National Wildlife Refuges and Climate Change

An Assessment of Climate in Comprehensive Conservation Planning

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Running Wild Media

The National Wildlife Refuge System is the nation's only system of public lands dedicated foremost to the protection of species and habitats. One of the most important challenges it faces is how to protect its wildlife and habitats in a changing climate. The U.S. Fish and Wildlife Service (FWS) has recognized this challenge, but its planning for the conservation of its trust resources, including the National Wildlife Refuge System and Endangered Species Act listed species, has sometimes fallen short of calling for the bold and comprehensive actions needed to protect biodiversity from the threats of climate change.

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The National Wildlife Refuge System Improvement Act of 1997 directed every national wildlife refuge (NWR) to develop a comprehensive conservation plan (CCP), a 15-year management plan to ensure the long-term conservation of fish, wildlife, and habitats in accordance with the purpose of the refuge and the mission of the System. Secretarial orders issued in 2001 and 2009 made clear that climate change impacts should be considered in refuge planning, and this was reiterated in a 2023 proposal to update planning policy. In 2011, Defenders of Wildlife analyzed the most recent CCP from each of the FWS regions to evaluate the extent to which climate change is considered and found that the level of inclusion of climate change varied considerably.[1] Since that time, development of new CCPs has slowed considerably, due primarily to funding constraints, and over half the CCPs in the FWS library[2] are from 2008 or earlier. Only 22 CCPs have been finalized since 2015. To determine if climate change planning has improved, we conducted this analysis again for these most recently published CCPs.

Methods

We evaluated CCPs in five categories: Background, Assessment, Actions, Monitoring, Research and Adaptive Management (MRAM) and Sustainability and Outreach. Since understanding and managing the impacts of climate change are fundamental to conserving biodiversity in a changing climate, the Assessment and Actions categories were worth the most points (eight points and seven points, respectively), followed by the MRAM category (four points). We also gave points for recognition of the needs and mandates to plan for climate change, and up to four points for sustainability initiatives and education efforts, since refuges provide an important opportunity to inform and inspire the public. The table below summarizes the scoring rubric, and a copy of the full scoring sheet and criteria is in the Appendix.

[1] https://defenders.org/sites/default/files/publications/ccp_climate_change_fact_sheet.pdf
[2] The full library of CCPs is available at: https://ecos.fws.gov/ServCat/Search/Advanced/17

Category (maximum points)		Scoring Criteria
Background (2 points)	Planning for Changing Conditions	Is climate change discussed in the Vision or Purpose and Need? (1 pt)
	Legal & Policy Considerations of Climate Change	Does the CCP reference either Secretarial Order on climate change? (1 pt)
Assessment (8 points)	Current & Future Climate Conditions	Is climate change discussed in general terms (1 pt) or with detailed climate projections (2 pts)?
	Impacts of Climate Change on Refuge Habitats	Are climate change impacts to habitat discussed in general terms (1 pt) or with detailed projections for some (2 pts) or most (3 pts) habitats?
	Impacts of Climate Change on Refuge Species	Are climate change impacts to species discussed in general terms (1 pt) or with detailed projections for some (2 pts) or most (3 pts) species?
Actions (7 points)	Protecting Refuge Habitats from the Impacts of Climate Change	Are actions to mitigate impacts to habitats discussed in general terms (1 pt) or with detailed strategies for some (2 pts) or most (3 pts) habitats?
	Protecting Refuge Species from the Impacts of Climate Change	Are actions to mitigate impacts to species discussed in general terms (1 pt) or with detailed strategies for some (2 pts) or most (3 pts) species?
	Considering Ecosystem Transformation	Are ecosystem transformation and management approaches considered? (1 pt)
Monitoring, Research, Adaptative Management (4 points)	Monitoring	Is monitoring of either (1 pt) or both (2 pts) climate variables and/or ecological responses described?
	Research	Is there a research program, plan or partnership to address climate-related issues described (1 pt)?
	Adaptive Management	Is a detailed adaptive management plan in place? (1 pt)
Mitigation, Sustainability, Outreach (4 points)	Emissions and Sustainability (not scored if the refuge lacks facilities)	Are 1-2 actions (1 pt) or 2+ actions (2 pts) to improve sustainability or reduce emissions described?
	Outreach and Education (not scored if the refuge lacks facilities and programs)	Is public education on climate change mitigation or adaptation included? (1 point each)
	Total Score:	25 possible points (with reductions where applicable)

Results

All 22 refuges incorporated climate change into their CCPs, but the level of comprehensiveness varied considerably, with individual refuge scores ranging from four to 17 points, and an average of 11. Only four plans had a score of 15 points or higher. The level of planning has not increased since the 2011 assessment. Refuges generally acknowledged the policy framework and had some level of assessment of impacts, scoring an average of 52% of the ten possible points in the Background and Assessment categories, but most lacked specific actions to ameliorate those threats, averaging only 36% of 11 possible points in the Actions and MRAM categories These results are similar to other work Defenders

has done looking at how well the FWS is planning management for endangered and threatened species[3]. These results make clear that gaps still remain in FWS's ability to make the transition from climate change planning to action.

Below we present the results for each refuge CCP, organized by region. There are eight FWS regions, and all but one (Region 2) had at least one refuge CCP finalized since 2015. Results are presented for each region, with the two westernmost regions grouped together. Results are presented first as a summary table, followed by a more detailed table for each refuge within the region.

Region 1 (Pacific) + Region 7 (Alaska)

The Pacific Region has two refuges with recent CCPs, and the Alaska region has one. The three refuges in these two regions represent the huge breadth of geographies and habitats protected by the Refuge System: our northernmost refuge in Alaska, one of the southernmost, in Hawaii, and a Pacific coastal refuge. All three refuges scored 11 points. Strengths for the region were discussion of impacts, monitoring, and greenhouse gas emissions and sustainability provisions; all had gaps on actions.

		Deer Flat	Kilauea Point	Arctic
Background (2 possible)	Planning for Changing Conditions (1)	1	0	1
	Legal & Policy Considerations of Climate Change (1)	1	0	1
Assessment (8 possible)	Current & Future Climate Conditions (2)	2	2	1
	Impacts on Refuge Habitats (3)	1	1	2
	Impacts on Refuge Species (3)	1	2	3
Actions (7 possible)	Protecting Refuge Habitats (3)	0	0	0
	Protecting Refuge Species (3)	0	1	0
	Considering Ecosystem Transformation (1)	0	0	0
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	2	1	1
	Research (1)	1	1	1
	Adaptive Management (1)	0	0	0
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	2	2	1/1*
	Outreach and Education (2*)	0	1	0
Total Score:		11/25 (44%)	11/25 (44%)	11/24 (46%)
***possible point total may be reduced if Refuge lacks facilities or programs**				No public facilities

[3] Delach et al. 2019, Weber et al. 2023, Wrobleski et al. 2023.

Refuge Name	Deer Flat National Wildlife Refuge
CCP Year	November 2015
Location	Next to Lake Lowell in western Idaho
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/164349
Major Habitats	Mudflats, emergent beds, and open water habitats of Lake Lowell, riparian forests, nonlake wetlands, and shrub-steppe
Key Species	Yellow warbler, song sparrow, mallard, western grebe, Canada goose, long-billed dowitcher, American white pelican, sage thrasher, loggerhead shrike
Plan Highlights	Includes downscaled climate projections and a general discussion of habitat and species impacts. Includes monitoring and research plans, and sustainability and emissions reduction measures.

Refuge Name	Kilauea Point National Wildlife Refuge
CCP Year	September 2015
Location	Coast of Hawaii's Big Island near Kilauea
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/133034
Major Habitats	Coastal woodland-grasslands, sea cliff, beach strand
Key Species	Newell's & Wedge-tailed Shearwater, Hawaiian goose, Hawaiian monk seal, Hawaiian hoary bat, Hawaiian short-eared owl, green turtle, Laysan albatross, white-tailed tropicbird, red-tailed tropicbird, red-footed booby, brown booby
Plan Highlights	Includes downscaled climate projections and a general discussion of habitat and species impacts. Includes monitoring and research plans, and sustainability and emissions reduction measures.

Refuge Name	Arctic National Wildlife Refuge
CCP Year	January 2015
Location	Northeast corner of Alaska
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/41955
Major Habitats	Wetlands, lakes, coastal habitats, boreal forest
Key Species	Alaska marmot, Alaska tiny shrew, Canada lynx, snowshoe hare, wolverine, arctic fox, gray wolf, grizzly bear, polar bear, moose
Plan Highlights	Includes detailed vulnerability information for refuge mammal species, drawing on a Defenders of Wildlife assessment. Has monitoring and research plans.

Region 3 (Midwest)

Both refuges in this region with recent CCPs are located in the upper Midwest, one adjacent to Lake Superior and the other on glacial outwash prairie. Both have assessment and sustainability measures in their plans, though Whittlesey Creek has more detailed actions.

		Glacial Ridge	Whittlesey Creek
Background (2 possible)	Planning for Changing Conditions (1)	0	1
	Legal & Policy Considerations of Climate Change (1)	1	1
Assessment (8 possible)	Current & Future Climate Conditions (2)	1	2
	Impacts on Refuge Habitats (3)	1	2
	Impacts on Refuge Species (3)	1	2
Actions (7 possible)	Protecting Refuge Habitats (3)	0	2
	Protecting Refuge Species (3)	0	2
	Considering Ecosystem Transformation (1)	0	0
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	0	0
	Research (1)	1	1
	Adaptive Management (1)	0	0
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	1	0
	Outreach and Education (2*)	1	0
	Total Score:	7/25 (28%)	13/25 (52%)

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Refuge Name	Glacial Ridge National Wildlife Refuge
CCP Year	Sept. 2016
Location	Northwestern Minnesota
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/103396
Major Habitats	Prairie-wetland habitats, savanna & early successional, forest
Key Species	Greater prairie-chicken, upland sandpiper, sandhill crane, bobolink, western prairie fringed orchid, blue-winged teal, marbled godwit, mallard, sedge wrens
Plan Highlights	General descriptions of climate change and its potential impacts to habitats and species. Discusses climate research partnerships, sustainability, and outreach.

Refuge Name	Whittlesey Creek National Wildlife Refuge
CCP Year	July 2015
Location	Northwest Wisconsin, near Chequamegon Bay
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/154266
Major Habitats	Coastal wetland, coldwater streams, lowland forest and shrub, riparian forest
Key Species	Coaster brook trout, wood turtle, water shrew, northern waterthrush, northern black currant, marsh horsetail, veery, American black duck, common mudpuppy, sora
Plan Highlights	Plan includes detailed climate projections and describes specific impacts to habitats and species. Contains specific management objectives for both species and habitats, such as preservation of brook trout under increasing water temperatures.

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Region 4 (Southeast)

The three Southeast region refuges with recent CCPs each protect river bottom habitats in Gulf Goast States. All used fairly general language to describe climate impacts and actions, and gave less attention to monitoring, research and outreach than other regions.

		Cahaba River	Cat Island	Theodore Roosevelt & Holt Collier
Background (2 possible)	Planning for Changing Conditions (1)	0	0	0
	Legal & Policy Considerations of Climate Change (1)	1	0	1
Assessment (8 possible)	Current & Future Climate Conditions (2)	2	1	1
	Impacts on Refuge Habitats (3)	0	1	1
	Impacts on Refuge Species (3)	0	0	1
Actions (7 possible)	Protecting Refuge Habitats (3)	0	1	0
	Protecting Refuge Species (3)	1	1	0
	Considering Ecosystem Transformation (1)	0	0	0
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	1	0	1
	Research (1)	1	0	0
	Adaptive Management (1)	0	0	0
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	0	0	1
	Outreach and Education (2*)	0	0	0
	Total Score:	6/25 (24%)	4/25 (16%)	6/25 (24%)

Refuge Name	**Cahaba River National Wildlife Refuge**
CCP Year	June 2020
Location	Southwest of Birmingham, Alabama
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/223173
Major Habitats	Longleaf pine woodland, wetlands, forests
Key Species	Cahaba shiner, goldline darter, round rocksnail, cylindrical lioplax, Georgia aster, Georgia rockcress, Cahaba lily
Plan Highlights	Downscaled climate change projections at the state level; discusses collaborative research efforts.

Refuge Name	Cat Island
CCP Year	Aug. 2015
Location	Along the Mississippi River northwest of Baton Rouge, Louisiana
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/162031
Major Habitats	Bald cypress-tupelo swamp, bottomland hardwoods, scrub/shrub swamps
Key Species	Mallard, gadwall, ring-necked duck, green-winged teal, swallow-tailed kite, bobcat, mink
Plan Highlights	General descriptions of climate change and its potential impacts to habitats, and on protecting habitats and species.

Refuge Name	Theodore Roosevelt and Holt Collier National Wildlife Refuges
CCP Year	October 2015
Location	Yazoo Swamp region northwest of Jackson, Mississippi
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/156840
Major Habitats	Yazoo Basin “blackswamp,” bottomland hardwoods, wetlands
Key Species	Louisiana black bear, opossum, armadillo, swamp rabbit, beaver, red fox, gray fox, raccoon, skunk, river otter, bobcat, 225 migratory bird species
Plan Highlights	General descriptions of climate change and its potential impacts to habitats and species, and a commitment to sustainable building and operations.

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Region 5 (Northeast)

Six refuges in the Northeast Region, which extends from Maine to Virginia, completed CCPs since 2015, more than any other region. Refuges in this region also boasted some of the highest scores, with a range of 10 to 17. Refuges in this region generally performed quite well in describing and managing for impacts to habitats. Consideration of ecosystem transformation was also a highlight of this region, possibly because several of the refuges are threatened by sea-level rise.

		Chincoteague, Wallops Island	James River	Massasoit	Monomoy	Plum Tree Island	Silvio O. Comte
Background (2 possible)	Planning for Changing Conditions (1)	1	1	0	1	0	1
	Legal & Policy Considerations of Climate Change (1)	1	1	1	1	1	1
Assessment (8 possible)	Current & Future Climate Conditions (2)	2	2	2	2	2	2
	Impacts on Refuge Habitats (3)	3	3	2	2	2	1
	Impacts on Refuge Species (3)	1	1	1	1	1	1
Actions (7 possible)	Protecting Refuge Habitats (3)	1	1	1	1	1	3
	Protecting Refuge Species (3)	0	0	0	1	1	1
	Considering Ecosystem Transformation (1)	1	1	0	1	0	1
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	1	0	2	1	2	2
	Research (1)	1	0	0	1	1	1
	Adaptive Management (1)	0	0	1	0	1	1
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	1	1	0	2	2	2
	Outreach and Education (2*)	2	1	0	0	0	0
Total Score:		15/25 (60%)	12/25 (48%)	10/25 (40%)	14/25 (56%)	14/25 (56%)	17/25 (68%)

Refuge Name	Chincoteague and Wallops Island National Wildlife Refuges
CCP Date	October 2015
Location	Eastern Shore of Virginia on Delmarva Peninsula
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/98418
Major Habitats	Barrier island, upland, sandy beach, dune edge, salt marsh, overwash, intertidal, “Lucky Boy” sea-level fen
Key Species	Piping plover, Wilson’s plover, gull-billed tern, black skimmer, least tern, American oystercatcher, monarch butterfly, loggerhead sea turtle, seabeach amaranth, Chincoteague pony
Plan Highlights	Extensive sea level rise information and discussion of impacts to beach and marsh habitats. Discusses the possibility of dune breach and major changes to coastal region. Researching restoration options. Developing educational exhibits and a toolkit on climate change.

Refuge Name	James River National Wildlife Refuge
CCP Date	June 2015
Location	Southeast of Richmond, Virginia
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/52306
Major Habitats	Pine-dominated, moist hardwood, and floodplain forests; freshwater marsh and shrub swamp; aquatic habitats; erosional bluffs; non-forested upland
Key Species	Bald Eagle, prothonotary warbler, spotted salamander, Atlantic sturgeon, brown-headed nuthatch, Chuck-will’s-widow
Plan Highlights	Discusses various climate related threats (sea-level rise, intensification of fire regime, groundwater changes) and which habitats are most vulnerable. Discusses possibility of pine forest transition to savannah.

Refuge Name	Massasoit National Wildlife Refuge
CCP Date	October 2017
Location	Plymouth, Massachusetts
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/216520
Major Habitats	Pine-oak and coastal plains pond
Key Species	Northern red-bellied cooter, New England cottontail, migratory birds, Plymouth gentian, rose coreopsis, terete arrowhead
Plan Highlights	Includes state-level climate information and potential impacts on several habitat types. Impacts described are mostly via expansion of invasive species. Monitoring both climate related and ecological response variables.

Refuge Name	Monomoy National Wildlife Refuge
CCP Date	March 2016
Location	Series of islands off the coast of Cape Cod, Massachusetts
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/98416
Major Habitats	Open water and shoals with eelgrass beds, intertidal flats, salt and freshwater marshes, dunes, freshwater ponds, and upland interdunal habitats
Key Species	Piping Plover, red knot, common tern, roseate tern, northeastern beach tiger beetle, American oystercatcher, horseshoe crab, black-crowned night-heron
Plan Highlights	Uses local-scale sea-level rise modeling to predict specific impacts to the individual islands of the refuge. Management focuses on reducing non-climate stressors and disturbance to dune and salt marsh habitats.

Refuge Name	Plum Tree Island National Wildlife Refuge
CCP Date	February 2018
Location	Along the Chesapeake Bay near Newport News, Virginia
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/144692
Major Habitats	Saltmarsh, maritime shrubland, dunes, beach, mudflats
Key Species	American black duck, black rail, common merganser, bufflehead, American oystercatcher, black skimmer, least tern, clapper rail, black-crowned night-heron, saltmarsh sparrow, northern harrier, Eastern hognose snake, loggerhead sea turtle, Northern diamondback terrapin, American eel, American shad, Atlantic sturgeon
Plan Highlights	Discusses projected regional climate impacts and vulnerability of the refuge, including sea-level rise impacts to saltwater marsh and mudflats. Plans adaptive management due to climate change uncertainties.

Refuge Name	Silvio O. Conte National Fish and Wildlife Refuge
CCP Date	January 2017
Location	Refuges comprises multiple units in Massachusetts, Connecticut, Vermont, and New Hampshire
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/173268
Major Habitats	Forested uplands and wetlands, including spruce-fir, hardwood, floodplain and forested swamps; early successional; open water, freshwater and saltwater marshes; coastal habitats
Key Species	Piping plover, Atlantic sturgeon, shortnose sturgeon, dwarf wedgemussel, Puritan tiger beetle, Jessup's milk-vetch, small whorled pogonia, northeastern bulrush, red knot, cobblestone tiger beetle, tri-colored bat, monarch butterfly
Plan Highlights	Includes climate change management provisions for forested upland and wetland habitats, coastal wetlands, and aquatic habitats, including using modeling to understand impacts and support decisions. Detailed research, modeling and adaptive management provisions.

Region 6 (Mountain-Prairie)

Four refuges in the Mountain-Prairie region – two in Colorado, one in Wyoming and one in Montana—completed CCPs since 2015. Overall scores for refuges in this region ranged from seven to 15 points. Refuges in Region 6 generally scored well on assessing and managing for climate change impacts on their habitats, and on implementing emissions reduction and sustainability measures.

		National Bison Range	National Elk Refuge	Rocky Mountain Arsenal	San Luis Valley
Background (2 possible)	Planning for Changing Conditions (1)	1	0	1	1
	Legal & Policy Considerations of Climate Change (1)	0	1	1	1
Assessment (8 possible)	Current & Future Climate Conditions (2)	1	1	2	1
	Impacts on Refuge Habitats (3)	1	1	1	2
	Impacts on Refuge Species (3)	0	0	2	0
Actions (7 possible)	Protecting Refuge Habitats (3)	2	0	2	2
	Protecting Refuge Species (3)	2	0	2	0
	Considering Ecosystem Transformation (1)	0	0	0	1
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	1	2	1	2
	Research (1)	1	1	0	1
	Adaptive Management (1)	0	0	0	0
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	1	1	2	2
	Outreach and Education (2*)	0	0	1	1
	Total Score:	10/25 (40%)	7/25 (28%)	15/25 (60%)	15/25 (60%)

Refuge Name	**National Bison Range**
CCP Date	Approved Dec. 2019
Location	North of Missoula, Montana
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/225315
Major Habitats	Grasslands, Forested, wetland and riparian
Key Species	Bison, grizzly bear, Canada lynx, wolverine, migratory birds
Plan highlights	Discusses climate change impacts on grassland habitats, including on invasive species. Considering climate change prior to undertaking restoration efforts. Aligning management actions with existing climate change plans.

Refuge Name	National Elk Refuge
CCP Date	Sept. 2015
Location	Northeast of Jackson, Wyoming
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/225320
Major Habitats	Grassland, wetland, woodland, and sagebrush shrubland communities
Key Species	Bighorn sheep, pronghorn, gray wolf, bison, elk, mule deer, moose, coyote, mountain lion, migratory birds, cutthroat trout
Plan highlights	Irrigation system to minimize effects of precipitation change on forage. Considering climate alterations to seasonal visitation patterns.

Refuge Name	Rocky Mountain Arsenal
CCP Date	2021
Location	Northeast of Denver, Colorado
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/225342
Major Habitats	Prairie, Shrubland, New Mexico locust thicket, woodland, wetland, riparian, lake
Key Species	Bald Eagle, Swainson's Hawk, burrowing owl, Cassin's sparrow, lark bunting, grasshopper sparrow, black-tailed prairie dog, black-footed ferret, bison
Plan Highlights	Discusses vulnerability assessments for bird species, and has climate related management objectives for short grass, relict prairie, and for bison and prairie dogs.

Refuge Name	San Luis Valley National Wildlife Refuge Complex
CCP Date	October 2015
Location	South-central Colorado, near Alamosa
CCP Link	https://ecos.fws.gov/ServCat/DownloadFile/225337
Major Habitats	Playas, wet meadows, willow and cottonwood riparian
Key Species	Sandhill crane, western chorus frog, migratory waterfowl
Plan Highlights	Has specific climate-related goals for water resources and aquatic habitats. Has a monitoring and research program to measure wildlife and habitat response to climate change.

Region 8 (Pacific Southwest)

Four refuges and refuge complexes in the Pacific Southwest region completed CCPs in recent years. These were all in California, except for a few units in the Klamath refuge complex, which are in Oregon. Overall scores for refuges in this region ranged from 8 to 12 points. Strengths for refuges in this region include actions to protect key species, monitoring, and sustainability measures such as emissions reductions.

		Sacramento NWR Units	Guadalupe-Nipomo Dunes	San Diego	Upper & Lower Klamath, Tule Lake, Clear Lake, Bear Valley
Background (2 possible)	Planning for Changing Conditions (1)	0	0	0	1
	Legal & Policy Considerations of Climate Change (1)	0	1	1	0
Assessment (8 possible)	Current & Future Climate Conditions (2)	1	1	2	1
	Impacts on Refuge Habitats (3)	1	3	0	1
	Impacts on Refuge Species (3)	1	1	1	0
Actions (7 possible)	Protecting Refuge Habitats (3)	0	1	0	1
	Protecting Refuge Species (3)	1	2	1	1
	Considering Ecosystem Transformation (1)	0	0	0	1
Monitoring, Research, Adaptative Management (4 possible)	Monitoring (2)	1	1	2	1
	Research (1)	1	0	1	1
	Adaptive Management (1)	0	0	1	0
Mitigation, Sustainability, Outreach (4 possible)	Emissions and Sustainability (2*)	2	0	2	1
	Outreach and Education (2*)	0	0/0*	1	0
Total Score:		8/25 (32%)	10/23 (43%)	12/25 (48%)	9/25 (36%)
***possible point total may be reduced if Refuge lacks facilities or programs**		Butte Sink, Willow Creek-Lurine, and North Central Valley WMAs	*no outreach/ education programs		Refuge complex has units in CA & OR; managed by Region 8

Refuge Name	Sacramento National Wildlife Refuge Complex: Butte Sink, Willow Creek-Lurline, and North Central Valley Wildlife Management Areas
CCP Date	Drafted 2019, Approved 2020
Location	Northwestern Central Valley, California
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/115749
Major Habitats	Wetlands, riparian
Key Species	Hoover's spurge, palmate-bracted bird's-beak, Contra Costa goldfields, meadowfoam, Colusa grass, hairy Orcutt grass, Greene's tuctoria, fairy shrimp, Valley elderberry longhorn beetle, green sturgeon, Chinook salmon, yellow-billed cuckoo
Plan Highlights	Plan includes research programs and partnerships to better understand climate change impacts. Describes sustainability efforts and lowering carbon footprint.

Refuge Name	Guadalupe-Nipomo Dunes National Wildlife Refuge
CCP Date	August 2016
Location	Coastal California, near Santa Maria
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/114423
Major Habitats	upland, freshwater marsh, and riparian woodlands
Key Species	California red-legged frog, Western snowy plover, California least tern, La Graciosa thistle, marsh sandwort
Plan Highlights	Detailed discussion (with modeling) of sea-level rise threat to marsh habitats. Discusses threat of extreme storm events to rare plant species.

Refuge Name	Lower Klamath, Clear Lake, Tule Lake, Upper Klamath, Bear Valley NWRs
CCP Date	December 2016
Location	This plan encompasses several refuges in northeastern California and southeastern Oregon.
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/114424
Major Habitats	Wetland and riparian, late-successional forests, sage-brush steppe
Key Species	Gray wolf, mountain lion, coyote, waterfowl, pheasant, deer, pronghorn, Ponderosa pine
Plan Highlights	Climate impacts and actions to protect habitats are described in general terms. The plan does begin to contemplate longer-term climate impacts and how management should prepare for those over the next 10 to 15 years.

Refuge Name	San Diego National Wildlife Refuge
CCP Date	May 2017
Location	East of San Diego, California
CCP Link	https://ecos.fws.gov/ServCat/Reference/Profile/133810
Major Habitats	Coastal sage scrub, maritime succulent scrub, grassland, chaparral, riparian woodlands, and vernal pools
Key Species	Coastal California gnatcatcher, least Bell's vireo, southwestern willow flycatcher, Quino checkerspot butterfly, Riverside fairy shrimp, California quail
Plan Highlights	Describes climate change threats to several plant species. Includes and adaptive management section that that emphasizes monitoring and refining management in response to climate change.

Conclusions and Recommendations

Our results suggest that refuges are not yet fully incorporating actions to protect species and habitats from the effects of climate change. Many of the refuges scored more highly in the Background and Assessment categories than they did in the Actions and MRAM categories, suggesting that that refuge managers are aware of the impacts of climate change to the species and habitats they protect, and of need to include climate change as part of planning, but they may not have the tools to respond effectively to these changes.


Jay Blanton

It is also possible that refuges are taking climate change actions that are not explicitly reflected in their CCPs. Natural resource managers around the country are increasingly applying a decision framework called "Resist-Accept-Direct" (RAD), to determine whether and how to respond to the possibility of ecological transformation and other major changes due to climate change effects (Schuurman et al. 2020). Several examples of the application of this framework are from national wildlife refuges responding to sea level rise impacts on salt marsh habitats (Lynch et al. 2021): The John H. Chafee NWR is "resisting" change by applying dredged materials to raise the elevation of the marsh. Chincoteague NWR is "accepting" change by moving visitor infrastructure and allowing waves to overtake waterfowl impoundments. And Blackwater NWR is applying both strategies in certain areas, while also "directing" change by acquiring adjacent low-lying lands that will likely become marsh in the future. Kenai and Tetlin National Wildlife Refuges in Alaska are also using this framework as rapid warming there drives major ecological changes (Magness et al. 2022). From the planning documents we reviewed, however, it seems that these frameworks have not yet been widely adopted within the comprehensive conservation planning

process. Increases in training, capacity building, funding, and direction to make climate-smart planning decisions, are all still needed.

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Appendix: Scoring Sheet and Criteria Description

For each refuge, the assessor reviewed the most recent final comprehensive conservation plan (CCP) in full, using the rubric below to score how each document handled climate change. For each topic area, the assessor chose the box best describing how fully the CCP treated climate change and awarding the corresponding number of points (1-3 possible per topic). Subtotals were summed for each category, and the final score was summed and a percentage score calculated. For some refuges that lacked programs or facilities, the denominator was reduced accordingly.

BACKGROUND (Total 2 points possible)

Planning for Changing Conditions (1 point):	
	The CCP does not mention climate change in the vision statement or in the section on "Purpose and Need for the Plan," nor does it mention managing the refuge in a dynamic or changing environment. (0 points)
	The CCP mentions climate change, either explicitly or indirectly (e.g., any mention made of managing the refuge in a dynamic or changing environment), in the vision statement or in the section on "Purpose and Need for the Plan." (1 point)
Notes	
Legal and Policy Considerations of Climate Change (1 point): (https://www.doi.gov/sites/doi.gov/files/migrated/whatwedo/climate/cop15/upload/SecOrder3289.pdf)	
	The CCP does not mention Secretarial Order 3289 or 3226. (0 points)
	The CCP mentions Secretarial Order 3289 or 3226. (1 point)
Notes	
Subtotal	

ASSESSMENT (Total 8 points possible)

Current and Future Climate Conditions (2 points):	
	The CCP does not mention climate change, either explicitly or indirectly (e.g., any mention made of recent extreme events), as a current or future problem impacting the refuge. (0 points)
	The CCP mentions recent extreme events and/or that climate change impacts are already being felt or are expected; it does not contain detailed references to downscaled climate projections for the region. (1 point)
	The CCP contains detailed references to downscaled climate projections for the region. (2 points)
Notes	
Impacts on Refuge Habitats (3 points):	
	The CCP does not mention any impacts of climate change on refuge habitats. (0 points)
	The CCP includes a general description of the impacts of climate change on refuge habitats. (1 point)
	The CCP includes detailed projections/assessments of climate change impacts for at least one, and up to half, of the refuge's major habitat types, or scientifically justified

	assessments that such habitats are not expected to be vulnerable to climate change. (2 points)
	The CCP includes detailed projections/assessments of climate change impacts for more than half of the refuge's major habitat types, or scientifically justified assessments that such habitats are not expected to be vulnerable to climate change. (3 points)
Notes	
Impacts on Refuge Species (3 points):	
	The CCP does not mention any impacts of climate change on refuge species. (0 points)
	The CCP includes a general description of the impacts of climate change on refuge species. (1 point)
	The CCP includes detailed projections/assessments of climate change impacts for at least one, and up to half, of the refuge's major species or groups, or scientifically justified assessments that such species are not expected to be vulnerable to climate change. (2 points)
	The CCP includes detailed projections/assessments of climate change impacts for more than half of the refuge's major species or groups, or scientifically justified assessments that such species are not expected to be vulnerable to climate change. (3 points)
Notes	
Subtotal	

ACTIONS (Total 7 points possible)

Protecting Refuge Habitats (3 points):	
	The CCP does not mention any actions to protect refuge habitats from climate change. (0 points)
	The CCP includes general language on taking action to protect habitats from climate change impacts; this may include incorporation of climate change effects (directly or indirectly) into the discussion of other threats (such as invasive species, disease, etc.). (1 point)
	The CCP includes specific management goals/objectives/strategies, based on climate change impact projections, to protect at least one, and up to half, of the refuge's major habitats identified as vulnerable to climate change. (2 points)
	The CCP includes specific management goals/objectives/strategies, based on climate change impact projections, for more than half of the refuge's major habitats identified as vulnerable to climate change. (3 points)
Notes	
Protecting Refuge Species (3 points):	
	The CCP does not mention any actions to protect refuge species or groups of species from climate change. (0 points)
	The CCP includes general language on taking action to protect species or groups of species from climate change impacts; this may include incorporation of climate change effects (directly or indirectly) into the discussion of other threats (such as invasive species, disease, etc.). (1 point)
	The CCP includes specific management goals/objectives/strategies, based on climate change impact projections, to protect at least one, and up to half, of the refuge's major

	species or groups of species identified as vulnerable to climate change. (2 points)
	The CCP includes specific management goals/objectives/strategies, based on climate change impact projections, for more than half of the refuge's major species or groups of species identified as vulnerable to climate change. (3 points)
Notes	
Contemplating Ecosystem Transformation (1 point)	
	The CCP does not consider the possibility of ecosystem transformation or major changes. (0 points)
	The CCP considers the possibility of ecosystem transformation, and discusses possible approaches (eg, the resistance/resilience/transformation framework or the resist/accept/direct framework) (1 point)
Notes	
Subtotal	

MONITORING/RESEARCH/ADAPTIVE MANAGEMENT (Total 4 points possible)

Monitoring (2 points):	
	The CCP does not mention any actions to monitor climate variables. (0 points)
	The CCP includes actions to monitor climate variables or climate-relevant information (temperature, precipitation, and ecological variables associated with climate change) **OR** actions to monitor ecological systems that might be affected by changes in these variables (1 point)
	The CCP includes actions to monitor climate variables or climate-relevant information (temperature, precipitation, and ecological variables associated with climate change) **AND** actions to monitor ecological systems that might be affected by changes in these variables. (2 points)
Notes	
Research (1 point):	
	The CCP does not mention a research plan to answer targeted research questions related to climate change. (0 points)
	The CCP lays out a research plan or describes partnerships with external entities to answer targeted research questions related to climate change. (1 point)
Notes	
Adaptive Management (1 point)	
	The CCP does not mention adaptive management or includes only pro forma language. (0 points)
	The CCP includes a detailed plan to advance adaptive management that incorporates climate change information (must go beyond a pro forma paragraph). (1 point)
Notes	
Subtotal	

CLIMATE CHANGE MITIGATION, SUSTAINABILITY, AND OUTREACH (Total 4 points possible)

Emissions and Sustainability (2 points):*	
	The CCP does not mention any actions to improve sustainability or reduce greenhouse gas

	emissions of facilities and operations (0 points).
	The CCP discusses 1-2 actions to improve sustainability or reduce greenhouse gas emissions of facilities and operations (1 point)
	The CCP discusses more than two actions to improve sustainability or reduce greenhouse gas emissions of facilities and operations (2 points)
Notes	
Outreach and Education (2 points):*	
	The CCP does not mention any actions to incorporate climate change into refuge education and outreach efforts. (0 points)
	The CCP includes actions to incorporate climate change adaptation OR mitigation actions into refuge education and outreach efforts. (1 point)
	The CCP includes actions to incorporate climate change adaptation AND mitigation actions into refuge education and outreach efforts. (2 points)
Notes	
Other items of note (discussion of climate and cultural resources, etc.)	
Notes	
Subtotal	
* If Refuge has no facilities or outreach programs, adjust possible points accordingly and note here:	