicago* spp., *Convolvulus* spp., *Solidago* spp.) offer nectar resources for the monarch.

Results of USDA-NRCS (2018) illustrate some relative abundance of these nectar resources in the various regions is summarized in the following table.

Region ¹⁵	Mean percent - [Relative Foliar Cover (Composition)] Leguminous forbs	Mean percent - [Relative Foliar Cover (Composition)] Non- Leguminous forbs
Midwest	11.0 ± 1.9 percent	12.8 ± 2.2 percent
Northeast	9.2 ± 2.5 percent	23.1 ± 7.1 percent
Northern Plains	9.3 ± 4.3 percent	8.8 ± 1.9 percent
South-Central	3.3 ± 0.8 percent	12.4 ± 2.8 percent
Southeast	8.3 ± 1.0 percent	13.7 ± 1.5 percent
West	8.1 ± 4.3 percent	20.4 ± 8.6 percent

Definitive relationships between these nectar plant resource metrics (richness, density, or abundance) cannot be inferred or established with monarch response. However, at the broad scale, the abundance of bee species is positively correlated with overall herbaceous plant species diversity (Hanula *et al.* 2015). The same positive correlation occurs with butterflies, as Myers *et al.* (2012) found that butterflies were six times more abundant and twice as species rich in restored sites with greater proportions of native forbs than on sites that had less diverse planting mixes.

An evaluation of 120 crop fields seeded to forbs and grasses in Colorado (CO) and MT revealed that 2 to 5 growing seasons after seeding, seeded forb cover was <10% in most fields and no seeded forbs were observed in 23% of fields (Rinella *et al.* 2022). As previously summarized in Part 4.2.1., Diffendorfer *et al.* (2024) estimated a <1% decline in spring and fall nectar resources in southern Texas and northern Mexico.

A more pernicious issue affecting working lands throughout the Action Area is the presence of invasive or aggressive herbaceous and woody species. Although no direct adverse relationships have been established with monarch butterfly distribution and abundance, invasive and

¹⁴ C4 plants are warm season grasses that use a different enzyme and process to photosynthesize than C3 plants. C3 plants are adapted to cool season establishment and growth in either wet or dry environments. On the other hand, C4 plants are more adapted to warm or hot seasonal conditions under moist or dry environments. A feature of C3 grasses is their greater tolerance of frost compared to C4 grasses.

¹⁵ Midwest – principally the states of MN, WI, IA, MO, IL, IN, OH

Northeast – principally the states of WV, PA, NJ, NY, DE, MA, CT, RI, VT, NH, ME

Northern Plains – principally the states of ND, SD, NE, WY, MT, WY, CO, KS

South-Central – principally the states of TX, OK, AR, LA

Southeast – principally the states of MS, TN, KY, VA, SC, NC, GA, FL

West – principally the states of NM, AR, CA, UT, ID, WA, OR

unwanted plants such as the ones profiled below can have profound and adverse changes in native plant species composition, affect broad taxonomic groups such as grassland birds (Lloyd *et al.* 1998; Anderson and Steidl 2023; Lautenbach *et al.* 2017), nectar resources (Clark 2024) and pollinator biodiversity (Arathi *et al.* 2021; Venbergen *et al.* 2018; Kovács-Hostyánszki *et al.* 2022) and even other declining taxa such as reptiles and amphibians (Mitchell *et al.* 2006).

NRI data was recently compiled on over a thousand non-Federal pastureland sites during 2013-2015 (USDA-NRCS 2016). Data was aggregated in accordance with the previous results above (e.g., USDA-NRCS 2018) in six regions. Invasive species group summaries appear below:

Cheatgrass (*Bromus tectorum*) is one of the more prevalent types of annual brome grasses. It has the potential to dramatically alter the ecosystems it invades, and can completely replace native vegetation and can change fire regimes (DiTomaso 2000). Although nationally cheatgrass is present on 14.0 ± 3.6 percent of non-Federal pasturelands, in the West and Northern Plains it is present on 30.1 ± 15.1 percent and 21.6 ± 14.3 percent, respectively. In the Midwest, Southeast, and South-Central regions cheatgrass is present on 15.5 ± 8.5 percent, 12.1 ± 4.7 percent, and 10.6 ± 6.2 percent, respectively, of non-Federal pasturelands.

Annual bromes (*Bromus* spp.) – Annual brome grasses included in this group (including cheatgrass) are highly invasive in shrub communities including sagebrush, and pinyon-juniper and often completely out-compete native grasses and forbs. Communities of annual bromes can be highly flammable in the late spring through early fall (Brooks 2016). Annual bromes are present on 39.4 ± 16.8 percent of non-Federal pasturelands in the West and 29.4 ± 16.5 percent in the Northern Plains region. In the South Central, Midwest, and Southeast regions annual bromes are present on 19.9 ± 7.5 percent, 16.1 ± 8.6 percent, and 15.4 ± 6.3 percent, respectively, of non-Federal pasturelands.

Johnsongrass (*Sorghum halepense*) is a tall, coarse, perennial grass that spreads aggressively via stout rhizomes. It grows in dense clumps or nearly solid stands that prevents growth of desirable vegetation. In the Southeast, South-Central, and Midwest regions, Johnsongrass is present on 23.0 ± 6.2 percent, 10.3 ± 4.5 percent, and 8.9 ± 6.1 percent, respectively, of non-Federal pasturelands. Nationally, Johnsongrass is present on 10.8 ± 2.7 percent of non-Federal pasturelands.

Multiflora rose (*Rosa multiflora*) is a subshrub or vine introduced from Japan to cultivate rose rootstock, but later was used for erosion control and as a component of living fences. Multiflora rose rapidly outcompetes surrounding vegetation, takes over pastures, and lowers crop yields (Johnson 2007, Wenning 2012). Multiflora rose is present on non-Federal pastureland in the Midwest (29.3 ± 8.2 percent), Northeast (21.1 ± 11.8 percent), Southeast (13.2 ± 4.9 percent), and South Central (5.0 ± 4.3 percent). Nationally multiflora rose is present on 12.8 ± 3.1 percent of non-Federal pastureland.

Eastern redcedar (*Juniperus virginiana*) has invaded many areas because of fire suppression and use in windbreaks and visibility screens. As eastern redcedar encroaches into grassland areas, it changes the composition and structure of the plant community. Eastern redcedar can compete with grasses for water, nutrients, and light and reduce forage production (DiTomaso 2000). Eastern redcedar is the most common juniper species observed on non-Federal pasturelands and is present in the Southeast (17.7 ± 5.5 percent), Midwest (11.2 ± 6.0 percent), South Central (3.9 ± 2.5 percent), and Northern Plains (3.4 ± 2.5 percent). Trace amounts are also present in the Northeast.

Junipers (*Juniperus* spp.) Some native invasive woody plant species such as junipers can invade areas replacing native shrubs, grasses, and forbs. Dense stands can alter nutrient and water cycles, and energy flow through the ecosystem, affect hydrology, and reduce wildlife habitat and forage for domestic animals and wildlife (DiTomaso 2000; Archer 1995). Juniper species (including Eastern redcedar, southern junipers, Pacific junipers, and montane and intermontane junipers) are present on non-Federal pastureland in the Southeast (18.6 ± 5.8 percent), Midwest (11.9 ± 6.1 percent), South Central (3.9 ± 2.5 percent), and Northern Plains (3.4 ± 2.5 percent). Trace amounts of juniper species were also observed on non-Federal pasturelands in the West and Northeast. Although southern junipers, Pacific junipers, and montane and intermontane junipers are common on rangelands (USDA-NRCS 2014), they are only present in trace amounts on non-Federal pasturelands in the West.

Japanese honeysuckle (*Lonicera japonica*) is an aggressive vine that seriously alters or destroys the understory and herbaceous layers of plant communities it invades. The shade tolerant vine often occurs along field edges, rights-of-way or in forested areas (Bravo 2005). Japanese honeysuckle is present on 13.2 ± 4.8 percent of non-Federal pastureland in the Southeast and trace amounts are present in the Northeast, Midwest, and South-Central regions.

Mesquite (*Prosopis* spp.) typically has a deep root system that enables it to withstand droughts and severe competition from grasses. Replacement of grasses by mesquite over time modifies the soils and microclimate, facilitating establishment of additional woody species (Archer 1995). Honey mesquite (*P. glandulosa*) and velvet mesquite (*P. velutina*) are the two most common species found in the southwestern U.S. (Ansley 1997). Mesquite is present on 17.0 ± 8.1 percent of non-Federal pastureland in the South-Central region and trace amounts are present in the West.

Although **Kentucky bluegrass** (*Poa pratensis*) is commonly planted on pasturelands especially in the north central and northeastern regions of the U.S. as an important persistent perennial cool-season forage species, it is listed as an invasive weed in the Great Plains. **Canada bluegrass** (*Poa compressa*) may have spread to many areas by contaminated seed for other bluegrass species and may become weedy and invasive in some regions or habitats. In the Great Plains Kentucky and Canada bluegrasses are

present on 86.0 (± 3.7) percent of non-Federal rangeland in North Dakota, 62.8 (± 3.5) percent in South Dakota, 39.9 (± 6.2) percent in Kansas, 37.9 (± 3.7) percent in Nebraska, and 31.7 (± 7.3) percent in Montana (Figures 51-53). Kentucky and Canada bluegrasses are perennial sodforming grasses that spread by strong rhizomes and seeds. These dense stands covering greater than 50 percent of the soil surface account for 38.9 (± 5.8) percent of non-Federal rangeland in North Dakota and 15.1 (± 3.6) percent in South Dakota.

In the subsequent years since this information was compiled, the spread and abundance of these undesired plants species has increased (Palit *et al.* 2021; Pastick *et al.* 2021; Hanberry 2021; Yang *et al.* 2024; Klein and Smith 2020; Eddy *et al.* 2020).

4.2.6 Biogeographical Scrambling of Milkweed (including non-natives species)

Establishment of the non-native tropical milkweed in the U.S. where it is not killed by winter freezes has increased the prevalence of parasitic infections and has facilitated the establishment of newly resident monarch populations (Altizer *et al.* 2000; Satterfield *et al.* 2016; Crone and Schultz 2021). Tropical milkweed does not deteriorate in the winter when native milkweed does and becomes a supplemental year-round foliage source for breeding and oviposition when monarchs would otherwise be in a state of reproductive diapause (Ducat 2020). Migration decreases incidence of the parasite OE, in populations. Migratory monarchs leave breeding areas where OE prevalence is typically high and migration culls infected individuals (Satterfield *et al.* 2015; 2016). Moreover, high larval densities in year-round resident populations can exacerbate the spread of OE (Lindsey *et al.* 2009; Satterfield *et al.* 2015). In CA, OE infection rates were nine times higher in non-migratory monarchs than in migratory monarchs sampled at overwintering sites (Satterfield *et al.* 2016). Migratory monarchs can also suffer from increased infection rates when they interact with resident populations. In Texas, migrant sites with resident monarchs were 13 times more likely to be infected by OE (Satterfield *et al.* 2018).

Monarch use of tropical milkweed may also directly reduce migratory success and larval survival and may cause additional adverse effects at increased temperatures that may result from climate change. Monarchs fed on the tropical milkweed had shorter, wider, and thinner forewings than those that fed on swamp milkweed and common milkweed, which have low and intermediate levels of cardenolides, respectively (Decker *et al.* 2019; Soule *et al.* 2020). Shorter and wider forewings are considered poorer for the gliding flight that is used during migration. At elevated temperatures designed to reflect future conditions caused by climate change, cardenolide levels increased in tropical milkweed (Faldyn *et al.* 2018). In addition to shorter forewings, monarchs that fed on the tropical milkweed grown under the simulated warming scenarios had lower adult survival and mass (Faldyn *et al.* 2018).

4.2.7 Conservation Efforts

While many factors have been implicated in the decline in monarch populations, the loss of milkweed and nectar resources (i.e., breeding and migratory habitat) has been targeted as the

threat that can be most easily addressed through conservation efforts. Protection, restoration, enhancement and creation of habitat is a central aspect of recent monarch conservation strategies, thus highlighting the importance of restoring and enhancing milkweed and nectar resources (Oberhauser *et al.* 2017, p. 6-8; Pleasants 2017, p. 43; Thogmartin *et al.* 2017b, p. 2-3; Midwest Association of Fish and Wildlife Agencies 2018, p. 52; Pelton *et al.* 2019, p. 4-5; Western Association of Fish and Wildlife Agencies 2019). Improved management at overwintering sites in CA has also been targeted to improve the status of western North American monarch butterflies (Pelton *et al.* 2019, p. 4; Western Association of Fish and Wildlife Agencies 2019).

Major conservation plans and efforts include the Mid-America Monarch Conservation Strategy developed by the Midwest Association of Fish and Wildlife Agencies (MAFWA), the Western Monarch Butterfly Conservation Plan developed by the Western Association of Fish and Wildlife Agencies (WAFWA), and the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands (CCAA/CCA) developed by entities from the energy and transportation sectors and the Energy Resources Center at The University of Illinois – Chicago. The Mid-America Monarch Conservation Strategy established a goal of adding 1.3 billion stems of milkweed on the landscape by 2038 (Midwest Association of Fish and Wildlife Agencies 2018). The 1.3 billion stem goal is an estimated goal for adding enough habitat to support 6 hectares of overwintering population for the ENA population (see (Pleasants 2017; Thogmartin *et al.* 2017a) although the number of stems needed may be substantially higher (Solis-Sosa *et al.* 2021). Twenty states—including AR, IL, IN, IA, KS, KY, Maryland (MD), MI, MN, MO, NE, New York (NY), ND, OH, OK, Pennsylvania (PA), SD, TX, West Virginia WV) and WI — have agreed to participate in the effort to reach the 1.3 billion stem goal, which will require contributions from multiple sectors of society, including private land owners, agricultural and non-governmental organizations, rights-of-way organizations, and Federal, state and local governments. The Western Monarch Butterfly Conservation Plan currently encompasses the states of AZ, CA, ID, Nevada (NV), OR, Utah (UT), and WA, which comprise the core of the western monarch range (Western Association of Fish and Wildlife Agencies 2019). The plan includes short-term goals of: 1) protecting and managing 50% of all currently known and active monarch overwintering sites, including 90% of the most important overwintering sites by 2029; and 2) providing a minimum of 50,000 additional acres of monarch-friendly habitat in California’s Central Valley and adjacent foothills by 2029. It also includes overwintering and breeding habitat conservation strategies, education and outreach strategies, and research and monitoring needs. The monarch CCAA will also contribute to the goals of these plans by coordinating and providing guidance to businesses and organizations in the energy and transportation sectors seeking to implement conservation efforts for monarchs. In exchange for implementing voluntary conservation efforts and meeting specific requirements and criteria, those businesses and organizations enrolled in the CCAA will receive assurance from the Service that they will not have to implement additional conservation measures should the species be

listed. The goal of the CCAA is enrollment of up to 26 million acres of land in the agreement, providing over 300 million additional stems of milkweed (Cardno 2020).

Recently, the USDA-Forest Service compiled forest management guidance conducive to strengthening monarch populations on federal lands in the Eastern U.S. (Kirschbaum *et al.* No Date). The strategy promotes effective monarch compatible habitat management across many plant associations found on these federal lands, including prairie/grasslands, glades, open woodlands and oak savannahs, and for streambank/shoreline/wetland habitat.

There are many other conservation efforts implemented under agreements, such as the USDA's Farm Service Agency (FSA) and its role in implementing the Conservation Reserve Program (CRP), which will be critical for meeting MAFWA and WAFWA's stated goals. Additionally, multiple Federal, state and local governments, non-governmental organizations, and private businesses and individuals have provided information about regional and local monarch conservation plans and efforts. Although not associated with any formal plans or agreements, the Service has also obtained information on thousands of small and backyard pollinator gardens through organizations such as Monarch Watch. Several land managers who oversee overwintering sites in CA have developed and implemented grove management strategies (e.g., Ardenwood Historical Farm, Lighthouse Field) or have added monarch groves in their general management plans (e.g., Vandenberg Air Force Base). Others are in the process of developing grove management plans for which funding has already been established (e.g., Ellwood Mesa Complex). At this time, grove management plans have been implemented by at least three overwintering sites and are currently being developed for at least seven more. An additional 37 overwintering sites are on public land that has a general management plan that specifically includes protections for monarch groves (Service 2022). Management and restoration of these sites may include activities such as replacing dead trees, modifying canopy structure, planting fall- and winter-blooming shrubs as nectar sources, and addressing monarch predation issues (Jepsen *et al.* 2015, entire).

The Service developed the Monarch Conservation Database (MCD) to capture information about monarch conservation plans and efforts to inform the listing decision. As of June 1, 2020, there are 48,812 complete monarch conservation effort records in the MCD that have a status of completed, implemented, or planned since 2014, and 113 monarch conservation plans. These efforts constitute a total of 5,635,992 acres (2,280,805 ha) of land area in the continental U.S. and Hawaii (5,534,451 acres (2,239,712 ha) and 97,949 acres (39,638 ha) in the ENA and western populations, respectively) enhanced or created for monarchs, with the most common conservation effort being direct planting of milkweed and other nectar resources [note that these values include all completed, implemented, and not yet completed efforts; completed and implemented efforts to-date total 4,542,323 acres (1,838,212 ha) nationally].

5 EFFECTS OF THE ACTION ON MONARCH BUTTERFLY

Per ESA Section 7 (50 CFR §402.02), *“Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.”*

Consequences to this species may occur later in time and may occur outside the Action Area.

5.1 INTRODUCTION & STRESSOR IDENTIFICATION

Eligible agricultural producers or entities may work with NRCS conservation planners to develop a Conservation Plan with the required elements, including but not limited to identifying resource concerns and the CPS/E(s) selected to address the identified resource concerns.

As described in Part 2, a Conservation Plan can be developed for any eligible land unit in the Action Area. All of the selected CPS/E(s) are then implemented in accordance with the Conservation Plan, which is tailored to the conditions in each planning unit (field, ownership, or defined geographic area) and where necessary evaluated by the existing land use (see Appendices 10.2 and 10.6). Once cross program coordination has occurred to ensure alignment among all Farm Bill program requirements for which the producer may have participated, the CPS/E(s) are implemented/applied and reviewed/certified by the NRCS conservation planner the eligible agricultural producer or entity can receive funding from the appropriate Farm Bill program to cover all or a portion of the cost of the completed work.

In identifying stressors and effects of the Proposed Action, the Service and NRCS accessed available literature both specific to the monarch, as well as other Lepidoptera species and more expansive groups of pollinators such as bees. Vectors of both direct and indirect effects were included. Available literature specific to monarch is explicitly summarized where available but information specific to monarch is limited. Thus, inferences and conclusions are drawn via this comprehensive view of pollinators due to the expected resource overlap and life history requirements of these taxa with the monarch (Part 4.2) as well as the expected similar adverse and beneficial responses to the Proposed Action.

NRCS and the Service worked collaboratively to identified four potential pathways of species stressors resulting from the Proposed Action.

- Human Induced, Unintentional Hazards, Including Noise and Vehicle Mortality
- Habitat Loss and Associated Earth Disturbances

- Vegetative Management (e.g., actions which affect vegetative structure and composition)
- Potential Exposure to Herbicides

Activities that are part of the Proposed Action are described in Part 2 with details provided in the Appendices. Explicitly, Appendix 10.7 provides an at-a-glance view of the potential species stressors and associated adverse effects from each CPS/E(s). Further, indications of beneficial effects are also highlighted, with additional details provided in Part 5.5.

The description of pathways of potential impacts to the species from the Proposed Action is important as it facilitates and informs the level, intensity and duration of risk or benefits at both the programmatic and project level – to the species and its supporting resource needs.

5.1.1 Considerations on Scope, Intensity, And Latency

The extent and magnitude of the effects described below vary based on the time of year the activities associated with the Proposed Action are undertaken, the area and land use where they occur, and the presence and life stage of monarch. Approved Conservation Plans and associated contracts lay out timing of all activities that may occur and consider local conditions and quality criteria objectives in accordance with the NRCS planning procedures.

Appendix 10.9 establishes a 3-year average of the frequency and areal extent of the CPS/E(s) in the Action Area.

It is essential to consider whether the activity is reasonably certain to incidentally take monarchs through effects to habitat (for example, impacts to open habitat that may include milkweed, nectar plants, or both while monarchs may be present), or directly to individuals of any life stage (for example, harm or mortality of eggs, larva, or adults). Specific considerations to the adversity created to the species include the duration of the activity and any latency effects – such as temporary adverse impacts to milkweed and/or floristic resources from the activities – but which will nevertheless generate long term beneficial outcomes. Recovery of the nectar resources may vary from one year to several growing seasons and are dependent upon severity of the treatment, type of treatment, any re-treatment or follow-up disturbances, and current vegetative condition prior to treatment. Milkweeds and nectar resources may recover the same growing season (See discussion within Part 5.4.3). Additional considerations must include environmental and stochastic elements such as weather and precipitation and overall disturbance regime in establishing adverse latency effects; however, no general conclusions can be drawn across the Action Area on this aspect of the analysis.

5.2 HUMAN INDUCED, UNINTENTIONAL DISTURBANCE – INCLUDING NOISE & VEHICLE MORTALITY

All of the CPS/Es, either directly or indirectly, have the potential to produce some level of noise and physical disturbance because they involve the presence of humans and/or associated equipment, vehicles, or machinery where applied in/near occupied habitats. Further, future

periodic disturbances have the potential to occur as maintenance actions for the implemented CPS/E(s) may be needed over their operational life. Sources that generate noise and disturbances might include both motorized (e.g., vehicles, chainsaw, weed trimmer) or nonmotorized (e.g., machete) equipment/ tools, heavy equipment (e.g., skid-steer, tractor, all-terrain vehicle [ATV], utility task vehicle [UTV], bulldozer) and any pull-behind or mounted equipment (e.g., bush hog or mulcher), as well as various equipment and facilities in all land uses where working lands exist.

Monarch caterpillars respond to sounds by freezing, contracting, falling to the ground, flicking their thorax in a vertical direction (Minnich 1936), releasing volatile chemicals (Rothchild and Bergstrom 1997), and increased heart rate (Davis *et al.* 2018) for sound frequencies between 50 and 900 Hz (Taylor and Yack 2019). The primary sound receptors are a pair of long hairs on upper thorax, i.e., upper thoracic trichoid sensilla (Taylor and Yack 2019). Repeated (chronic) exposure of traffic noise causes habituation and did not result in a significant physiological response (Davis *et al.* 2018). Caterpillars exposed to long-term simulated predator sounds (wasp buzzing), however, exhibited reduced development time and lower pupal weight (Lee *et al.* 2021).

Traffic noise induces a state of physiological stress (increased heart rate) in monarch larvae that had not been habituated to the noise, indicating noise can be stressful to monarchs (Davis *et al.* 2018). Chronic exposure (constant levels for long periods) did not cause the same physiological reaction. Desensitization (one possible reason that chronic noise doesn't cause the same effect as acute exposure) could lead to weakened stress reactions and reduced reaction times (even as adults), potentially leaving them more vulnerable to predation (Davis *et al.* 2018). Adults lack auditory-sensing structures, so extent to which acute noise is a concern for adults is unclear.

Vehicles kill millions of monarchs every year. The Services' SSA (Service 2020) found that information was insufficient to conclude that it was increasing or is a primary driver in monarch declines but that it "warrants future attention." In a recent unpublished preprint, Momeni-Dehaghi (2024) contend that roadkill is a major factor in monarch population declines. Monarchs flying at or below about 6 meters may be most at risk with collisions or injury from trucks (Mora Alvarez *et al.* 2019). At two sites in Mexico, about 25% and 41% crossed at or below 6 m, respectively (Mora Alvarez *et al.* 2019). Monarchs appear to descend to altitudes where they are more vulnerable to collision at the end of the day when they are looking for roosting locations (Mora Alvarez *et al.* 2019, p. 4).

In the U.S., monarch mortality is especially high during migration where monarchs concentrate into 'funnels' in the eastern and central U.S. (Tracy *et al.* 2019, p. 455). During fall migration in 2016, vehicles killed about three million monarchs in the "Central Funnel" – equal in magnitude to about 5% of that winter's population estimate in Mexico (Kantola *et al.* 2019, p. 156; Tracy *et al.* 2019, p. 452, 454). Specific locations of roadkill hotspots shift over time and with variations in traffic volume and monarch presence/abundance (Kantola *et al.* 2019, p. 154). For example,

roadkill mortality of monarchs on U.S. Interstate 10 between Sheffield and Sonora (TX) was about 70,000 in 2016 compared to about 5,000 in 2017 (Kantola *et al.* 2019, p. 158).

Mortality can also be significant north of the migratory funnels. McKenna *et al.* (2001, p. 68) estimated that vehicles killed more than 500,000 monarchs along interstate highways in IL on or about the week of September 16, 1998. They found “many more” males than females and suggested that male chasing behavior increased likelihood of colliding with vehicles (McKenna *et al.* 2001, p. 68). They also suggested that the abundance of whorled milkweed (*A. verticillata*) “within two m of the roadway edge” might have led to the high mortality (McKenna *et al.* 2001, p. 68).

Landscape features like canyons can also contribute to concentration of monarchs at road crossings (Mora Alvarez *et al.* 2019, p. 5).

The Service does not conclude that this stressor presents a significant source of concern in the Proposed Action, but cannot conclude it rises to the level of insignificance or discountable at the individual Conservation Plan level.

5.3 HABITAT LOSS AND ASSOCIATED EARTH DISTURBANCES

Certain structural CPS/E(s) (labeled “S” in Appendices 10.6 and 10.7) associated with infrastructure improvements and/or modernization have the potential to create permanent losses of suitable/occupied habitat. These CPS/E(s) generally envelope a footprint of less than 5,000 square feet (~0.05 ha), are typically located in areas of previously disturbed or highly manipulated areas (such as proximate to farmsteads, equipment sheds, headquarters, or disturbed/eroding areas in need of stabilization or restoration), and/or are intended to replace or upgrade an existing structure or fixed feature. Consequently, the risk of adverse effects to monarch is minimal in the majority of instances - primarily due to the likely absence of milkweed or flora resources within the affected footprint(s) and indirect disturbance effects of supporting construction/staging actions.

However, some structural CPS/Es are likely to be applied in land uses where some resource needs of the monarch may occur and – any resulting adverse consequences to the species are heightened if these CPS/Es are implemented/applied during the time monarchs are using these affected areas/ resource. This convergence increases the likelihood of mortality of any/all life stages.

Considerations of Effect on Caterpillars and Instars

Permanent habitat removal will result in the loss of vegetation of the impacted area, which could include milkweed. This would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants & Oberhauser, 2013).

If asphalt, concrete, or other impervious materials are associated with the land use change, this could result in impacts to local hydrology which could result in changes to existing vegetation, runoff, and waterways. Hydrological impacts that change vegetation could impact milkweed availability, density, and vigor in adjacent areas, which would impact caterpillars by reducing the foodplant. Changes to runoff patterns may increase the amount of toxins associated with the purpose of the hardscaping (e.g., petroleum products used in machinery), which could result in lethal or sublethal toxicity to caterpillars that consume plants absorbing these toxins (Najar-Rodríguez *et al.*, 2008; Bohnenblust *et al.*, 2016; Gove *et al.*, 2007; Halsch *et al.*, 2020; Oberhauser *et al.*, 2009; Olaya-Arenas *et al.*, 2020).

In instances where hardscaping eliminates vegetation cover or results in darkening of the existing surface (e.g., tarmac, asphalt), an increase local temperature could occur, which could affect larval development such that physiological processes are interrupted or shifted to non-optimal conditions (York & Oberhauser, 2002; Zalucki, 1982).

Considerations of Effect on Milkweed Resources and Nectar Resources and Adult Monarchs

Permanent habitat loss eliminates or severely inhibits vegetation growth in areas surrounding the footprint of the impact, including milkweed and nectar resources. Any monarch resource needs within the immediate footprint will be eliminated by the hardscaping. Runoff and hydrological impacts associated with reduced permeability could impact milkweed outside the hardscaped area by increasing toxins and altering seasonal water regimes, thus reducing milkweed expanse, density, and vigor (Hall *et al.*, 2022; Najar-Rodríguez *et al.*, 2008). In an analysis of monarch occurrence records in the eastern U.S., (Inamine *et al.*, 2016) found that the threats driving the decline in abundance occurred during the migratory phase, which could be a decrease in nectar plant availability.

Considerations on the Effects of Changes in Hydrology within Monarch Habitat¹⁶

Certain CPS/E(s) may involve actions which, associated with the placement of structures, may result in inundation of monarch habitat (to the extent such habitat currently exists in the area of inundation). The effects of inundation of existing monarch habitat may be similar to those previously described in the preceding paragraphs depending upon the timing, extent, and duration of such inundation. Inundation of lands with existing monarch habitat can injure and kill caterpillars by drowning eggs, caterpillars, or pupae. This will result in direct mortality to any caterpillars within the footprint. Inundation of existing monarch habitat could result in the reduction, loss, or occlusion of vegetation in the impacted area, which could include milkweed. To the extent such inundation, reduce available food resources for monarch caterpillars, lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar

¹⁶ Because of the variability or occurrence of site-specific baseline conditions of monarch habitat associated with this actions affecting hydrology, the narrative combines the discussion of both potential adverse and beneficial effects.

fitness may result (Pleasants & Oberhauser, 2013). Lastly, inundation of existing monarch habitat could also result in the loss of migration resources as well as nectar resources.

Inundation is only problematic if what is being inundated is existing monarch habitat, which is not the case for most NRCS wetland easements since NRCS is restoring degraded wetlands in agricultural landscapes. This generally means they are actively in agricultural (e.g., cropland) production when NRCS conducts the restoration actions. Furthermore, the result of developing an NRCS supported easement on these sites includes the cessation of intensive agricultural and the permanent protection of not only the wetland areas but the associated habitats (uplands/forests, etc.) that have been included in the easement area.

Certain CPS/E(s) may also involve actions with result in the changes in hydrology – including using dewatering techniques or involving water diversions from areas used by monarchs. These CPS/E(s) are generally applied in marginal habitats and are associated with irrigation of cropland, or for temporary dewatering/diversion actions to facilitate the restoration of riparian and aquatic habitats. Dewatering and diversion activities may result in collateral, incidental, or accidental inundation of adjacent areas. Dewatering and diversion actions may be permanent or temporary depending upon the site-specific conditions and objective of the applied CPS/E(s).

In instances where inundation could occur, it is mentioned in preceding paragraph. Dewatering activities have the potential to change the local hydrology upon which milkweed plants depend. In cases where milkweed plants are deprived of the necessary water for physiological processes, they may experience wilting, reduced growth, or mortality. Alternatively, dewatering may produce conditions that increase or improve monarch habitat.

Diversion activities also have the potential to change local hydrology. These changes can include increasing or decreasing the soil moisture content such that it exceeds the tolerances of milkweed plants. Site-specific circumstances may increase (or decrease) monarch resource needs as a result of a CPS/E targeted diversion.

Dewatering and diversion may injure and kill caterpillars if such activities sufficiently change the hydrological conditions such that areas occupied by caterpillars suffer in milkweed loss or inundation of caterpillar habitat. Reduction in milkweed vigor may result in insufficient food for caterpillars located on impacted plants, resulting in incomplete development and lack of recruitment into the adult population. Total loss of milkweed would result in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants & Oberhauser, 2013).

Changes to local hydrology could result in changes to existing vegetation, runoff, and waterways. In ways that may negatively or positively impact monarchs. Hydrological impacts that change vegetation could increase or decrease both milkweed and nectar plant availability, density, and vigor in adjacent areas, which depending on the nature of the change would impact monarch at all stages. Waterway changes to existing habitat may impact caterpillars by

changing the vegetation community such that it no longer supports milkweed or creates local flooding which would drown eggs, caterpillars, or pupae resulting in mortality.

For the purposes of evaluating CPS/E(s) which support wetland, riparian, or aquatic habitat restoration and management, any changes in hydrology or diversion would only be temporary since the goal is to restore the hydrology, not remove it. The Service concludes that these CPS/E(s), in situations where monarch resource needs are present, any temporary effects as described above would be more than off-set by the long-term restoration outcome for that site and rangewide.

5.3.1 Synthesis of Expected Habitat Losses and Associated Earth Disturbances

If there were monarch adults, pupae, larvae, or eggs present these would be directly affected. Direct interactions would include crushing, drowning, collisions, burning, disturbance, or displacement. Additional effects to resources upon which monarchs depend could include loss of vegetative cover, potentially including milkweed and nectar sources. These direct interactions and stressors could affect oviposting, incubation, foraging by larvae, pupation, and nectaring. For any individual monarch that may be present, vegetation removal could result in mortality, displacement, avoidance, decreased dispersal, disturbance, reduced reproduction, and decreased foraging success. For CPS/E(s) that result in permanent structures, or actions which result in replacement of existing monarch habitat with unsuitable habitat/land uses, there would be a permanent loss of these areas for monarch use.

For CPS/E(s) that result in temporary habitat losses and earth disturbance actions which may be associated with the restoration or rehabilitation of areas – any resources that may be present for the monarch before vegetation removal would likely be replaced within few or several months, at least for those CPS/E(s) supporting a habitat restoration or water management outcome.

5.4 VEGETATIVE MANAGEMENT

This part discusses and evaluates the effects of many of the available CPS/E(s) which focus on vegetation management of grasslands, pasturelands, rangelands, and forestlands. The activities are generally not associated with permanent habitat losses and associated stressors to the monarch as described in Part 5.3 above. Activities encompassed herein include: (1) establishing native and mixed native/nonnative plants; and (2) techniques which affect vegetative structure and composition using mechanical or chemical treatments or resulting from livestock utilization. Anticipated effects described herein also consider interrelated and interdependent supporting actions such as adding nutrients and/or soil amendments, physical effects of the use of supporting equipment, and effects of herbicides.

Any of the affected CPS/E(s) could occur during the time when monarchs (of any/all life stage(s)) are present.

5.4.1 Nutrients and Soil Amendments

The addition of soil amendments sometimes occurs before planting the conservation cover or associated with other actions addressing the affected resource concerns such as applying fertilizers associated with habitat restoration objectives (Appendix 10.2). Because the land would likely be devoid of suitable vegetation, assuming that vegetation removal would occur before soils are amended, there would be no appropriate habitat for monarchs, therefore no effects. Once the land is cleared and prepared, the planting or restoration action would occur. If there were a case of soil amendments and nutrients being added before vegetation were removed, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

5.4.2 Actions which establish, seed or otherwise plant vegetation

With prepared land (pre-existing vegetation removed and soils amended, if required), there would be no effects to monarchs from seeding or plantings, as no suitable habitat for monarch butterflies is likely to be present. If there were a case of seeding occurred before vegetation were removed – or in cases when vegetation removal is incomplete, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

5.4.3 Actions which Temporarily Affect Vegetative Structure and Composition

The effects of these activities to monarchs are similar and are described together below. Monarchs may be present depending on the cover, location, and time of year. Direct mortality to all monarch life stages could occur during management activities. As with establishment activities, some vegetation management is likely to take place when monarchs are not present. Prescribed fire is sometimes carried out, for example, before monarchs have returned in the spring.

Light disking and interseeding typically are related activities, with disking sometimes occurring prior to interseeding to prepare soil for seeding and to increase germination and survival. Light disking and interseeding could employ tractors or other similar equipment. This could lead to effects on all life stages present at the time of disking and interseeding when monarchs may be present. Direct effects could include crushing, collisions, displacement, and general disturbance. Stressors would be from disturbance of any milkweed or nectar sources present.

5.4.3.1 *Effects of Mowing*

Mowing can injure and kill caterpillars by direct contact with blades, wheels, and other parts of mowers. Bar mowers (blades on a non-rotating bar) contact fewer caterpillars than rotary mowers (multiple rotating blades); addition of a conditioner (crushes grass after cutting) increases the contact with caterpillars (Humbert *et al.* 2010). Vegetation removal using other mechanical equipment (e.g., backhoes, graders) would likely remove all vegetation and remove and kill any associated caterpillars. Vegetation removal using hand tools would be more

targeted, minimizing the chances of removing vegetation occupied by caterpillars and give more opportunity to identify and avoid milkweed with caterpillars.

Mowing could kill or injure adults. Steidle *et al.* (2022) found a decrease in adult Lepidoptera in roadside grassland after mowing with a conventional mowing head. Using mowers designed to minimize effects to insects or mower additions such as flushing bars can decrease the potential for effects to adult Lepidoptera (Oppermann *et al.* as cited in Steidle *et al.* 2022; Steidle *et al.* 2022).

Effects on Milkweed Resources

Monarchs may increase egg-laying in milkweed patches after they are mowed, but timing of such disturbances would have to be right to ensure a net benefit to monarch productivity. Egg-laying on regenerating stems of butterfly milkweed and swamp milkweed – two non-clonal species – increased after mowing. In green milkweed (*A. viridis*), an important non-clonal monarch host plant in the south-central U.S., Dee and Baum (2019) found that “Limiting mowing during the early summer flowering season could support efforts to maximize host plant and nectar availability for monarchs.” Green milkweed typically senesces in August but after summer fires in Oklahoma, monarchs continued to lay eggs on the species into late August and September (Baum and Sharber 2012).

Effects of mowing common milkweed, a clonal species, have been mixed. He and Agrawal (2020) reported no differences in egg-laying in mowed versus unmowed common milkweed. Fischer *et al.* (2015) and Knight *et al.* (2019), however, both found significantly more eggs in mowed than in unmowed plots. Monarchs preferred to lay eggs on common milkweed plants 1-3 weeks after they were mowed (Knight *et al.* 2019). Mowing conducted too late in the growing season would produce optimal leaf tissue conditions for larvae after the local peak of egg-laying and could cause high mortality of developing larvae.

Effects of Mowing on Nectar Resources

In the Upper Midwest, mowing during the growing season can reduce floral abundance and nectaring resources for monarchs for 3-5 weeks (Haan and Landis 2020). Some species respond to mowing by blooming later than normal.

In addition to first-year mowing, Glidden *et al.* (2023) recommend using diverse and balanced seed mixes and dormant season planting to accelerate plant establishment, maximize floral density, and improve establishment of spring and fall forbs.

In an analysis of monarch occurrence records in the eastern U.S., (Inamine *et al.* 2016) found that the threats driving the decline in abundance occurred during the migratory phase, which could be a decrease in nectar plant availability.

Effects of Mowing on Predator Avoidance

Disturbance (e.g., mowing) may reduce predation pressure on caterpillars indirectly by removing aphid-infested stems that attract predators and by resetting milkweed phenology (Haan and Landis 2019, p. 3). Regenerating milkweed stems host lower predator densities (Haan and Landis 2020).

5.4.3.2 Effects of Prescribed Fire

Habitat responses to fire are complex and highly varied, but flowering may be reduced among species that would typically bloom in the first phenoperiod immediately following a fire (Miller *et al.* 2019; Pavlovic *et al.* 2011). After a March fire, for example, flowering of species that typically bloom in Midwestern oak savannas in April or May might be reduced in the year of the burn, whereas summer and fall blooming species may be unaffected (Pavlovic *et al.* 2011). Mid-summer fires are likely to decrease forage availability after the fire within the affected growing season, but then increase blooming of early-season species the following spring (Pavlovic *et al.* 2011). Green milkweed typically senesces in August but after summer fires in OK, monarchs continued to lay eggs on the species into late August and September (Baum and Sharber 2012).

Mason *et al.* (2021) conducted a meta-analysis of the effects of fire and responses of bees, butterflies, and ground beetles; with over 100 pyroentomology studies evaluated. This revealed that:

- For butterflies, fires that occurred in coniferous forests significantly increased richness, but significantly decreased abundance. Mason *et al.* (2021) attributed this to fires eliminating individuals, but also creating a more open environment where other, non-forest specialist butterflies can colonize (Kwon *et al.*, 2013).
- High severity fire significantly decreased butterfly abundance, but low severity fire's mean effect was positive, with the authors concluding that this might be the case due to more plant species surviving lower severity than higher severity fires which increases food availability and those surviving plants might create refugia for butterfly individuals, regardless of their developmental stage.
- Lastly, even though the 0 year and 1–5-year post fire, characteristics showed no statistically significant effect for richness, the mean effects for each grouping increased. This suggests that butterfly richness does not benefit from fires in the short term, but over time it can gradually increase.

The timing, intensity, and frequency prescribed burns and supporting actions (e.g., fire lines, staging equipment), can have detrimental effects on monarchs through the killing of eggs, larvae, or adults. Monarchs, especially at the egg, instar and caterpillar stages have limited mobility and likely would not escape from the fire. These may be crushed by equipment, burns during the prescribed fire itself, or trampled by human presence in the affected area.

5.4.3.3 Effects of Forest Management

Forested areas are not currently considered a primary land use containing extensive monarch resource needs (Bhowmik and Bandeen 1976; Hartzler and Buhler 2000; Service 2020 (Table 2A2)). Some studies have documented forested land uses as migratory stopover habitat (Rudolph *et al.* 2006). The rangewide importance and/or use of forested habitats by monarchs and related stressors due to management of these systems are not available - but are anticipated to be minor across the Action Area. Inferences from other pollinators and other butterflies to ascertain stressors is herein summarized below. NRCS supports a wide-range of CPS/E within these land uses (Frequency of use of the forest-related CPS/E(s) is presented in Appendices 10.6, 10.7, 10.9, and 10.10.)

As a group, pollinators are generally more abundant in open forests relative to closed forests (Fye 1972; Hanula *et al.* 2016), although information on forest-obligate species remains limited (Winfree 2010). Methods used to create these open forest habitats include fire (Grundel *et al.* 2010; Taylor and Catling 2011), harvesting or thinning (Fye 1972; Fultz 2005; Romey *et al.* 2007; Taki *et al.* 2010; Proctor 2012; Neill and Puettmann 2013), shrub removal (Hanula and Horn 2011a, 2011b; Hudson 2013) or a combination of these (Rudolph and Ely 2000; Campbell 2005; Campbell *et al.* 2007a, 2007b; Rudolph *et al.* 2006a, 2006b). Dense shrub layers negatively impact herbaceous plant cover and diversity (Woods 1993; Baker and Van Lear 1998; Collier *et al.* 2002; Gerber *et al.* 2008; Hudson *et al.* 2014) and, in turn, pollinators (McKinney and Goodell 2010; Hanula *et al.* 2011a, 2011b; Fielder *et al.* 2012; Hudson *et al.* 2013; Hanula *et al.* 2015).

Forest actions similar to those described above which focus on forest management (prescribed fire, forest stand improvement, thinning actions, and associated CPS/E(s)) germane to measuring beneficial responses to bees and other pollinators are expected to also benefit the monarch. Some data provides direct evidence of this supposition. Rudolph *et al.* (2006), assessed the effects of restoration of fire-maintained shortleaf pine-bluestem habitat (versus unmanaged stands) on lepidopteran communities, butterfly and nectar resources in the Ouachita Mountains in west-central AR. Their results showed that restored sites in the Ouachita Mountains consisting of a fire-maintained shortleaf pine-bluestem community supported a higher abundance of the monarch during migration than un-restored, fire-suppressed controls. Similar results were found for fire-maintained pine communities in eastern Texas (Rudolph and Ely 2000) and within longleaf pine ecosystems of the North Carolina sandhills (Moylett *et al.* 2020). In northern hardwood forests, Procter *et al.* (2011) found that group-selection silviculture in hardwood forests proved beneficial to native pollinating insects by increasing nectar plant composition in the resulting forest canopy gaps.

Forest management actions can adversely affect the monarch by changes in the abundance of flora resources, may disturb and remove migratory staging and concentration areas, and result in disturbances to adults during all seasons when present in the immediate vicinity of a treatment area.

5.4.3.4 Effects of Grazing

The development of prescribed grazing plan is a significant activity supported by NRCS throughout the Action Area, with notable emphasis west of the 100th meridian in the U.S. (Frequency of use of the grazing-related CPS/E(s) is presented in Appendices 10.6, 10.7, 10.9, and 10.10.)

Limited information is available on the direct effects of grazing on monarchs – in terms of quantification of direct mortality of any life stage. More information was accessed and analyzed to ascertain and identify any direct and indirect effects to the monarch’s conservation needs. Additionally, inferences from the literature were drawn from the effects of grazing on other pollinators on resources such as nectar plants, forb availability, and other aspects pertinent to understanding how grazing can affect the species.

Across all pollinators (including monarch) - positive, neutral and negative effects from grazing have been reported in the literature (*Thapa-Magar et al. 2020; Hanberry et al. 2021; Glenny et al. 2022*). Life history of the specific pollinator, type of grazers, grazing intensity and duration, plant and pollinator community composition, climate, and interactions with other disturbances all factor into the response of pollinators to grazing (Vogel et al. 2007, Kimoto et al. 2012, Moranz et al. 2014, Cutter et al. 2022). In addition, the effects from grazing, both direct and indirect on butterflies, varies across ecoregions (Bussan 2022). Most of the research on the effects of grazing on milkweed and monarchs has occurred in the Midwest (Poynor 2019, Dickson et al. 2023).

Effects on milkweed resources

Grazing can directly reduce milkweed abundance as some species of *Asclepias* are palatable forage by cattle.

- In Nebraska, Poynor (2019) examined whether milkweed grazing differs in a patch-burn-grazing system, and experimentally clipped *A. syriaca* flowers and stems to determine the effects on monarch egg laying and milkweed growth. Results suggest that even when cattle grazed grasses less in some burn patches, they still grazed milkweed the same amount, suggesting preferential milkweed grazing. Further, Poynor (2019) concluded that experimental removal of flowers did not significantly affect monarch egg laying or milkweed growth but clipping of stems had large effects. These results suggest spring cattle grazing causes declines in milkweeds and monarch egg laying.
- Leone *et al.* (2019) found, that in Minnesota tallgrass prairie, monarchs were more abundant at sites managed with prescribed fire than with grazing, but found no difference in milkweed and forb frequency between burned and grazed prairies. Leone *et al.* (2019) concluded that there was no relationship between monarch abundance and the other predictor variables tested: milkweed frequency, site area, forb frequency, and percent prairie in a 1.5 km buffer area surrounding each site. A subsequent study by Leone et al. (2022) also found that monarch abundance was higher in areas managed

with fire when compared to those that were grazed. In this follow-up study, the stocking rate and the number of years a site was grazed were not correlated with butterfly abundance, but the authors acknowledge that there may be indirect effects of grazing that they were not able to quantify. For example, fire may increase nectar availability while grazing could reduce the amount or quality of floral resources (Leone et al. 2022).

- Johnson (2023) assessed the effects of cattle grazing strategies and combined grazing/burn actions on several species of *Asclepias* in South Dakota. He found that modified twice-over rest-rotation grazing led to higher milkweed abundance than patch-burn or season-long grazing and that milkweed is highly correlated with both monarch adult and juvenile abundances. As with other accessed literature, the species of milkweed in the area was important as Johnson (2023) noted that cattle disproportionately grazed common (*A. syriaca*) and showy (*A. speciosa*) milkweed more than oval-leaf (*A. ovalifolia*). Overall, Johnson (2023) concluded that rangelands may benefit monarchs, but the outcome likely depends on selected management, milkweed species, and time of season.
- Dickson *et al.* (2023), examined the amount of milkweed grazed by cattle under patch-burn-grazing management on grasslands in Nebraska. Although management regimes and sampling date both significantly affected the number of milkweed stems present during the grazing season, they summarized that milkweed abundance was significantly higher in ungrazed than grazed grassland units, with average milkweed abundance across the growing season ranging from 34- to 185-fold (median 74-fold) higher in ungrazed than grazed grassland units. Dickson *et al.* (2023) concluded that cattle grazing on common/showy milkweed has adverse consequences to monarch reproductive success.

Although monarchs utilize a variety of milkweed species as obligate host plants (Mattila and Otis 2003), common milkweed (*Asclepias syriaca*) may be more important for the species than other *Asclepias* species (Malcolm and Zalucki 1996). Varied responses of individual species of milkweed from management actions such as grazing and fire appear to be specific and thus have consequences to monarch reproduction success and utilization. For example, grazing and use of fire was assessed over a 27-year period within the tall-grass prairies in the Flint Hills Region of Kansas (Ricono *et al.* 2018) on eight (8) species of milkweed and results indicate that:

- Grazers were found to have a negative effect on abundance for most milkweeds. However, 2 species of milkweed did not decrease in cover (*A. stenophylla* and *A. viridis*); these species have higher cardenolide content and are considered more toxic to livestock.
- *Asclepias* species overall increased in the presence of burning but individual species' response varied as follows:
 - *A. viridiflora* and *A. viridis* decreased in abundance when burning without grazing was applied, although *A. tuberosa* and *A. stenophylla* increased at relatively low rates compared to other milkweeds studied.

- *A. syriaca*, *A. lanuginosa*, and *A. verticillata* all dramatically increased in abundance in burned plots that were not grazed, while *A. verticillata* also increased at a similar rate in plots that were not burned.
- Decline in *A. syriaca* abundance in the presence of grazing and burning was stronger than declining patterns observed in other *Asclepias* species studied.

Effects on Nectar Resources

The presence of livestock may create physical disturbances to monarch. Livestock grazing can adversely impact butterfly populations directly by trampling during immobile life stages (egg, larvae, and pupae) or when weather conditions may restrict adult movement (Warren 1993). Grazing can also adversely impact butterfly populations indirectly by altering plant community composition (Stoner and Joern 2004), removing adult nectar resources, introducing invasive weeds (Hayes and Holl 2003), and changing hydrology in mesic/hydric habitats (Belsky et al. 1999). Grazing can also result in adverse, benign, and beneficial effects on butterflies depending upon stocking densities. Light rotational grazing can maintain vegetation heights and habitat heterogeneity favorable to some butterflies (Ravenscroft 1994).

Grazing alone can affect forb abundance (Collins *et al.* 1998) and cover (Davies *et al.* 2009), though the outcome strongly depends on stocking rate (Wallis DeVries *et al.*, 2007) and spatial and temporal variation in grazing patterns (Whitt and Wallander 2022). Alternatively, within mesic grasslands in CA, Hayes and Holl (2003) found that native grass cover and species richness did not differ in grazed and ungrazed sites, but cover and species richness of native perennial forbs were higher in ungrazed sites.

Within North Dakota (Missouri Coteau Region), Patton and Nyren (2015) presented results from a study ongoing since 1989 (27 years) on the effects of grazing intensity on plant species and the sustainability of forage production in pasture land uses. Five treatments were included: no grazing; light (65% forage retention), moderate (50% forage retention), heavy (35% forage retention) and extreme (20% forage retention) grazing. For each intensity treatment, plant density and composition of shrubs, forbs and bunch grasses were assessed. Conclusions and recommendations specific to forbs (and thus relevant to monarch) from this study are:

- Total forb density was highest on the extreme treatment and lowest on the light and ungrazed treatments.
- Forb production – expressed in pounds/acre – was highest in the moderate grazing treatments but not significantly different than the heavy grazing treatments.
- Prior-year condition of these pastures and adapting to weather trends early in the grazing season are key management metrics in optimizing plant-grazer relationships as temperature and precipitation affects available forage conditions throughout the utilization period.

Mabry (2002) evaluated the effects of grazing in oak-hickory dominated woodlands in central IA and found strong differences in vegetation between plots in currently and recently grazed woods compared to plots in ungrazed woods. Specifically:

- All species associated with ungrazed plots were native, and there were a high number of perennial herbs, and herbs with fleshy roots associated with these plots. They also had more species characteristic of moist forests with closed canopies and habitats with little human disturbance, and with ranges restricted to the eastern U.S. hardwoods.
- Conversely, 30% of species associated with grazed plots were exotic. Species associated with grazed sites were also more likely to be annuals, have fibrous roots, occur in a wide variety of habitats, and to have a cosmopolitan distribution.

Stahlheber and D'Antonio (2013) conducted a meta-analysis on grazing within CA grasslands and found that exotic forb showed a dramatic uniform increase in cover with grazing – especially on dry sites, but that native forb increased in cover and richness when grazed during the wet season. These results lend support to the use of grazing to enhance native forb richness and native grass cover in some settings although this must be weighed against increases in the cover of exotic forbs. Evans *et al.* (2023) also concluded over an 8-year study on CA grasslands that targeted grazing strategies produced greater cover of native annual forbs and simultaneously controlled invasive grasses. Alternatively, Lesage *et al.* (2022) found over a 15-year period that although grazed prairies continued to have greater native annual forb richness than ungrazed sites, native annual forb richness declined. Lesage *et al.* (2022) concluded that drought and increasing aridity may be driving declines in native annual forb richness instead of grazing pressure.

In the sand sage brush grasslands in the southern Great Plains, one study found that richness in annual forb was not affected by stocking rates, including heavy grazing, and forb populations were more responsive to weather (Gillen and Sims 2004). Thacker *et al.* (2012) reported that moderately stocked rangeland had a greater abundance of forbs than lightly stocked pastures (Thacker *et al.* 2012). Light to moderate levels of grazing usually result in a richer diversity of plant species than do heavy levels of grazing or no grazing at all, especially in the more humid grasslands such as the tall-grass prairie in the USA (Risser *et al.* 1981). Moderate grazing by bison increased plant biodiversity on tallgrass systems (Hartnett *et al.* 1996, Collins *et al.* 1998), and moderate grazing by cattle increased plant biodiversity on tallgrass (Collins 1987), mixed-grass prairie (Biondini *et al.* 1998), and shortgrass steppe (Milchunas *et al.* 1990, 1992). Very heavy grazing that removed 90% of above-ground biomass reduced diversity on mixed-grass prairie (Biondini *et al.* 1998).

In summary, stressors created from grazing include alteration of blooming flower abundance and diversity, changes in physical structure of vegetation, changes in the composition and availability of milkweeds, alteration of soil characteristics, and negative effects on microhabitat temperature and moisture (see Hanberry *et al.* 2021; Fleischner 1994; DeBano 2006; Kimoto *et al.* 2012; Schmalz *et al.* 2013; Moranz *et al.* 2014; Buckles and Harmon-Threatt 2019).

Grazing affects life functions, including ovipositing, incubation, larval foraging, nectaring, and pupation. Further, grazing can adversely affect the monarch by changes in availability and abundance of milkweed resources, changes in nectar resources, and direct mortality of eggs, caterpillars, and pupae. Further, presence of animals when the monarch is present creates a hazard to all life stage(s) from crushing or accidental ingestion but data is lacking on this stressor.

5.4.3.5 Effects of Brush Management

Brush management is the practice of removing, reducing, or manipulating woody vegetation to achieve a desired plant community condition (structure and composition). Unwanted brush can be managed by chemical or mechanical methods, fire, or improved grazing management. The applicable method depends on economics, soil, the type of brush on the land, the topography, and the type of operation. Vegetative treatments involving brush management generally involve more intensive mechanical methods (larger equipment, more vegetative and earth disturbances) than previously outlined and many include grubbing, mastication (grinding, shredding, or chopping) and mulching.

NRCS supports applying brush management in a wide-variety of land uses. (Frequency of use is presented in Appendices 10.6, 10.7, 10.9, and 10.10.) As applied in all land uses, this generally involves the management or removal of invasive, exotic, or aggressive woody plants. NRCS' support for this form of vegetative management is principally focused throughout grassland and rangelands in the western U.S. but occurs throughout the Action Area.

Expected outcomes of brush management are typically focused on a positive forage response for livestock by removing these woody plants with subsequent treatments (plantings, fire, mowing, herbaceous weed control efforts) to sustain the preferred plant associations. Brush management is also supported by NRCS to explicitly produce benefits for wildlife species – including mule deer (*Odocoileus hemionus*) and other game species, and for sensitive and declining species as grassland birds species (e.g., sage grouse (*Centrocercus urophasianus*), ruffed grouse (*Bonasa umbellus*), quail (*Colinus* spp.), and prairie chicken (*Tympanuchus* spp., among many others). see Part 5.5.4 and Part 5.5.6)).

Removal may be done by hand with motorized (e.g., chainsaw, weed trimmer) or nonmotorized (e.g., machete) tools, heavy equipment (e.g., skidder, tractor, all-terrain vehicle [ATV], utility task vehicle [UTV], bulldozer) and any pull-behind or mounted equipment (e.g., bush hog, mulcher), bush hog and stump spray (i.e., cutting down vegetation with the bush hog, then applying herbicide to stumps), and/or herbicide application (including basal, hack-and-squirt injection, cut stump, foliar, or soil treatment). Herbicides may be applied manually (e.g., stem injection, hack-and-squirt injection, direct streamline stem spray, or direct foliar spray from backpack applicators) or mechanically from the ground (e.g., sprayers mounted to an ATV or tractor). Manual application methods are more precise and can be used to spot treat in an area to avoid of nontarget plants. Mechanical application methods in the form of band spraying to

cover a certain width (generally the width of a crop row) may be used to treat a larger area, where appropriate. Mechanical treatments that may occur in habitats may include grubbing and mastication and mowing.

Limited information is available on specific effects to monarchs. Literature was accessed for evaluating species-stressor responses with particular emphasis on forb responses and similar species responses (e.g., pollinators/other Lepidoptera). Inferences are drawn, as noted herein.

Ansley *et al.* (2021) evaluated the control of honey mesquite (*Prosopis glandulosa*) using herbicide treatments on control efficacy and effects on understory conditions include preferred grass and forbs in Texas. This 2-year study concluded that annual forbs responded favorably to herbicide treatments of mesquite.

After chaparral (*Calystegia* sp.) dominated plant communities were masticated, they tended to have an expansion of nonnative grasses and a reduction in native forbs 3 to 7 years after treatment (Perchemlides *et al.* 2008; Potts *et al.* 2010; Potts and Stephens 2009).

Harrington *et al.* (2021) evaluated seven hardwood treatments on plant communities associated with longleaf pine restoration efforts in South Carolina, and concluded that directed foliar spray was the most effective treatment for achieving many of the desired understory characteristics of a longleaf pine woodland, including a diverse understory dominated by herbaceous vegetation, although shredding, stem injection, basal spray, and directed foliar treatments increased herb species richness by 7 to 11 species over that observed in the non-treated control. Further, Harrington *et al.* (2021) concluded that observed collateral damage to the herb community from several of the herbicide treatments (e.g., vegetation gaps around trees in the stem injection and directed foliar treatments, bare-ground conditions in first year after the broadcast foliar treatment) appeared to be short term, and recovery of herb species richness in these treatments was evident by the second year.

Reinhardt *et al.* (2017) evaluated the effectiveness of oak savanna restoration and management involving mechanized strategies (bulldozing, masticating, and shear cutting) in combination with prescribed burning and native seed treatments and vegetative response in context with the needs of the Karner blue butterfly (*Lycaeides melissa samuelis*) on 13 sites in MI. Results suggest that all of the mechanical methods were effective for promoting management goals of higher herbaceous plant cover, higher wild lupine cover, reduced woody plant cover, and lower invasive species cover. Further, Reinhardt *et al.* (2017) concluded that follow-up actions such as prescribed fire and seeding appears to be effective for furthering these management goals by reducing woody plant cover; creating more exposed soil for plant colonization; and promoting desired cover types, while minimizing undesired cover types.

Payton *et al.* 2011 examined the effects of various vegetative treatments on improving Gunnison sage grouse habitat in CO; and found that the harrowing¹⁷ was more effective than mowing in improving annual and perennial forb canopy cover.

Within degraded woodlands in New Mexico, Kleintjes *et al.* (2004), evaluated the effects of an overstory reduction and slash mulching treatment over a 2-year period upon butterfly abundance and species richness between a pair of treated and control watersheds. They found butterfly abundance and species richness were significantly greater on the treated watershed in both years, and these measures were correlated with significant increases in forb and grass cover in the treated watershed.

Mclver and Macke (2014) evaluated the response of butterflies to sagebrush steppe restoration treatments (16 sites in the states of CA, ID NV, OR, UT and WA over 7 years) that involved a combination of prescribed fire, mechanical and herbicide methods. Among their conclusions: (a) spatial (among-site) and temporal (among-year) variation in butterfly community structure was very high and tended to overwhelm patterns of treatment response; (b) When species and species groups did respond to treatment, response was generally positive regardless of treatment type, with response to prescribed fire vs. its mechanical surrogates (clear-cutting, mastication) more similar than expected; (c) Similarity in response among treatments was likely due to the fact that woody vegetation removal, whether by fire or by machine, enhanced grass and forb production in turn provided more resources for butterfly larvae (host plants) and adults (nectar); and (d) when a positive response was found, these positive effects generally persisted through 4 year post-treatment, indicating that the mechanisms behind treatment response are long lasting.

Shinneman *et al.* (2023) completed a meta-analysis of the ecological effects of various vegetative treatments on six widespread pinyon and juniper tree species of the interior western U.S. that primarily occupy semi-arid environments. The authors assessed and summarized the potential effects of pinyon and juniper removal on plant and wildlife communities, as well as several non-living ecosystem components and processes (for example, bare ground, hydrologic, litter). This included results from 48 studies conducted between 2014 and 2021 (treatment studies and results on federal lands) in the states of AZ, CO, ID, MT, NM., NV, OR, UT, WA, and WY). This meta-analysis included the work of Mclver and Macke (2014) summarized above on butterflies and was the only available data on this taxa. Nevertheless, insights in this meta-analysis are germane to monarch conservation and response for its summary of plant community response – specifically that the authors conclusions are that:

¹⁷Harrowing is dragging a 25- to 50-foot-wide frame with large teeth welded to parallel bars behind a tractor, churning soil and uprooting vegetation.

- Abundance of native herbaceous plant species was found to increase more often after mastication than following cutting;
- Consistently more positive than negative responses for general understory vegetation (that is, including both native and exotic species) among nearly all treatment types (except pile burning);
- Cutting and mastication without secondary treatments resulted in more positive than negative responses for perennial plant species abundance (However, depending on the abundance and composition of exotic species, such understory responses may also result in enhanced fire risk, loss of native diversity, and inadequate wildlife habitat conditions.)

The effects of brush management methods on the monarch will be dependent upon the treatment method, location, the amount of plant material removed, as well as the presence of monarch during the treatment(s) and the distribution and abundance of milkweed and floristic resources within the treated areas. Some specific vulnerability of soils to erode or compact was noted as a consequence of mastication by Jain *et al.* (2018), thus some aspects of brush management may generate long term adverse effects on site recovery and associated loss of use by monarchs. Generally, brush management can adversely affect the monarch by changes in availability and abundance of milkweed resources, changes in nectar resources, and direct mortality of instars, eggs, and caterpillars. The limited availability of assessments to date however does indicate the brush management can result in a positive response in available forbs and nectar resources regardless of habitat or land use applied; inferring a benefit to the monarch.

5.4.3.6 Effects of the Use of Herbicides to Support Vegetation Management

Generally, herbicides may be used to support implementation of vegetative objectives which suppress shrubs and hardwoods to control understory/midstory conditions in forested landscapes; suppress select weedy, invasive, or aggressive undesirable plant species associated with a habitat management objective; and are used in conjunction with physical or mechanized treatments to generate a desired vegetative condition and structure in all land uses.

Effects to monarchs may include exposure to herbicides in all land uses through both direct contact (spray drift/ residues) or ingestion of plant material. Frequency of use of CPS/E(s) which may result in the application of herbicides are presented in Appendices 10.6, 10.7, 10.9, and 10.10.

Specific peer-review literature on the monarch from the effects of herbicides were not discovered in the available literature. In evaluating the literature, several inferences can be drawn from systematic literature reviews specific to either established effects on changes in vegetative structure (and specifically to effects on forb or nectar resources) or, where available, responses of other butterfly/pollinator species. Results were especially concentrated in southern pine systems.

The Service concludes that stressors from herbicide uses are minor in scope rangewide but cannot currently conclude the effects are discountable or insignificant at the individual Conservation Plan scale – especially for activities which involve the use of herbicides while the monarch is present. As outlined and explained in Appendix 10.8, NRCS’ role in the ultimate decision to select and use an herbicide is at the discretion of the eligible agricultural entity. The analysis of this stressor focuses on any potential adverse indirect effects on the monarch’s resource needs.

5.4.3.6.1 In Forested Systems

Forestry land uses throughout the Action Area may rely upon herbicides to assist in achieving desired conservation outcomes, including improved forest productivity, facilitate regeneration, and restore ecological function (Society of American Foresters 2019). Toxicity and risk data suggest that the many herbicides used many forested land uses (e.g., glyphosate, triclopyr) are generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label (USFS 2011a; 2011b). Additionally, risk and exposure of these compounds is reduced as treatments involving the use of herbicides are generally infrequent during a typical stand rotation. For example,

Within southern pine (*Pinus* spp.), specific conditions always dictate treatment schedules, but generally herbicides are generally applied a maximum of 3–4 times (in many stands only 1–2 times) over the life of a southern working pine stand managed for sawtimber (~25–35-year rotations) (Briggs, *et al.* 2024). In these pine forests, applications are typically made on 1) recently clearcut sites for site preparation before planting to reduce woody vegetation such as trees, shrubs, and vines; 2) newly planted seedlings (1–2 years) to reduce competition from herbaceous (grass or broadleaf weeds) vegetation; 3) juvenile (2–4 years) stands to control woody competitors not controlled during site preparation; and 4) mid-rotation (> 14 years) stands to reduce competing hardwood trees (Cunningham 2008; Fox *et al.* 2007; Shepard *et al.* 2004).

In Northern Forests, such as within the State of WA, current guidance indicates that herbicides are typically applied once or twice in the 40–65-year life span of managed conifer stands (Washington State Department of Natural Resources 2024).

Within hardwood forests in Pennsylvania, guidance indicates that only one application is made over an 80- to 100-year rotation for hardwood regeneration establishment (Jackson and Finely 2007).

Briggs, *et al.* (2024) completed a review of available information on the effects of forest herbicide in working pine (*Pinus* spp.) forests in the southern U.S. on insects including butterflies. Their meta-analysis included responses to understory plants and impacts on insect taxa associated with understory vegetation and its litter layer. The authors concluded that: (1) herbicides have few reported long-term impacts on understory herbaceous cover and species richness/diversity when applied according to labeled uses and application rates; (2) the method

of chemical treatment (e.g., broadcast spray or banded application) may influence understory plant structure and composition; (3) responses of insects to herbicides were species- and taxa-specific and highly variable given their forage/habitat requirements and life histories; and (4) long-term research is needed to evaluate the effects of herbicides on vegetation-associated insects to provide a comprehensive profile of herbicide nontarget impacts.

Within shortleaf pine-oak-hickory forests in LA, Kohlman (2023) evaluated restoration efforts using three different management regimes: 1) prescribed burning with active herbicide treatments for non-desirable plant species, 2) burning only, and 3) no active management on pollinators. Kohlman reported greater diversity, evenness, and richness where burning occurred compared to no management; and that the combination of burning and herbicide treatment produced ~1.5 times higher diversity than no management sites.

A literature review was completed for the effects of forest herbicides on wildlife taxa on Pacific Northwest Ecosystems (National Council for Air and Stream Improvement (NCASI) 2009)). The authors concluded that: (1) studies have shown that herbicides have low toxicity to wildlife, tend to dissipate quickly, have limited mobility (rapidly fixed in environments), and do not bioaccumulate; (2) forest herbicides can enter aquatic ecosystems via accidental runoff or drift, but this riparian contact is minimized through the use of vegetation buffers, drift prediction models, application timing, and droplet size; and (3) when herbicides are applied at recommended rates in managed forests, direct toxic effects on wildlife and fish – including insects - are not expected.

5.4.3.6.2 In Grassland and other non-Forested Land Uses

The Proposed Action includes the use of herbicides to treat woody plant species and inhibit succession, control and eliminate invasive species, and to accelerate restoration and management objectives within non-forested land uses. Spot applications to control invasive plants may be used on suitable vegetative cover for monarch. Application can be accomplished using backpack applicators, cutting and dab the cut stems, hoses from vehicle mounted spray tanks, or other spot treatment methods as needed.

Herbicides can have indirect negative effects on pollinators (Bohnenblust *et al.* 2016; Abraham *et al.* 2018; Latty and Dakos 2019, Iriart *et al.* 2020). However, when used in combination with other restoration techniques, such as supplemental plantings, grazing, and prescribed fire, herbicides are a necessary component of management actions that can result in long term benefits in restoring and managing grassland systems, including enhancing nectar resources for the monarch and other pollinators (D’Antonio and Meyerson 2002; Kelley *et al.* 2013; Reid *et al.* 2009; Kyser *et al.* 2013a; Davies *et al.* 2020; Espinoza *et al.* 2020; Miller 2021).

Most herbicides used in rangeland applications have low toxicity for insects (DiTomaso *et al.*, 2010); however, rangeland herbicides may reduce pollinator insects by killing plants important to insects (Black *et al.*, 2011). Herbicide use could directly reduce milkweed and nectar resources. Such direct interactions and effects to resources could affect all monarch life stages.

5.4.4 Synthesis - Species Response to Vegetative Manipulation Actions

Many NRCS practices promote vegetative management actions on land uses such as hayland, within previous degraded lands, linear/irregular areas with cropland systems, or others. The purposes of these actions are primarily to either improve livestock forage and silage production, or to address other resource concerns such as soil erosion, nutrient management, carbon sequestration. Actions to manage the vegetation are also associated with water management to abate non-point source pollution to adjacent aquatic systems and for aesthetic, logistical, or production purposes in cropland and forestry landscapes. Lastly, many CPS/E(s) as applied are expected to benefit the species and its resource needs (Appendix 10.7).

Various vegetative management activities tied to the Proposed Action as described above include potential targeted use of herbicides, removal of dense woody vegetation, mowing, prescribed burning, brush management, seeding of native species and associated site preparation, control of invasive or defined noxious or undesirable species, prescribed grazing, and specific combinations of these techniques for enhancement of species-specific life history conditions.

If butterflies (of any life stage) are present, the following adverse effects could occur: disturbance; injury or death to eggs, larvae, and pupae from trampling, vehicles, or equipment; harassment of adults due to smoke and fire; incineration of caterpillars and instars from fire; ingestion of all limited mobility life stages by livestock; mortality or injury from the effects of human presence; and potential lethal and sublethal effects from some herbicides. These activities may also disrupt essential behaviors such as feeding and resting.

Additional stressors to monarchs include removal or disturbance of changes in the characteristics or suitability of vegetative cover - potentially including adverse effects on milkweed and nectar sources. For individual monarchs, vegetation removal could result in mortality, displacement, disturbance, reduced reproduction and decreased egg laying, pupation, and foraging success.

5.5 BENEFICIAL EFFECTS

5.5.1 Associated with Management of Grassland and Hayland Land Uses

The accessed scientific literature strongly supports the Proposed Action's restoration and enhancement actions as mitigating the effects of habitat loss for the monarch (Tonietto and Larkin 2017; Blaauw and Isaacs 2014). The disturbance components of vegetative management actions such as burning, grazing, mowing, and brush management are expected to be beneficial to the monarchs' conservation needs primarily through enhancements of the migratory and nectar resources by removing or reducing unwanted invasive woody vegetation, replanting desired plant species, and by generating a compatible disturbance regime on these land uses.

As described in Part 5.4.3, temporary adverse effects are possible from all of the actions which affect vegetative structure and composition especially with the monarch present on the treated

area(s). Alternatively, some studies have documented large numbers of eggs and larvae on regenerating milkweed stems as many milkweed species regrow after disturbances from mowing, haying, and burning (Baum and Sharber, 2012; Fischer *et al.*, 2015; Alcock *et al.*, 2016; Haan and Landis, 2019; Knight *et al.*, 2019). Taken together, this evidence suggests growing season disturbance could potentially be used to enhance monarch breeding habitat and help stabilize the population (Hann and Landis 2020). It is, however, unclear if this landscape and population level expression(s) of benefit compensates or effectively nullifies adverse effects if the activities are conducted when the monarch is present. Further, establishing specific associations between these anthropogenic sources of stressors is difficult to parse from factors such as precipitation and longer phase influences such as drought and soil conditions (Hernández *et al.* 2021; Liang *et al.* 2018; Souther *et al.* 2020; Orr *et al.* 2022).

Restoration and planting actions are also expected to enhance reproductive success of monarchs. Cutting and Tallamy (2015) found that areas planted and designed specifically to cultivate milkweed and nectar producing species of flowers enhanced monarch ovipositing as compared to unmanaged sites (monarchs oviposited at 2.0 and 6.2 times more eggs per plant per observation in the two-year study).

Manzanares *et al.* (2022) concluded from assessing managed and unmanaged sites in Nebraska that by choosing a diverse seed mix of native plants with a milkweed component and undertaking conservation-based management practices, a land manager increases the chances of providing monarch breeding habitat. Similarly, Zaya *et al.* (2017) reported that agricultural areas that were not managed for pollinators had fewer milkweeds than natural areas (e.g., grasslands, wetlands, and forests) in Illinois. They also found that sites planted with low-diversity seed mixes or those frequently mowed or sprayed with herbicides, as well as those that are overgrazed, are poor Monarch habitat. In West Texas' arid rangelands, Brym *et al.* (2021) concluded that milkweed plants restoration strategies that maximize the first-year survival of milkweed may be the most effective at maintaining plant numbers over time and should be prioritized.

Such beneficial responses can be extrapolated with many NRCS supported vegetative practices (e.g., Prescribed Burning, Prescribed Grazing, Wildlife Habitat Planting, Range Planting, Upland Wildlife Habitat Management) as actions may include flora/milkweed plantings and subsequent suitable management prescriptions. In addition to seeding actions, other pre-seeding management treatments affect success; Perkins *et al.* (2024) found that in establishing wildflower habitat for pollinators, investment in ground preparation and seeding density has the greatest impact on sown species establishment.

Garrido *et al.* (2019) used different grazing treatments on natural and disturbed grasslands and found that grazing increased plant species richness, and bumblebee and butterfly activity. Many other studies show this same pattern and use similar vegetation measurements (Potts *et al.* 2003; Wratten *et al.* 2012; Delaney *et al.* 2015; Van Halder *et al.* 2017; Drobney *et al.* 2020; Herrera 2020; Porto *et al.* 2020, Garrido *et al.* 2019).

Lastly, a certain body of evidence suggests that monarchs can benefit from growing-season disturbance to grassland habitats in their breeding range, with regenerating stems of milkweed host plants supporting more oviposition and lower densities of arthropod predators (Haan and Landis 2020). Milkweed that regrows after disturbance is very attractive to ovipositing monarchs; several studies have documented large numbers of eggs and larvae on regenerating stems (Fischer *et al.* 2015, Alcock *et al.* 2016, Haan and Landis 2019, Knight *et al.* 2019). These stems also contain fewer predatory arthropods for the first several weeks of regeneration (Haan and Landis 2019b). Since predation rates on early-stage monarchs are quite high (Prysby 2004, De Anda & Oberhauser 2015, Myers *et al.* 2019), the reduction in predators following disturbance could provide them with enemy-free space.

5.5.2 Associated with Marginal Areas

NRCS supported planting and compatible vegetative management in marginal areas¹⁸ can directly and indirectly benefit monarchs. This is especially relevant within an intensive row-crop, forestry, or otherwise unsuitable landscapes such as urban areas. These marginal grasslands include field boundaries, field margins, linear strips otherwise unusable for economic uses, areas around farmsteads and farm tracks, as well as features such as terraces and conveyances initially created to reduce soil erosion or control off-site transport of water, soil or nutrient (Farhat *et al.* 2014; Ockinger and Smith 2007; Clark and Reeder 2007; Iowa State University 2014). Even semi-natural areas with planted forbs and other flowering plants in intensive row-crop settings are useful; Shulte *et al.* (2017) found that incorporating prairie strips into corn and soybean fields can reduce erosion and nutrient loss while increasing biodiversity. Modeling suggests that isolated patches of milkweed distributed at low density across the landscape could profoundly increase the number of eggs that a monarch lays during its lifetime (Zalucki and Lammers 2010).

Farhat *et al.* (2014) found that butterfly biodiversity increased with restoration actions that increased planting diversity for both habitat generalists and specialized species of conservation concern. Further, the authors concluded that while marginal grasslands associated with agriculture are not equivalent to lands managed specifically for conservation, these areas may still remain valuable to butterfly conservation, which includes the intrinsic value they provide as corridors and stepping stones for migration and dispersal (Farhat *et al.* 2014; Panzer *et al.* 2010; Dover and Settele 2009). Even small, linear grasslands have conservation value beyond their roles as corridors (Saarinen 2002; Tschardt *et al.* 2002; Davis *et al.* 2007; Hopwood 2008).

Inferences from bumblebee response to changes in flora composition of sites provides helpful insights for the monarch. This research demonstrates that application/implementation of some

¹⁸ As defined herein, marginal lands are those areas not intentionally managed for grazing, crop, or forestry purposes but instead are managed for other purposes (e.g., safety, aesthetics, roadways, rights-of-way for transmission lines, etc.) within or adjacent to these land uses more oriented to economic production purposes. For NRCS this characterization includes, but is not limited to, “Farmstead”, “Other”, and “Associated Agricultural Land” land use definitions (Part 2.8.2).

CPS/E(s), when specifically focused on optimizing floral composition and abundance, will increase bumblebee abundance (Morandin and Kremen 2013, Wood *et al.* 2015, Venturini *et al.* 2017b) and increase pollination by wild bees in adjacent crop fields (Morandin and Kremen 2013, Blaauw and Isaacs 2014, Williams *et al.* 2015, Isaacs *et al.* 2017, Venturini *et al.* 2017a, Venturini *et al.* 2017b). Even small patches of wildflower habitat can provide over 33 percent of the pollen collected by bumblebees in resource poor landscapes (Venturini *et al.* 2017a).

For the monarch, especially in the west, some data suggests an increase in resident populations (Crone and Schultz 2021; James 2021), producing opportunities to maintain and create monarch habitat in otherwise developed or unproductive lands.

Many of the NRCS vegetative practices outlined in Parts 10.4 and 10.5 are applied in farmsteads, urban areas, shoulders of equipment tracks, within intensive cropland landscapes, and other areas where minimal monarch resources currently exist. Therefore, targeted planting and management actions such as these can potentially enhance monarch conservation. Any incremental benefits might create proportionally larger benefits to the species as baseline resources may already be lacking.

5.5.3 Associated with Forest Management

Forested habitats are anticipated to offer some conservation value to migratory monarchs. NRCS supported actions such as forest thinning, patch-cut, shelterwood cut, gap creation, brush management, and uses of prescribed fire and other methods to manage forest succession, reduce fuel loads, suppress the shrub layers, or target tree selection strategies are all expected to generate benefits to the forb and floristic resources within the range of the monarch and therefore support the monarch resource needs (Part 3.5). An excellent summary on forest management activities and expected benefits to pollinators is provided in Hanula *et al.* (2016).

These responses appear to be consistent across forest types. For example:

- Romey *et al.* (2007) examined the effects of small scale (approximately 2 ha) tree removals from a northern hardwood forest in NY, resulting in 30, 60, and 100% overstory tree removal and found the greater the forest cover removed, the higher the bee abundance and diversity in the openings.
- Springer *et al.* (2023) noted that within the Ponderosa Pine forest of the southwestern U.S., that forest thinning and prescribed burning actions nearly doubled native cover and increased native species richness by about 50% relative to untreated controls. These effects persisted for over a decade after treatment, even under the influence of significant and persistent drought.
- Hanula *et al.* (2015) examined seven forest types typical of the Piedmont region of the southern U.S. and found that lower leaf area index (i.e., more light) resulting from lower stand densities (basal area) was associated with greater numbers and species richness of bees.

- Huntzinger (2003) reported many times more butterfly species in burned forests compared to unburned conifer forests in OR and CA. These results were attributed to higher total areas of sunlit patches in burned forests.
- Working in southern Appalachian hardwood forests, Campbell *et al.* (2007a) found enhance butterfly and pollinator richness, including monarchs, when they compared removal of a native understory shrub, which was the dominant component of the understory as a result of long-term fire exclusion, to prescribed burning and shrub removal followed by burning.
- Wagner *et al.* (2003) stressed the need for prescribed fire, mechanical cutting, or a combination of both for maintaining the open-canopy shrubland barrens required by rare butterfly and moth species in northeastern U.S. forests.

Even the result of operational components of timber harvests within larger forested landscapes create valuable foraging areas to monarchs and other pollinators. Among these are landing sites. Lee *et al.* (2021) assessed log landings (open areas where harvested logs are loaded for transport) to determine if these serve as an important microhabitat component of early seral stands. For sites in the Pocono Mountains (PA), an applied hierarchical distance model revealed that log landings supported twice as many bees and five times as many butterflies as timber harvest interiors. Lee *et al.* (2021) concluded that because they create open conditions with high floral abundance, these component serve as concentrated resource hubs for bees and butterflies (including monarchs specifically identified in this research).

Sheehan and Klepzig (2021) conducted a meta-analysis of the relationship between arthropods and fire within the long pine ecosystem (southern U.S.) and concluded that management actions such as prescribed fire, forest thinning, control of mid-story hardwood and/or invasive understory plant species are expected to benefit monarchs and other pollinators by sustaining or facilitating suitable understory conditions. While southern pine forests are not presently considered significant areas for migrating monarchs, efforts to create and sustain open understory conditions will enhance forbs and other floristic resources important to successful monarch migration.

5.5.4 Associated with Brush Management

In the Southern Great Plains and especially TX, KS, OK, and NM, NRCS supports control of aggressive and invasive species such as mesquite (*Prosopis* spp). eastern red cedar (*Juniperus virginiana*) and buffelgrass (*Pennisetum ciliare*). An estimated 25% of Texas' grasslands are infested and 16 million acres (6.5 million hectares) are so invaded that it is suppressing the majority of grass/forb production (Brown and Archer 1989) and native plant diversity (Murray *et al.* 2021). The geographic extent of the affected area overlaps with the monarch concentration area in southern TX. Selected and timed strategies, including seeding of native species, uses of herbicide, prescribed fire, and high-intensity, short-duration grazing have been all been found to restore diverse, native warm season perennial grasslands which create better habitat for native grassland bird species and pollinators (Murray *et al.* 2021). Gowdy *et al.*

(2022) documented increases in butterfly species richness and relative abundance – including monarch - over an 8-year grassland restoration effort in southern TX using prescribed fire, multiple disking and herbicide applications, and native-plant seeding.

5.5.5 Associated with Targeted Wildlife Species Management

Management activities which target life history requirements of other species will also benefit the monarch. NRCS has a large conservation investment in non-federal lands promoting the sustainability and management of grasslands throughout the western U.S.. For example, NRCS has provided assistance on over 9.7 million acres (~3.9 million hectares) throughout 11 western states since 2010 supporting sage-grouse conservation (USDA-NRCS 2022). The sagebrush biome has a diverse mosaic of sagebrush species, subspecies, and hybrids that is the foundation for even richer floras of grasses and forbs (see Dumroese *et al.* 2016). NRCS is supporting landowner actions which focus on restoring degraded riparian areas and wet meadows, arresting woodland expansion, and treating non-native weeds once introduced as forages. This is occurring to enhance nesting and brood success of sage grouse hens (and especially newly-hatched chicks) which have a critical need for annual and perennial forbs and their associated hosted high-protein invertebrates. Thus, focusing on forbs during restoration work on rangelands in the western U.S. offers the potential to achieve multiple management objectives that are currently of high priority: conserving pollinators and sage-grouse and enhancing their value to monarch butterflies (Dumroese *et al.* 2016).

Similarly, in southern great plains, the NRCS' Great Plains Biome Working Lands for Wildlife effort has targeted control of invasive conifers and mesquite and other aspect of declining rangeland health on over 1.9 million acres (~769,000 hectares) in 5 states (CO, KS, OK, TX, and NM) since 2010 (USDA-NRCS 2022). Expected restoration actions enhancing grassland birds such as the Lesser Prairie Chicken (*Tympanuchus pallidicinctus*) are expected to enhance monarch butterflies through production of forbs and floristic resources in these rangeland systems.

The recently deployed Southeastern Grasslands Initiative by NRCS with specific emphasis to target conservation of the northern bobwhite (*Colinus virginianus*) in 25 eastern states will benefit the monarch (USDA-NRCS 2022). CPS/E(s) such as brush management, prescribed grazing, prescribed burning, herbaceous weed treatments, and various planting actions will be offered to landowners to stabilize existing habitat, rehabilitate grasslands and savannas, and recover native wildlife and plant species to achieve improved ecosystem health. NRCS expects to enroll over 5 million acres (~2 million hectares) by 2026.

Additionally, NRCS practices which can be targeted to reduce the ecological effects of introduced invasive annual grasses – especially *Bromus tectorum* (cheatgrass), and *B. arvensis* (field brome) are likely beneficial to forb availability and thus monarch conservation. Recent studies by Kray *et al.* (2024) on this topic specific to grazing on sites in WY and NE concluded that combining temporal analyses of livestock diets and forage plant phenology can be useful

for precisely targeting grazing of invasive species to control spread and abundance of annual bromes will also support restoration of native mixedgrass prairie plant communities.

Keele *et al.* (2023) quantified the degree to which monarch butterflies and other pollinators benefit from early successional habitat management actions of certain eastern U.S. forests¹⁹ that target needs of the golden-winged warbler (*Vermivora chrysoptera*), a declining migratory songbird. Results suggest that (a) the presence of immature monarchs was positively associated with floral abundance; (b) the presence of immature monarchs and milkweed presence were both positively associated with proportion of emergent herbaceous wetland cover within 500 m and 1 km; (c) immature monarch density increased with milkweed density and (d) the presence of adult monarchs was positively associated with size of treatment area. Keele *et al.* (2023) concluded that given the overlap in distribution and ecological needs, efforts to manage golden-winged warbler habitat can contribute to monarch habitat goals.

5.5.6 Landscape Effects

Landscape context and configuration (e.g., linear or block) may play a role in obtaining a conservation response for other pollinators (such as bees). Davis *et al.* (2008) examined differences in the butterfly, bee, and forb community composition in linear and block prairie remnants, determined correlations between species diversity among butterflies, bees and forbs in the 20 prairie remnants sampled, and examined correlations of community similarity among butterflies, bees and forbs. The authors concluded that distinct communities exist for butterflies and forbs in block versus linear sites and that the bee and forb communities in block and linear sites can be distinguished on the basis of a few species. Diversity of one group was a poor predictor of diversity in another, except for a significant inverse relationship between bees and butterflies, indicating these two pollinator taxa may be responding very differently to microhabitat components within fragmented ecosystems Davis *et al.* (2008). Because of the opportunistic nature of NRCS' effort, which is driven by voluntary participation of eligible landowners, we expect that the advantages and benefits provided to both the monarch and other pollinators will accrue at similar rates. That is, cooperating landowners will restore and enhance both linear and block patches of plant communities within their management systems; thereby, providing compatible and equitable management actions benefiting the monarch.

Targeted applications of the evaluated CPS/E(s) may have disproportioned adverse (or beneficial) effects as for many states in the Action Area – milkweed abundance is extremely local or specific to certain areas/habitat types. For example, in ID, suitable milkweed habitat was predicted to be primarily along the Snake River and tributaries in south portion of the state, with smaller amounts of habitat in the Pend Oreille, Coeur d'Alene, and Clearwater River valleys (of north ID) and the Salmon River (of east-central ID) or approximately 7.4 % of the state (Swancara *et al.* 2019).

¹⁹ In the case of golden-winged warbler, this included alder shrub wetlands and upland deciduous forest.

Select habitat types or features may also be more valuable to the species – for example, within AZ, Morris *et al.* (2015) compiled available records and concluded that although breeding can occur in most areas where milkweed was available, the riparian and wetland habitats had the highest breeding densities. Further, these areas were the most important migratory routes – with migrating monarchs reported mainly along water sources, especially rivers (Morris *et al.* 2015). Conservation actions supporting monarchs in these habitats (which only occupy 0.3% of the total surface area of AZ (U.S. Census Bureau 2010)), will intentionally benefit up to 80% percent of Arizona’s wildlife species are dependent on riparian areas for breeding, migration, shelter, and seasonal forage during some part of their life cycle (Chaney *et al.* 1990).

Waterbury *et al.* (2019) results in ID and WA reveals that although geographically widely distributed within both states, moist-soil sites within matrices of grasslands, wetlands, deciduous forest, and shrub-steppe supporting large, contiguous, and high-density milkweed stands are key monarch breeding habitats.

Many of the CPS/E have the potential to improve the suitability of existing non-cropland land uses by habitat creation, habitat enhancement, or creating compatible management/treatment strategies (e.g., 327, 340, 342, 647, 386, 394, 511, 512, 561, 422, 315, 603, 338, 528, 550, 643, 391, 390, 654, 381, 395, 580, 490, 645, 601, 658, 659, 657, 644, 420, 380, 650, and 384 -see Appendix 10.9 for frequency of use and geographic footprints). This is especially relevant to those vegetative manipulation practices focused on grassland/pastureland/hayland systems (e.g., Prescribed Fire (338), Prescribed Grazing (528), Range Planting (550), Forage and Biomass Planting (=Pasture and Hay Planting) (512), and Forage Harvest Management (=Harvest & Biomass Planting) (511)). Further, riparian related management actions which increase both milkweed and flora abundant will greatly amplified benefits to the monarch – primarily in western and arid states within the Action Area.

5.5.7 Scope of Beneficial Effects

Monarch butterflies can be found throughout almost the entire continental U.S. during the breeding season (Grace 1997; Jepsen *et al.* 2015), with most monarch breeding east of the Rocky Mountains appears to occur in a region stretching from TX to OH (Flockhart *et al.* 2013).

The Proposed Action is continually generating beneficial effects. The primary benefit is originating from the described activities which promote vegetation management, including plantings, removing/halting exotic species degradation of native habitats, and establishing and maintaining appropriate disturbance regimes in grasslands and associated agricultural areas which create and maintain monarch resource needs.

The effects of mowing on milkweed suggest a positive effect on egg laying and survival if timed appropriately or if monitoring for monarch presence is conducted beforehand, and potentially negative short-term impacts and direct mortality when done when monarchs are present. Mowing is also important to maintaining grasslands that are subject to woody encroachment and where other ecological disturbances are unavailable. The potentially long-term benefits of

mowing to maintain a habitat could outweigh any temporary adverse effects of management particularly when timed correctly.

Further, forest management actions promoted by NRCS include prescribed fire, thinning, re-planting, brush management, maintaining early successional forest stand conditions, conversion from commercial pulp production, and general forest health actions such as patch cuts and other techniques that create open canopies or improve understory conditions. Such treatments, which may be correlated with improving game species production (e.g., deer, turkey, bob-white quail, dove) and timber objectives are nevertheless expected to produce forest conditions that are beneficial to the monarch by opening forest canopies, and directly or indirectly increasing the availability of native forb and nectar plant sources. Further, the Service expects benefits to the monarch will be generated through forest management actions which control invasive species and promote early successional forest stand conditions.

Similar benefits are occurring in rangelands. As grazing and related brush management CPS/E(s) are predominate actions supported by NRCS (Appendices 10.9 and 10.10), outcomes that are already in place which aim to increase or maintain a diversity of flowering plants and control invasive species. This produces benefits to the baseline flora and forb resources benefiting the monarch incidental to these efforts which are primarily focused on livestock carrying capacity and/or specific needs of the targeted wildlife species (Gilgert and Vaughan 2011; Bates *et al.* 2016; Dumroese *et al.* 2016; Pelton *et al.* 2016) throughout the Action Area and especially in relation to the Working Lands for Wildlife initiatives established since 2010. However, some studies suggest that significant investment in controlling unwanted invasive species must be substantially increased in both scope and frequency to create long-term benefits in reversing invasive brush species rates of expansion (Scholtz *et al.* 2021) as stand level interventions produce benefits but appear ineffective at reversing degrading landscape trends (Briske 2017; Scholtz *et al.* 2021; Fuhlendorf *et al.* 2017; Twidwell *et al.* 2020; Remington *et al.* 2024)

An additional benefit of deliberate planting actions within any land use is that it may benefit pollinators by helping buffer against pesticides associated with tillage agriculture (Longing *et al.* 2020), even if planted cover does not provide host plants or nectar sources. If planted cover does provide host plants or nectar sources, it also can be instrumental in maintaining large patch sizes and increasing connectivity (Niemuth *et al.* 2021). In addition to providing nectar sources, planted forage species such as alfalfa are often associated with livestock, which presents additional opportunities for maintaining, managing, and restoring pasture in the vicinity (The Xerces Society 2018).

The surrounding landscape context, relative supply and demand for pollination services, and nearby seminatural habitat loss can have a significant influence on the impact of the affected CPS/E(s) on conserving the monarch and generally on pollinators and pollination services. NRCS sponsored and supported agricultural conservation practices implemented as part of NRCS programs are expected to be most effective in landscapes with 1-20% seminatural habitat cover

where they meaningfully augment resources (Tscharntke *et al.*, 2012). In contrast, conservation management may have little to no benefit in landscapes with <1% seminatural habitat cover resulting in insufficient source populations and in complex landscapes with more seminatural habitat and abundant pollinator nesting and foraging resources (Tscharntke *et al.*, 2012).

Significant amplification of the benefits of the Proposed Action exists as suggested by Olimpi and Karpanty (2023). This national assessment (Olimpi and Karpanty 2023) synthesized the potential benefits to pollinators from fifty-one (51) NRCS conservation practice standards to pollinators – primarily through increasing the availability of floral and nesting resources. The authors then assessed the extent to which NRCS pollinator habitat enhancements applied in recent years have occurred in structurally simple landscapes where conservation benefits are expected to be greatest and in regions most vulnerable to the loss of pollination services. [That is, are NRCS practices more common in regions with large areas of pollinator-dependent crops and limited pollinator habitat (pollinator mismatch; high demand relative to a low supply of pollinators) and have experienced, or will experience, seminatural habitat loss?] Data evaluated included modeling the distribution of >700,000 applied NRCS pollinator practice instances across the U.S. in response to pollinator mismatch, recent seminatural habitat loss through land use conversion (2008-2021), and projected seminatural habitat conversion (2050 or 2100) under two future climate-related land-use scenarios. Results from Olimpi and Karpanty (2023) indicate:

- about 20% of recently-applied NRCS pollinator practices are in landscapes with little (1-20%) surrounding seminatural habitat, where expected conservation benefits are highest.
- NRCS pollinator practices had the greatest contribution to seminatural habitat across the Great Plains, whereas core and supporting practices provided the greatest contributions to seminatural habitat in the northern Great Plains and southeastern U.S.
- NRCS pollinator practices currently applied are estimated to have created or enhanced 2.5% of available seminatural habitat - yet support 3.9% of the national supply of pollinators in the U.S.
- Six regions exist where the demand for pollinators by pollination-dependent crops is expected to be higher than the supply of pollinators due to recent losses in seminatural habitat and projected future losses. These areas include Central Valley of CA; Central WA; parts of Kansas, Oklahoma, and Texas in the Southern Great Plains; Western Michigan; Texas's Gulf Coast; and parts of Delaware, Maryland, and New Jersey on the East Coast.

The authors conclude that targeted enrollment that considers both landscape context and vulnerability to loss of pollination services could increase the efficacy of NRCS practices in the present and increase the potential of the NRCS to ensure the delivery of pollination services in the future (Olimpi and Karpanty 2023).

Individually and collectively, the Service concludes that management actions such as described above supported by NRCS are critical to creating and maintaining monarch-compatible working grassland, rangelands and forest lands throughout the Action Area. Discrete effects at the site scale; however, on the monarch and its resource needs pollinators can be positive or negative, requiring consideration of timing, local conditions, seed mixes, duration and scope, legacy land use, and specific execution of the treatment (Kimoto *et al.* 2012; Smallidge and Leopold 1997; Swengel 2001; Hartley *et al.* 2007; Mader *et al.* 2011; Kral *et al.* 2017; Niemuth *et al.* 2021).

6 CUMULATIVE EFFECTS

Part 3 provided a description of sources of impacts to monarchs other than the Proposed Action that could contribute to cumulative effects to the monarch. Analyses of the consequences to the monarch butterfly caused by each of these activities follows.

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area (50 CFR § 402.02). For the effects of insecticides below, information is provided in Appendix 10.8 specific to NRCS' policy on this subject.

6.1 EXPOSURE TO INSECTICIDE DUE TO NON-FEDERAL ACTIVITIES IN THE ACTION AREA

The Service's Monarch SSA (Service 2020) estimated a continued threat to monarchs from exposure to pesticides, as pesticide use relates to the increasing global need for food supply and demand for increasing crop yields. Impacts from insecticides can be from direct exposure, ingestion, residual exposure, and other pathways. Additionally, insecticide exposure may have sublethal effects on monarchs, such as reduced mass, or may impact different life stages differently. NRCS' role and influence in the topic is provided in Appendix 10.8.

6.1.1 Scale of Exposure

The Monarch SSA describes the condition of the monarch population under several threat modeling scenarios. The monarch is projected to decline as much as 30 and 68 percent, respectively (Service 2020). Contributing to this worst-case scenario are increasing pesticide use and land conversion to agriculture because of higher demand for food; the significant overlap of agricultural land in the areas most important to monarch production; and a lack of standardized and broad-scale efforts to reduce pesticide exposures.

Approximately 40 percent of U.S. land, 893 million acres, was in production in 2022 (USDA 2023). Although recent pesticide sales and expenditure data are lacking, 2012 expenditures on insecticides topped \$5 billion in the U.S., with 60 million pounds (57 percent of total expenditure) being used for agriculture, (USEPA 2017)). Based on data included in the National Pesticide Use Survey, approximately 21 percent of planted acres in Iowa were treated with insecticides on an annual basis.

6.1.2 Types of Exposure

Insecticide exposure pathways to both monarch adults and larvae include the ingestion of insecticide on or within plant tissue and direct contact with airborne insecticides. Specifically, exposure can result from the following.

- Direct spray of pesticides can result in direct contact or uptake via dietary pathways.
- Pesticide drift from the application site as droplets, vapor, or dust can cause direct or dietary exposure. Exposure to drift is influenced by atmospheric conditions, application equipment, and application best practices. This makes testing the effects of the full range of scenarios difficult (H. Zhu *et al.* 1994, Teske *et al.* 2002, Hanna and Schaefer 2009). Increasingly, pesticide labels require drift reduction measures such as setbacks from natural areas, installing vegetated filter strips or buffers, avoiding applications near pollinators or flowering plants, and use of drift controls.
- Systemic exposure from plants taking up some insecticides into their tissues, resulting in dietary exposure to adults and larvae. Neonicotinoid insecticides are taken up by plant tissues (Goulson 2013). Monarchs may be routinely exposed to one or more neonicotinoid insecticides in milkweed near corn and soybean fields, but maximum concentrations may be below levels that would adversely affect monarch larvae (Hall *et al.* 2022).

6.1.3 Effects of Insecticides

Once monarchs are exposed to insecticides, the effects could result in lethal and sublethal effects, depending on the degree of exposure and toxicity of the insecticide. Several studies indicate that certain insecticides cause harm to monarchs at various life stages. Described here are recent peer-reviewed papers that have examined the exposure and effects of insecticides. It is important to note that toxicity studies are designed to determine the level or “dose” of a substance that will produce measurable undesirable effects. In the case of insecticides, such studies are used to inform label requirements, legally enforceable instructions on how to safely handle and use insecticides.

A laboratory study by Barger *et al.* (Bargar *et al.* 2020) examined the transfer of the neonicotinoid clothianidin from soil to milkweed to larvae and to adult. At label application rates approved for greenhouse use (9.4 to 881.7 grams of active ingredient per acre), concentrations in leaves, larvae, and adult monarchs were not detectable and no significant effects to larval growth and survival, pupae and adult mass were observed. However, at application rates greatly exceeding label requirements (ranging from 228 to 3,553.8 grams of active ingredient per acre), this study did demonstrate for the first time, the transfer of clothianidin from soil to milkweed to adult monarchs. At these higher application rates, consumption of exposed leaves negatively affected both larval growth and adult survival.

Krishnan *et al.* (2021) conducted contact and dietary toxicity tests on monarch butterfly larvae at each life stage for five insecticides registered for foliar application on maize and soybean: a

pyrethroid (beta-cyfluthrin), an anthranilic diamide (chlorantraniliprole), an organophosphate (chlorpyrifos), and two neonicotinoids (imidacloprid and thiamethoxam). Contact and dietary effects differed among larval stages with first instars being the most sensitive followed by third and fifth instars. Beta-cyfluthrin and chlorantraniliprole were the most toxic insecticides across all instars. For the neonicotinoids, clothianidin was more toxic to larvae than both imidacloprid and thiamethoxam.

Grant *et al.* (2021) used the larval dose-response curves generated from the Krishnan *et al.* (2021) toxicity studies to model monarch mortality rates caused by insecticide drift exposure downwind from sprayed crop fields. Two scenarios were estimated/modeled - predicted spraying for soybean aphid and true armyworm (a corn pest). For aerial applications using beta-cyfluthrin and chlorantraniliprole for the soybean aphid management, models predicted larval mortality between 100 and 32 percent at distances 0-60 meters (0 ~196 feet) downwind based on contact toxicity. Dietary toxicity data predicted larval mortality was between 100 and 10 percent at 0-60 meters (0 ~196 feet) downwind. Larval mortality for chlorpyrifos, imidacloprid, and thiamethoxam, (using contact toxicity data) was 99, 91, and 67 percent. For the same insecticides, larval mortality was 96, 80, and 83 percent based on dietary toxicity data. Modeling for high ground boom applications produced similar predictions; however, lower mortality was predicted at distances 15, 30, and 60 meters (~49, ~98, ~196 feet) downwind compared to aerial applications. Across the scenarios, the mortality rates were generally highest for the first instars and lowest for fifth instars. The lowest percentage of monarch mortality was modeled at 60 meters (0 ~196 feet) downwind from the crop edge. Although Grant *et al.* (2021) estimated high monarch larval mortality rates downwind of maize and soybean fields treated with foliar insecticide applications, they noted that changes in wind speed and direction could mean different field edges will experience different levels of insecticide exposure.

Monarch larvae exposed to the highest dose of clothianidin (51–70 ng/g) experienced pupal deformity, low survival to eclosion²⁰, smaller body size, and weaker adult grip strength. This effect was most evident for monarchs reared on the lowest cardenolide milkweed in the study – swamp milkweed. Although neonicotinoid residues are ubiquitous on milkweeds in agricultural and ornamental settings, commonly encountered doses below 50 ng/g are unlikely to cause substantial declines in monarch survival or migratory performance (Prouty *et al.* 2021). Results show that adult monarchs tolerate field-relevant doses as high as 54 ng/mL for imidacloprid and 75 ng/mL for clothianidin, with minimal lethal or sub-lethal effects until much higher doses are supplied. Prouty *et al.* (2023) concluded that adult monarchs are more tolerant of ingested clothianidin and imidacloprid than indicated by previous research. Monarchs are also able to adjust egg laying and foraging behaviors “based on which pesticides are present on their host-plants”, a behavior that has been demonstrated at field-relevant pesticide concentrations (Olaya-Arenas *et al.* 2020). In Iowa restored prairies in or near corn

²⁰As defined, eclosion means the act of an insect emerging from the pupal case or hatching from the egg.

and soybean fields, Hall *et al.* (2022) detected noenicitinoids in 80% of milkweed samples, but at concentrations 10-130-fold below levels indicative of chronic adverse effects to monarch larvae.

6.1.4 Insecticide Effects Summary

In summary, lab toxicity testing is important to discern levels of toxicity of insecticides on the tested species and can result in dose-response information. Linking lab toxicity data to in-field exposure can present challenges. Often lab tests involve use of insecticides at rates that far exceed label requirements to produce measurable responses. Additionally, a range of environmental factors influence insecticides application and drift including weather conditions (humidity, temperature, wind), topography, surrounding vegetation, application methods, and employed BMPs. Studies that utilize toxicity data to project biologically relevant exposures utilize various modeling and in-field research. Understanding drift is a key component to estimating exposure potential for monarch butterflies. With a focus on factors that are manageable through conservation actions directly related to land use practices, or managing insecticide exposure can manage risk to the monarch.

Krishnan *et al.* (2021) and Grant *et al.* (2021) found that multiple insecticides pose risks to the monarch based on laboratory toxicity tests. When these effects were incorporated into a model to predict risk from drift, all insecticides resulted in mortality up to 60 meters (~196 feet) of a field. Despite this, the authors suggest that establishing monarch habitat in agricultural landscapes could still benefit the monarch because of its population dynamics and vagile behavior – i.e., females will lay eggs after spraying and larvae will develop when residual insecticide concentrations have fallen below adverse levels. The authors concluded that the benefits of establishing habitat close to crop fields outweigh the adverse effects of insecticide spray drift; that is, metapopulation extirpation is not a concern for monarchs.

6.2 CLIMATE CHANGE

A significant portion of the discussion below is taken from the 2020 SSA (Service 2020).

Projected changes in the breeding-season climate threaten to decrease abundance of the monarch in the eastern U.S. (Zylstra *et al.* 2022). Climate change can affect monarchs both directly and indirectly on both the overwintering and breeding grounds (Nail and Oberhauser 2015, entire). In the Action Area, eastern monarchs overwinter in some coastal U.S. areas (Kendrick and McCord 2023) and western monarchs overwinter in both AZ and CA. In CA, climate change is predicted to cause a significant change in the distribution of overwintering monarchs. Results from climatic niche modeling by Fisher *et al.* (2018, p. 10) suggest that climate change will result in an inland and upslope displacement of suitable overwintering conditions.

Climate change impacts, particularly increasing temperatures and heatwaves, may impact monarch fecundity (Oberhauser 1997, p. 168-169), mating success (Solensky and Oberhauser 2009, p. 6), caterpillar success (Yang *et al.* 2022), survival during migration and while overwintering (Masters *et al.* 1988, entire, Alonso-Mejia *et al.* 1997, entire), and may cause monarchs to cease fall migration and to instead reproduce (James 2024).

Laboratory studies indicate optimal temperatures for monarch range from 27–29°C with sublethal effects beginning around 30–36°C range, with an upper lethal thermal limit of 42°C (Zalucki 1982, p. 243, York and Oberhauser 2002, p. 294, Zalucki and Rochester 2004, p. 225, Nail *et al.* 2015a, p. 101). Nail *et al.* (2015a) found nighttime temperatures of 34°C during periods with daytime temperatures of 38°C resulted in lower survival, indicating that respites from elevated temperatures are important in allowing monarchs to survive temperature stress (Nail *et al.* 2015a, p. 104). Temperatures consistently above 33°C to 35°C are unsuitable for monarchs and may account for their general absence from southern U.S. states after spring (Malcolm *et al.* 1987, p. 78, Zalucki and Rochester 1999, p. 155-157). High temperatures and drought conditions may be particularly impactful during the crucial spring migration for the ENA population (Zylstra *et al.* 2021).

A warming climate may influence breeding habitat by altering suitable locations for both monarchs and their milkweed host plant (Batalden *et al.* 2007, p. 1369-1370, Lemoine 2015, entire, Zylstra *et al.* 2022). Drought may also influence the amount and availability of nectar needed for migrating butterflies and the supply of nectar in key areas like south-central TX (Stevens and Frey 2010, p. 740, Brower *et al.* 2015, entire, Espeset *et al.* 2016, p. 826, Saunders *et al.* 2019, p. 8262). The coastal non-migratory population may also be impacted by loss of habitat through rising sea levels due to climate change (Tampa Bay Climate Science Advisory Panel 2015). While drought and increased temperatures may reduce monarch habitat in some areas, the climatically suitable niche for monarchs may increase, potentially increasing their summer breeding grounds if both monarchs and milkweed are able to adapt while also negatively impacting monarchs by lengthening fall migration distances (Lemoine 2015, p. 10-17).

Climate change may additionally impact monarchs in ways that are more difficult to measure. This may include phenological mismatch (e.g., timing of milkweed and nectar sources not aligning with monarch migration; Thogmartin *et al.* 2017b, p. 13) or range mismatch with associated species (e.g., changed environmental suitability of monarch natural enemies; Mccoshum *et al.* 2016, p. 229-233).

In addition to future climate change, current climatic elements (e.g., temperature & moisture) - both local and regionally and associated with both short term annual and longer frequency scales - affect local, regional and species level survival rates (at all life stages) and reproductive fitness of monarch butterflies. Saunders *et al.* (2016) modelled weekly site-specific summer abundances (1996-2011) of monarch butterflies in the Midwestern states as a function of climate conditions experienced during a shared spring migration/breeding phase in Texas and separate summer recruitment periods in OH and IL. This ecological model predicted Monarchs

breeding in the Midwest exhibit spatial-temporal synchrony in OH and IL; and that cooler spring temperatures, average to above average precipitation in TX, and cooler than average summer temperatures are associated with higher population abundances in both states. Further, because annual spring weather conditions in TX primarily drive yearly abundances, as opposed to localized summer effects, year-specific counts are often difficult to predict reliably, specifically when predictive spring conditions are outside the range of typical regional conditions (Saunders *et al.* 2016).

Stevens and Fry (2010) reported a similar effect of moisture on the Western Monarch populations, concluding that variation in moisture availability, as measured by Palmer's drought severity index (PDSI) , across the western region predicted monarch abundance.

Regional or localized climate conditions may have disproportionate effects on the eastern monarch population. This is especially true in Southern TX. For example, Zipkin *et al.* (2012) assessed and modeled the role of climate conditions experienced both during a spring migration/ breeding phase in TX as well as during subsequent arrival and breeding during the main recruitment period in OH for the monarch. Using data from a state-wide butterfly monitoring network in OH, the results suggest that climate acts in conflicting ways during the spring and summer seasons. Zipkin *et al.* (2012) reported that high spring precipitation in TX is associated with the largest annual population growth in OH and the earliest arrival to the summer breeding ground, as are intermediate spring temperatures in TX. Further, the authors found that the timing of monarch arrivals to the summer breeding grounds is not affected by climate conditions within OH. Once in OH for summer breeding, precipitation has minimal impacts on overall abundances, whereas warmer summer temperatures are generally associated with the highest expected abundances, yet this effect is mitigated by the average seasonal temperature of each location in that the warmest sites receive no benefit of above average summer temperatures (Zipkin *et al.* 2012).

An important and potentially mitigating consideration in estimating climate change effects as described above must account for beneficial human interventions at the site scale. Edwards *et al.* (2023), conducted a meta-analysis of at-risk butterflies' shifts in phenology from climate change and resulting population responses for 114 populations of 31 at-risk butterfly species across 91 sites in the U.S.. As part of this characterization, they assessed management histories for each population including fire, mowing, grazing, use of herbicides, planting and other approaches used to improve habitat quality using reports and interviews with site manager. Edwards *et al.* (2023) detected two important patterns across this set of at-risk butterfly populations. First, populations with the least phenological constancy had the steepest rates of decline. Second, that butterfly populations in sites with frequent management interventions were increasing in abundance while those in places without these interventions were declining. In addition, Edwards *et al.* (2023) found that phenological constancy was high at sites with management, which suggests that management interventions can be used to mitigate the population-level consequences of climate change. Edwards *et al.* (2023) supported this

conclusion by suggesting that reduced phenological shifting may have occurred because management interventions led to spatially heterogeneous habitat, which in turn allowed butterfly activity to track optimal conditions by moving within a site rather than shifting phenology.

6.3 GENERALIZED LAND USE TRENDS AND EFFECTS

The contribution of non-federal activities to the current condition of monarch include human population growth and associated developments, row cropping/intensive agriculture, forest management, energy development, mining, road construction, urbanization, water development, oil and gas development, infrastructure (pipelines, roads, power lines), and wind and solar power development. Those actions are driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

Resource-based industries create many long-lasting environmental changes - such as 1) conversion of species habitats to urban, agricultural and other incompatible land uses, 2) loss of natural disturbance regimes due to either inappropriate management actions or management actions not implemented, and 3) introduction of non-native species. Those changes often reduce the ability of the monarch populations to find and utilize both migratory routes and milkweed. This interferes with their behavior in ways that reduces their survival throughout (all of) their life cycles.

6.4 INVASIVES AND INTRODUCED SPECIES

Invasive species are a rangewide conservation challenge (reviewed in Poland 2021). As profiled herein, the adverse effects on monarch habitat suitability and quality by invasive grasses and woody plant encroachment persist throughout the Action Area. Further, introduced and commercially available plant species such as tropical milkweed (*Asclepias curassavica*) may have profound direct and indirect effects on the health and survival of monarchs at the site and rangewide scales (Clement and Crawford 2020; Mach *et al.* 2023; James 2024) which may be compounded by the effects of the species' distribution shifts created by climate change (Momeni-Dehaghi *et al* 2024). These consequences are expected to increase in the future.

When considered together, the above cumulative effects are likely to have a continued rangewide negative effects on monarchs.

7 SYNTHESIS AND CONCLUSION FOR MONARCH BUTTERFLY

This Part summarizes and interprets the findings of the previous Parts (status, baseline, effects, and cumulative effects) relative to the purpose of the CO for the monarch butterfly, which is to determine whether the Proposed Action is likely to jeopardize its continued existence.

7.1.1.1.1 Status

The monarch butterfly in North America is generally in decline since the 1990's, with a particularly severe decline in the western U.S. Loss of breeding habitat (milkweed) from conversion of natural habitat into agricultural lands, loss of nectar resources, loss of overwintering habitat in Mexico, exposure to pesticides, and climate change have led to declines of monarch numbers since detailed records began being kept in the mid-1990s. The recent SSA from the Service estimated a probability of extinction of 48 to 69 percent for migratory monarchs in eastern North America over the next 60 years, under current conditions (Service 2020). Low abundance of monarchs along with important and unpredictable variations in abundance in eastern North America increase the risk of quasi-extinction (Thogmartin 2024). For monarchs in the West, modeled probability of extinction was 60 to 68 percent within the next 10 years, and 99 percent over the next 60 years under current conditions (Service 2020). See Part 4 for further details on Status.

7.1.1.1.2 Baseline

Because the scope of the Proposed Action potentially envelopes eligible agricultural producers throughout the entire range of the monarch butterfly in the U.S., the baseline feature of the monarchs has been previously profiled and discuss in Part 3 above. NRCS' implementation of its Title II conservation assistance programs reaches significant acreages throughout the Action Area (Appendices 10.2, 10.9 and 10.10). Supplemental appropriations by the U.S. Congress in 2022 (Pub. L. Public Law (U.S.) 117–169) may ultimately provide an additional \$19.5 billion over five years²¹ to support USDA's conservation programs. As a result, the effects of the Proposed Action on the monarch butterfly and its conservation needs herein described are expected to increase throughout the Action Area.

7.1.1.1.3 Effects

Adverse effects would be to individuals in the form of mortality through loss of eggs, larvae, and pupae, as well as displacement, disturbance, and mortality of adults. These effects would occur where activities described above take place and overlap where the monarch and its conservation needs are reasonably likely to occur on any land planning unit eligible for NRCS programs. Some potential displacement effects and resulting loss of either individual fitness or opportunities for ovipositing may occur if vegetative treatments or habitat losses occur within

²¹ This is in addition to the \$2 billion available for these programs through the current (2018) Farm Bill, including \$860 million for EQIP, \$600 million for CSP, \$450 million for ACEP, and \$250 million for RCPP.

an area actively used by monarchs. Additionally, displacement effects may persist if the treated area becomes incompatible from the management prescription just prior to the arrive of the spring of autumn migration periods.

Most of the adverse effects of NRCS' supported activities outlined herein are expected to be short-term and localized. Further, many CPS/E(s) will be applied when the monarch is not present on the affected areas, thereby limiting adverse consequences to individual butterflies. Some features of the Proposed Action will result in permanent habitat loss and localized reductions or eliminations of the monarch's conservation needs. Individually and cumulatively, these adverse long- and short-term effects will occur at varied levels of intensity, reach, and influence on the species and its conservation needs based upon a variety of factors at the site, proximate site effects, as well as logistical and operational effects (timing and frequency of the applied CPS/E(s)). Damping or amplification of these effects on the monarch are also manifested by climatic conditions and actions outside of the influence of NRCS.

Conversely, potentially significant rangewide benefits are expected from NRCS' continued implementation of its Title II Authorities. As described in preceding parts, many CPS/E(s) are expected to create, maintain, or enhance milkweed and nectar resources – either intentional or incidental - to address resource concerns across all land uses. One expected significant benefit will be that within these eligible lands, milkweed and nectar-rich plants will be planted or maintained along field borders in cropland systems, in buffers along waterways or around wetlands, in otherwise marginal agricultural lands currently with grass, and in pastures and other suitable locations.

Within grassland and rangeland systems, NRCS supported actions such as mowing, herbaceous weed treatment, prescribed fire, prescribed grazing, and brush management that remove or manage invasive species (e.g., woody plant encroachment), conserve and protect specific communities types (riparian areas, wet meadows) and/or develop and implement livestock forage utilization and retention strategies for targeted species such as the Lesser Prairie Chicken, Bobwhite Quail, and Sage Grouse are all expected to simultaneously support conserving, improving, or enhancing the conservation needs of the monarch.

Within forest lands, NRCS supported treatments such as brush management, herbaceous weed treatment, prescribed fire, and stand improvement may produce short-term adverse effects when the species is present but are anticipated to generate long term conservation outcomes – especially if the original objective is to create sufficient conditions in the understory which creates and maintains forbs, and other nectar resources.

NRCS influence in cropland systems is limited to cultivation and soil conservation-focused actions but NRCS supported vegetative management actions proximate or embedded within these intensive agricultural landscape (edge of fields, remnant unplowed areas and around farm-steads) may benefit the species. For example, researchers found that planting native forbs and other perennials covering as few as 10 percent area in an intensively managed agricultural

landscape in Iowa enhanced butterfly and other pollinators diversity and richness and provided significant water quality benefits (reduced sediment export by 95 percent, total phosphorus export by 90 percent and total nitrogen export by nearly 85 percent when compared to losses from the 100 percent row-crop (no-till) watersheds (Iowa State University 2014)). Lowe (2020) conducted a meta-analysis of 54 studies on planting nectar resources along crop field edges and concluded the evidence overwhelming supports this technique to increase pollinator richness and abundance and that plantings become more effective as they mature.

Habitat suitability for the monarch butterfly is generally structured primarily by host plant habitat associations, which are in turn structured by a diverse suite of climatic and human management and disturbance variables (Lemonie 2015; Dilts *et al.* 2019). It is currently unclear at the rangewide scale whether or not the expected beneficial outcomes supported by NRCS (as outlined in Part 5.5) will manifest at the appropriate intensity and persistence to counter-act the expected degradation of the environmental baseline as monarch butterflies are exposed to multiple stressors that cause varying degrees of mortality within and among all life stages. Such influences are outside of NRCS' Proposed Action.

However, as evaluated by a recent national assessment of the value of NRCS' suite of CPS/E(s) which support pollinators (Olimpi and Karpanty 2023) it is clear substantial opportunities exist – both rangewide and within certain targeted areas – to accelerate efforts to increase habitat suitability and quantity of both milkweed and floristic resources for the monarch. Further, these opportunities will amplify NRCS' current reach to eligible private lands using its Title II authorities as evaluated and described herein.

At this point in the implementation of the Proposed Action and our analysis, these benefits, however, cannot be articulated in quantified metrics such as absolute increases in numbers of milkweed stems per acre, positive change in percent of forbs at the landscape level, or associated measures of other beneficial plant associations and compatible serial stages at the appropriate spatial and temporal scales. The voluntary nature of NRCS' assistance compounds predictions. Further, significant uncertainty exists in translating these improved or enhanced vegetative conditions to measured changes in population growth/trajectory. However, as the status of the science, sophistications of models, and available information improves - including future collaborations between NRCS, the Service, and other entities - metrics for evaluation and success will be developed and applied to corroborate and affirm these expected beneficial effects of the Proposed Action.

The scientific community continues to debate and evaluate the reasons and solutions to the monarch's decline and the specific bifurcated dialogue on the conservation benefits of either (1) restoration of milkweeds in the summer breeding range or (2) enhancing monarch survival during their spring and fall migrations by creating and enhancing nectar resources. It is therefore important to note that NRCS has advocated for both approaches within its historical, current, and future implementation of its Title II Authorities under the Farm Bill. As such, year-round conservation needs of the monarch are being addressed in the Action Area.

7.1.1.1.4 Cumulative Effects

Other impacts from outside of the Proposed Action, including from continued exposure to insecticides and effects of climate change and invasive species would continue to have negative effects on monarch and monarch habitat. Further, conversion of habitat to intensive row-crops or other non-compatible land uses are also likely to adversely affect the monarch.

Cumulatively, the Service finds that effective implementation of Proposed Action is anticipated to result in a positive population response by the species at the rangewide scale. This positive response is expected as threats are reduced; notably in enhancing milkweed/nectar species availability across the landscape.

7.1.1.1.5 Use of Habitat as a Surrogate

It is important to estimate the scope of the Proposed Action to be able to do a meaningful jeopardy analysis. Within the context of the potential extent on NRCS' actions on private lands, as estimated and described in Appendices 10.2, 10.7, 10.9 and 10.10, it is impractical to evaluate the amount of take anticipated or to monitor take-related impacts to this species in terms of individual monarchs. First, no population estimates for monarch throughout the Action Area and monarch use of the Action Area changes within and between years. Additionally, it is not practical to monitor take-related impacts in terms of individual monarchs for the following reasons: (1) eggs, caterpillars, and pupae are the life stages most likely to be impacted by the Proposed Action; these life stages are very inconspicuous, making detection difficult, and (2) surveys for individuals, including adults, across millions of acres is not practical.

As a result, predicting the precise number of individuals that will be affected by the Proposed Action is not possible. However, as discussed above, evaluating the extent of both risk and benefit to the species can be achieved by estimating the use, geographic footprint, and expected frequency of the CPS/E(s) across space and time throughout the Action Area. These metrics can be remotely identified, measured, and monitored, and used to estimate the extent of anticipated effects. This is especially relevant to the connections between land cover type where the CPS/E(s) are implemented and expected availability of both milkweed and nectar resources, creating a causal link to potential monarch presence. As such, this surrogate estimated at a national or region scale is the most reasonable means for determining when the amount or extent of anticipated take may be exceeded.

50 CFR 402.14(i)(1)(i) states that surrogates may be used to express the amount or extent of anticipated take provided the Biological Opinion (when and if derived from this CO) as long as it (1) describes the causal link between the surrogate and take of the listed species; (2) describes why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and (3) sets a clear standard for determining when the amount or extent of the taking has been exceeded.

7.1.1.1.6 Conclusion

After reviewing the status of the species, the environmental baseline for the Action Area, the effects of the Action, and the cumulative effects, it is the Service's opinion that the Proposed Action is not likely to jeopardize the continued existence of the monarch. The Service bases its conclusion on the following:

- NRCS has existing initiatives and actions in place using its Title II authorities which are improving the status of the monarch butterfly and its conservation needs.
- The long-term outcome of many aspects of the Proposed Action is to generate and maintain monarch-compatible forestry, rangeland, grassland, and pastureland management systems. Many CPS/E(s) implemented by NRCS successfully enable the adoption and implementation of working land management systems that will intentionally and/or indirectly create, enhance, and restore vegetative cover, structure, and composition benefiting the monarch butterfly. These benefits may be removed for a variety of reasons related to landowner decisions but the Service's expectations are that this will occur infrequently throughout the Action Area. Any site scale benefits are helpful to sustain the monarch.
- A supplemental benefit from the Proposed Action are opportunities to create and maintain suitable vegetative conditions in otherwise marginal areas on eligible lands, including edge of fields, rights-of-way, and remnant areas within intensive agricultural landscapes. Incremental benefits in these land uses may have outsized and disproportional beneficial impacts to the species, especially in the core reproductive range of the upper Midwest of the U.S..
- NRCS actions in the western population are supporting resource needs for the monarch, especially those CPS/E(s) which conserve and manage riparian systems, wetlands habitats, and wet meadows in arid/semi-arid rangelands.
- Existing NRCS conservation investments in the removal and management of invasive grasses and woody plant are likely to benefit the monarch rangewide.
- The Proposed Action is expected to reduce exposure and risk of insecticides and other chemical inputs to the monarch - including those associated with croplands - and help ameliorate non-target or drift effects of these compounds - through NRCS's advocacy of the adoption of CPS 595 and associated Enhancements.
- At the individual Conservation Plan level, some adverse effects to individual monarchs and any supporting resource needs may occur; however, the Service expects that activities of the Proposed Action will have a net benefit to monarch.
- Removal or change of monarch compatible management systems at the rangewide scale are not expected to diminish the monarchs' numbers, reproduction, or distribution so

that the likelihood of survival and recovery in the wild is appreciably as NRCS' influence in rangewide status will cumulatively expand habitat suitability by continually enrolling landowners within its Title II programs. This will increase milkweed availability and increase the spatial distribution and abundance of both migration and nectar resources for the species within the Action Area, which in turn supports migration survival and reproduction success of the species rangewide.

8 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a Proposed Action, implement recovery plans, or develop information that is useful for the conservation of listed species. Based on the analyses and findings of this Conference Opinion, no conservation recommendations are necessary to avoid, minimize, or otherwise offset potential adverse effects on the monarch butterfly or monarch butterfly habitat from NRCS-administered Farm Bill Programs.

Table 8-1 outlines the Service's recommendations that are relevant to the candidate species addressed in this CO and that are consistent with the authorities of NRCS.

Table 8-1. Service's conservation recommendations for USDA NRCS

Conservation Recommendations for the Monarch
In cooperation with the Service, 1) identify for incorporation into conservation plans, geographically appropriate recommendations on how to time or to otherwise implement CPS/E(s) to avoid or minimize adverse effects to the monarch; 2) develop a plan to effectively communicate these to producers; and 3) implement the plan.
In cooperation with the Service, develop and implement additional incentives and initiatives to encourage enrollment of lands which include CPS/E(s) that would benefit the monarch and other pollinators.
Integrate program authorities among USDA conservation programs which will result in amplified benefits to the monarch by creating, managing, and enhancing conservation lands. If NRCS would like to pursue this recommendation, the Service has specific topical areas and details to share to begin these integration discussions with other USDA conservation programs.
Expand the internal capacity for the advocacy and adoption of CPS 595 (Pest Management Conservation System) and related enhancements – including specific outreach to crop consultants, Cooperative Extension Agents, and related partners.
As a component of NRCS' implementation of the USDA' Climate Smart Agriculture and Forestry Strategy (CSAF), design programs and actions that are compatible and beneficial to implementing both the objectives of CSAF and monarch conservation.
In cooperation with the Service and FSA, develop joint and streamlined technical and financial assistance processes and programs for landowners interested in conservation of monarchs and other pollinators.
For the population of monarchs that overwinter in California coastal areas and then migrate inland to breed, availability of milkweed may be especially important in areas where the first generation of monarchs are produced each spring. Coordinate with the Service to identify geographic areas where targeting of native pollinators plantings could provide especially important milkweed resources for the western monarch population.

9 REINITIATION NOTICE

This concludes the voluntary conference for implementation of NRCS' authorities and programs under Title II of the Farm Bill. NRCS may ask the Service to adopt the CO as a biological opinion, issued through formal consultation, if the species is listed. The request must be in writing. If the Service determines there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the CO as the biological opinion for the Proposed Action and no further section 7 consultation will be necessary.

Because this CO does not include critical habitat, if critical habitat is proposed or designated, that represents new information for which we will need to address effects in our updated biological opinion. In addition, USFWS is not providing an incidental take statement with this CO, so an incidental take statement will need to be added to the updated biological opinion, as appropriate.

10 APPENDICES

10.1 NRCS PLANNING PROCESS

NRCS, in accordance with agency regulation and policy (NRCS, General Management [GM]-180-409) implements a nine-step conservation planning process, as provided in the NRCS National Planning Procedures Handbook (NRCS, H-180-600). These procedures outline how NRCS conservation planners (trained, skilled practitioners) help their clients (individuals, groups, and communities) take a comprehensive approach to the proper use and protection of natural resources (soil, water, air, plants, animals, energy, and humans) on the client's privately owned (including Tribal lands) or leased lands (including public lands).

The NRCS conservation planning process is a three-phase, nine-step process. Although the nine steps are shown in sequence, the process is dynamic and can start with any of the first three steps and some activities may not necessarily occur in a particular planning step each time.

Phase I - Collection and Analysis (Understanding the Problems and Opportunities)

Step 1. Identify Problems and Opportunities

Step 2. Determine Objectives

Step 3. Inventory Resources

Step 4. Analyze Resource Data

Phase II - Decision Support (Understanding the Solutions)

Step 5. Formulate Alternatives

Step 6. Evaluate Alternatives

Step 7. Make Decisions

Phase III -Application and Evaluation (Implement Practices and Understanding Results)

Step 8. Implement the Plan

Step 9. Evaluate the Plan

Through this planning process, the NRCS and the client develop a Conservation Plan (Plan). The plan is a written record of the client's decisions (i.e., the client is the decision maker) that includes information on the proposed land management treatments (called conservation practices/enhancements) to address one or more of the identified natural resource problems or concerns. The plan also includes a resource inventory, an evaluation of the proposed treatments on the natural resources, and recommendations to avoid, minimize or mitigate any adverse effects that the proposed treatments may have on a natural resource. Plans can be developed at various geographic levels, including: (1) Conservation Plan (specific area, field, or smaller); (2) multi-ownership level; or (3) watershed.

The Nine-Step Planning Process

Planning Step 1 and 2 – Identify the Problems and Opportunities and Determine Client Objectives

These initial steps involve the NRCS conservation planner and the client visiting on-site to identify the existing, potential and perceived natural resource problems/concerns and opportunities. This includes an exchange of information to learn about the land and the client's objectives, which will continue as planning progresses and additional information is gathered.

NRCS will help the client think more broadly about the onsite and offsite problems and opportunities for natural resource protection or enhancement and to consider policy issues, such as complying with Federal, state or local laws.

If NRCS discerns that opportunities for resource enhancements may exist on-site or off-site (i.e., going beyond addressing resource concerns), it is NRCS policy that planners will include this in the formulation of the planning objectives (the objectives of society as well as those of the client will be considered). An individual's objectives may be in harmony with society's best interest, or they may be in direct conflict. NRCS uses the evaluation process (step 5 and 6) to develop positive and negative points until the client has enough detail to make an informed decision.

NRCS assistance may be withdrawn when a client's objectives will result in a negative effect on natural resources (onsite or offsite), if they are not consistent with the goals of the agency, or if a client fails to agree to the actions necessary for NRCS to comply with regulatory requirements (such as the ESA).

Planning Step 3 and 4 – Inventory the Resources and Analyze Resource Data

The resource inventory and analysis is the basis of NRCS planning efforts. It includes the identification of the natural resources and the special environmental concerns (resources protected by policy, law or regulation) that are present, potentially present, or potentially affected by the project. This "benchmark of the conditions" furthers the understanding of the natural resources and the special environmental concerns in and surrounding the planning area by providing either a quantifiable assessment or descriptive narrative of the findings.

NRCS inventories all applicable natural resources and all special environmental concerns. Not just those that the client is interested in addressing.

The inventory is used to identify if there are current or expected degradations of a natural resource (called a Resource Concern) by comparing the present condition with the Planning Criteria (PC). NRCS has established PC as a quantitative or qualitative statement of the minimum level of condition or health to sustain a given resource concern.

Conversely, the inventory may discern that opportunities for resource enhancements may exist on-site or off-site (i.e., going beyond the minimum level of addressing resource

concerns). It is NRCS policy that planners will include these opportunities in the formulation of the planning objectives by revisiting step 1.

Planning Step 5 and 6 – Formulate and Evaluate Alternatives

NRCS evaluates the actions or system of actions that will achieve the client and societal objectives, address the identified resource concerns, take advantage of the opportunities, and prevent or lessen the possibility of additional problems occurring. The process of formulating and evaluating the actions continues until one or more technically feasible alternatives are developed with the client. Alternatives may include structural conservation practices, such as water control structures; nonstructural conservation practices, such as water management; and conservation measures which mitigate potential adverse effects on the resources.

Conservation Practices and Enhancements are covered in greater detail in Parts 2.6 and 2.7.

NRCS uses a conservation effects process (NRCS, H-180-600.26) to refine the evaluation of effects on the natural resources by using the Conservation Practice Physical Effects (CPPE) matrix, Conservation Practice Network Diagrams, Case Study, and professional judgment. The process includes a comparison of the alternative with the benchmark condition where the effect is the difference. The effects will be described in the Environmental Evaluation in narrative form and in qualitative terms, at a minimum, and in quantitative terms to the extent possible. It will be provided in an easy-to-understand manner for consideration by the decision-maker.

NRCS evaluates the effects for all applicable natural resources even when the assistance provided only addresses individual resource concerns.

NRCS evaluates the effects on all ecological values protected by law or Executive Order (the special environmental concerns), which includes listed species, proposed species, candidate species, and their habitats.

The analysis includes documentation of the nature and extent of the effects, including the direct, indirect, short-term, long-term and cumulative effects. For special environmental concerns, the analysis concludes by a determination of whether the proposed alternatives will have “no effect” or “may affect.” In determining the effects, NRCS must use the best scientific and commercial data available.

If NRCS discerns that an action may result in a potential adverse effect, planners will add additional practices/actions/measures in the system in order to mitigate those effects. In such situations, planners will re-evaluate the revised actions’ effects on the resources and repeat the process until they develop a combination of practices that (1) meets both the client and societal objectives, (2) meets the PC for the identified resource concerns, and (3) has avoided or minimized all negative effects.

NRCS verifies that each alternative complies with national, State, Territorial, local, and Tribal laws and regulations.

Planning Step 7 – Make Decisions

The client determines which alternative to implement based on the client's clear understanding of the effects for each alternative. The NRCS planner prepares the necessary documentation such as the Conservation Plan and any necessary additional documents.

NRCS will discuss the advantages and disadvantages of each alternative, including constraints that may be imposed by Federal, State, Tribal, or local regulations.

The NRCS is required to inform clients of NRCS' threatened and endangered species policy when the client is considering or has chosen an action that 'may adversely affect' federally listed species or designated critical habitat; species proposed for federal listing or proposed critical habitat; candidate species, or State and Tribal designated species of concern. This includes informing the participant of their responsibilities and implications under the ESA.

NRCS informs the client that if NRCS funding or other implementation assistance is sought, NRCS will need to meet the consultation requirements of this document, the resulting Concurrence/Biological Opinion documentation from the Service, and that some activities may be modified as a result.

Planning Step 8 and 9 – Implement and Evaluate the Plan

Implementation is the process of carrying out the CPS/E(s), actions and measures that make-up the Conservation Plan. For NRCS, this includes providing technical assistance, and in many instances, financial assistance, for installing practices and management systems.

The client may be able to implement the Conservation Plan without additional assistance. However, additional technical assistance, such as design and layout, is usually necessary.

When NRCS is providing additional assistance (technical or financial) Plan revisions may be warranted. When a revision is made, NRCS documents the reasoning and repeats the appropriate planning steps to ensure that the revised actions are evaluated.

If, at any time during CPS/E installation, it is determined that NRCS specifications are not being followed, NRCS immediately notifies the client orally and in writing as to what corrective action is needed. If corrective action is not taken, NRCS assistance will be withdrawn.

Upon practice installation, NRCS conducts a final inspection and records the installation data verifying that each practice/action/measure has been installed and meets standards and specifications, as designed.

NRCS re-emphasizes to the client the need for and the benefits of proper operation and maintenance of the CPS/E(s) and related actions.

NRCS and the client evaluate the effectiveness of the implemented plan to ensure that it is functioning as planned and achieving the objectives. This continued contact with the client helps NRCS to determine whether the implementation results are meeting ecological, economic, and social objectives and solving resource concerns in a manner satisfactory to the client and beneficial to the affected resources concern and the affected species. These evaluations can occur at any time or interval depending upon the complexity of the project or the site-specific needs and situation. But at a minimum, they occur during the status reviews which are conducted annually throughout the life of the contract; to monitor progress on application of the selected CPS/E(s), ensure contract compliance, and to schedule future technical assistance.

10.2 NRCS NATURAL RESOURCE CONCERN CROSSWALK

Readers Note: This information is provided in a series of spreadsheets, attached separately to this document.

The file name is: Table 10.2 Resource Concerns, Causes & Conservation Activities.xls

10.3 COMPONENTS AND STRUCTURE OF CONSERVATION PRACTICE STANDARDS

CPS Development. The national development of conservation practice standards follows the guidelines of the NPPH. NRCS uses an interdisciplinary team approach that is posted for public review and comment in the *Federal Register*.

Provided below are the primary sections of a conservation practice standard²²:

DEFINITION: briefly describes the conservation practice and/or the technology delivered by the practice. **PURPOSE (S):** The primary conservation objectives for which the conservation practice is applied. Purposes must relate to resource concerns (SWAPAE +H) that can be addressed by the technology in the standard.

CONDITIONS WHERE PRACTICE APPLIES: The land uses and/or site conditions that affect suitability or function of the practice are described.

CRITERIA: are presented for each PURPOSE indicated above. Additional criteria for some or all of the purposes may be needed if there are design elements that apply only to that purpose. The CRITERIA section shall include important design elements about which decisions must be made, including any necessary minimum and maximum limits. Criteria must be followed.

PLANS AND SPECIFICATIONS: lists information that needs to be in the Conservation Plan to ensure that the practice is properly applied in the field (such as specifying the kind, amount, or quality of materials to be used, or timing or sequence of installation activities). Items listed in this section carry the same weight as criteria.

OPERATION AND MAINTENANCE: include required management actions and corrective actions that contribute to the longevity and functioning of the conservation practice. Operation encompasses normal management actions, such as mowing for weed control. Maintenance involves corrective actions, such as needed repairs due to normal wear and tear. Items listed in this section carry the same weight as criteria.

Conservation Practice Life Spans are the minimum time (in years) that the implemented practice is expected to be fully functional for its intended purpose(s). The established conservation practice lifespans are based on following an operation and maintenance plan developed for the practice. For example, a grassed waterway with the appropriate operation and maintenance has a lifespan of 10 years. States use the national lifespans unless a variance is requested in writing.

Lifespans for “structural” practices may vary from three (3) years for small earthen structures to 20 years or longer for large earthen or concrete structures, buried pipelines, etc. The minimum

²²See also: <https://directives.nrcs.usda.gov/sites/default/files2/1716227048/Subpart%20B%20-%20Conservation%20Practice%20Standards%20and%20Supporting%20Documents.pdf>

lifespan for permanent “vegetative” establishment type practices is five (5) years. A one (1) year application lifespan is established for those “management” type, where practices are reapplied (other than normal operation and maintenance) annually or more than one time on the same land to achieve its purpose(s). Examples of one (1) year lifespans include: Prescribed Grazing, Cover Crops, Nutrient Management, Irrigation Water Management, Residue and Tillage Management practices, etc.

Network Effect Diagrams. NRCS prepares network effect diagrams for each practice, or related sets of practices which act together to achieve desired purposes. Network effect diagrams are flow charts of direct, indirect and cumulative effects resulting from installation of the practices. Completed network effect diagrams are an overview of expert consensus on the direct, indirect, and cumulative effects of installing proposed practice installation. They show the potential positive and negative outcomes of practice installation and the potential mitigation measures. They are useful as a reference point for next steps, and as a communication tool with partners and the public. Network effect diagrams are collectively organized within NRCS’ national virtual library – found at this url: <https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>.

10.4 ENHANCEMENTS

As with CPS, each conservation enhancement has a number and letter code:

Each one starts with an E for Enhancement. The E is followed by three numbers, which refer to the conservation practice number the enhancement builds upon. For instance, 646 is the practice code for Seasonal Water Development and Management. The three-digit number code is then followed by a letter. For instance, there are 4 enhancements that are tied back to Seasonal Water Development and Management (646), and they are lettered A through D. Putting those altogether, then, E646C would, for instance, indicate an enhancement based upon the Seasonal Water Development and Management, with specific emphasis and actions designed to manipulate vegetation and maintain closed structures for shorebird late summer habitat.

Each enhancement is described in detail in an enhancement job sheet that includes the following information: (1) Enhancement name; (2) Base conservation practice; (3) Applicable land uses; (4) Enhancement life span; (5) Resource concerns addressed; (6) Enhancement description; (7) Criteria, spelling out what is required; and (8); Documentation and implementation requirements. New enhancements may be added each year by NRCS. In 2024, for instance, there were 140 enhancements to address resource concerns such as soil quality, soil erosion, water use and conservation, wildlife habitat, plant health and biodiversity, air quality, energy conservation enhancements, and carbon storage. Within CSP, NRCS has also established “bundles” of actions which, in 2024, focused on establishing stream buffers, adoption of precision agricultural planting, climate smart soil health, forest management, and for wildlife species such as pheasant/quail, and longleaf pine species.

Through CSP, producers can choose from approximately 140 enhancements to address resource concerns on their operation. Conservation practice standards and quality criteria for resource concerns can be found in sections II and III of the [Field Office Technical Guide](#).

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Brush management to improve wildlife habitat \(E314A\)](#)
- [Herbaceous weed treatment to create desired plant communities consistent with the ecological site \(E315A\)](#)
- [Conservation cover for pollinators and beneficial insects \(E327A\)](#)
- [Establish Monarch butterfly habitat \(E327B\)](#)
- [Conservation crop rotation on recently converted CRP grass/legume cover \(E328C\)](#)
- [Leave standing grain crops unharvested to benefit wildlife \(E328D\)](#)
- [Soil health crop rotation \(E328E\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Modifications to improve soil health and increase soil organic matter \(E328F\)](#)
- [Crop rotation on recently converted CRP grass/legume cover for soil organic matter improvement \(E328G\)](#)
- [Conservation crop rotation to reduce the concentration of salts \(E328H\)](#)
- [Forage harvest to reduce water quality impacts by utilization of excess soil nutrients \(E328I\)](#)
- [Improved crop rotation to provide benefits to pollinators \(E328J\)](#)
- [Multiple crop types to benefit wildlife \(E328K\)](#)
- [Leaving tall crop residue for wildlife \(E328L\)](#)
- [Diversify crop rotation with canola or sunflower to provide benefits to pollinators \(E328M\)](#)
- [Perennial grain crop conservation rotation \(E328O\)](#)
- [Low Nitrogen Requirement Annual Crop Rotation \(E328P\)](#)
- [No till to reduce soil erosion \(E329A\)](#)
- [No till to reduce tillage induced particulate matter \(E329B\)](#)
- [No till to increase plant-available moisture \(E329C\)](#)
- [No till system to increase soil health and soil organic matter content \(E329D\)](#)
- [No till to reduce energy \(E329E\)](#)
- [No-till into green cover crops to improve soil organic matter quantity and quality \(E329F\)](#)
- [Controlled traffic farming to reduce compaction \(E334A\)](#)
- [Strategically planned, patch burning for grazing distribution and wildlife habitat \(E338A\)](#)
- [Short-interval burns to promote a healthy herbaceous plant community \(E338B\)](#)
- [Sequential patch burning \(E338C\)](#)
- [Cover crop to reduce soil erosion \(E340A\)](#)
- [Intensive cover cropping to increase soil health and soil organic matter content \(E340B\)](#)
- [Use of multi-species cover crop to improve soil health and increase soil organic matter \(E340C\)](#)
- [Intensive orchard/vineyard floor cover cropping to increase soil health \(E340D\)](#)
- [Use of soil health assessment to assist with development of cover crop mix to improve soil health \(E340E\)](#)
- [Cover crop to minimize soil compaction \(E340F\)](#)
- [Cover crop to reduce water quality degradation by utilizing excess soil nutrients \(E340G\)](#)
- [Cover crops to suppress excessive weed pressures and break pest cycles \(E340H\)](#)
- [Using cover crops for biological strip till \(E340I\)](#)
- [Cover crop to improve moisture use efficiency and reduce salts \(E340J\)](#)
- [Reduced tillage to reduce soil erosion \(E345A\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Reduced tillage to reduce tillage induced particulate matter \(E345B\)](#)
- [Reduced tillage to increase plant-available moisture \(E345C\)](#)
- [Reduced tillage to increase soil health and soil organic matter content \(E345D\)](#)
- [Reduced tillage to reduce energy use \(E345E\)](#)
- [Switch to Renewable Power Source \(E372A\)](#)
- [Renewable Energy Source for Large Internal Combustion Engines \(E372B\)](#)
- [Dust suppressant re-application for stabilization \(E373A\)](#)
- [Modify field operations to reduce particulate matter \(E376A\)](#)
- [Silvopasture to improve wildlife habitat \(E381A\)](#)
- [Incorporating “wildlife friendly” fencing for connectivity of wildlife food resources \(E382A\)](#)
- [Installing electrical fence offsets and wire for cross-fencing to improve grazing management \(E382B\)](#)
- [Grazing-maintained fuel break to reduce the risk of fire \(E383A\)](#)
- [Biochar production from woody residue \(E384A\)](#)
- [Enhanced field borders to reduce soil erosion along the edge\(s\) of a field \(E386A\)](#)
- [Enhanced field borders to increase carbon storage along the edge\(s\) of a field \(E386B\)](#)
- [Enhanced field borders to decrease particulate emissions along the edge\(s\) of a field \(E386C\)](#)
- [Enhanced field borders to increase food for pollinators along the edge\(s\) of a field \(E386D\)](#)
- [Enhanced field borders to increase wildlife food and habitat along the edge\(s\) of a field \(E386E\)](#)
- [Increase riparian herbaceous cover width for sediment and nutrient reduction \(E390A\)](#)
- [Increase riparian herbaceous cover width to enhance wildlife habitat \(E390B\)](#)
- [Increase riparian forest buffer width for sediment and nutrient reduction \(E391A\)](#)
- [Increase stream shading for stream temperature reduction \(E391B\)](#)
- [Increase riparian forest buffer width to enhance wildlife habitat \(E391C\)](#)
- [Extend existing filter strip to reduce water quality impacts \(E393A\)](#)
- [Stream habitat improvement through placement of woody biomass \(E395A\)](#)
- [Fishpond management for native aquatic and terrestrial species \(E399A\)](#)
- [Enhance a grassed waterway \(E412A\)](#)
- [Establish pollinator habitat \(E420A\)](#)
- [Establish monarch butterfly habitat \(E420B\)](#)
- [Advanced Tailwater Recovery \(E447A\)](#)
- [Complete pumping plant evaluation for water savings \(E449A\)](#)
- [Alternated Wetting and Drying \(AWD\) of rice fields \(E449B\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Advanced Automated IWM – Year 2-5, soil moisture monitoring \(E449C\)](#)
- [Advanced Automated IWM – Year 1, Equipment and soil moisture or water level monitoring \(E449D\)](#)
- [Convert from Cascade to Furrow Irrigated Rice Production – reduce irrigation water consumption \(E449E\)](#)
- [Intermediate IWM— Year 1, Equipment with Soil moisture or Water Level monitoring \(E449F\)](#)
- [Intermediate IWM— Years 2-5, Soil Moisture or Water Level monitoring \(E449G\)](#)
- [Intermediate IWM— Years 2 -5, using soil moisture or water level monitoring \(E449H\)](#)
- [IWM - Year 1, Retrofit Equipment with Speed Control on Sprinkler Irrigation System \(E449I\)](#)
- [Intermediate IWM – 20% Reduced Water usage \(E449J\)](#)
- [Manage livestock access to waterbodies to reduce nutrients or pathogens to surface water \(E472A\)](#)
- [Mulching to improve soil health \(E484A\)](#)
- [Reduce particulate matter emissions by using orchard or vineyard generated woody material as mulch \(E484B\)](#)
- [Mulching with natural materials in specialty crops for weed control \(E484C\)](#)
- [Lowbush blueberry field mulching for moisture management \(E484D\)](#)
- [Harvest of crops \(hay or small grains\) using measures that allow desired species to flush or escape \(E511A\)](#)
- [Forage harvest management that helps maintain wildlife habitat cover, shelter or continuity \(E511B\)](#)
- [Forage testing for improved harvesting methods and hay quality \(E511C\)](#)
- [Forage harvest management to improve terrestrial habitat for wildlife and invertebrates during critical over-winter periods \(E511D\)](#)
- [Cropland conversion to grass-based agriculture to reduce soil erosion \(E512A\)](#)
- [Forage and biomass planting to reduce soil erosion or increase organic matter to build soil health \(E512B\)](#)
- [Cropland conversion to grass for soil organic matter improvement \(E512C\)](#)
- [Forage plantings that help increase organic matter in depleted soils \(E512D\)](#)
- [Establish pollinator and/or beneficial insect and/or Monarch habitat \(E512I\)](#)
- [Establish wildlife corridors to provide habitat continuity or access to water \(E512J\)](#)
- [Diversifying forage base with interseeding forbs and legumes to increase pasture quality \(E512L\)](#)
- [Forage plantings that improve wildlife habitat cover and shelter or structure and composition \(E512M\)](#)
- [Maintaining quantity and quality of forage for animal health and productivity \(E528A\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Grazing management that improves Monarch butterfly habitat \(E528B\)](#)
- [Incorporating wildlife refuge areas in contingency plans for wildlife \(E528C\)](#)
- [Grazing management for improving quantity and quality of food or cover and shelter for wildlife \(E528D\)](#)
- [Improved grazing management for enhanced plant structure and composition for wildlife \(E528E\)](#)
- [Stockpiling cool season forage to improve structure and composition or plant productivity and health \(E528F\)](#)
- [Improved grazing management on pasture for plant productivity and health with monitoring activities \(E528G\)](#)
- [Prescribed grazing to improve/maintain riparian and watershed function-elevated water temperature \(E528H\)](#)
- [Grazing management that protects sensitive areas-surface or ground water from nutrients \(E528I\)](#)
- [Prescribed grazing on pastureland that improves riparian and watershed function \(E528J\)](#)
- [Prescribed grazing that improves or maintains riparian and watershed function-erosion \(E528L\)](#)
- [Grazing management that protects sensitive areas from gully erosion \(E528M\)](#)
- [Improved grazing management through monitoring activities \(E528N\)](#)
- [Clipping mature forages to set back vegetative growth for improved forage quality \(E528O\)](#)
- [Implementing Bale or Swath Grazing to increase organic matter and reduce nutrients in surface water \(E528P\)](#)
- [Use of body condition scoring for livestock on a monthly basis to keep track of herd health \(E528Q\)](#)
- [Management Intensive Rotational Grazing \(E528R\)](#)
- [Soil Health Improvements on Pasture \(E528S\)](#)
- [Grazing to Reduce Wildfire Risks on Forests \(E528T\)](#)
- [Contingency Planning for Resiliency \(E528U\)](#)
- [Advanced Pumping Plant Automation \(E533A\)](#)
- [Complete pumping plant evaluation for energy savings \(E533B\)](#)
- [Install variable frequency drive\(s\) on pump\(s\) \(E533C\)](#)
- [Switch fuel source for pumps \(E533D\)](#)
- [Range planting for increasing/maintaining organic matter \(E550A\)](#)
- [Range planting for improving forage, browse, or cover for wildlife \(E550B\)](#)
- [Enhanced Rain Gardens for Wildlife \(E570A\)](#)
- [Stream crossing elimination \(E578A\)](#)
- [Stream corridor bank stability improvement \(E580A\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets Enhancements](#)

- [Stream corridor bank vegetation improvement \(E580B\)](#)
- [Improving nutrient uptake efficiency and reducing risk of nutrient losses \(E590A\)](#)
- [Reduce risks of nutrient loss to surface water by utilizing precision agriculture technologies \(E590B\)](#)
- [Improving nutrient uptake efficiency and reducing risk of nutrient losses on pasture \(E590C\)](#)
- [Reduce risks of nutrient losses to surface and groundwater by increasing setback awareness via precision technology \(E590D\)](#)
- [Reduce risk of pesticides in surface water by utilizing precision pesticide application techniques \(E595A\)](#)
- [Reduce risk of pesticides in surface water and air by utilizing IPM PAMS techniques \(E595B\)](#)
- [Increase the size requirement of refuges planted to slow pest resistance to Bt crops \(E595D\)](#)
- [Eliminate the use of chemical treatments to control pests and to increase the presence of dung beetles \(E595E\)](#)
- [Improving soil organism habitat on agricultural land \(E595F\)](#)
- [Reduce resistance risk by utilizing PAMS techniques \(E595G\)](#)
- [Planting for carbon sequestration and storage \(E612B\)](#)
- [Establishing tree/shrub species to restore native plant communities \(E612C\)](#)
- [Adding food-producing trees/shrubs to an agroforestry system \(E612D\)](#)
- [Cultural plantings \(E612E\)](#)
- [Sugarbush management \(E612F\)](#)
- [Tree/shrub planting for wildlife habitat \(E612G\)](#)
- [Enhanced Wildlife Habitat Management for Upland Landscapes \(E645D\)](#)
- [Restoration of sensitive coastal vegetative communities \(E643A\)](#)
- [Restoration and management of rare or declining habitat \(E643B\)](#)
- [Restore glade habitat to benefit threatened and endangered species and state species of concern \(E643C\)](#)
- [Low-tech process-based restoration to enhance floodplain connectivity \(E643D\)](#)
- [Managing Flood-Irrigated Landscapes for Wildlife \(E644A\)](#)
- [Reduction of attractants to human-subsidized predators in sensitive wildlife species habitat \(E645A\)](#)
- [Manage existing shrub thickets to provide adequate shelter for wildlife \(E645B\)](#)
- [Edge feathering for wildlife cover \(E645C\)](#)
- [Close structures to capture and retain rainfall for waterfowl and wading bird winter habitat \(E646A\)](#)

For more information on producer-specific enhancements, please visit [Enhancement Factsheets](#)

Enhancements

- [Extend retention of captured rainfall for migratory waterfowl and wading bird late winter habitat \(E646B\)](#)
- [Manipulate vegetation and maintain closed structures for shorebirds mid-summer habitat \(E646C\)](#)
- [Manipulate vegetation and maintain closed structures for shorebird late summer habitat \(E646D\)](#)
- [Manipulate vegetation on fields with captured rainfall for waterfowl & wading bird winter habitat \(E647A\)](#)
- [Provide early successional shorebird habitat between first crop and ratoon crop \(E647B\)](#)
- [Maintain most soil vegetation on cropland edges to enhance waterfowl and shorebird habitat \(E647C\)](#)
- [Establish and maintain early successional habitat in ditches and bank borders \(E647D\)](#)
- [Maintaining and improving forest soil quality. \(E666A\)](#)
- [Forest management to enhance understory vegetation \(E666D\)](#)
- [Reduce height of the forest understory to limit wildfire risk \(E666E\)](#)
- [Reduce forest stand density to create open stand structure \(E666F\)](#)
- [Reduce forest density and manage understory along roads to limit wildfire risk and improve habitat \(E666G\)](#)
- [Increase on-site carbon storage \(E666H\)](#)
- [Crop tree management for mast production \(E666I\)](#)
- [Facilitating oak forest regeneration \(E666J\)](#)
- [Creating structural diversity with patch openings \(E666K\)](#)
- [Forest Stand Improvement to rehabilitate degraded hardwood stands \(E666L\)](#)
- [Snags, den trees, and coarse woody debris for wildlife habitat \(E666O\)](#)
- [Summer roosting habitat for native forest-dwelling bat species \(E666P\)](#)
- [Forest songbird habitat maintenance \(E666R\)](#)
- [Facilitating longleaf pine regeneration and establishment \(E666S\)](#)

Bundles

CSP applicants who want to increase their conservation stewardship even further may consider “bundles” of enhancement activities. Some enhancements work together to provide increased conservation benefits when they are implemented as a group. Producers may consider adopting these enhancement groups or “bundles” on their operation.

Each bundle has three or more required enhancements, and for some bundles, the applicant has the option to pick additional enhancements from a select list that addresses specific resource concerns.

Bundles have enhancements grouped according to land use – crop, pasture, range, and forest. They are also grouped as agency initiatives, such as Long Leaf Pine, Mississippi River Basin, Buffers and Working Lands for Wildlife. Bundles receive a higher level of financial assistance to encourage the holistic approach to generate additional conservation benefits.

- [Buffer Bundle #1 \(B000BFF1\)](#)
- [Crop Bundle #10 – YEAR 1 Irrigated Cropland \(MRBI/Ogallala\) \(B000CPL10\)](#)
- [Crop Bundle #11 - Year 2+ Irrigated Cropland \(MRBI/Ogallala\) \(B000CPL11\)](#)
- [Crop Bundle #12 – Non-Irrigated Precision Ag \(MRBI\) \(B000CPL12\)](#)
- [Crop Bundle #13 – Non-Irrigated Cropland \(MRBI\) \(B000CPL13\)](#)
- [Crop Bundle #14 – YEAR 1+ Irrigated Precision Ag Cropland \(MRBI\) \(B000CPL14\)](#)
- [Crop Bundle #15 – YEAR 2+ Irrigated Precision Ag Cropland \(MRBI\) \(B000CPL15\)](#)
- [Crop Bundle #16 – Non-Irrigated Cropland with Water Bodies \(MRBI\) \(B000CPL16\)](#)
- [Crop Bundle #17 – Non-Irrigated Cropland with Water Bodies Riparian Forest Buffer \(MRBI\) \(B000CPL17\)](#)
- [Crop Bundle #18 – Precision Ag \(B000CPL18\)](#)
- [Crop Bundle #19 – Soil Health Precision Ag \(B000CPL19\)](#)
- [Crop Bundle #20 – Soil Health Assessment \(B000CPL20\)](#)
- [Crop Bundle #21 – Crop Bundle \(Organic\) \(B000CPL21\)](#)
- [Crop Bundle #22 – Erosion Bundle \(Organic\) \(B000CPL22\)](#)
- [Crop Bundle #23 – Pheasant and quail habitat \(B000CPL23\)](#)
- [Crop Bundle #24 – Cropland Soil Health Management System \(B000CPL24\)](#)
- [Crop Bundle # 25- Climate Smart Advanced Soil Health \(B000CPL25\)](#)
- [Forest Bundle #1 \(B000FST1\)](#)
- [Forest Bundle #2 – Post-fire Management \(B000FST2\)](#)
- [Forest Bundle #3 \(B000FST3\)](#)
- [Forest Bundle #4 \(B000FST4\)](#)
- [Forest Bundle #5: \(B000FST5\)](#)
- [Grazing Bundle #1 – Range and Pasture \(B000GRZ1\)](#)
- [Grazing Bundle #2 – Range and Pasture \(B000GRZ2\)](#)
- [Grazing Bundle #3 – Range and Pasture \(B000GRZ3\)](#)
- [Grazing Bundle #4 – Range and Pasture \(B000GRZ4\)](#)
- [Grazing Bundle #5 – Range and Pasture \(B000GRZ5\)](#)
- [Longleaf Pine Bundle #1 \(B000LLP1\)](#)
- [Longleaf Pine Bundle #2 \(B000LLP2\)](#)
- [Longleaf Pine Bundle #4 \(B000LLP4\)](#)
- [Pasture Bundle #5 – Pasture \(B000PST5\)](#)
- [Pasture Bundle 6 – Pasture \(B000PSTX\)](#)
- [Range Bundle #4 – Range \(B000RNG4\)](#)

10.5 CONSERVATION PRACTICE STANDARDS

Note: The below offers hyperlinks to information on each NRCS Conservation Practice Standard – the hyperlink provides access to the standard, and most include overviews, conservation practice physical effects worksheets, and network effect diagrams.

- [Access Control \(Ac.\) \(472\)](#)
- [Access Road \(Ft.\) \(560\)](#)
- [Agrichemical Handling Facility \(No.\) \(309\)](#)
- [Air Filtration and Scrubbing \(No.\) \(371\)](#)
- [Alley Cropping \(Ac.\) \(311\)](#)
- [Amending Soil Properties with Gypsum Products \(Ac.\) \(333\)](#)
- [Amendments for Treatment of Agricultural Waste \(au\) \(591\)](#)
- [Anaerobic Digester \(No.\) \(366\)](#)
- [Animal Mortality Facility \(No.\) \(316\)](#)
- [Anionic Polyacrylamide \(PAM\) Application \(Ac.\) \(450\)](#)
- [Aquaculture Ponds \(Ac.\) \(397\)](#)
- [Aquatic Organism Passage \(Mi.\) \(396\)](#)
- [Bivalve Aquaculture Gear and Biofouling Control \(Ac.\) \(400\)](#)
- [Brush Management \(Ac.\) \(314\)](#)
- [Channel Bed Stabilization \(Ft.\) \(584\)](#)
- [Clearing and Snagging \(Ft.\) \(326\)](#)
- [Combustion System Improvement \(No.\) \(372\)](#)
- [Composting Facility \(No.\) \(317\)](#)
- [Conservation Cover \(Ac.\) \(327\)](#)
- [Conservation Crop Rotation \(Ac.\) \(328\)](#)
- [Constructed Wetland \(Ac.\) \(656\)](#)
- [Contour Buffer Strips \(Ac.\) \(332\)](#)
- [Contour Farming \(Ac.\) \(330\)](#)
- [Contour Orchard and Other Perennial Crops \(Ac.\) \(331\)](#)
- [Controlled Traffic Farming \(Ac.\) \(334\)](#)
- [Cover Crop \(Ac.\) \(340\)](#)
- [Critical Area Planting \(Ac.\) \(342\)](#)
- [Cross Wind Ridges \(Ac.\) \(588\)](#)
- [Cross Wind Trap Strips \(Ac.\) \(589c\)](#)
- [Dam \(No.\) \(402\)](#)
- [Dam, Diversion \(No.\) \(384\)](#)
- [Deep Tillage \(Ac.\) \(324\)](#)
- [Denitrifying Bioreactor \(No.\) \(605\)](#)
- [Dike and Levee \(Ft.\) \(356\)](#)
- [Diversion \(Ft.\) \(362\)](#)

Note: The below offers hyperlinks to information on each NRCS Conservation Practice Standard – the hyperlink provides access to the standard, and most include overviews, conservation practice physical effects worksheets, and network effect diagrams.

- [Drainage Water Management \(Ac.\) \(554\)](#)
- [Dry Hydrant \(No.\) \(432\)](#)
- [Dust Control on Unpaved Roads and Surfaces \(Sq. Ft.\) \(373\)](#)
- [Dust Management for Pen Surfaces \(Ac.\) \(375\)](#)
- [Early Successional Habitat Development/Management \(Ac.\) \(647\)](#)
- [Emergency Animal Mortality Management \(No.\) \(368\)](#)
- [Energy Efficient Agricultural Operation \(No.\) \(374\)](#)
- [Energy Efficient Building Envelope \(No.\) \(672\)](#)
- [Energy Efficient Lighting System \(No.\) \(670\)](#)
- [Feed Management \(Au.\) \(592\)](#)
- [Fence \(Ft.\) \(382\)](#)
- [Field Border \(Ac.\) \(386\)](#)
- [Field Operations Emissions Reduction \(Ac.\) \(376\)](#)
- [Filter Strip \(Ac.\) \(393\)](#)
- [Firebreak \(Ft.\) \(394\)](#)
- [Fish Raceway or Tank \(Ft. and Ft³\) \(398\)](#)
- [Fishpond Management \(Ac.\) \(399\)](#)
- [Forage Harvest Management \(Ac.\) \(511\)](#)
- [Forest Farming \(Ac.\) \(379\)](#)
- [Forest Stand Improvement \(Ac.\) \(666\)](#)
- [Forest Trails and Landings \(Ac.\) \(655\)](#)
- [Fuel Break \(Ac.\) \(383\)](#)
- [Grade Stabilization Structure \(No.\) \(410\)](#)
- [Grassed Waterway \(Ac.\) \(412\)](#)
- [Grazing Land Mechanical Treatment \(Ac.\) \(548\)](#)
- [Groundwater Testing \(No.\) \(355\)](#)
- [Heavy Use Area Protection \(Sq. Ft.\) \(561\)](#)
- [Hedgerow Planting \(Ft.\) \(422\)](#)
- [Herbaceous Weed Treatment \(Ac.\) \(315\)](#)
- [Herbaceous Wind Barriers \(Ft.\) \(603\)](#)
- [High Tunnel System \(Sq.Ft.\) \(325\)](#)
- [Hillside Ditch \(Ft.\) \(423\)](#)
- [Irrigation Canal or Lateral \(Ft.\) \(320\)](#)
- [Irrigation Ditch Lining \(Ft.\) \(428\)](#)
- [Irrigation and Drainage Tailwater Recovery \(No.\) \(447\)](#)
- [Irrigation Field Ditch \(Ft.\) \(388\)](#)
- [Irrigation Land Leveling \(Ac.\) \(464\)](#)

Note: The below offers hyperlinks to information on each NRCS Conservation Practice Standard – the hyperlink provides access to the standard, and most include overviews, conservation practice physical effects worksheets, and network effect diagrams.

- [Irrigation Pipeline \(Ft.\) \(430\)](#)
- [Irrigation Reservoir \(Ac-Ft\) \(436\)](#)
- [Irrigation System, Microirrigation \(Ac.\) \(441\)](#)
- [Irrigation System, Surface and Subsurface \(Ac.\) \(443\)](#)
- [Irrigation Water Management \(Ac.\) \(449\)](#)
- [Land Clearing \(Ac.\) \(460\)](#)
- [Land Reclamation, Abandoned Mined Land \(Ac.\) \(543\)](#)
- [Land Reclamation, Landslide Treatment \(No. and Ac\) \(453\)](#)
- [Lined Waterway or Outlet \(Ft.\) \(468\)](#)
- [Livestock Pipeline \(Ft.\) \(516\)](#)
- [Livestock Shelter Structure \(No.\) \(576\)](#)
- [Mine Shaft and Adit Closing \(No.\) \(457\)](#)
- [Monitoring Well \(No.\) \(353\)](#)
- [Mulching \(Ac.\) \(484\)](#)
- [Nutrient Management \(Ac.\) \(590\)](#)
- [Obstruction Removal \(Ac.\) \(500\)](#)
- [On-Farm Secondary Containment Facility \(No.\) \(319\)](#)
- [Open Channel \(Ft.\) \(582\)](#)
- [Pasture and Hay Planting \(Ac.\) \(512\)](#)
- [Pest Management Conservation System \(Ac.\) \(595\)](#)
- [Pond \(No.\) \(378\)](#)
- [Pond Sealing or Lining-Compacted Soil \(Ft²\) \(520\)](#)
- [Pond Sealing or Lining-Concrete \(Ft²\) \(522\)](#)
- [Pond Sealing or Lining-Geomembrane or Geosynthetic Clay Liner \(No.\) \(521\)](#)
- [Precision Land Forming and Smoothing \(Ac.\) \(462\)](#)
- [Prescribed Burning \(Ac.\) \(338\)](#)
- [Prescribed Grazing \(Ac.\) \(528\)](#)
- [Pumping Plant \(No.\) \(533\)](#)
- [Range Planting \(Ac.\) \(550\)](#)
- [Recreation Land Improvement and Protection \(Ac.\) \(566\)](#)
- [Residue and Tillage Management, No-Till \(Ac.\) \(329\)](#)
- [Residue and Tillage Management, Reduced Till \(Ac.\) \(345\)](#)
- [Restoration of Rare or Declining Natural Communities \(Ac.\) \(643\)](#)
- [Riparian Forest Buffer \(Ac.\) \(391\)](#)
- [Riparian Herbaceous Cover \(Ac.\) \(390\)](#)
- [Road/Trail/Landing Closure and Treatment \(Ft.\) \(654\)](#)

Note: The below offers hyperlinks to information on each NRCS Conservation Practice Standard – the hyperlink provides access to the standard, and most include overviews, conservation practice physical effects worksheets, and network effect diagrams.

- [Rock Wall Terrace \(Ft.\) \(555\)](#)
- [Roof Runoff Structure \(No.\) \(558\)](#)
- [Roofs and Covers \(No.\) \(367\)](#)
- [Row Arrangement \(Ac.\) \(557\)](#)
- [Saline and Sodic Soil Management \(Ac.\) \(610\)](#)
- [Saturated Buffer \(Ft.\) \(604\)](#)
- [Sediment Basin \(No.\) \(350\)](#)
- [Shallow Water Development and Management \(Ac.\) \(646\)](#)
- [Short Term Storage of Animal Waste and Byproducts \(Cubic Yards\) \(318\)](#)
- [Silvopasture \(Ac.\) \(381\)](#)
- [Sinkhole Treatment \(No.\) \(527\)](#)
- [Spoil Disposal \(Ac.\) \(572\)](#)
- [Soil Carbon Amendment \(Ac.\) \(336\)](#)
- [Spring Development \(No.\) \(574\)](#)
- [Sprinkler System \(Ac.\) \(442\)](#)
- [Stormwater Runoff Control \(Ac.\) \(570\)](#)
- [Stream Crossing \(No.\) \(578\)](#)
- [Stream Habitat Improvement and Management \(Ac.\) \(395\)](#)
- [Streambank and Shoreline Protection \(Ft.\) \(580\)](#)
- [Stripcropping \(Ac.\) \(585\)](#)
- [Structure for Water Control \(No.\) \(587\)](#)
- [Structures for Wildlife \(No.\) \(649\)](#)
- [Subsurface Drain \(Ft.\) \(606\)](#)
- [Surface Drain, Field Ditch \(Ft.\) \(607\)](#)
- [Surface Drain, Main or Lateral \(Ft.\) \(608\)](#)
- [Surface Roughening \(Ac.\) \(609\)](#)
- [Terrace \(Ft.\) \(600\)](#)
- [Trails and Walkways \(Ft.\) \(575\)](#)
- [Tree/Shrub Establishment \(Ac.\) \(612\)](#)
- [Tree/Shrub Pruning \(Ac.\) \(660\)](#)
- [Tree/Shrub Site Preparation \(Ac.\) \(490\)](#)
- [Underground Outlet \(Ft.\) \(620\)](#)
- [Upland Wildlife Habitat Management \(Ac.\) \(645\)](#)
- [Vegetated Treatment Area \(Ac.\) \(635\)](#)
- [Vegetative Barrier \(Ft.\) \(601\)](#)
- [Vertical Drain \(No.\) \(630\)](#)

Note: The below offers hyperlinks to information on each NRCS Conservation Practice Standard – the hyperlink provides access to the standard, and most include overviews, conservation practice physical effects worksheets, and network effect diagrams.

- [Waste Facility Closure \(No.\) \(360\)](#)
- [Waste Recycling \(No.\) \(633\)](#)
- [Waste Separation Facility \(No.\) \(632\)](#)
- [Waste Storage Facility \(No.\) \(313\)](#)
- [Waste Transfer \(No.\) \(634\)](#)
- [Waste Treatment \(No.\) \(629\)](#)
- [Waste Treatment Lagoon \(No.\) \(359\)](#)
- [Wastewater Treatment, Milk House \(No.\) \(627\)](#)
- [Water and Sediment Control Basin \(No.\) \(638\)](#)
- [Water Harvesting Catchment \(No.\) \(636\)](#)
- [Water Well \(No.\) \(642\)](#)
- [Watering Facility \(No.\) \(614\)](#)
- [Waterspreading \(Ac.\) \(640\)](#)
- [Well Decommissioning \(No.\) \(351\)](#)
- [Wetland Creation \(Ac.\) \(658\)](#)
- [Wetland Enhancement \(Ac.\) \(659\)](#)
- [Wetland Restoration \(Ac.\) \(657\)](#)
- [Wetland Wildlife Habitat Management \(Ac.\) \(644\)](#)
- [Wildlife Habitat Planting \(Ac.\) \(420\)](#)
- [Windbreak/Shelterbelt Establishment and Renovation \(Ft.\) \(380\)](#)
- [Woody Residue Treatment \(Ac.\) \(384\)](#)

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10.6 CPS AND RELEVANT LAND USES

Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Access Control (Ac)	472	S	The temporary or permanent exclusion of animals, people, vehicles, and equipment from an area.	C	F	R	P	Pr	FS	D	W	O	AL
Access Road (Ft)	560	S	An access road is an established route for equipment and vehicles.	C	F	R	P	Pr	FS	D		O	AL
Agrichemical Handling Facility (no)	309	S	A facility with an impervious surface to provide an environmentally safe area for the handling of on-farm agrichemicals.	C	F	R	P		FS	D		O	AL
Air Filtration and Scrubbing (no)	371	S	A device or system for reducing emissions of air contaminants from a structure via interception and/or collection.						FS	D			
Alley Cropping (ac)	311	V	Trees or shrubs are planted in sets of single or multiple rows with agronomic, horticultural crops or forages produced in the alleys between the sets of woody plants that produce additional products.	C									
Amending Soil Properties with Gypsum Products (ac)	333	V	Using gypsum (calcium sulfate dihydrate) derived products to change the physical and/or chemical properties of soil.	C			P						
Amendments for Treatment of Agricultural Waste (AU)	591	V	The addition of chemical or biological additives to manure, process wastewater, contaminated storm water runoff, or other wastes to reduce adverse effects on air and/or water.	C	F	R	P		FS	D		O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Anaerobic Digester (no)	366	S	A component of a waste management system that provides biological treatment in the absence of oxygen.						FS				
Animal Mortality Facility (no)	316	S	An on-farm facility for the treatment or disposal of animal carcasses due to routine mortality.				P		FS				
Anionic Polyacrylamide (PAM) Application (Ac)	450	S	Application of water-soluble anionic polyacrylamide (PAM) to the soil.	C	F	R	P	Pr	FS	D	W	O	AL
Aquaculture Pond (Ac)	397	S	A water impoundment for farming of freshwater and saltwater organisms including fish, mollusks, crustaceans, and aquatic plants.			R	P		FS		W	O	
Aquatic Organism Passage (Mi)	396	S	Modification or removal of barriers that restrict or impede movement of aquatic organisms.	C	F	R	P	Pr	FS	D	W	O	AL
Bivalve Aquaculture Gear and Biofouling Control (Ac)	400	M	Actions that reduce, clean, or remove biofouling organisms and other waste from bivalve production areas while minimizing environmental risk and risk to species of concern.								W		
Brush Management (Ac)	314	V	The management or removal of woody (non-herbaceous or succulent) plants including those that are invasive and noxious.		F	R	P	Pr				O	AL
Channel Bed Stabilization (Ft)	584	S	Measure(s) used to stabilize the bed or bottom of a channel.	C	F	R	P	Pr	FS	D	W	O	AL
Clearing and Snagging (Ft)	326	V	Removal of specified vegetation along the bank (clearing) and selective removal of snags, drifts, or other obstructions (snagging) from natural or improved streams (includes channels).	C	F	R	P	Pr	FS	D	W	O	AL
Combustion System Improvement (No)	372	S	Installing, replacing, or retrofitting agricultural combustion systems and/or related	C	F	R	P	Pr	FS	D	W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
			components or devices for air quality and energy efficiency improvement.										
Composting Facility (No)	317	S	A structure or device to contain and facilitate an aerobic microbial ecosystem for the decomposition of manure, other organic material, or both, into a final product sufficiently stable for storage, onfarm use, and application to land as a soil amendment.						FS				
Conservation Cover (Ac)	327	V	Establishing and maintaining permanent vegetative cover	C	F	R		Pr	FS	D		O	AL
Conservation Crop Rotation (Ac)	328	V	A planned sequence of crops grown on the same ground over a period of time (i.e. the rotation cycle).	C									
Constructed Wetland (Ac)	656	S	An artificial wetland ecosystem with hydrophytic vegetation for biological treatment of water.	C	F	R	P	Pr	FS			O	AL
Contour Buffer Strips (Ac)	332	V	Narrow strips of permanent, herbaceous vegetative cover established around the hill slope, and alternated down the slope with wider cropped strips that are farmed on the contour.	C									
Contour Farming (Ac)	330	V	Aligning ridges, furrows, and roughness formed by tillage, planting and other operations at a grade near the contour to alter the velocity or the direction of water flow.	C									
Contour Orchard and Other Perennial Crops (Ac)	331	V	Planting orchards, vineyards, or other perennial crops so that all cultural operations are done on or near the contour.	C									
Controlled Traffic Farming (Ac)	334	M	Controlled traffic farming (CTF) is confining all high load wheel/track traffic from farm	C			P						

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
			equipment to specific lanes or tramlines (traffic pattern) in crop fields year after year.										
Cover Crop (Ac)	340	V	Grasses, legumes, and forbs planted for seasonal vegetative cover.	C	F	R	P	Pr				O	AL
Critical Area Planting (Ac)	342	V	Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal seeding/planting methods.	C	F	R	P	Pr	FS	D		O	AL
Cross Wind Trap Strips (Ac)	589	V	Herbaceous cover established in one or more strips typically perpendicular to the most erosive wind events.	C									
Cross Wind Ridges (Ac)	588	V	Ridges formed by tillage, planting, or other operations and aligned perpendicular to prevailing wind direction during critical wind erosion periods.	C								O	
Dam (No)	402	S	An artificial barrier that can impound water for one or more beneficial purposes.	C	F	R	P	Pr		D	W	O	AL
Dam, Diversion (No)	348	S	A structure built to divert all or part of the water from a waterway or a stream.	C	F	R	P	Pr	FS	D	W	O	AL
Deep Tillage (Ac)	324	V	Performing tillage operations below the normal tillage depth to modify adverse physical or chemical properties of a soil.	C	F	R	P	Pr	FS	D		O	AL
Denitrifying Bioreactor (No)	605	S	A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow through enhanced denitrification.						FS				
Dike and Levee (Ft)	356	S	A barrier used to retain water on the landscape using a wetland dike; or, a barrier used	C	F	R	P	Pr	FS	D	W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
			to exclude water from the landscape and protect property and infrastructure from flooding using a flood control levee.										
Diversion (Ft)	362	S	A channel usually constructed across the slope with a supporting ridge on the lower side.	C	F	R	P	Pr	FS	D		O	AL
Drainage Water Management (Ac)	554	M	The process of managing the drainage volume and water table elevation by regulating the flow from a surface or subsurface agricultural drainage system.	C			P		FS			O	AL
Dry Hydrant (No)	432	S	A nonpressurized permanent pipe assembly installed to permit withdrawal of water by suction from a water source.	C	F	R	P	Pr	FS	D		O	AL
Dust Control on Unpaved Roads and Surfaces (Sq Ft)	373	M	Controlling direct particulate matter emissions produced by vehicle and machinery traffic or wind action from unpaved roads and other surfaces by applying a palliative on the surface.	C	F	R	P	Pr	FS	D		O	AL
Dust Management for Pen Surfaces (Ac)	375	M	Reducing or preventing the emissions of particulate matter arising from animal activity on open lot surfaces at animal feeding operations.						FS				
Early Successional Habitat Development-Mgt (Ac)	647	M	Manage plant succession to develop and maintain early successional habitat to benefit desired wildlife and/or natural communities.	C	F	R	P	Pr	FS	D	W	O	AL
Emergency Animal Mortality Management (No)	368	S	A means or method for the management of animal carcasses from catastrophic mortality events.						FS				

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Energy Efficient Agricultural Operation (No)	374	S	Development and implementation of improvements to reduce, or improve the energy efficiency of on-farm energy use.	C	F	R	P	Pr				O	
Energy Efficient Building Envelope (No)	672	S	A boundary between a conditioned space and an unconditioned space that meets or exceeds best practices for energy efficiency.						FS	D			
Energy Efficient Lighting System (No)	670	S	An agricultural lighting system with increased energy efficiency.						FS	D			
Feed Management (AU)	592	M	Manipulating and controlling the quantity and quality of available nutrients, feedstuffs, ingredients, or additives fed to livestock and poultry.						FS				
Fence (Ft)	382	S	A constructed barrier to animals or people.	C	F	R	P	Pr	FS	D	W	O	AL
Field Border (Ac)	386	V	A strip of permanent vegetation established at the edge or around the perimeter of a field.	C			P					O	
Field Operations Emissions Reduction (Ac)	376	M	Adjusting field operations and technologies to reduce emissions of particulate matter (PM) and oxides of nitrogen from field operations.	C	F	R	P						AL
Filter Strip (Ac)	393	V	A strip or area of herbaceous vegetation that removes contaminants from overland flow.	C	F	R	P	Pr	FS	D		O	AL
Firebreak (Ft)	394	V	A permanent or temporary strip of bare or vegetated land planned to retard fire.	C	F	R	P	Pr	FS	D		O	AL
Fish Raceway or Tank (No)	398	S	A channel or tank with a continuous flow of water constructed or used for high-density fish production.						FS		W		
Fishpond Management (Ac)	399	M	Managing impounded aquatic habitat and water quality for the production of fish.	C	F	R	P		FS		W		AL
Forage Harvest Management (Ac)	511	V	The timely cutting and removal of forages as hay, green-chop, or ensilage.	C			P						

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Forest Farming (Ac)	379	V	Managing or establishing stands of trees or shrubs in coordination with the management and/or cultivation of understory plants or nontimber forest products.	C	F		P						
Forest Stand Improvement (Ac)	666	V	The manipulation of species composition, stand structure, or stand density by cutting or killing selected trees or understory vegetation to achieve desired forest conditions or obtain ecosystem services.		F		P	Pr				O	
Forest Trails and Landings (Ft)	655	S	A temporary or infrequently used route, path, or cleared area.		F			Pr				O	
Fuel Break (Ac)	383	V	A strip or block of land on which the vegetation, debris and detritus have been reduced and/or modified to control or diminish the risk of the spread of fire crossing the strip or block of land.		F	R		Pr	FS	D		O	
Grade Stabilization Structure (No)	410	S	A grade stabilization structure is a structure used to control the grade in natural or constructed channels.	C	F	R	P	Pr	FS	D	W	O	AL
Grassed Waterway (Ac)	412	V	A shaped or graded channel that is established with suitable vegetation to convey surface water at a nonerosive velocity using a broad and shallow cross section to a stable outlet.	C			P	Pr	FS	D		O	AL
Grazing Land Mechanical Treatment (Ac)	548	S	Modifying physical soil and/or plant conditions with mechanical treatments.		F	R	P						
Groundwater Testing (No)	355	M	Testing the physical, biological, and chemical quality of groundwater from a water well or spring.	C	F	R	P	Pr	FS	D		O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Heavy Use Area Protection (Sq Ft)	561	V	Stabilization or protection of an intensively used area.	C	F	R	P	Pr	FS	D		O	AL
Hedgerow Planting (Ft)	422	V	Establishment of dense vegetation in a linear design to achieve a natural resource conservation purpose.	C			P	Pr	FS	D		O	AL
Herbaceous Weed Treatment (Ac)	315	V	The removal or control of herbaceous weeds including invasive, noxious, prohibited, or undesirable plants.		F	R	P	Pr	FS	D		O	AL
Herbaceous Wind Barriers (Ft)	603	V	Herbaceous vegetation established in narrow strips within the field to reduce wind speed and wind erosion.	C				Pr				O	
High Tunnel System (SqFt)	325	S	An enclosed polyethylene, polycarbonate, plastic, or fabric covered structure that is used to cover and protect crops from sun, wind, excessive rainfall, or cold, to extend the growing season in an environmentally safe manner.	C									
Hillside Ditch (Ft)	423	S	A narrow channel with a supporting ridge on the lower side, constructed across the slope on steeply sloping land.	C	F	R	P	Pr	FS			O	AL
Irrigation and Drainage Tailwater Recovery (No)	447	M	A system designed to collect, store, and convey irrigation tailwater, rainfall runoff, field drain water, or combination thereof for reuse in water distribution to the crop.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation Canal or Lateral (Ft)	320	S	A permanent channel constructed to convey irrigation water from the source of supply to one or more irrigated areas.	C	F	R	P	Pr	FS	D		O	AL
Irrigation Ditch Lining (Ft)	428	S	A lining of impervious material or a chemical treatment, installed in an irrigation ditch, canal, or lateral.	C	F	R	P	Pr	FS	D	W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Irrigation Field Ditch (Ft)	388	S	An irrigation ditch constructed in or with earth materials, to convey water from the source of supply to a field or fields in an irrigation system.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation Land Leveling (Ac)	464	S	Reshaping the surface of land to be irrigated, to planned lines and grades.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation Pipeline (Ft)	430	S	A pipeline and appurtenances installed to convey water for storage or application, as part of an irrigation water system.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation Reservoir (No)	436	S	A constructed dam, pit, or tank used to store water for irrigation.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation System, Microirrigation (Ac)	441	S	An irrigation system for frequent application of small quantities of water on or below the soil surface as drops, tiny streams, or miniature spray through emitters or applicators placed along a water delivery line.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation System, Surface and Subsurface (Ac)	443	S	A system that delivers irrigation water by surface means, such as furrows, borders, and contour levees, or by subsurface means through water table control.	C	F	R	P	Pr	FS	D	W	O	AL
Irrigation Water Management (Ac)	449	M	The process of determining and controlling the volume, frequency, and application rate of irrigation water.	C	F	R	P	Pr	FS	D	W	O	AL
Land Clearing (Ac)	460	V	Removal of trees, stumps, and other vegetation from wooded areas.	C		R	P	Pr	FS	D		O	AL
Land Reclamation, Abandoned Mined Land (Ac)	543	M	Reclamation of land and water areas adversely affected by past mining activities.									O	

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Land Reclamation, Landslide Treatment (Ac)	453	M	Stabilize in-place natural materials, mine spoil, waste, or overburden to prevent downslope movement.	C	F	R	P	Pr	FS	D		O	AL
Lined Waterway or Outlet (Ft)	468	S	A waterway or protected outlet section having an erosion-resistant lining of concrete, stone, synthetic turf reinforcement fabrics, or other permanent material.	C	F	R	P	Pr	FS	D		O	AL
Livestock Pipeline (Ft)	516	S	A pipeline and appurtenances installed to convey water for livestock or wildlife.	C	F	R	P	Pr	FS	D		O	AL
Livestock Shelter Structure (No)	576	S	A permanent or portable structure to protect animals from negative environmental factors.		F	R	P		FS				
Mine Shaft and Adit Closing (No)	457	S	Closure of underground mine openings by filling, plugging, capping, and installing barriers, gates, or fencing.								W	O	
Monitoring Well (No)	353	S	A well designed and installed to obtain representative ground water samples and hydrogeologic information.						FS				
Mulching (Ac)	484	V	Applying plant residues or other suitable materials to the land surface.	C	F	R	P	Pr	FS	D		O	AL
Nutrient Management (Ac)	590	M	Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.	C	F	R	P	Pr	FS	D		O	AL
Obstruction Removal (No)	500	S	Removal and disposal of buildings, structures, other works of improvement; vegetation, debris, or other materials.	C	F	R	P	Pr	FS	D		O	AL
On-Farm Secondary Containment Facility (No)	319	S	A permanent facility designed to provide secondary containment of oil and petroleum products used on-farm.						FS				

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Open Channel (Ft)	582	S	An open channel is a natural or artificial channel in which water flows with a free surface.	C	F	R	P	Pr	FS	D	W	O	AL
Pasture and Hay Planting (Ac)	512	V	Establishing adapted and compatible species, varieties, or cultivars of perennial herbaceous plants suitable for pasture or hay production.	C			P						
Pest Management Conservation System (Ac)	595	M	A system that combines an integrated pest management (IPM) decision-making process with natural resource conservation to address pest and environmental impacts.	C	F	R	P	Pr	FS	D	W	O	AL
Pond (No)	378	S	A water impoundment made by constructing an embankment, excavating a dugout, or a combination of both. In this standard, NRCS defines ponds constructed by the first method as embankment ponds and those constructed by the second method as excavated ponds. Ponds constructed using a combination of the excavation and embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more above the lowest original ground along the centerline of the embankment.	C	F	R	P	Pr	FS	D		O	AL
Pond Sealing or Lining - Concrete (Sq Ft)	522	S	A liner for an impoundment constructed using reinforced or nonreinforced concrete.	C	F	R	P	Pr	FS			O	AL
Pond Sealing or Lining, Compacted Clay Treatment (Sq Ft)	521D	S	A liner for a pond or waste storage impoundment constructed using compacted soil without soil amendments.	C	F	R	P	Pr	FS	D		O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Pond Sealing or Lining, Compacted Soil Treatment (Sq Ft)	520	S	A liner for an impoundment constructed using compacted soil with or without soil amendments.	C	F	R	P	Pr	FS	D		O	AL
Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Sq Ft)	521	S	A liner for an impoundment constructed using a geomembrane or a geosynthetic clay material.	C	F	R	P	Pr	FS	D		O	AL
Precision Land Forming and Smoothing (Ac)	462	S	Precision land forming is reshaping the surface of land to planned grades.	C			P		FS	D		O	
Prescribed Burning (Ac)	338	V	Planned fire applied to a predetermined area.	C	F	R	P	Pr				O	AL
Prescribed Grazing (Ac)	528	V	Managing the harvest of vegetation with grazing and/or browsing animals with the intent to achieve specific ecological, economic, and management objectives.	C	F	R	P	Pr	FS	D	W	O	AL
Pumping Plant (No)	533	S	A facility that delivers water or wastewater at a designed pressure and flow rate.	C	F	R	P	Pr	FS			O	
Range Planting (Ac)	550	V	The seeding and establishment of herbaceous and woody species for the improvement of vegetation composition and productivity of the plant community to meet management goals.		F	R	P	Pr					AL
Recreation Land Improvement and Protection (Ac)	566	S	Recreation land grading and shaping is reshaping the surface of the land to support recreational land use.		F	R		Pr	FS	D		O	
Residue and Tillage Management, No Till (Ac)	329	V	Limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year around.	C			P					O	

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Residue and Tillage Management, Reduced Till (Ac)	345	V	Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.	C			P					O	
Restoration of Rare or Declining Natural Communities (Ac)	643	M	Re-establishment of abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals.	C	F	R	P	Pr	FS	D	W	O	AL
Riparian Forest Buffer (Ac)	391	V	An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.	C	F	R	P	Pr	FS	D		O	AL
Riparian Herbaceous Cover (Ac)	390	V	Grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils, established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats.	C	F	R	P	Pr	FS	D		O	AL
Road/Trail/Landing Closure and Treatment (Ft)	654	S	The closure, decommissioning, or abandonment of roads, trails, and/or landings and associated treatment to achieve conservation objectives.		F	R		Pr				O	AL
Rock Wall Terrace (Ft)	555	S	A fitted rock wall constructed across the slope to create a farmable area.	C		R	P	Pr				O	AL
Roof Runoff Structure (No)	558	S	A structure that will collect, control, and convey precipitation runoff from a roof.						FS	D			
Roofs and Covers (No)	367	S	A rigid, semirigid, or flexible manufactured membrane, composite material, or roof structure placed over a waste management						FS	D			

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
			facility, agrichemical handling facility, or an on-farm secondary containment facility.										
Row Arrangement (Ac)	557	V	A system of crop rows on planned directions, grades, and lengths.	C	F								
Salinity and Sodic Soil Management (Ac)	610	M	Management of land, water and plants to reduce accumulations of salts and/or sodium on the soil surface and in the crop rooting zone.	C	F	R	P	Pr	FS	D		O	AL
Saturated Buffer (Ft)	604	S	A subsurface, perforated distribution pipe used to distribute drainage system discharge beneath a vegetated buffer along its length and discharge channel.	C			P		FS				
Sediment Basin (No)	350	S	A basin constructed with an engineered outlet, formed by constructing an embankment, excavating a dugout, or a combination of both.	C	F	R	P	Pr	FS	D		O	AL
Shallow Water Development and Management (Ac)	646	M	The inundation of lands to provide habitat for fish and wildlife.	C	F	R	P	Pr	FS	D	W	O	AL
Short Term Storage of Animal Waste and By-Products (Cu-Ft)	318	S	Temporary, nonstructural measures used to store solid or semisolid organic agricultural waste or manure (stackable livestock and poultry manure, bedding, litter, spilled feed, or soil mixed with manure) on a short-term basis between collection and utilization.						FS				
Silvopasture (Ac)	381	S	Establishment and/or management of desired trees and forages on the same land unit.		F		P						
Sinkhole Treatment (No)	527	M	The treatment of sinkholes in karst areas to reduce contamination of groundwater resources and to improve farm safety.	C	F	R	P	Pr	FS	D		O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Soil Carbon Amendment (Ac)	336	M	Using amendments derived from plant or animal residues to improve the physical, chemical, and biological properties of the soil.	C	F	R	P		FS	D			AL
Spoil Disposal (Cu-Ft)	572	S	Disposal of surplus excavated materials from construction activities.	C	F	R	P	Pr	FS	D		O	AL
Spring Development (No)	574	S	The collection and use of water from seeps or springs.	C	F	R	P	Pr	FS	D		O	AL
Sprinkler System (Ac)	442	S	A distribution system that applies water by means of nozzles operated under pressure.	C	F	R	P	Pr	FS	D	W	O	AL
Stormwater Runoff Control (Ac)	570	S	Measures or systems to control the quantity and quality of stormwater runoff.	C	F	R	P	Pr	FS	D		O	AL
Stream Crossing (No)	578	S	A stabilized area or structure constructed across a stream to provide controlled access for people, livestock, equipment, or vehicles.	C	F	R	P	Pr	FS	D		O	AL
Stream Habitat Improvement and Management (Ac)	395	M	Improve, restore, or maintain the ecological functions of a stream and its adjacent floodplain and riparian area.	C	F	R	P	Pr	FS	D	W	O	AL
Streambank and Shoreline Protection (Ft)	580	S	Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries.	C	F	R	P	Pr	FS	D		O	AL
Stripcropping (Ac)	585	V	Growing planned rotations of erosion-resistant and erosion-susceptible crops or fallow in a systematic arrangement of strips across a field.	C									
Structure for Water Control (No)	587	S	A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water.	C	F	R	P	Pr	FS	D	W	O	AL
Structures for Wildlife (No)	649	S	A structure installed to replace or modify a missing or deficient wildlife habitat component.	C	F	R	P	Pr	FS	D	W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Subsurface Drain (Ft)	606	S	A conduit, or system of conduits, installed beneath the ground surface to manage soil water conditions.	C	F	R	P	Pr	FS	D		O	AL
Surface Drain, Field Ditch (Ft)	607	S	A graded channel on the field surface for collecting and conveying excess water.	C	F	R	P	Pr	FS	D		O	AL
Surface Drain, Main or Lateral (Ft)	608	S	An open drainage ditch for moving the excess water collected by a field ditch or subsurface drain to a safe outlet	C	F	R	P	Pr	FS	D		O	AL
Surface Roughening (Ac)	609	V	Performing tillage operations that create random roughness of the soil surface	C									
Terrace (Ft)	600	S	An earth embankment or a combination ridge and channel, constructed across the field slope.	C									
Trails and Walkways (Ft)	575	S	A constructed path with a vegetated, earthen, gravel, paved, or other hard surface to facilitate the movement of animals, people, or off-road vehicles.	C	F	R	P	Pr	FS	D		O	AL
Tree/Shrub Establishment (Ac)	612	V	Establishing woody plants by planting seedlings or cuttings, by direct seeding, and/or through natural regeneration.	C	F	R	P	Pr	FS	D		O	AL
Tree/Shrub Site Preparation (Ac)	490	V	Treatment of areas to improve site conditions for establishing trees and/or shrubs.	C	F	R	P	Pr	FS	D		O	AL
Tree-Shrub Pruning (Ac)	660	V	The removal of all or parts of selected branches, leaders, or roots from trees and shrubs.	C	F	R	P	Pr	FS	D		O	AL
Underground Outlet (Ft)	620	S	A conduit or system of conduits installed beneath the ground surface to convey surface water to a suitable outlet.	C	F	R	P	Pr	FS	D	W	O	AL
Upland Wildlife Habitat Management (Ac)	645	M	Provide and manage upland habitats and connectivity within the landscape for wildlife.	C	F	R	P	Pr	FS	D	W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Vegetated Treatment Area (Ac)	635	V	An area of permanent vegetation used for agricultural wastewater treatment.	C			P		FS				
Vegetative Barrier (Ft)	601	V	Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.	C	F	R	P	Pr	FS	DL		O	AL
Vertical Drain (No)	630	S	A well, pipe, pit, or bore in porous underground strata into which drainage water can be discharged without contaminating groundwater resources.	C	F	R	P	Pr	FS	DL		O	AL
Waste Facility Closure (No)	360	S	The decommissioning of facilities, and/or the rehabilitation of contaminated soil, in an environmentally safe manner, where agricultural waste has been handled, treated, and stored or both and is no longer used for the intended purpose.						FS				
Waste Recycling (No)	633	M	The on-farm agricultural use of nonagricultural waste by-products, or the off-farm nonagricultural use of agricultural waste by-products.	C	F	R	P	Pr				O	AL
Waste Separation Facility (No)	632	S	A filtration or screening device, settling tank, settling basin, or settling channel used to partition solids and/or nutrients from a waste stream.						FS				
Waste Storage Facility (No)	313	S	An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.						FS				
Waste Transfer (No)	634	S	A system using structures, pipes or conduits installed to convey wastes or waste byproducts						FS				

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
			from the agricultural production site to storage/treatment or application.										
Waste Treatment (No)	629	M	Use of mechanical, chemical, or biological technologies to change the characteristics of manure and agricultural waste.						FS				
Waste Treatment Lagoon (No)	359	S	A waste treatment impoundment made by constructing an embankment and/or excavating a pit or dugout.						FS				
Wastewater Treatment Milk House (No)	627	S	The physical, mechanical, and biological treatment of dairy milk house wastewater.						FS				
Water and Sediment Control Basin (No)	638	S	An earth embankment or a combination ridge and channel constructed across the slope of a minor drainageway.	C	F	R	P	Pr	FS	D	W	O	AL
Water Harvesting Catchment (No)	636	S	A facility for collecting and storing water from an area that has been treated to increase precipitation runoff.	C	F	R	P	Pr	FS	D		O	AL
Water Well (No)	642	S	A hole drilled, dug, driven, bored, jetted, or otherwise constructed into an aquifer for agricultural water supply.	C	F	R	P	Pr	FS	D		O	AL
Watering Facility (No)	614	S	A watering facility stores or provides drinking water to livestock or wildlife.	C	F	R	P	Pr	FS	D	W	O	AL
Waterspreading (Ac)	640	S	A system of diverting or collecting runoff from natural watercourses and spreading the runoff over relatively flat areas.	C	F	R	P	Pr				O	
Well Decommissioning (No)	351	M	The sealing and permanent closure of an inactive, abandoned, or unusable water or monitoring well.	C	F	R	P	Pr	FS	D		O	AL
Wetland Creation (Ac)	658	M	A wetland created on a site location that was historically not a wetland.	C	F	R	P	Pr			W	O	AL

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Practice Name (units of measure)	Code	Type	Practice Description	Crop	Forest	Range	Pasture	Protected	Farmstead	Developed Land	Water	Other	Associated Ag. Land
				Land Uses Where Applied									
Wetland Enhancement (Ac)	659	M	The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions.	C	F	R	P	Pr			W	O	AL
Wetland Restoration (Ac)	657	M	The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site.	C	F	R	P	Pr			W	O	AL
Wetland Wildlife Habitat Management (Ac)	644	M	Retaining, developing or managing wetland habitat for wetland wildlife.	C	F	R	P	Pr	FS	D	W	O	AL
Wildlife Habitat Planting (Ac)	420	V	Establishing wildlife habitat by planting herbaceous vegetation or shrubs.	C	F	R	P		FS	D		O	AL
Windbreak/Shelterbelt Establishment and Renovation (Ft)	380	V	Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations.	C			P		FS	D		O	AL
Woody Residue Treatment (Ac)	384	V	The treatment of residual woody material that is created due to management activities or natural disturbances.	C	F	R	P	Pr	FS	D		O	AL

Land use definitions.

Crop (C) Land used primarily for the production and harvest of annual or perennial field, forage, food, fiber, horticultural, orchard, vineyard, or energy crops.

Forest (F) Land on which the historic and/or introduced vegetation is predominantly tree cover managed for the production of wood products or non-timber forest products.

Range (R) Land on which the historic and/or introduced vegetation is predominantly grasses, grass-like plants, forbs or shrubs managed as natural ecosystem. Range land may include natural grasslands, savannas, shrublands, tundra, alpine communities, marshes and meadows.

Pasture (P) Land composed of introduced or domesticated native forage species that is used primarily for the production of livestock. Pastures receive periodic renovation and cultural treatments, such as tillage, fertilization, mowing, weed control, and may be irrigated. Pastures are not in rotation with crops.

Farmstead (FS) Land used for facilities and supporting infrastructure where farming, forestry, animal husbandry, and ranching activities are often initiated. This may include dwellings, equipment storage, plus farm input and output storage and handling facilities. Also includes land dedicated to the facilitation and production of high-intensity animal agriculture in a containment facility where daily nutritional requirements are obtained from other lands or feed sources.

Water (W) Geographic area whose dominant characteristic is open water or permanent ice or snow. May include intermingled land, including tidal-influenced coastal marsh lands.

Associated Agriculture Lands (AL) Land associated with farms and ranches that are not purposefully managed for food, forage, or fiber and are typically associated with nearby production or conservation lands. This could include incidental areas, such as idle center pivot corners, odd areas, ditches and watercourses, riparian areas, field edges, seasonal and permanent wetlands, and other similar areas.

Designated Protected Areas (Pr) Land or water used for the preservation, protection, and observation of the existing resources, archaeological or historical interpretation, resource interpretation, or for aesthetic value. These areas are officially designated by legislation or other authorities. Examples: legislated natural or scenic areas and rural burial plots.

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Developed Land (D) Land occupied by buildings and related facilities used for residences, commercial sites, public highways, airports, and open space associated with towns and cities.

Other (O) Land that is barren, sandy, rocky, or that is impacted by the extraction of natural resources, such as minerals, gravel or sand, coal, shale, rock, oil, or natural gas.

Type of Practice:

S – Structural

V – Vegetative

M – Management

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10.7 POTENTIAL TEMPORARY AND INCIDENTAL STRESSORS AND KNOWN BENEFITS – BY CPS/E

<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Access Control (Ac)	472	S	The temporary or permanent exclusion of animals, people, vehicles, and equipment from an area.	X		X			
Access Road (Ft)	560	S	An access road is an established route for equipment and vehicles.	X	X				
Agrichemical Handling Facility (no)	309	S	A facility with an impervious surface to provide an environmentally safe area for the handling of on-farm agrichemicals.	X	X				
Air Filtration and Scrubbing (no)	371	S	A device or system for reducing emissions of air contaminants from a structure via interception and/or collection.					X	
Alley Cropping (ac)	311	V	Trees or shrubs are planted in sets of single or multiple rows with agronomic, horticultural crops or forages produced in the alleys between the sets of woody plants that produce additional products.	X		X			X
Amending Soil Properties with Gypsum Products (ac)	333	V	Using gypsum (calcium sulfate dihydrate) derived products to change the physical and/or chemical properties of soil.			X			
Amendments for Treatment of Agricultural Waste (AU)	591	V	The addition of chemical or biological additives to manure, process wastewater, contaminated storm water runoff, or other wastes to reduce adverse effects on air and/or water.					X	

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Anaerobic Digester (no)	366	S	A component of a waste management system that provides biological treatment in the absence of oxygen.					X	
Animal Mortality Facility (no)	316	S	An on-farm facility for the treatment or disposal of animal carcasses due to routine mortality.					X	
Anionic Polyacrylamide (PAM) Application (Ac)	450	S	Application of water-soluble anionic polyacrylamide (PAM) to the soil.					X	
Aquaculture Pond (Ac)	397	S	A water impoundment for farming of freshwater and saltwater organisms including fish, mollusks, crustaceans, and aquatic plants.	X	X				
Aquatic Organism Passage (Mi)	396	S	Modification or removal of barriers that restrict or impede movement of aquatic organisms.	X		X			
Bivalve Aquaculture Gear and Biofouling Control (Ac)	400	M	Actions that reduce, clean, or remove biofouling organisms and other waste from bivalve production areas while minimizing environmental risk and risk to species of concern.					X	
Brush Management (Ac)	314	V	The management or removal of woody (non-herbaceous or succulent) plants including those that are invasive and noxious.	X	X	X	X		X
Channel Bed Stabilization (Ft)	584	S	Measure(s) used to stabilize the bed or bottom of a channel.	X	X				
Clearing and Snagging (Ft)	326	V	Removal of specified vegetation along the bank (clearing) and selective removal of snags, drifts, or other obstructions (snagging) from natural or improved streams (includes channels).	X	X	X			

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	<u>Human-Induced Unintentional Hazards</u>	<u>Habitat Loss/Earth Disturbance</u>	<u>Vegetative Management</u>	<u>Potential Use of Herbicides</u>	<u>Unlikely to generate Stressors</u>	<u>Beneficial</u>
Combustion System Improvement (No)	372	S	Installing, replacing, or retrofitting agricultural combustion systems and/or related components or devices for air quality and energy efficiency improvement.					X	
Composting Facility (No)	317	S	A structure or device to contain and facilitate an aerobic microbial ecosystem for the decomposition of manure, other organic material, or both, into a final product sufficiently stable for storage, onfarm use, and application to land as a soil amendment.		X				
Conservation Cover (Ac)	327	V	Establishing and maintaining permanent vegetative cover	X	X	X	X		X
Conservation Crop Rotation (Ac)	328	V	A planned sequence of crops grown on the same ground over a period of time (i.e. the rotation cycle).	X		X			
Constructed Wetland (Ac)	656	S	An artificial wetland ecosystem with hydrophytic vegetation for biological treatment of water.	X	X	X			
Contour Buffer Strips (Ac)	332	V	Narrow strips of permanent, herbaceous vegetative cover established around the hill slope, and alternated down the slope with wider cropped strips that are farmed on the contour.	X		X			X
Contour Farming (Ac)	330	V	Aligning ridges, furrows, and roughness formed by tillage, planting and other operations at a grade near the contour to alter the velocity or the direction of water flow.	X		X			
Contour Orchard and Other Perennial Crops (Ac)	331	V	Planting orchards, vineyards, or other perennial crops so that all cultural operations are done on or near the contour.	X		X			X

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Controlled Traffic Farming (Ac)	334	M	Controlled traffic farming (CTF) is confining all high load wheel/track traffic from farm equipment to specific lanes or tramlines (traffic pattern) in crop fields year after year.					X	
Cover Crop (Ac)	340	V	Grasses, legumes, and forbs planted for seasonal vegetative cover.	X		X			X
Critical Area Planting (Ac)	342	V	Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal seeding/planting methods.	X		X			X
Cross Wind Trap Strips (Ac)	589	V	Herbaceous cover established in one or more strips typically perpendicular to the most erosive wind events.	X		X			X
Cross Wind Ridges (Ac)	588	V	Ridges formed by tillage, planting, or other operations and aligned perpendicular to prevailing wind direction during critical wind erosion periods.	X		X			X
Dam (No)	402	S	An artificial barrier that can impound water for one or more beneficial purposes.	X	X	X			
Dam, Diversion (No)	348	S	A structure built to divert all or part of the water from a waterway or a stream.	X	X	X			
Deep Tillage (Ac)	324	V	Performing tillage operations below the normal tillage depth to modify adverse physical or chemical properties of a soil.	X		X			

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Denitrifying Bioreactor (No)	605	S	A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow through enhanced denitrification.					X	
Dike and Levee (Ft)	356	S	A barrier used to retain water on the landscape using a wetland dike; or, a barrier used to exclude water from the landscape and protect property and infrastructure from flooding using a flood control levee.	X	X				
Diversion (Ft)	362	S	A channel usually constructed across the slope with a supporting ridge on the lower side.	X	X				
Drainage Water Management (Ac)	554	M	The process of managing the drainage volume and water table elevation by regulating the flow from a surface or subsurface agricultural drainage system.	X					
Dry Hydrant (No)	432	S	A nonpressurized permanent pipe assembly installed to permit withdrawal of water by suction from a water source.	X	X				
Dust Control on Unpaved Roads and Surfaces (Sq Ft)	373	M	Controlling direct particulate matter emissions produced by vehicle and machinery traffic or wind action from unpaved roads and other surfaces by applying a palliative on the surface.	X					
Dust Management for Pen Surfaces (Ac)	375	M	Reducing or preventing the emissions of particulate matter arising from animal activity on open lot surfaces at animal feeding operations.	X					

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Early Successional Habitat Development-Mgt (Ac)	647	M	Manage plant succession to develop and maintain early successional habitat to benefit desired wildlife and/or natural communities.	Dependent upon the selected vegetative and structural CPS/E(s)					
Emergency Animal Mortality Management (No)	368	S	A means or method for the management of animal carcasses from catastrophic mortality events.	X	X				
Energy Efficient Agricultural Operation (No)	374	S	Development and implementation of improvements to reduce, or improve the energy efficiency of on-farm energy use.					X	
Energy Efficient Building Envelope (No)	672	S	A boundary between a conditioned space and an unconditioned space that meets or exceeds best practices for energy efficiency.					X	
Energy Efficient Lighting System (No)	670	S	An agricultural lighting system with increased energy efficiency.					X	
Feed Management (AU)	592	M	Manipulating and controlling the quantity and quality of available nutrients, feedstuffs, ingredients, or additives fed to livestock and poultry.					X	
Fence (Ft)	382	S	A constructed barrier to animals or people.	X	X				
Field Border (Ac)	386	V	A strip of permanent vegetation established at the edge or around the perimeter of a field.	X		X			X
Field Operations Emissions Reduction (Ac)	376	M	Adjusting field operations and technologies to reduce emissions of particulate matter (PM) and oxides of nitrogen from field operations.	X				X	

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Filter Strip (Ac)	393	V	A strip or area of herbaceous vegetation that removes contaminants from overland flow.	X		X			X
Firebreak (Ft)	394	V	A permanent or temporary strip of bare or vegetated land planned to retard fire.	X	X	X			X
Fish Raceway or Tank (No)	398	S	A channel or tank with a continuous flow of water constructed or used for high-density fish production.					X	
Fishpond Management (Ac)	399	M	Managing impounded aquatic habitat and water quality for the production of fish.					X	
Forage Harvest Management (Ac)	511	V	The timely cutting and removal of forages as hay, green-chop, or ensilage.	X		X	X		
Forest Farming (Ac)	379	V	Managing or establishing stands of trees or shrubs in coordination with the management and/or cultivation of understory plants or nontimber forest products.	X		X	X		X
Forest Stand Improvement (Ac)	666	V	The manipulation of species composition, stand structure, or stand density by cutting or killing selected trees or understory vegetation to achieve desired forest conditions or obtain ecosystem services.	X	X	X	X		X
Forest Trails and Landings (Ft)	655	S	A temporary or infrequently used route, path, or cleared area.	X	X	X			X
Fuel Break (Ac)	383	V	A strip or block of land on which the vegetation, debris and detritus have been reduced and/or modified to control or diminish the risk of the spread of fire crossing the strip or block of land.	X	X	X			

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	<u>Human-Induced Unintentional Hazards</u>	<u>Habitat Loss/Earth Disturbance</u>	<u>Vegetative Management</u>	<u>Potential Use of Herbicides</u>	<u>Unlikely to generate Stressors</u>	<u>Beneficial</u>
Grade Stabilization Structure (No)	410	S	A grade stabilization structure is a structure used to control the grade in natural or constructed channels.	X	X				
Grassed Waterway (Ac)	412	V	A shaped or graded channel that is established with suitable vegetation to convey surface water at a nonerosive velocity using a broad and shallow cross section to a stable outlet.	X		X			X
Grazing Land Mechanical Treatment (Ac)	548	S	Modifying physical soil and/or plant conditions with mechanical treatments.	X	X	X			X
Groundwater Testing (No)	355	M	Testing the physical, biological, and chemical quality of groundwater from a water well or spring.					X	
Heavy Use Area Protection (Sq Ft)	561	V	Stabilization or protection of an intensively used area.	X		X			X
Hedgerow Planting (Ft)	422	V	Establishment of dense vegetation in a linear design to achieve a natural resource conservation purpose.	X		X			X
Herbaceous Weed Treatment (Ac)	315	V	The removal or control of herbaceous weeds including invasive, noxious, prohibited, or undesirable plants.	X	X	X	X		X
Herbaceous Wind Barriers (Ft)	603	V	Herbaceous vegetation established in narrow strips within the field to reduce wind speed and wind erosion.	X		X			X
High Tunnel System (SqFt)	325	S	An enclosed polyethylene, polycarbonate, plastic, or fabric covered structure that is used to cover and protect crops from sun, wind, excessive rainfall, or cold, to extend the growing season in an environmentally safe manner.					X	

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Hillside Ditch (Ft)	423	S	A narrow channel with a supporting ridge on the lower side, constructed across the slope on steeply sloping land.	X	X				
Irrigation and Drainage Tailwater Recovery (No)	447	M	A system designed to collect, store, and convey irrigation tailwater, rainfall runoff, field drain water, or combination thereof for reuse in water distribution to the crop.	X	X				
Irrigation Canal or Lateral (Ft)	320	S	A permanent channel constructed to convey irrigation water from the source of supply to one or more irrigated areas.	X	X				
Irrigation Ditch Lining (Ft)	428	S	A lining of impervious material or a chemical treatment, installed in an irrigation ditch, canal, or lateral.	X	X			X	
Irrigation Field Ditch (Ft)	388	S	An irrigation ditch constructed in or with earth materials, to convey water from the source of supply to a field or fields in an irrigation system.	X	X				
Irrigation Land Leveling (Ac)	464	S	Reshaping the surface of land to be irrigated, to planned lines and grades.	X	X				
Irrigation Pipeline (Ft)	430	S	A pipeline and appurtenances installed to convey water for storage or application, as part of an irrigation water system.	X	X				
Irrigation Reservoir (No)	436	S	A constructed dam, pit, or tank used to store water for irrigation.	X	X				
Irrigation System, Microirrigation (Ac)	441	S	An irrigation system for frequent application of small quantities of water on or below the soil surface as drops, tiny streams, or miniature spray through emitters or applicators placed along a water delivery line.	X	X				

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Irrigation System, Surface and Subsurface (Ac)	443	S	A system that delivers irrigation water by surface means, such as furrows, borders, and contour levees, or by subsurface means through water table control.	X	X				
Irrigation Water Management (Ac)	449	M	The process of determining and controlling the volume, frequency, and application rate of irrigation water.	X	X				
Land Clearing (Ac)	460	V	Removal of trees, stumps, and other vegetation from wooded areas.	X	X				X
Land Reclamation, Abandoned Mined Land (Ac)	543	M	Reclamation of land and water areas adversely affected by past mining activities.	X	X	X			X
Land Reclamation, Landslide Treatment (Ac)	453	M	Stabilize in-place natural materials, mine spoil, waste, or overburden to prevent downslope movement.	X	X	X			X
Lined Waterway or Outlet (Ft)	468	S	A waterway or protected outlet section having an erosion-resistant lining of concrete, stone, synthetic turf reinforcement fabrics, or other permanent material.	X	X				
Livestock Pipeline (Ft)	516	S	A pipeline and appurtenances installed to convey water for livestock or wildlife.	X	X				
Livestock Shelter Structure (No)	576	S	A permanent or portable structure to protect animals from negative environmental factors.	X	X				
Mine Shaft and Adit Closing (No)	457	S	Closure of underground mine openings by filling, plugging, capping, and installing barriers, gates, or fencing.					X	

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Monitoring Well (No)	353	S	A well designed and installed to obtain representative ground water samples and hydrogeologic information.					X	
Mulching (Ac)	484	V	Applying plant residues or other suitable materials to the land surface.	X	X	X			
Nutrient Management (Ac)	590	M	Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.					X	X
Obstruction Removal (No)	500	S	Removal and disposal of buildings, structures, other works of improvement; vegetation, debris, or other materials.	X	X				X
On-Farm Secondary Containment Facility (No)	319	S	A permanent facility designed to provide secondary containment of oil and petroleum products used on-farm.	X					
Open Channel (Ft)	582	S	An open channel is a natural or artificial channel in which water flows with a free surface.	X	X				
Pasture and Hay Planting (Ac)	512	V	Establishing adapted and compatible species, varieties, or cultivars of perennial herbaceous plants suitable for pasture or hay production.	X		X			X
Pest Management Conservation System (Ac)	595	M	A system that combines an integrated pest management (IPM) decision-making process with natural resource conservation to address pest and environmental impacts.						X
Pond (No)	378	S	A water impoundment made by constructing an embankment, excavating a dugout, or a combination of both.	X	X				

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Pond Sealing or Lining - Concrete (Sq Ft)	522	S	A liner for an impoundment constructed using reinforced or nonreinforced concrete.					X	
Pond Sealing or Lining, Compacted Clay Treatment (Sq Ft)	521D	S	A liner for a pond or waste storage impoundment constructed using compacted soil without soil amendments.					X	
Pond Sealing or Lining, Compacted Soil Treatment (Sq Ft)	520	S	A liner for an impoundment constructed using compacted soil with or without soil amendments.					X	
Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Sq Ft)	521	S	A liner for an impoundment constructed using a geomembrane or a geosynthetic clay material.					X	
Precision Land Forming and Smoothing (Ac)	462	S	Precision land forming is reshaping the surface of land to planned grades.	X					
Prescribed Burning (Ac)	338	V	Planned fire applied to a predetermined area.	X	X	X			X
Prescribed Grazing (Ac)	528	V	Managing the harvest of vegetation with grazing and/or browsing animals with the intent to achieve specific ecological, economic, and management objectives.	X	X	X			X
Pumping Plant (No)	533	S	A facility that delivers water or wastewater at a designed pressure and flow rate.	X	X				
Range Planting (Ac)	550	V	The seeding and establishment of herbaceous and woody species for the improvement of vegetation composition and	X		X			X

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
			productivity of the plant community to meet management goals.						
Recreation Land Improvement and Protection (Ac)	566	S	Recreation land grading and shaping is reshaping the surface of the land to support recreational land use.	X	X	X			
Residue and Tillage Management, No Till (Ac)	329	V	Limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year around.	X		X			
Residue and Tillage Management, Reduced Till (Ac)	345	V	Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.	X		X			
Restoration of Rare or Declining Natural Communities (Ac)	643	M	Re-establishment of abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals.	Dependent upon the selected vegetative and structural CPS/E(s)					
Riparian Forest Buffer (Ac)	391	V	An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.	X		X			X
Riparian Herbaceous Cover (Ac)	390	V	Grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils, established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats.	X		X			X

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Road/Trail/Landing Closure and Treatment (Ft)	654	S	The closure, decommissioning, or abandonment of roads, trails, and/or landings and associated treatment to achieve conservation objectives.	X		X			X
Rock Wall Terrace (Ft)	555	S	A fitted rock wall constructed across the slope to create a farmable area.	X	X				
Roof Runoff Structure (No)	558	S	A structure that will collect, control, and convey precipitation runoff from a roof.					X	
Roofs and Covers (No)	367	S	A rigid, semirigid, or flexible manufactured membrane, composite material, or roof structure placed over a waste management facility, agrichemical handling facility, or an on-farm secondary containment facility.					X	
Row Arrangement (Ac)	557	V	A system of crop rows on planned directions, grades, and lengths.	X		X			
Salinity and Sodic Soil Management (Ac)	610	M	Management of land, water and plants to reduce accumulations of salts and/or sodium on the soil surface and in the crop rooting zone.	X		X			
Saturated Buffer (Ft)	604	S	A subsurface, perforated distribution pipe used to distribute drainage system discharge beneath a vegetated buffer along its length and discharge channel.	X		X			
Sediment Basin (No)	350	S	A basin constructed with an engineered outlet, formed by constructing an embankment, excavating a dugout, or a combination of both.	X	X				

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<u>Practice Name (units of measure)</u>	<u>Code</u>	<u>Type</u>	<u>Practice Description</u>	Human-Induced Unintentional Hazards	Habitat Loss/Earth Disturbance	Vegetative Management	Potential Use of Herbicides	Unlikely to generate Stressors	Beneficial
Shallow Water Development and Management (Ac)	646	M	The inundation of lands to provide habitat for fish and wildlife.	Dependent upon the selected vegetative and structural CPS/E(s)					
Short Term Storage of Animal Waste and By-Products (Cu-Ft)	318	S	Temporary, nonstructural measures used to store solid or semisolid organic agricultural waste or manure (stackable livestock and poultry manure, bedding, litter, spilled feed, or soil mixed with manure) on a short-term basis between collection and utilization.					X	
Silvopasture (Ac)	381	S	Establishment and/or management of desired trees and forages on the same land unit.	X		X			X
Sinkhole Treatment (No)	527	M	The treatment of sinkholes in karst areas to reduce contamination of groundwater resources and to improve farm safety.					X	
Soil Carbon Amendment (Ac)	336	M	Using amendments derived from plant or animal residues to improve the physical, chemical, and biological properties of the soil.	X				X	
Spoil Disposal (Cu-Ft)	572	S	Disposal of surplus excavated materials from construction activities.	X	X	X			
Spring Development (No)	574	S	The collection and use of water from seeps or springs.	X		X			
Sprinkler System (Ac)	442	S	A distribution system that applies water by means of nozzles operated under pressure.					X	

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Stormwater Runoff Control (Ac)	570	S	Measures or systems to control the quantity and quality of stormwater runoff.	X	X				
Stream Crossing (No)	578	S	A stabilized area or structure constructed across a stream to provide controlled access for people, livestock, equipment, or vehicles.	X	X				
Stream Habitat Improvement and Management (Ac)	395	M	Improve, restore, or maintain the ecological functions of a stream and its adjacent floodplain and riparian area.	Dependent upon the selected vegetative and structural CPS/E(s)					
Streambank and Shoreline Protection (Ft)	580	S	Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries.	X	X	X			
Stripcropping (Ac)	585	V	Growing planned rotations of erosion-resistant and erosion-susceptible crops or fallow in a systematic arrangement of strips across a field.	X		X			X
Structure for Water Control (No)	587	S	A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water.	X	X				
Structures for Wildlife (No)	649	S	A structure installed to replace or modify a missing or deficient wildlife habitat component.	X					
Subsurface Drain (Ft)	606	S	A conduit, or system of conduits, installed beneath the ground surface to manage soil water conditions.	X	X				
Surface Drain, Field Ditch (Ft)	607	S	A graded channel on the field surface for collecting and conveying excess water.	X	X				

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Surface Drain, Main or Lateral (Ft)	608	S	An open drainage ditch for moving the excess water collected by a field ditch or subsurface drain to a safe outlet	X	X				
Surface Roughening (Ac)	609	V	Performing tillage operations that create random roughness of the soil surface	X					
Terrace (Ft)	600	S	An earth embankment or a combination ridge and channel, constructed across the field slope.	X		X			
Trails and Walkways (Ft)	575	S	A constructed path with a vegetated, earthen, gravel, paved, or other hard surface to facilitate the movement of animals, people, or off-road vehicles.	X		X			
Tree/Shrub Establishment (Ac)	612	V	Establishing woody plants by planting seedlings or cuttings, by direct seeding, and/or through natural regeneration.	X	X	X			X
Tree/Shrub Site Preparation (Ac)	490	V	Treatment of areas to improve site conditions for establishing trees and/or shrubs.	X	X	X			X
Tree-Shrub Pruning (Ac)	660	V	The removal of all or parts of selected branches, leaders, or roots from trees and shrubs.	X	X	X			
Underground Outlet (Ft)	620	S	A conduit or system of conduits installed beneath the ground surface to convey surface water to a suitable outlet.	X	X				
Upland Wildlife Habitat Management (Ac)	645	M	Provide and manage upland habitats and connectivity within the landscape for wildlife.	Dependent upon the selected vegetative and structural CPS/E(s)					
Vegetated Treatment Area (Ac)	635	V	An area of permanent vegetation used for agricultural wastewater treatment.	X	X				X

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Vegetative Barrier (Ft)	601	V	Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.	X		X			X
Vertical Drain (No)	630	S	A well, pipe, pit, or bore in porous underground strata into which drainage water can be discharged without contaminating groundwater resources.	X	X				
Waste Facility Closure (No)	360	S	The decommissioning of facilities, and/or the rehabilitation of contaminated soil, in an environmentally safe manner, where agricultural waste has been handled, treated, and stored or both and is no longer used.					X	
Waste Recycling (No)	633	M	The on-farm agricultural use of nonagricultural waste by-products, or the off-farm nonagricultural use of agricultural waste by-products.					X	
Waste Separation Facility (No)	632	S	A filtration or screening device, settling tank, settling basin, or settling channel used to partition solids and/or nutrients from a waste stream.					X	
Waste Storage Facility (No)	313	S	An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.	X	X				
Waste Transfer (No)	634	S	A system using structures, pipes or conduits installed to convey wastes or waste byproducts from the agricultural production site to storage/treatment or application.					X	

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Waste Treatment (No)	629	M	Use of mechanical, chemical, or biological technologies to change the characteristics of manure and agricultural waste.					X	
Waste Treatment Lagoon (No)	359	S	A waste treatment impoundment made by constructing an embankment and/or excavating a pit or dugout.	X	X	X			
Wastewater Treatment Milk House (No)	627	S	The physical, mechanical, and biological treatment of dairy milk house wastewater.					X	
Water and Sediment Control Basin (No)	638	S	An earth embankment or a combination ridge and channel constructed across the slope of a minor drainageway.	X	X				
Water Harvesting Catchment (No)	636	S	A facility for collecting and storing water from an area that has been treated to increase precipitation runoff.					X	
Water Well (No)	642	S	A hole drilled, dug, driven, bored, jetted, or otherwise constructed into an aquifer for agricultural water supply.	X	X				
Watering Facility (No)	614	S	A watering facility stores or provides drinking water to livestock or wildlife.	X	X				
Waterspreading (Ac)	640	S	A system of diverting or collecting runoff from natural watercourses and spreading the runoff over relatively flat areas.	X	X				
Well Decommissioning (No)	351	S	The sealing and permanent closure of an inactive, abandoned, or unusable water or monitoring well.					X	
Wetland Creation (Ac)	658	M	A wetland created on a site location that was historically not a wetland.	Dependent upon the selected vegetative and structural CPS/E(s)					
Wetland Enhancement (Ac)	659	M	The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally	Dependent upon the selected vegetative and structural CPS/E(s)					

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			functioning wetland site; sometimes at the expense of other functions.						
Wetland Restoration (Ac)	657	M	The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site.	Dependent upon the selected vegetative and structural CPS/E(s)					
Wetland Wildlife Habitat Management (Ac)	644	M	Retaining, developing or managing wetland habitat for wetland wildlife.	Dependent upon the selected vegetative and structural CPS/E(s)					
Wildlife Habitat Planting (Ac)	420	V	Establishing wildlife habitat by planting herbaceous vegetation or shrubs.	X		X			X
Windbreak/Shelterbelt Establishment and Renovation (Ft)	380	V	Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations.	X	X	X			X
Woody Residue Treatment (Ac)	384	V	The treatment of residual woody material that is created due to management activities or natural disturbances.	X	X	X			

10.8 NRCS POLICY ON PEST MANAGEMENT

NRCS National Policy [GM_190_404 - Part 404 - Pest Management] (available at: <https://directives.sc.egov.usda.gov/Landingpage/59e56444-4784-4f10-8253-376a5e3d5f0d>) governs the role of NRCS within the Proposed Action. **The decision to apply pesticides and herbicides is within the sole discretion of the individual cooperators eligible for NRCS programs.** NRCS recognizes that the Service, as part of its responsibilities to administer the ESA, must consider the effects of the decision to apply pesticides in its analysis and conclusions (Parts 6 and 7).

A summary of the approach and limitations of NRCS' National Policy is presented below, but the reader is encouraged to read the entire referenced policy:

404.10 Pest Management Technical Assistance

A. Guidance and requirements in this Subpart describe the policy applicable to all NRCS technical assistance that involves pest management. All NRCS employees will follow this policy when providing technical assistance. Third Party Vendors/Technical Service Providers and other non-NRCS employees will follow this policy when assisting clients with conservation activities for which NRCS has technical responsibility.

B. Certification. NRCS personnel and partners providing conservation planning and practice application assistance for pest management must meet certification requirements established by the STC in accordance with GM, Title 180, Part 409, Section 409.9, and job approval authority policy.

C. NRCS may serve various roles in assisting clients with Pest Management. This does not mean all roles are required on all acres, or in order of the list below. Roles are driven by the conservation planning process and the client's objectives. All practice purposes or resource concerns do not need to be addressed. Potential NRCS roles in pest management are to offer clients assistance to: (1) Adopt PAMS activities that protect natural resources, categorized as Prevention, Avoidance, Monitoring and Suppression (PAMS) activities. (2) Evaluate environmental hazards associated with a client's probable pest management strategies. (3) Mitigate the identified environmental hazards of pest management strategies through PAMS practices and activities. (4) Inventory, assess, and suppress noxious and invasive weeds on non-cropland. (5) Suppress weeds to ensure successful implementation and/or maintenance of permanent vegetative conservation practices.

D. Technical Assistance

(1) NRCS pest management assistance applies to all: (i) land uses. (ii) crops including organic, specialty crops, forage, trees etc. (iii) pests including noxious and invasive species. (iv) tactics: chemical, biological, genetic, cultural, mechanical/physical to varying degrees.

(2) Pest Management recommendations: (i) Chemical. NRCS shall not develop chemical pest management recommendations or interpret pesticide label instructions for clients including specific pesticides formulation, rates, timing or application methods. The only exception is when NRCS personnel are professionally certified and/or licensed for pesticide application. They may make available a site-specific application rate recommendation within land grant university guidance and the pesticide's label range when adequate reference source(s) are available to justify a specific rate. (ii) Biological traditionally refers to introducing predators, parasites and diseases of pests. NRCS will not make biological tactic recommendations regarding introduction of this type. NRCS shall only develop biological pest suppression recommendations that utilize biological processes such as weed suppression utilizing grazing animals use of cover crops to outcompete and/or smother weed growth. (iii) Genetic: Use of pest resistant plant varieties by plant breeding or genetic engineering may also include genetically modifying pests themselves, releasing sterile male insects. NRCS does not make genetic tactic recommendations but would inventory their use and assess impacts to natural resources. (iv) Cultural, mechanical, physical: NRCS assists clients to develop appropriate cultural and mechanical/physical methods of pest suppression based on NRCS conservation practice standards. (v) NRCS may provide clients with the most current pest management references. References will be based on reputable scientific research that is peer reviewed from land grant universities, Extension, Agricultural Research Service (ARS), Animal and Plant Health Inspection Service (APHIS) and non-profit non-government organizations such as biological and agricultural research centers, stations, and foundations. The recommendations in these references must be in accordance with all Federal, State, Tribal, local laws, and regulations.

(3) NRCS evaluates the environmental hazards of cultural, biological, and chemical pest management suppression activities selected by the clients using professional judgement and current agency tools. NRCS develops and recommends appropriate PAMS activities.

(4) When clients request assistance with PAMS activities that include pesticides, NRCS provides an evaluation of the pesticide hazard(s) for the planned pesticides and any pesticides that have lower hazard ratings.

(5) A Pest Management Conservation System may stand-alone under the CPS 595 or incorporate other standards such as Forest Stand Improvement, Herbaceous Weed Treatment, Brush Management and others.

(6) NRCS cooperates with the appropriate Federal, State, Tribal, and local agencies when assisting clients with pest management. NRCS pest management activities must follow all Federal, State, Tribal, and local environmental laws, regulations, and ordinances.

(7) NRCS cooperates with APHIS and appropriate State agencies when assisting clients with pests (e.g., invasive species), which may require quarantine or eradication to

suppress the spread of the pest. Typical NRCS assistance may include providing available resource information such as soils and climate data.

(8) NRCS assists clients who request an assessment of pest management hazards to beneficial organisms (e.g., native pollinators, honeybees, parasitic wasps, lady beetles, etc.) and to develop appropriate mitigation.

(9) NRCS shall not provide assistance in suppressing pests in or on animals (e.g., fly suppression for livestock, worm suppression for goats)

(10) It is the clients', or their representatives', responsibility to ensure that all pesticides applied are currently registered for their intended use at their location by EPA, and that the application of the pesticides are not further restricted by State or other local laws or ordinances. The product label must contain specific instructions for the proposed use; or the proposed use must be permitted by special local needs registration or emergency exemptions from registration.

(11) On NRCS-operated properties, such as Plant Material Centers (PMCs), personnel who apply or supervise the application of approved pesticides must follow all label instructions and be trained and certified according to State pesticide applicator regulations and wear the appropriate Personal Protective Equipment.

(12) NRCS will cooperate with Federal and State (and equivalent) conservation agencies and the private sector to identify research needs for pest management and mitigation that reduce environmental hazard.

(13) Pest types include diseases, vertebrate and invertebrate pests, and weeds. NRCS pest management does not focus on large vertebrate pests such as feral swine and deer. These are often managed through targeted programs by other agencies and departments.

(14) NRCS may withdraw technical assistance for pest management that will result in a negative effect on natural resources, onsite or offsite. See 440-M-525.4.

404.11 Pest Management Environmental Hazard Analysis

A. Resource Concerns, selected by the client will be evaluated in the conservation planning process including: (1) The potential impacts of pesticides on ground water, surface water, air (chemical drift and volatilization), humans and non-target plants and animals. (2) The potential impacts of mechanical pest suppression activities on on-site soil loss and potential offsite resource effects. (3) The potential impacts of biological pest suppression activities on natural resources. (4) The potential impacts of cultural pest suppression activities (e.g., burning) on natural resources, specifically air and soil quality resources.

B. Pest management impacts on natural resources will be evaluated with current agency tools, procedures and professional judgment. NRCS may use land grant university publications and other peer reviewed literature.

C. States (or equivalent) utilizing pesticide environmental hazard screening tools other than current agency tools, need to coordinate their use with the Director of the ESD and the National Pest Management Specialist of the ESD.

D. If an appropriate analysis tool or procedure is not available for a proposed pest management method, the environmental hazard analysis is left to the professional judgment of the planner. Analysis inputs and results should be documented in the conservation plan to justify the need for mitigation.

E. When pest suppression activities have significant potential to impact identified resources negatively, appropriate mitigation shall be discussed with the client for their decisions. Mitigation includes most PAMS activities: (1) Conservation practices such as Filter Strip, Conservation Crop Rotation, Residue Management, Irrigation Water Management, Windbreak, etc. (2) Activities such as harvest timing, delayed planting, resistant varieties, transgenic crops, application timing, precision application, lower volatility product etc.

F. The client selected PAMS conservation practices and activities will be planned and documented in the conservation plan.

Application of the National Policy on Pest Management

As mentioned in various parts of this document, NRCS does not offer financial support to purchase or apply insecticides and fungicides. It does offer financial support for developing an appropriate risk assessment and to identify alternatives and other strategies to reduce the risk and exposure of these compounds on non-target species. These strategies and options – with NRCS assistance – are additional to the USEPA label instructions²³ which includes a consultation with the Service on effects of the compounds on ESA protected species and compliance with the Federal Insecticide, Fungicide, and Rodenticide Act as amended (7 U.S.C. §136)²⁴.

NRCS' FA is through the cooperator retaining the technical services of a specialist (such as an extension agent, crop advisor, or other certified entity to develop a Pest Management Risk Mitigation Plan (see flowchart below). If adopted by the Producer, this is a component of the larger conservation planning process – and specific to application(s) of pesticides for some

²³ Requirements for Pesticide Labels are found here: https://www.ecfr.gov/cgi-bin/text-idx?SID=a8de8692c293c9ce06581f762b8195af&mc=true&tpl=/ecfrbrowse/Title40/40cfr156_main_02.tpl

²⁴ The USEPA has continued to work with the Service and the National Marine Fisheries Service (NMFS) to develop shared interim scientific methods for use in pesticide consultations, based on recommendations from the 2013 National Academy of Sciences' report "Assessing Risks to Endangered and Threatened Species from Pesticides".

CPS/E and related to control invasive plant species (using such CPS/E as Pest Management Conservation System (595), (314) and herbaceous weed control (315)) and in pests in cropland settings.

Additionally, NRCS uses a WIN-PST as an element of its assistance to producers. WIN-PST is a Tier-1, Windows-based tool that uses the Soil/Pesticide Interaction Screening Procedure, Version 2 (SPISP II) developed by Goss and Wauchope (1990). WIN-PST is a pesticide environmental risk screening tool used to evaluate the potential for pesticides to move off-site with water and eroded soil/organic matter. The ratings are based on the potential for a chemical to move below the root zone or to a field's edge. The soil-pesticide loss interaction ratings are then adjusted to provide a qualitative risk assessment of the effects of a specific chemical on human health or non-target species from chemical exposure. Ratings can be adjusted to reflect numerous management factors that affect the fate of chemicals in the environment (e.g., application rate and timing, irrigation, residue management, etc.) and site conditions (i.e., high water table, slopes greater than 15 percent or the presence of macropores). The soil/pesticide ratings are first approximations of pesticide movement potential and should not by themselves be used to make pest management recommendations. They can, however, help in the decision-making process. The WIN-PST software and documentation can be downloaded from the NRCS National Water and Climate Center website at: <http://www.wcc.nrcs.usda.gov/pestmgt/winpst.html>.

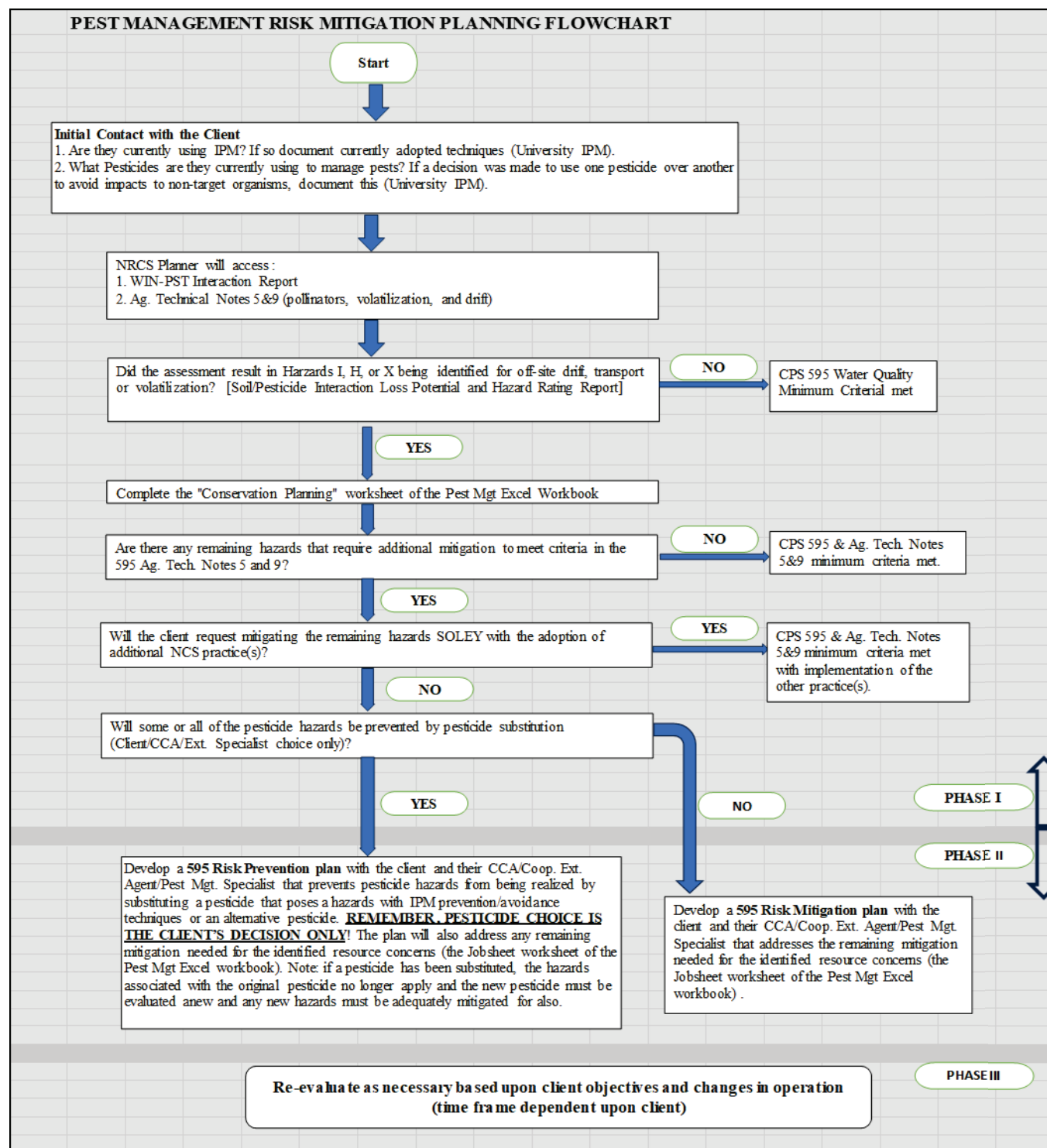
The SPISP II ratings do not take pesticide toxicity into account; however, WIN-PST Interaction Reports include hazard ratings which combine the soil/pesticide interaction ratings with exposure adjusted toxicity ratings. The result is, for any WIN-PST interaction rating and exposure-adjusted rating, a single hazard (potential hazard) rating for each target species (i.e., risk to human health and fish toxicity). WIN-PST classifies the potential hazards into five classes: X – Extra High; H – High; I – Intermediate; L – Low; and V – Very Low.

In general, action (mitigation techniques) would be taken for soil/pesticide interactions classified as 'Extra High', 'High,' or 'Intermediate.' Mitigation measures may include changes in pesticide use (i.e., a different pesticide, reduced rate, banding or spot spraying instead of broadcast applications, etc.), adoption of buffer practices that reduce the movement of soil particles off-site (i.e., residue management, filter strips, windbreaks, etc.), or adoption of cultural and/or biological control practices. Hazard ratings do not preclude the use of a pesticide. Pesticide users must follow USEPA label directions and the local university extension pesticide recommendations.

This context is essential to understanding the elements described and utilized below which characterize and establish the effects for the Proposed Action on the monarch.

A graphical depiction of the NRCS support to delivery of Pest Management Risk Mitigation Planning appears below:

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10.9 RESOURCE CONCERN BY LAND USE – NATIONAL [SUM (UNIT OF MEASURE SPECIFIC) AND FREQUENCY OF USE (COUNT)]²⁵

Readers Note: This information is provided in a PDF, attached separately to this document.

File Name: Appendix 10.9_Resource Concern Improvement by Land Use_20241202.pdf

Notes:

CPPE data link <<https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-physical-effects>> downloaded 11/4/2024

- [Conservation Practices Physical Effects \(CPPE\) - FY25](#) (411.66 KB)
 - Downloads as “cppe-fy25-national.xlsx”
- [RMS Planning Tool – FY25 National](#) (530.58 KB)
 - Downloads as “Copy of rms-planning-tool-fy25-national.xlsm”

RCA data link <[RCA Data Downloads | Natural Resources Conservation Service](#)> downloaded 10/22/2024

Information/notes directly from the downloaded file:

“Source: USDA, NRCS, National Planning and Agreements Database (NPAD) October 2023
Conservation Practices Applied by Conservation Program and Fiscal Year (including practice count)

Conservation practices are planned and applied at the land unit level. The land unit is the smallest unit of land that has a permanent or contiguous boundary, a common land cover and land management, and a common owner or a common producer. The following tables include data for the fiscal years since enactment of the 2008 Food, Conservation, and Energy Act (Farm Bill) in 2009.

This RCA release uses an updated field definition. Before 2021 the National Planning and Agreements Database (NPAD) Land Unit Id was used to represent fields wherever estimates of unique acres treated were required. This identifier is found in the planning land unit database layer. However, since conservation plans are often updated as producers’ conservation decisions evolve over time, there can be multiple land unit identifiers associated with the same field in NPAD. This can result in overestimating the number of fields and the associated unique acres. The Resource Analytics Lab uses a location based algorithm to eliminate the overcounting of fields by grouping applications using the same geographic coordinates and treating them as a single field.

As conservation practices are measured in different units (acres, feet, square feet, etc.), the challenge for reporting performance at various levels is how to aggregate across practices. Although practices may affect resources beyond the land unit boundary, or be applied only on part of the land unit, the land unit does provide a common metric to aggregate over practices since each applied practice is associated with a specific land unit. Analysis of the data reveals that most practices are measured in acres and most of the practice applied amounts match the land unit acres of the field on which the practice was applied. Therefore, land unit acreage is the metric on which the acres of land receiving conservation treatment are calculated.

²⁵ Notes at the end of this Appendix discuss the origin of this data.

10.10 EXAMPLE OF CPS/E(s) - STATE AND BY MONARCH CONSERVATION UNIT

Readers Note: This information is provided in a PDF, attached separately to this document.

File Name: Appendix 10.10_Example of CP&Es that may affect_20241202.pdf

10.11 PARTNERSHIP AGREEMENT

This information is available upon request.

10.12 BIBLIOGRAPHY/LITERATURE CITED

This information is available upon request.

10.13 ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
°C	degrees Celsius
Ac	acre(s)
Action (also Proposed Action)	<i>see Glossary</i>
APHIS	Animal Plant Health Inspection Service
ATV	all-terrain vehicle
BE	beneficial effect – <i>see Glossary</i>
BMP	best management practices
BLM	Bureau of Land Management
BO	biological opinion – <i>see Glossary</i>
candidate	a species for which the Service has determined that listing is warranted but precluded by higher-priority actions
CFR	Code of Federal Regulations
cm	centimeter(s)
CO	Conference Opinion – <i>see Glossary</i>
CPPE	Conservation Practice Physical Effects
CPS	Conservation Practice Standard – <i>See Glossary</i>
CPS/E	Conservation Practice Standard/Conservation Stewardship Program Enhancement – <i>See Glossary</i>
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program – <i>See Glossary</i>
CTA	conservation technical assistance
DBH	diameter at breast height
Document	<i>See Glossary</i>
eFOTG	Electronic Field Office Technical Guide – also can be referred to as the FOTG in NRCS policy manuals and administrative guidance documents.

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ENA	Eastern North American
Enhancement	<i>See Glossary</i>
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)
FA	financial assistance
FR	Federal Register
ft	foot or feet
ft ²	square feet
GM	general management
ha	hectare(s)
in.	inch or inches
IPM	Integrated Pest Management – also now known by NRCS as Pest Management Conservation System (PMCS)
km	kilometer(s)
LAA	may affect, likely to adversely affect – <i>See Glossary</i>
m	meter(s)
m ²	square meters
mi	mile(s)
NE	no effect – <i>See Glossary for specific definition/application</i>
NHCP	National Handbook of Conservation Practices
NLAA	may affect, not likely to adversely affect – <i>See Glossary for specific definition/application</i>
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
pers. comm.	personal communication
PC	planning criteria – <i>see Glossary</i>
PLU	Planning Land Unit - <i>see Glossary</i>
PMCS	Pest Management Conservation System

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RMS	Resource Management System – <i>see Glossary</i>
RPMs	reasonable and prudent measures
RUSLE2	Revised Universal Soil Loss Equation – Version 2
Service	U.S. Fish and Wildlife Service
sp.	various species of a taxon
Sq.Ft.	square feet
SWAPAE+H	soil, water, air, plants, animals, energy plus human considerations
SVAP	Stream Visual Assessment Protocol
T & Cs	terms and conditions
TSS	total suspended solids
U.S.	United States
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USFS	U.S. Forest Service
UTV	utility task vehicle
WEPS	Wind Erosion Prediction System
WIN-PST	Windows Pesticide Screening Tool

10.14 GLOSSARY

Action – see Proposed Action

Action Area - “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” Origin: Regulations (1986) codified as 50 CFR §402.02 See also [Conservation Plan] specific Action Area.

Actively Managed: Land receiving annual management treatments which include, but are not limited to grazing, tillage, crop rotation, fertilization, mowing, weed control, and may be irrigated.

Adverse Modification: Means direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of listed species.

Adversely Affect – See May Affect, Likely to Adversely Affect

Agricultural Commodity: Any crop planted and produced by annual tilling of the soil including tilling by one-trip planters, or sugarcane. [FSA Manual, Part 525]

Agricultural Producer – see Cooperator.

Alternatives - One or more options provided to the client that meets both client and societal objectives, as considered after the Benchmark Condition and expected future trends are noted. An alternative treats one or more Resource Concern. Alternatives must be consistent with the FOTG, Sections II, III and IV.

Alternative System - A conservation system that is presented to a client during the planning process as one of multiple alternatives to address resource concerns or opportunities. When a client decides which of the offered alternative systems will be implemented, the selected alternative becomes the planned system.

Animal Feeding Operation - A lot or facility where animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period.

Associated Agricultural Lands: A land use defined by USDA as: “Land associated with farms and ranches that are not purposefully managed for food, forage, or fiber and are typically associated with nearby production or conservation lands. This could include incidental areas, such as idle center pivot corners, odd areas, ditches and watercourses, riparian areas, field edges, seasonal and permanent wetlands, and other similar areas.

Benchmark Condition - the present condition of the Planning Area based upon the Natural Resources, which also includes the existing enterprises (i.e., current crops, farming practices, and livestock type and condition), trends, opportunities, objectives, sociological and economic characteristics, and others as needed. Planning objectives and the complexity of each situation determine the level of detail necessary for inventories and evaluations.

Beneficial Effects – [BE] “are contemporaneous positive effects without any adverse effects to the species.” Origin: Handbook, p. xv. Additional Information: This is one of the three possible conditions for an effects determination of “May Affect, Not Likely to Adversely Affect”.

Biological Assessment [BA] – as defined herein – this document. A BA a document prepared by an action agency to evaluate the potential effects of the action on listed and proposed species and designated and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary from USFWS. 16 U.S.C. §1536(c)(1); 50 C.F.R. §402.12.

The statutory provision states that BAs are required if listed species may be present. 16 U.S.C. §1536(c)(1). The Services have interpreted this requirement to apply only to major construction activities, and to be triggered when critical habitat may be present as well—not just listed species. 50 C.F.R. §402.12. The Services’ regulations define “major construction activities” to mean projects with physical impacts that are major federal actions “significantly affecting the quality of the human environment” as the term is used in NEPA. 50 C.F.R. §402.02. The contents of a BA are left to the discretion of the action agency and depend on the nature of the action. A BA may include: (1) description of the Proposed Action; (2) information from on-site inspections for listed species; (3) expert opinions; (4) reviews of scientific literature; (5) analyses of the effects of the action on species and critical habitat, including cumulative effects and any studies conducted to assess the effects; and (5) analyses of the effects of any alternative actions the action agency considered. Origin: 50 C.F.R. §402.12(f)

Biological Opinion – [BO] – “...the document that states the opinion of the USFWS as to whether or not the Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.” Origin: Regulations (1986) codified as 50 CFR §402.02.

Breeding habitat – specific to the monarch butterfly and this document, breeding habitat are those areas and land uses where any species of milkweed are found. Milkweed occurs in nearly every county, in every state in the contiguous U.S.

Candidate Species – “means any species being considered by the Secretary for listing as an endangered or threatened species, but not yet the subject of a proposed rule.” Origin: Regulations, 50 CFR §424.02.

Case Studies - Information regarding the effects of conservation can be relayed to conservation planners in a case study; where the study has identified conservation systems and their effects. This type of case study becomes part of the FOTG, Section V, Part B (Conservation Effects).

Commercial - Land on which a dwelling or dwellings are constructed or placed for the interchange of goods or commodities.

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Commercial Thinning - Any type of thinning producing merchantable material at least equal to the value of the direct costs of harvesting.

Concentrated Animal Feeding Operation [CAFO] - An animal feeding operation that meets the USEPA definition of a Concentrated Animal Feeding Operation as provided in 'Guide Manual on NPDES Regulations for Concentrated Animal Feeding Operations' U.S. Environmental Protection Agency, December 1995.

Conference – Defined in the regulations as “a process which involves informal discussions between a Federal agency and the USFWS under Section 7(a)(4) of the ESA regarding the impact of an action on proposed species or proposed critical habitat and recommendations to minimize or avoid the adverse effects.” (50 CFR 402.02) Discussed further in the regulations at 50 CFR 402.10 “Federal agencies shall confer with the USFWS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. The conference is designed to assist the Federal agency and any applicant in identifying and resolving potential conflicts at an early stage in the planning process.” Origin: 402.02 and 402.10. Additional Information: conferences are concluded with either a Conference Report or (if requested) a Conference document. Conference documents may be adopted as a biological opinion after listing, under certain conditions (402.10). Many agencies voluntarily request to conference on projects that they determine “may affect” (as opposed to the likely to jeopardize) proposed species, critical habitat (402.10) or candidate species. Adoption of the conference opinion should be requested in writing.

Conference Concurrence – a phrase sometimes used by consultation practitioners to identify a letter concurring with an action agency’s determination that a project may affect, but is not likely to adversely affect a proposed species, proposed critical habitat or candidate species. If the species is listed or the critical habitat designated, the action agency can request adoption of the document as a concurrence letter. Origin: Working definition.

Conference document – The document analyzing the effects of a Federal agency’s action on a proposed species or proposed critical habitat, and documenting the USFWS’ conclusion regarding whether a Proposed Action is likely to jeopardize a proposed species or cause destruction or adverse modification of proposed critical habitat. Origin: Working definition from discussion 50 CFR §402.10 and pp. 6-4 through 6-6 of the Handbook. Additional Information: A conference opinion uses the same format as a biological opinion and may be adopted as a biological opinion after listing, under certain conditions (§402.10). An incidental take statement may be included but is not in effect until the species is listed. Adoption of the conference opinion should be requested in writing.

Conservation Plan – [Plan]. A record of the client’s decisions and supporting information for treatment of a unit of land meeting planning criteria for one or more identified natural resource concerns as a result of the planning process. The plan describes the schedule of implementation for practices and activities needed to address identified natural resource

concerns and takes advantage of opportunities. The plan may include components such as comprehensive nutrient management plan, grazing plan, integrated pest management plan, etc. The needs of the client, the resources, and Federal, State, Tribal, and local requirements will be met. This will generally correspond with a [Conservation Plan] specific Action Area (see below).

[Conservation Plan] specific Action Area – For purposes of this document, it refers to the specific geographic boundary of where specific HMPs and associate CPS/E will be applied. Typically, this will be a specific unit of land owned/managed/leased by a cooperator. The NRCS planner will then conduct an assessment of the likelihood of presence of a species or the presence of designated critical habitat within the specifically designated Action Area for that Conservation Plan (it may extend beyond the legal boundaries for purposes of the species assessment in rare instances).

Conservation Planner - A person who possesses the necessary skills, training, and experience to implement the NRCS nine-step planning process to meet client objectives of solving natural resource concerns. A “certified” conservation planner has demonstrated skill and proficiency.

Conservation Planning - The activity of NRCS and others in helping a client use the planning process, which is intended to result in a Conservation Plan or an areawide Conservation Plan.

Conservation Practice – [CPS] A specific treatment, such as a structural or vegetative measure, or management technique, commonly used to meet specific needs in planning and implementing conservation, for which standards and specifications have been developed. Conservation practices are contained in the FOTG, Section IV, which is based on the National Handbook of Conservation Practices (NHCP).

Conservation Practice Physical Effects [CPPE]- The CPPE documents, found in the FOTG, Section V, and the National Handbook of Conservation Practices, display in subjective terms the physical effects conservation practices have on the natural resources and their associated problems or concerns.

Conservation Recommendations – “are suggestions of the USFWS regarding discretionary measures to minimize or avoid adverse effects of a Proposed Action on listed species or critical habitat or regarding the development of information.” Origin: Regulations (1986) codified as 50 CFR §402.02. Additional information: “The USFWS may provide with the biological opinion a statement containing discretionary conservation recommendations. Conservation recommendations are advisory and are not intended to carry any binding legal force.” [50 CFR Part §402.14 (j)]. The Handbook (p. xii) expressed the regulatory definition this way: “... non-binding suggestions resulting from formal or informal consultation that: (1) identify discretionary measures a Federal agency can take to minimize or avoid the adverse effects of a Proposed Action on listed or proposed species, or designated or proposed critical habitat; (2) identify studies, monitoring, or research to develop new information on listed or proposed species, or designated or proposed critical habitat; and (3) include suggestions on how an

action agency can assist species conservation as part of their action and in furtherance of their authorities under Section 7(a)(1) of the ESA.”

Cooperator – [Equivalent to client, landowner, agricultural producer, eligible entity]. An individual, business, group, or unit of government that is the recipient of NRCS technical and financial assistance. NRCS clients, generally fall into two broad categories: individual owners, managers, partners or businesses, with primary responsibility for their business dealings with NRCS, and groups or local sponsoring organizations or other government officials, responsible for fulfilling requirements or exercising judgments consistent with law, Executive order, and established Federal policy. Examples of the first group include persons, groups, Tribes, corporations, and organizations. Examples of the second group include conservation districts and units of government.

Critical Habitat – “the term “critical habitat” for a threatened or endangered species means - (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the ESA, on which are found those physical or biological features and (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA, upon a determination by the Secretary that such areas are essential for the conservation of the species.” In some cases, not all areas occupied by a species are designated as critical habitat. Origin: ESA, Section 3.

Crop- A land use defined by USDA as: “Land used primarily for the production and harvest of annual or perennial field, forage, food, fiber, horticultural, orchard, vineyard, or energy crops.”

Decisionmaker - An individual, business, group, unit of government, or other entity that has the authority by ownership, position, office, delegation, or otherwise to decide on a course of action.

Designated Protected Areas – A land use defined by USDA as: “Land or water used for the preservation, protection, and observation of the existing resources, archaeological or historical interpretation, resource interpretation, or for aesthetic value. These areas are officially designated by legislation or other authorities. Examples: legislated natural or scenic areas and rural burial plots.”

Destruction or Adverse Modification – “a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.” Origin: Regulations (2016) codified as 50 CFR §404.02. [Additional Information: This is a determination made by the USFWS in a Biological document regarding a project’s effects to proposed or designated critical habitat.]

Developed Land – A land use defined by USDA as: " Land occupied by buildings and related facilities used for residences, commercial sites, public highways, airports, and open space associated with towns and cities. "

Direct Effect - The immediate effects of the project on the species or its habitat.

Discountable Effects - are those extremely unlikely to occur. Based on best judgment a person would not... (2) expect discountable effects to occur. Origin: Handbook, p. xv Additional information: This is one of the three possible conditions for an effects determination of May Affect, Not Likely to Adversely Affect.

Eclosing - Eclosion is the process by which an adult insect emerges from its pupal case or a larva emerges from its egg. The word comes from the French word éclosion, which comes from the Latin words ex (out of) and clausus (shut)

Effects of Conservation Alternatives – The proposed Alternatives are compared with the Benchmark Condition to estimate the outcome of the actions. The effect of conservation alternatives is the difference between the benchmark and the proposed alternative. Quantification of the effects depends upon the degree of detail used to describe or measure the benchmark and expected alternative conditions. The effect will be described in narrative form, in qualitative terms, at a minimum, and in quantitative terms to the extent possible. It will also be recorded in an easy-to-understand manner for consideration by the decision-maker.

Effects of An Action - are all consequences to listed species or critical habitat that are caused by the Proposed Action, including the consequences of other activities that are caused by the Proposed Action but that are not part of the action. A consequence is caused by the Proposed Action if it would not occur but for the Proposed Action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. Origin: 50 CFR § 402.02 - Definitions.

Eligible entity – see Cooperator.

Endangered Species – "...any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this ESA would present an overwhelming and overriding risk to man." Origin: ESA, Section 3.

Environmental Evaluation (EE) - is the part of planning that inventories and estimates the potential effects on the human environment of alternative solutions to resource problems. A wide range of environmental data, together with social and economic information, is considered in determining whether a Proposed Action is a major Federal action significantly affecting the human environment. The EE for a program, regulation, or individual action is used to determine the need for an EA or an EIS. It also aids in the consideration of alternatives and the identification of available resources. The EE process is undertaken to:

- (i) To identify environmental concerns that may be affected, gather baseline data, and predict effects of alternative courses of actions.
- (ii) To provide data to applicants for use in establishing objectives commensurate with the scope and complexity of the Proposed Action.
- (iii) To assist in the development of alternative courses of action; (40 CFR §1502.14).
- (iv) To perform other related investigations and analyses as needed, including economic evaluation, engineering investigations, etc.
- (v) To assist in the development of detailed plans for implementation, operation and maintenance.

Farmstead – a land use defined by USDA as: “Land used for facilities and supporting infrastructure where farming, forestry, animal husbandry, and ranching activities are often initiated. This may include dwellings, equipment storage, plus farm input and output storage and handling facilities. Also includes land dedicated to the facilitation and production of high-intensity animal agriculture in a containment facility where daily nutritional requirements are obtained from other lands or feed sources.”

Floodplain - The nearly level plain that borders a stream and is subject to inundation under flood- stage conditions. This geomorphic feature is represented by the floodplain soils layer provided by the NRCS GIS Specialist located in the Soils Feature dataset of the NRCS Customer Service Toolkit.

Forest – A land use defined by USDA as: “ Land on which the historic and/or introduced vegetation is predominantly tree cover managed for the production of wood products or non-timber forest products.”

Formal Consultation – “...is a process between the USFWS and the Federal agency that commences with the Federal agency's written request for consultation under Section 7(a)(2) of the ESA and concludes with the USFWS' issuance of the biological opinion under Section 7(b)(3) of the ESA.” Origin: codified as 50 CFR §402.02 and §402.14.

Harm - To include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.

Harass - Actions that create the likelihood of injury to listed species to such and extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering.

Hay: Herbage of grasses, legumes, or comparatively fine-stemmed forbs cut and cured for later use as livestock feed.

Hayland - An area used primarily for the production of hay.

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Headquarters: Land used for dwellings, barns, pens, corrals, or other facilities used in connection with farm and ranch operations.

Heavy Equipment - Heavy equipment is machinery that can do heavy-duty work. The equipment itself comprises numerous sizes. Heavy equipment performs large operations, such as earthwork. This includes: (1) Skid Steer Loaders; (2) Backhoe Loaders; (3) Wheel Tractor Scrapers; (4) Blast Hole Drills; (5) Cranes; (6) ride-on Trenchers; (7) Road Graders; (8) Excavators; (9) All-terrain Forklifts; (10) Bulldozers; and (11) Feller Bunchers.

Incidental Take – “...takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant.” Origin: codified as 50 CFR §402.02

Incidental Take Statement – A section after the conclusion of a Biological document that “...(i) specifies the impact of such incidental taking on the species, (ii) specifies those reasonable and prudent measures that the Secretary considers necessary or appropriate to minimize such impact, (iii) in the case of marine mammals, specifies those measures that are necessary to comply with section 1371(a)(5) of this title with regard to such taking, and (iv) sets forth the terms and conditions (including, but not limited to, reporting requirements) that must be complied with by the Federal agency or applicant (if any), or both, to implement the measures specified under clauses (ii) and (iii).” Origin: Working definition.

Indirect Effects - Those effects that are caused by or will result from the Proposed Action and are later in time but are still reasonably certain to occur. [50 CFR §402.02]

Informal Consultation – “...is an optional process that includes all discussions, correspondence, etc., between the USFWS and the Federal agency or the designated non-Federal representative prior to formal consultation, if required.” Origin: codified as 50 CFR §402.02.

Insignificant Effects – “relate to the size of the impact and should never reach the scale where take occurs. ...Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects. Origin: Handbook, p. xv. Additional information: This is one of the three possible conditions for an effects determination of “May Affect, Not Likely to Adversely Affect”.

Interdependent Actions - Actions having no independent utility apart from the Proposed Action. For example, a water control structure to be installed concurrently with a dam has no independent utility but for the presence of the dam and is therefore interdependent and interrelated (see below) with the Proposed Action to build a dam.

Interrelated Actions - An action that is part of a larger action and depends on the larger action for its justification. For example, a stream crossing is often interrelated to the construction of a road or trail that leads to the stream.

Introduced Species - Species of plant that are not part of the original flora of the area in which they are planted.

Jeopardize the Continued Existence of – a phrase used in the ESA, but only defined in the regulations. “...to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.” Origin: codified as 50 CFR §402.02. Additional Information: The determination of jeopardy is based on the effects of the action on the continued existence of the entire population of the listed species or on a listed population.

Landowner – see Cooperator.

Listed Species – “...any species of fish, wildlife or plant which has been determined to be endangered or threatened under section 4 of the ESA. Listed species are found in 50 CFR §17.11-§17.12”. Origin: codified as 50 CFR §402.02

Likely to Adversely Affect [LAA] – “...the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the Proposed Action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. In the event the overall effect of the Proposed Action is beneficial to the listed species, but is also likely to cause some adverse effects, then the Proposed Action is “likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the Proposed Action, a “likely to adversely affect” determination should be made. A “likely to adversely affect” determination requires the initiation of formal Section 7 consultation. [Clarification of usage]”. Origin: Handbook, p. xv.

May Affect - the appropriate conclusion when a Proposed Action may pose any effects on listed species or designated critical habitat. When the Federal agency proposing the action determines that a “may affect” situation exists, then they must either initiate formal consultation or seek written concurrence from the Services that the action “is not likely to adversely affect” listed species.

Metapopulation Extirpation - In a metapopulation (a “group” of populations), extirpation is when an occupied patch becomes unoccupied. This is the local extinction of a species or organism in a specific area, but it can continue to exist elsewhere. Metapopulations can persist when local populations are quickly recolonized after local extinctions. This is possible because of asynchrony, which means that not all populations crash at the same time.

Migratory habitat – specific to the monarch and this document, migratory habitat are those areas where monarchs occur during migration. Such areas generally but not always include available milkweed and nectar resources.

Mitigate (Mitigation) – NRCS definition is too moderate or alleviate the degree of effect on resource quality or condition. Mitigation includes the following: (i) Avoiding the impact altogether by not taking a certain action or parts of an action, (ii) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, (iii) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment (iv) Reducing or eliminating the

impact over time by preservation and maintenance operations during the life of the action (v) Compensating for the impact by replacing or providing substitute resources or environments.

Natural Resource - Any naturally occurring resource needed by an organism, population, or ecological system. NRCS applies this term to soil, water, air, plants, animals, energy, and humans (SWAPAE+H).

Network Effect Diagrams - found in the National Handbook of Conservation Practices, are flow charts that represent an overview of expert consensus on the direct, indirect, and cumulative effects of installing proposed practices. Network Effect Diagrams show the potential positive and negative outcomes of practice installation and are useful as a reference point for evaluating the effects of alternative systems.

No Effect [NE] – “...the appropriate conclusion when the action agency determines its Proposed Action will not affect (including beneficial effects on) a listed species or designated critical habitat.” Origin: Handbook, p. xvi.

Not Likely to Adversely Affect [NLAA] – A phrase first mentioned and described in the preamble of the 1986 regulations and in the regulations under the description of informal consultation (but not defined there). “...If during informal consultation it is determined by the Federal agency, with the written concurrence of the USFWS, that the action is not likely to adversely affect listed species or critical habitat, the consultation process is terminated, and no further action is necessary.” (50 CFR §402.13(a) The Handbook defined the criteria for what effects would fit into that category of effect. “...the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.” [50 CFR §402.13(a)]. Origin: Regulations (1986) codified as 50 CFR 402.13(a) and Handbook, p. xv.

Offsite - Locations outside the planning area on which conservation treatment is being considered. It also refers to areas outside the planning unit that are considered for potential effects.

Off-site effects - Those effects which are reasonably certain to occur outside the immediate boundary of the site or property as a result of the Proposed Action.

Onsite - Locations within the planning area on which conservation treatment has direct effect.

Opportunities- This creates a broader view that goes beyond the search for resource problems to recognize where resource enhancements may be achieved. For example, if a given area does not have a significant soil resource concern onsite, opportunities may still exist to make on-farm improvements that could increase efficiency and profitability, while at the same time reducing negative water or air quality effects offsite. If NRCS discerns that opportunities for

resource enhancements may exist on-site or off-site (i.e., going beyond addressing resource concerns), it is NRCS policy that planners will include this in the formulation of the planning objectives (the objectives of society as well as those of the client will be considered). H-180-600.40(E)(1)(ii).

Other – A land use defined by USDA as: “Land that is barren, sandy, rocky, or that is impacted by the extraction of natural resources, such as minerals, gravel or sand, coal, shale, rock, oil, or natural gas.”

Overwintering habitat – Specific to monarchs and for purposes of this document, overwintering habitat are those areas where monarchs spend the winter months (generally October through March) in dense clumps and reproductive diapause, then migrate to breeding habitat in the spring, migrate during the summer breeding season locally and long-distance, and in the fall to return to overwintering habitat from breeding grounds. As of 2024, the majority of overwintering sites occur within 1.5 miles of the Pacific Ocean or San Francisco Bay, at low elevations 200-300 ft, and are often on slopes oriented to the south, southwest or west (high solar radiation), and or in small canyons. Some small overwintering sites exist in inland California, and areas of Arizona.

Partial Cutting - Any removal of only part of a stand for purposes other than regenerating a new age class: partial cutting is not considered a regeneration method.

Pasture – A land use defined by USDA as: “ Land composed of introduced or domesticated native forage species that is used primarily for the production of livestock. Pastures receive periodic renovation and cultural treatments, such as tillage, fertilization, mowing, weed control, and may be irrigated. Pastures are not in rotation with crops.”

Planning Area - A planning area is generally the entire operating unit, but it can be a group (or groups) of fields with similar land use and management in which the decision has been made to initiate the planning process. A field is normally the smallest increment for planning resource management systems or practices. However, in rare instances, a subfield (a field within a field for example, the drainage area into a waterway and the outlet area below the waterway) may be appropriate. The planning area must be large enough to encompass the area that influences, and the area that is impacted by, the resource management system or practice being planned.

Planning Criteria - A quantitative or qualitative statement of a treatment level required to achieve a minimum level of treatment for a given resource concern for a particular land area. It is established in accordance with local, State, Tribal, territorial, and Federal programs and regulations in consideration of ecological, economic, and social effects.

Planning Land Unit – (PLU) a unique geographic area that is the minimum unit for planning. PLUs are defined by polygons and have the following characteristics: (1) A common land use and land use modifier; (2) Owned, operated, or managed by the same clients; and/or (3) Boundary lines with labels, such as a name or number. PLUs are edited and attributed in the

Case PLU Layer of the owner's tract folder. For conservation planning purposes, users can merge or split land units in a tract.

Pre-commercial Thinning - A thinning that does not yield trees of commercial value, usually designed to reduce stocking to concentrate growth on more desirable trees.

Proposed Action – equivalent to the definition of “Federal Action” defined in 50 CFR §402.02. e.g., “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include but are not limited to: (a) actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or (d) actions directly or indirectly causing modifications to the land, water, or air.” Origin: Regulations (1986) codified as 50 CFR §402.02.

Programmatic Consultation – “...consultation addressing an agency's multiple actions on a program, regional or other basis. [Clarification of usage]”. Origin: Handbook, p. xvii.

Quality Criteria - Refers to the level or condition of the resource that is considered to be minimally acceptable. All technical assistance provided to resource users will be directed toward achieving the criteria level established for SWAPA -soil, water, air, plants, animals. Resource quality criteria provide a means of determining the adequacy of technical assistance to land users by evaluating the ability of planned Resource Management Systems (RMS) to achieve certain levels in an acceptable time frame. Quality criteria are quantitative or qualitative statements that are established in accordance with local, state, and federal programs and regulations in consideration of ecological, economic and social effects.

Range - A land use defined by USDA as: “Land on which the historic and/or introduced vegetation is predominantly grasses, grass-like plants, forbs or shrubs managed as natural ecosystem. Range land may include natural grasslands, savannas, shrublands, tundra, alpine communities, marshes and meadows.”

Reasonable and Prudent Measure [RPM] - Reasonable and prudent measures refer to those actions the Director [of the Service] believes necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take. As defined by 50 CFR § 402.02.

Recently - Within 12 months.

Residential - Land on which a dwelling or dwellings are constructed or placed for human inhabitancy.

Resource Concern - An expected degradation of the soil, water, air, plant, or animal resource base to the extent that the sustainability or intended use of the resource is impaired. Because NRCS quantifies or describes resource concerns as part of a comprehensive conservation planning process, that includes client objectives, human and energy resources are considered components of the resource base.

Resource Management System (RMS) - is a combination of conservation practices and resource management, identified by land or water uses, for the treatment of all resource concerns for soil, water, air, plants, and animals that meets or exceeds the quality criteria in the Field Office Technical Guide (FOTG) for resource sustainability.

Salvage Cuts - The harvesting of dead or damaged trees - or of trees in danger of being killed by insects, disease, flooding, or other factors - in order to save their economic value.

Sanitation Cuts - The removal of trees to improve stand health by stopping or reducing actual or anticipated spread of insects and disease.

Seed tree Cuts - An even-aged regeneration method in which a new age class develops from seeds that germinate in fully exposed micro-environments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established.

Shelterwood Cuts - A method of regenerating an even-aged stand in which a new age class develops beneath the moderated micro-environment provided by the residual trees. The sequence of treatments can include three distinct types of cuttings: 1) An optional preparatory cut to enhance conditions for seed production; 2) an establishment cut to prepare the seed bed and to create a new age class; and 3) a removal cut to release established regeneration from competition with the overwood. Cutting may be done uniformly throughout the stand (Uniform Shelterwood), in groups or patches (Group Shelterwood), or in strips (Strip Shelterwood).

Significant Structures - heavy use areas, solid/liquid separation facility, waste storage facility, agrichemical handling facility, compost facility, waste treatment lagoon, Anaerobic digester - controlled temperature, and water and sediment control basin.

Special Environmental Concern (SEC) - Concerns (including human considerations) that are protected by law, Executive order, or agency policy and will need to be analyzed according to the laws, regulations, or Executive orders established to protect them. The list of NRCS special environmental concerns is described in Title 190, Part 610, Subpart C, and is included on the NRCS-CPA-52 worksheet.

Species – "...includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Origin: ESA, Section 3.

Streams – Naturally occurring bodies of perennial, intermittent, or ephemeral flowing water regardless of order or classification (e.g., rivers, creeks, bayous).

Stressor: Any physical, chemical, or biological alteration of the environment (i.e., increase, decrease, introduction, or removal) that can lead to an adverse individual response, which in turn can result in population and/or species level responses. Stressors act indirectly on a species through impacts to the resources it needs to fulfill its life cycle.

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Take: To “harass”, “harm”, pursue, hunt, shoot, wound, kill, trap, capture, collect or attempt to engage in any such conduct.

Technical Service Provider [TSP] - Individuals, private businesses, American Indian tribes, non-profit organizations, and public agencies which are certified by NRCS to offer planning, design, and implementation services eligible cooperators.

Terms and Conditions [T&C] - identified in the 50CFR §402 regulations, but not specifically defined there. Generally, they are actions designed to implement Reasonable and Prudent Measures (including reporting requirements). Origin: Working definition. Additional Information: See regulations (1986) codified as 50 CFR §402.14(i)(1)(iii). See also the USFWS Section 7 Handbook pp. 4-51 and 4-52.

Threatened Species – “...any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” Origin: ESA, Section 3.

Water – A land use defined as USDA as: “Geographic area whose dominant characteristic is open water or permanent ice or snow. May include intermingled land, including tidal-influenced coastal marsh lands. “

Glossary Source:

NRCS, 2013. National Planning Procedures Handbook (NPPH), Amendment 6. Handbook, Title 180, Part 600. U.S. Department of Agriculture. Natural Resources Conservation Service. January 2013.

Laye, D. 2016. A Working Glossary for Practitioners of Consultation under Section 7 of the Endangered Species ESA”, 2nd Edition. April 2016. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Lakewood, CO.